# A Strategic Approach to Adaptability in Office Buildings

by

Siri Hunnes Blakstad

Doktor Ingeniør Thesis

Norwegian University of Science and Technology
Faculty of Architecture, Planning and Fine Arts
Department of Building Technology

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# Foreword

How will we use our office buildings in 50 years? When designing buildings, this is a fundamental question, because buildings are usually constructed to last for decades, and what happens inside them, in their environment, and in society, is subject to constant and unpredictable change. As Heraclitus puts it; as the water flows, the river will always change:

> "You cannot step twice into the same river". Heraclitus c. 544-483 BC

Still, the "river" is always there, even though the water constantly flows. We relate to the river as an artefact that is constant, at least during a lifetime. Buildings are also often treated as constants, although both manmade and possibly altered and adapted by man. But buildings will, like rivers, undergo continuous changes, even though they appear to be the same. In a world where more and more people start to realise the truth in Heraclitus' saying, the way we deal with change will receive more attention. One needs to know how to deal with personal and professional change. Organisations are challenged by rapidly changing markets and environments. While personal and organisational change is thought to happen more frequently, we know that buildings are solid and relatively durable. But how do buildings deal with the challenges posed by changes in use, in businesses, in individual preferences, and in society?

Change is related to time and the transition from past to present, and, hopefully; to the future. As humans we seem to have rather short attention spans, as most of us focus on our present situation and short-term comfort more than on the distant future. Today, however, we are aware of the dangers of our short attention spans and of how our activities consume the world's resources at a worrying speed. Buildings consume resources, and efficient use and reuse of buildings during their lifetime may be one way of showing more long-term responsibility.

Both the increasing speed of changes and the search for more environmentally friendly ways of constructing and using buildings require a life-cycle perspective on buildings.

## Buildings

We live most of our lives within or between buildings. We regard buildings as solid, durable objects. They define the places we live in, the cities we visit, the universities we go to, and the organisations we work in. We e relate to them as objects that will last for decades, sometimes even centuries. Most buildings are built to last the lifetime of



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their constructors. Still, we notice changes in buildings; some are demolished, new ones are constructed, some are maintained, others grow old and grey, they are extended, or even get «face-lifts».

All buildings are subjects to change. They undergo both slow, barely noticeable changes and major retrofits during their lifetime. Sometimes these changes are carried out in order to maintain and repair the building, but more often than not we see that refurbishment and retrofits come about because of changes in the users' or in society's requirements. In office buildings, the occupants form organisations within the administration, finance, or knowledge/information business. Changes in these businesses are becoming more frequent. This will again pose new requirements on the office building. One of these demands is that the building should be able to change and adapt to support the changes in organisations.

> «Almost no buildings adapt well. They're designed not to adapt; also budgeted and financed not to, constructed not to, administered not to, maintained not to, regulated and taxed not to, even remodelled not to. But all buildings ... adapt anyway, however poorly, because of the usage in and around them are changing constantly». Quote Stewart Brand (Brand, 1994).

In this quote, Stewart Brand points at the complexity of this problem; it involves all stages in the building's life cycle and it involves different actors and different activities at the different stages. He also points out that the pressure for change comes from within the building (users and organisations) or from the environment (society, new regulations, users' expectations, fashion, etc.).

Exposed to changing requirements, all buildings will change. But all buildings do not change in the same manner. Some will discourage dynamic adaptations, others are easy to change. Some buildings have a «personality» that people want to keep and live with in spite of the inconveniences. Other buildings are hated by their occupants and the public, and thus will not experience the same forgiveness if they fail to satisfy their users' requirements.

## A Strategic Approach

Much of the work that has been done to improve buildings' capacity to change has focused on developing physical and technical solutions. Important means have been modularization and standardisation, which have contributed to rationalising design and construction. The office building in which I am sitting while writing this, is planned according to a module which corresponds with the length of the fluorescent tubes of that time. This once so rational choice has less meaning today, when lighting equipment comes in all sizes and shapes. The rational reason behind this solution has disappeared, but the building designed and constructed according to these requirements continues to serve as an office building that faces changed requirements, demands, and challenges that were unthinkable at the time of construction. It continues to do so, not because of the dimensions of lighting fixtures, but because it has a spatial and functional organisation that is rather general and which can be used under different requirements. For us who work here, the building is probably more a source of resignation, for some even a nuisance and an example of bad taste, but no one can deny that it still works. What is already constructed will usually be regarded as given, as something one must relate to and use according to its potential and possibilities. Maybe the conclusion is that the lighting fixture-module wasn't such a bad idea after all? It totally failed to predict the future, but it delivered a building that serves its purpose today, 40 years after construction, even though the rational reason for applying it is long gone. That is not bad for a prediction that failed!

But many predictions will not produce buildings that are still usable when their rational justification for existence changes. Many approaches to building design have aimed at supplying adaptability and flexibility by developing systems and technical answers that rely on an expectation of how the building will be used in the future. While many approaches have succeeded and are widely used today, others have failed because they have missed the target, either by not supplying flexibility where it is most needed, or by depending on predictions and anticipations about the future that turned out to be mistaken. Others failed because they produced buildings that nobody wants to work in anymore due to low esthetical, functional, and technical quality.

So even though more flexibility has been a goal for many years, we still face problems with adaptations of buildings to fit the changing needs of users. I think it is time to approach the problem from a different angle. In this work, a strategic approach to adaptability is investigated. The intention is to focus on the matching and the management of requirements and solutions during the lifetime of the building, and to suggest how one can work strategically to improve long-term adaptability and reduce mismatches between buildings and their users.

There is not one office design and office layout that will provide the best work environment for any organisation. As organisations differ, so must their offices. There is no reason to believe that we have reached the final and best answers to how we should design environments for office work. Most probably, the offices we consider to be on the "leading edge" in current office design, will be old-fashioned tomorrow. So how do we relate an uncertain future when designing and adapting buildings? To me the answer is obvious: if we don't know what the future will look like, we still have to develop ways to cope with this uncertainty and to design buildings and work environments that will be able to adapt to future changes. In short: we must enhance adaptability. This is not only a question about how to build in brick, steel, and concrete, but also about how we plan, design, manage, use, and think about buildings. Even though this seems straightforward and even banal, it has proved to be a complex issue. During the last years, more and more people have talked about making these changes, and from different points of view proposed new methods, models, and practices. My contribution will be to suggest that a Strategic Approach can be implemented when planning, designing, and in the management of offices, and to show how a strategic decision-making process can be used in order to reduce mismatches between buildings and users.

## This project

I began this project in 1997. After working at SINTEF Architecture and Building Technology for some years, I was offered the opportunity to work on a dr.ing project at NTNU, Faculty of Architecture, Planning and Fine Art, Department of Building Technology, with Professor Tore Haugen. The project was financed by the Norwegian Research Council, through The Norwegian Building Research Institute (NBI). It was named "Buildings in a Life Cycle Perspective", and was managed by senior researcher and architect Kirsten Arge at NBI. The first year of a dr.ing project is filled with courses and exams, so I was just starting to define the nature of the main project when I went to Delft in spring 1998. The semester I spent at TU Delft, Faculty of Architecture, at the Department for Real Estate and Project Management, with Professor Hans de Jonge, assistant professor Geert Dewulf and their colleagues, was important in shaping the basic approach to the problem. Professor Tore Haugen, Professor Anne Grete Hestnes, senior researcher Kirsten Arge, and researcher/architect Geir Hansen have acted as a team of supervisors throughout the process, and they have offered me both their professional and personal support.

According to Kuhn, scientific inquiry attracts people for a number of reasons:

> "Among them are the desire to be useful, the excitement of exploring new territory, the hope of finding order, and the drive to test established knowledge". Quote Kuhn page 37 (Kuhn, 1962).

When I started on my dr.ing project, 4 years ago, I had a vision about this work being useful for practice. Reading the manuscript today, I realise that it has become rather theoretical. My only excuse is that working on a dr.ing-project is a once-in-a-lifetime opportunity to delve into theoretical questions, and to pursue interesting thoughts. I took that opportunity. Of course, the Strategic Approach is meant to be implemented in practice, and I hope it will be useful to practitioners, such as architects and planners, as well as to people in charge of real estate strategies in user organisations or as owners and developers of office buildings. Still, my ambitions are much more modest now than they were in the initial phases of the project. I started out wanting to change the world; today I realise that all that has changed is the way *I look at the world*. Maybe this is as much as one can ask for, as every journey starts with a first step. My hope is that some of my readers will find this work interesting enough to motivate the next steps.

# Summary

This thesis, “A Strategic Approach to adaptability in office buildings”, is the result of a doktor ingeniør-project financed by a NBI project called “Buildings in a life cycle perspective”. The work was carried out at the Department of Building Technology, Faculty of Architecture, Planning and Fine Arts at NTNU in the period 1997 - 2001.

The main objective of this work is to develop and present knowledge about adaptability in office buildings and how this knowledge can be enhanced. Adaptability is thought to be important in order to reduce mismatches between buildings and their user organisations. Mismatches will occur in the Building – User Relationship over a period of time. The level of mismatch will vary, but at one point the mismatch exceeds the acceptable mismatch level, and major adaptations in the building, in the use of the building, or in how the user organisation finances and procures real estate, are needed. The acceptable mismatch level will vary from situation to situation, but there will always be some level of mismatch in the Building – User Relationship, and minor adaptations must be carried out continuously.

As opposed to many of the earlier works that have dealt with these issues, this work is mainly focused on adaptability, not only on flexibility. Adaptability is here defined as *“the ability to change, responding to internal or external changes”*, and it is seen as something that approaches the problem “from the top”. Flexibility, on the other hand, is seen as more solution-oriented, giving possibilities for change within a limited set of alternatives. Flexibility is still seen as important, but as one of several ways to achieve physical adaptability, together with partitionability, multifunctionality, and extendability. This work is also more based on a social-constructivist approach to the problem, and on the socio-technical relationships between buildings and users, rather than on technical solutions.

The main reason to engage oneself in the study of adaptability in office buildings is that we have seen the changes that have taken place in offices during the last 100 years, and that we expect these changes to accelerate. During the history of office buildings there has been a large variety in office layouts and workplace design. The use of the building and the workplace ideals may change, but the actual building is more durable. Thus, most buildings will meet a change in requirements during their lifetime, to which they have to be adapted. Some existing buildings adapt readily to change, others are more difficult to alter. The building will be adapted if the value of adapting the building into new or future use is thought to be greater than the value of the alternatives and the cost of adaptations. This value can be both financial value and value of use.

The value of use is most clearly seen in the Building – User Relationship (BUR). This is a dialectic relationship between buildings and users, where the two sides are believed to mutually affect each other. When the organisation changes, the building must be adapted in response to a new situation. On the other hand, the organisation will adapt itself to the possibilities and constraints in the building. The BUR is not necessarily only concerned with one user. It can also be seen as the relationship between the building and several users or between the user and several buildings. Major and continuous changes and adaptations will happen in both cases, and the same approach, with some adaptations, can be used.

Because the BUR is thought to be constantly changing, there is always a mismatch between supply (what the building can offer) and demand (what the organisation needs). This mismatch must be managed in order to create the best possible fit between the building and the user organisation.

To manage the mismatches, one has to consider planning and decision-making under uncertainty. An understanding of the direction and the future on the demand side (the user organisation), as well as a strategy for developing the supply side (the building) must be developed. The interface between the two has to be managed in a long-term perspective. In order to deal with this, a strategic way of managing the mismatch is chosen, and the Strategic Approach to adaptability is based on a strategic iterative decision-making process. The metaphor of design has been used to explore and explain the iterative decision-making process, which is based on interaction between the phases of awareness, analysis, and action.

The main ingredients in the Strategic Approach are:

1. A "mindset", which is a way of thinking about changes in the Building – User Relationship. This mindset includes knowledge about organisations and buildings and how they change and affect each other.
2. Strategic, iterative decision-making based on a process of awareness, analysis, and action. This decision-making process can be applied in different situations. Two situations of special relevance to the Building – User Relationship have been described in this work: The management of BUR mismatches, which is the continuous process of adapting buildings and user organisations to each other, and the Strategic Approach used in the building's life cycle, from initiative, concept, programming, design, and construction, to use and operation.
3. Some tools can be applied within the strategic decision-making process to aid decision-making. For ex. assess uncertainty, for financial analysis, to anticipate the future, to evaluate buildings, to structure planning processes, for visualising, or for problem solving. In this work, two tools have been described in detail: scenarios and layering.
4. Measures are actual solutions that can be applied (a) to the building, (b) to the use of buildings, or (c) in finance and contracts, to enhance adaptability. Actual measures are outside the scope of this work, where the main focus is on strategic decision-making and the Building – User Relationship. They are, however,

mentioned when appropriate, i.e. in the description of design strategies and of layering.

This study is mostly explorative, and an interpretative research approach has been used. This means that concepts and theories have been developed during the enquiry. An iterative research process with empirical and theoretical studies was used. The research instruments were interviews, workshops, and case studies, as well as a final example case, which is used to demonstrate the Strategic Approach in practice.

4 cases are presented: Dagbladet, a major retrofit process of a building complex with several buildings of different ages, which focused on a layered and phased retrofit process. Gjensidige, a new corporate headquarters for a large insurance company, which in its new building focused on strategic decisions and end-user involvement. Office XX, an experimental building with technical solutions that encourages flexibility and give possibilities for easy assembly and disassembly of the building or parts of it. And finally K-bank's new headquarters, Colosseum Park, which was developed as a commercial multi-purpose office building.

The Strategic Approach is finally applied to an example, in order to show how it could have been used in practice. A description of the real sequence of events is compared to an idealised version of the example; a simulation of the Strategic Approach used in the "Consultants Inc. project". The study shows that Consultants Inc. might have benefited from using the approach. The next step will, however, be to test the Strategic Approach in a pilot case and monitor the long-term effects on adaptability and BUR mismatches.

The main results from this work have been:
- That a Strategic Approach based on an understanding of the dynamics in the Building-User Relationship, and a strategic decision-making process has been developed, as well as some tools and methods which can be applied within a Strategic Approach. Some of this is developed in this project. Other issues are based on previous works, but used within the framework, the Strategic Approach, developed in this project.
- That a Strategic Approach has been shown to be important and necessary to improve adaptability in office buildings.



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# Abbreviations

| | |
|---|---|
| BUR | Building-User Relationship |
| CEO | Chief Executive Officer |
| CREM | Corporate Real Estate Management / Corporate Real Estate Manager |
| FM | Facilities Management / Facilities Manager |
| ICT | Information and communication technology |
| LCA | Life Cycle Assessment |
| LCC | Life Cycle Costs |
| SA | Strategic Approach |

# Chapter 1
# Introduction

# Introduction

In 1994 I was involved, together with other researchers at SINTEF and NTNU, in a project called “Architecture and Economy”, where we, among other things, studied office buildings in Norway. In 1995, after two years of case studies and background research, we published a study of challenges in office design and a case study of 6 contemporary Norwegian office buildings. Issues like area efficiency, financial performance, economical parameters, design, and workplace layout were examined, as well as the design and building process seen from the architect’s point of view.

The common office layout in Norway at that time was either cellular or combi-office, and in the report we studied the different possible office layouts and their implications for area efficiency, cost, and adaptability (Blakstad and Haugen, 1995). We discovered that office design was a hot topic at that time, and that there was a lot of work being published on these issues. Internationally, new alternative office solutions were discussed which were still relatively unknown in Norway at the time. The flexible office, the new workplace, and alternative officing were some of the names used to describe a new way of planning and using office space. The new office concepts were being implemented in Sweden, Denmark, the Netherlands, the United States, and Great Britain. Soon these ideas reached Norway as well, and they were given a lot of attention in workshops and seminars, and the first projects were initiated. Today, there are several examples of new office solutions in Norway, even though the majority of workplaces are still located in more traditional office buildings and office layouts.

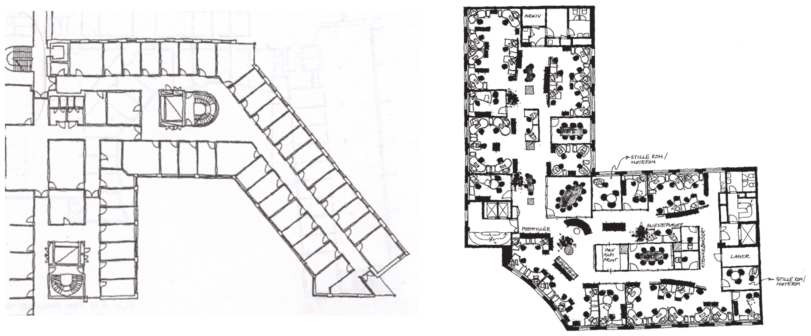

Figure 1. Left: Cellular offices in office building at Stjørdal for Statoil. Per Knudsen Arkitektkontor. 1993. (Blakstad and Haugen, 1995). Right: Innovative offices at Telenor Mobil, Andersen & Flåte ANS Interiørarkitekter. 1997. (Arge and de Paoli, 2000).

The attention and effort spent on design, construction, management, and research on offices is enormous. Annually there are large conferences with delegates from all over the world who meet and discuss office developments. One of these annual conferences alone, the World Workplace Europe, arranged by IFMA (International Facility Management Association) and EuroFM (European Facility Management Network), attracts hundreds of people. The focus on workplace design and management comes, however, primarily from professionals involved in Facilities Management, design, or support of office functions, not so much from the user organisations.

During the last years, we have seen that a large number of new books on office-related subjects have been published. The attention to workplaces is followed by a demand for research, as most of the ideas that are presented are based on individual cases or are part of the marketing of products and services.

For me, these experiences turned out to be interesting for at least two reasons. One was that the efforts to change workplace design gave me an opportunity to combine two of my main professional interests, namely architecture and organisational theory. The other was that the focus on different office solutions and layouts implied that there had to be an element of change, both in the way we design and construct offices, and in the building itself. In order to facilitate the different workplace concepts we need buildings that are able to adapt to changing needs. In 1997, NBI started a Strategic Program called “Buildings in a life cycle perspective”, and I was given the possibility to explore these issues further in a Dr.ing-project. The main point of interest to me when I entered this project was the office building and its relationship with the office work that went on inside it, the dialectic relations between organisations and people, and their physical environment; the building. On a fundamental level, this is about changes in office work in general, but also about the life cycle of buildings and how they change and adapt.

The other main theme in this work is a life cycle perspective on office buildings. In this thesis, this is expressed through the assumption that the dialectic relationship between buildings and their occupants, both on an organisational and an individual level, develops and changes during the building’s life-time. Buildings go through a life cycle from creation to construction, use, and changes, and finally demolition. Organisations may change quickly and may be dynamic and unpredictable, while buildings are more static. The result of this, if we watch the relationship over a period of time, is that there will always be mismatches. The purpose of this work is to investigate how the mismatches can be managed.

## 1.1 Changes in office buildings

Today, office buildings put their mark on every city in the world. Both in number and influence, the office buildings are the evolutionary winners in the struggle for dominance. As a building type it has been extremely successful, even though it is quite young. The office building found its present identity only about 100-150 years ago, when administrative and information-handling activities grew and the number of people employed in white-collar work exploded. Innovations in building technology opened up new possibilities, and the structural steel frame, the elevator, and electric lights were important elements in the development of the American high-rise office buildings which were built in New York and Chicago as we entered the twentieth century. The "skyscraper" soon became the office archetype, and is still today the most common symbol of office activities.

A study of the history of office buildings reveals how building technology enabled the evolution of the office *building*, and how new work-technology, such as telephones and typewriters, contributed to the development of the office *work* (Blakstad, 1997). From history, we can also see that there are clear connections between the types of office work performed, the most influential management theories at the time, and the design of the office building. Office buildings are children of their time. The technological possibilities, the current office work-processes and ideals as well as the prevailing architectural style put their marks on them, see figures 2-5 on the next page.

There are at least two things we can learn from the history of office buildings, which has helped define this work:

1. Office buildings are products of their time, and have changed a lot during the years.
2. There is a strong connection between the office *work* that is performed and the office *building*. Buildings are physical structures that represent the social structures inside them. This relationship is evident in the way offices are built to facilitate the work that is carried out, and to illustrate the management ideas of their time.

Both observations are important for the direction of the rest of this project. The first represents a challenge, because there is no reason to believe that the office buildings of today will still be up to date in the future. As office buildings have changed in the past, so must we also expect them to change in the future.

The work that goes on in the building is related to the office building and its architecture, and we do expect office work to continue to change. It is therefore reasonable to expect office buildings to change too. Another lesson to be learned from the second observation is that there is *a relationship between buildings and their users*. The building will affect its users, and the user organisation will affect the building. The relationship between buildings and users is dynamic; it changes all the time. The Building – User Relationship (BUR) and its dynamic changes represents a challenge in planning, design, construction, and management of offices. While organisations change suddenly and frequently, buildings are slow and expensive to change. Mismatches in the relationship are therefore inevitable.

To manage the mismatch and to plan and build office buildings that will be able to function in a future, uncertain situation is certainly a challenge. In this work, adaptability is put forward as one possible way to manage the mismatch and to plan for future, uncertain situations. Adaptability means the ability to change, respond to internal or external changes, and may be described as the capacity to answer to unexpected changes.

Den Danske Petroleums-Aktieselskab. Denmark. 1890 (Flagstad & Laustsen, 1983)

Trygg, Engelbrektsplan. Sweden. 1910 (Bedoire, 1979)

Topsikring, Ballerup. Denmark. 1974 (Flagstad & Laustsen, 1983)


Figure 2 - 5:
The office workplace has changed a lot in only a century.

From administrative functions performed in residential-like environments in the beginning of the 20th century, large open plan offices in the pre-war period, to huge office landscapes in the '60s and cellular or combi-offices in the '80s and '90s.

Canon Stockholm. Sweden. 1978. (Arkitektur, 1979)

# 1.2 Office innovations

Current trends in business and new workstyles require office buildings that are able to accommodate high levels of both transience and volatility[1]. Transience is caused by tenant turnover. During the last years, contract spans have become shorter, tenants move more frequently, and more and more companies rent space instead of owning it themselves. Volatility is caused by changes in work settings. This is in turn caused by changes in:

- The way office work is carried out in organisations; new ideas about management and work
- New types of office work
- Technological innovation, both when it comes to building technology and the technology that is utilised by the organisation, e.g. new possibilities in ICT
- Structural and demographic changes in the workforce
- Legislation, new requirements and standards, both for buildings and for work environments
- Changes in the real estate market and in design, construction, and management of offices

Some of this will be discussed further in other parts of this work, but the main point here is that these are changes and challenges which will influence the way we design, construct, and manage offices. Some of the answers to these challenges during the last years have been to experiment with new, alternative office concepts, innovative office solutions, etc. The literature on innovative office solutions is extensive, and several "frameworks" to characterise the different office solutions have been developed. Two of the most useful will be presented here, in order to show the variety of possible office solutions.

**The office, the whole office, and nothing but the office**

A framework developed at the Technical University of Delft, the Netherlands, characterise different offices according to how they relate to the three dimensions of Use, Space, and Location, see figure 6.

By looking at this framework it is obvious that within the same physical solution (e.g. cellular office), there can be different solutions for use (1:1 or shared) and several possible locations (central - decentralised). The options depend on all three dimensions. The possibilities for changes in one or all three dimensions become more plausible than if one uses a stable, one-dimensional framework. The greater variability is a reflection of the development in "innovative offices" during the last decade. There are more available alternatives now than in traditional office design, where the main question was: "cellular or open?" Because there are a greater variety of choices available, one can expect more rapid changes and a greater uncertainty about how the office building will be used in the future.

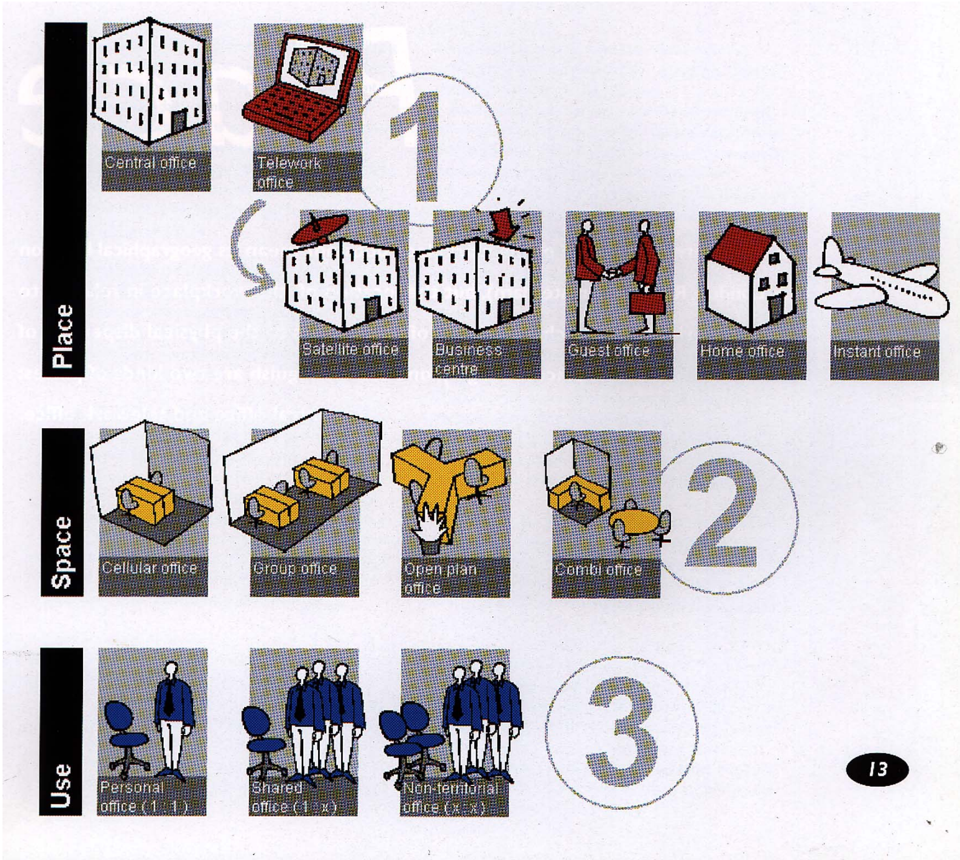


Figure 6. A framework for different office solutions, Place, Space and Use. From “The office, the whole office, and nothing but the office” (Vos et al., 1997).

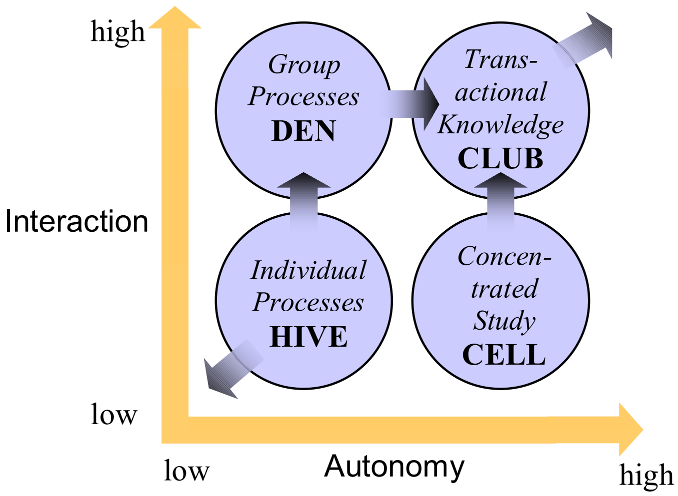


Figure 7. The work-pattern model from “The New Office”. The different work-patterns are defined based on their degree of interaction and autonomy. *(Duffy, 1997)* and *(Laing et al., 1998)*.

**New Environments for Working**

A similar diversification of possible office solutions can be found in Francis Duffy's work. Both in his "The New Office" (Duffy, 1997) and in "New Environments for Working" (Laing et al., 1998) he presents a framework that implies a greater variety of workplaces. He constructs 4 metaphors for different work-patterns: the Den, the Hive, the Cell, and the Club. These are defined based on their degree of work autonomy and interaction.

Duffy predicts that the development today is towards more interaction and a greater autonomy, and that more workplaces will behave like "the Club":

> "The pattern of occupancy tends to be intermittent over an extended working day. A wide variety of time-shared task-based settings serve both concentrated individual and group interactive work. Individuals and teams occupy space on an "as-needed" basis, moving around it to take advantage of a wide range of facilities. The ratio of sharing depends on the precise content of the work activity and the mix of in-house versus out-of-office working, possibly combining tele-working, home-working, and working at client and other locations." F. Duffy (Duffy, 1997) Page 65.

In "New Environments for Working", this is combined with models for different HVAC systems and different building types. The affinities between the different patterns are analysed in order to determine what kind of solutions work well together.

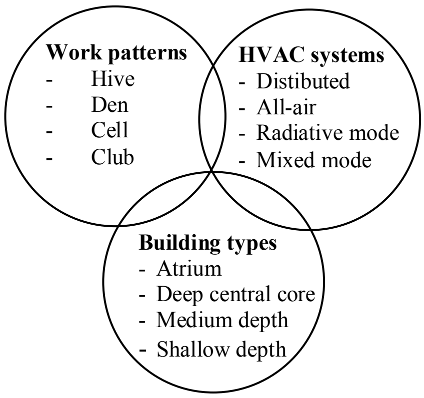


Figure 8. The relationships between the three systems: work-patterns, building types and HVAC systems *(Laing et al., 1998)*.

In the report the shifts from one work-pattern to another are analysed, so that the constraints in moving from e.g. the Cell to the Club and the best combination of HVAC system and building type are determined. Although this leads to some interesting conclusions about the best matches, it is too simplified for most real cases, because the variety of options depends on different combinations in space, location, and use, and because changes can be temporary and often unpredictable.

## 1.2.1 More need for flexibility?

It is reasonable to believe that the greater variety of workplace solutions, and the possibilities to differentiate both in locations and in the way the office is fitted out, will lead to more rapid changes than before. But the real push for more flexibility comes from the demand side, from the users of office buildings. Businesses have during the last 10 years experienced an almost religious belief in change. Users move more often than before, and businesses expand and collapse with short time spans. This is reflected in the way organisations use their offices. This puts an even greater incentive on developing flexible and adaptable office solutions and buildings.

Office layouts have also changed, from static layouts, where every employee had his/her own desk or office, to solutions with shared workspaces and teamoffices, where people are expected to move around. This means that the office layout and the ratio between stationary workplaces and dynamic work- and meeting space have changed, see figure 9.

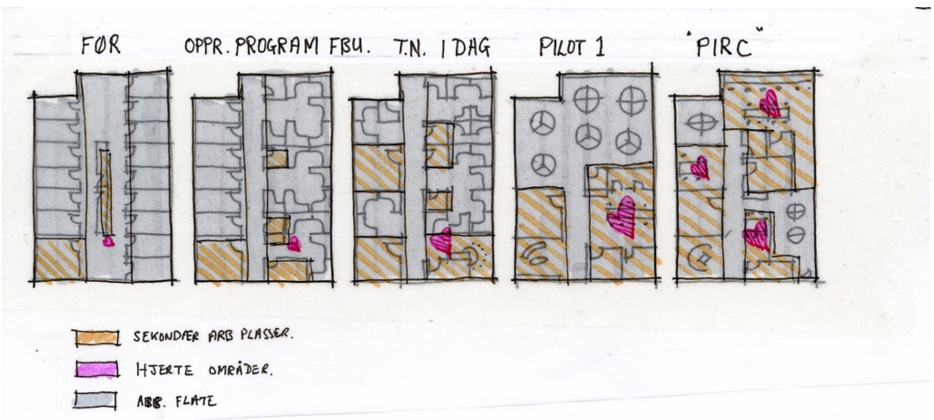


Figure 9. Illustration from the Telenor project at Fornebu. DARK Design has made a study of the development where we see more shared, dynamic team-workspaces and meeting-places and a reduced number of individual, static workspaces, from the traditional solution (left) to the new solutions which are implemented at Fornebu (right). Illustration from Netten Østberg, DARK Design.

The new, flexible office solutions are demanding because they will always be in flux, and this makes it difficult for those who are responsible for providing space and facilities. Providing space, building and fitting out offices takes time, requires preliminary planning, and once the project is finished, it is difficult and expensive to make further changes. This brings us back to the mismatch, and we see that the pace of change in today's business is making the mismatches even more severe, and thus more important to manage.

### 1.2.2 Challenges

Trends and office solutions may, as we have seen, change quickly, but the office building will stand for decades, and will probably contain different types of offices during its lifetime. Owners of buildings want to know how they can design and manage buildings that can accommodate different types of users, and organisations want to know how their offices can contribute to their work in a positive way. At the same time there is a push both for more general office buildings and more custom-made workplaces.

**Challenge 1:**

The first challenge is thus related to the building's possibilities of accommodating the shifting requirements and trends in office layout and use, and its ability to keep up with the accelerating pace of change. The building must be both general enough to accommodate different users, and at the same time have the ability to be fitted out to support the actual user organisation in the best possible way.

**Challenge 2:**

We have seen that there is a relationship between buildings and their users. Due to changes, there is usually a mismatch in this relationship. This is the second challenge: To manage the mismatches between users and buildings, and to plan and build office buildings for an uncertain future.

In this work, it will be argued that these challenges are best met by using a Strategic Approach. The Strategic Approach is an approach to adaptability and to managing BUR mismatches which is based on an iterative, strategic decision-making process.

# 1.3 The Life Cycle Perspective on Buildings

Changes in office work and in the relationship between buildings and users is the first main theme in this work. The other main theme is the life cycle perspective on office buildings and their users. A traditional view of the stages in a building's life cycle is linear, as shown in figure 10.

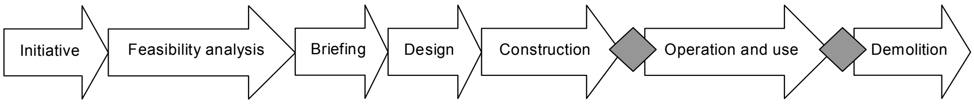


Figure 10. A traditional representation of the building process as linear. In some contemporary works, the "operation and use" phase is extended in order to emphasise its importance and its duration in relation to the other phases.

The linear model is based on the assumption that everything is done in the "right" order, and that it is possible to structure the process in a rational way along a timeline. Earlier, the building process was characterised by a high degree of predictability and long development cycles. The development of the building design and construction was based on linear predefined processes and stable step-by-step models. Today it is becoming more difficult to predict future needs. Innovation cycles are being shortened. Sudden changes create a need to be able to start development without having defined the objectives and specifications clearly. The design team has to cope with changes at all times during the process. Decisions are being pushed forward, so that the just-in-time concept applies for decision-making as well as production. This shift from a linear to a circular development and production process is well documented in product development theory and practice, as stated by Granath, Lindahl and Adler (Granath et al., 1995)

The same changes have already taken place in construction, and we have experienced a shift from a stable and predictable context with a linear process, to a more unpredictable context characterised by loosely defined specifications, a high degree of changes both in construction and use, and with involvement from many actors. In order to represent these processes, a circular model has been chosen. This is to emphasise that all processes will repeat itself, as changes happen during the building's life cycle, and that there is not one final, stable state, but a continuous flow of changes and adaptations, see illustration on next page.

The construction industry will primarily focus on the phases above the circle, as this is their main contribution to the building process. Their customers; building owners and users, will, however, be more interested in how the building performs during use and operation. Changes may occur in all stages of the process. Applied to a real building process, the model will consist of several loops as changes in one phase will influence both the next phase and the work done in the previous phase.

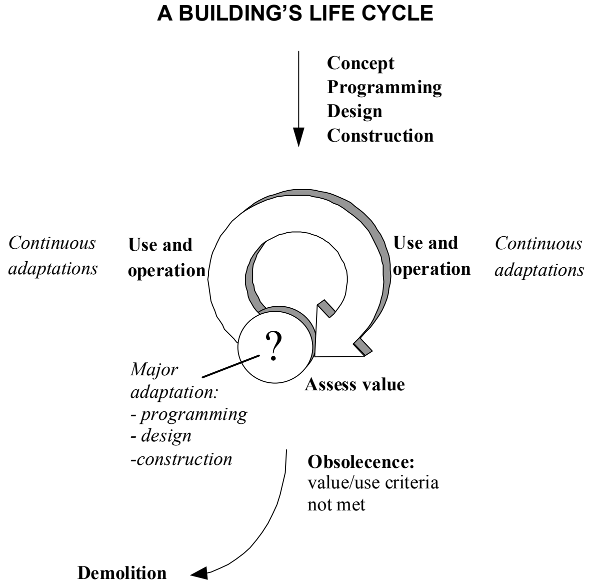


Figure 11. The cyclical building process. During the initial phases (initiative, briefing, design and construction processes) the building is created. During its lifespan, here represented as a cycle, use and operation alternate with adaptations, some of which will require a new programming, design, and construction process. At certain stages the building will reach a situation where its future usability and value will have to be assessed, and obsolescence may occur. This can happen because of its technical state, or because the mismatch with the occupying organisation is unacceptable. At this major decision point the building can face major adaptation, or if the value and use criteria are not met: demolition.

### Changes during design and construction

The development of the brief, design, and construction will in many cases be intertwined and run parallel in time. During the development of the project, the "demand side"; owners and users of the building, will have to state their interests and needs in such a way that the design can be developed in order to answer to those specifications. This is a dialectic process, where there are challenges both in incorporating the different perspectives, knowledge, and actors, and in the development of the design as a response to changes both during design and construction and during operation and maintenance.

### Changes and adaptations in use

During use and operations there are continuous changes, instigated from the demand side, or from the maintenance and repair of the building itself. In figure 11, we distinguished between two main types of adaptations: continuous adaptations and major adaptations. Both continuous and major adaptations occur at different times in the building's life cycle. The "adaptation circle" rotates at different speeds. Sometimes a building or a part of a building goes through major adaptations shortly after construction, in other cases this can take several decades. Adaptations can happen on a day-today basis, or several months or years apart. At major decision points, some buildings are adapted, meaning that they will be put into a state where they can continue to serve as office buildings. This usually requires planning, design, and construction works, before the building "re-enters" for another life-cycle loop. As we will see, the building is adapted if it has some sort of value to its owner/users that is believed to be greater than the cost of changing it: Building quality, property value, site and location, functional qualities, or "soft issues" like image, love, and identification.

Later, the Dagbladet case will be presented, as well as an overview of the changes in Dagbladet's buildings since the 1950's. As the changes and retrofits were mapped, it became clear that changes most often were due to:
- New technology in the work-process
- Changes in workstyle, organisational changes
- Expansions (changes in organisational size)
- Changing requirements and governmental regulations, both when it comes to work environment and building acts.

These reasons for changing and adapting the building are probably the most important ones, and are the "drivers for change" in most buildings. The reasons for change will occur at different rates in different buildings and user organisations. Social issues and matters of taste and fashion will also make an impact on the rate of changes in the building. This has been studied in more detail by researchers who have been interested in reasons for building obsolescence.

**Obsolescence**

At the point in the building's life cycle where its value is assessed, it may be judged to have inadequate value to its users and owners. It has become obsolete. According to Nutt and Sears, any item of equipment or mode of operation is obsolete when it has become completely useless (Nutt and Sears, 1971). They define "obsolescence", on the other hand, as the process of becoming obsolete. They stress that the degree of obsolescence will be subjectively perceived with reference to a particular situation or condition. This judgement will be influenced by the viewpoint and interest of the stakeholder, and of the alternatives at hand.

There are different forms of building obsolescence (Nutt and Sears, 1971), (Baum, 1993):
- Aesthetic (or visual) obsolescence, resulting from outdated appearance
- Functional obsolescence, changes in occupiers' requirements due to new ways of working or new technology
- Legal obsolescence, resulting from the introduction of new standards
- Social obsolescence, resulting from increasing demands by occupiers, or by society in general, for better work environments and improved facilities
- Tenure obsolescence, where regulatory arrangements become increasingly inappropriate to meet organisational requirements
- Structural/physical obsolescence, resulting from technical deterioration that will

make the facility increasingly inadequate.
- Financial obsolescence, when costs are not balanced by returns and benefits
- Environmental obsolescence, when the conditions in a neighbourhood render it increasingly unfit for its present usage patterns
- Locational obsolescence, where the resources and image of a location are increasingly detrimental to organisational and staff expectations
- Site obsolescence, where site value becomes greater than the facility asset.

Obsolescence may result in demolition of the building. Sometimes the values and the potential in the building is still thought to have enough value to be adapted, although this may require heavy retrofits and changes of functions and use in the building (adaptive reuse). In these cases, the building will be repaired and adapted into a state when it enters a new life cycle.

### 1.3.1 Why adapt buildings?

Why are buildings adapted? In the previous parts, and in the Norwegian Standard (NS3454, 2000), there is a distinction between adaptations; continuous adaptations and major adaptations. There are different mechanisms behind the two different types of adaptations: continuous adaptations are about adjusting the balance in the relationship between the building and the user organisation in order to reduce the mismatches. Major adaptations, on the other hand, are dependent of perceptions of value at the point in time where the mismatches are so severe that some serious action has to be taken.

**Adaptations in order to reduce mismatches and maintain performance**

Day-to-day adaptations, and adaptations and upgrades to reduce the BUR mismatch and maintain the building's performance, will happen at a regular basis in any building. Both changes in the existing user organisations and in relation to new users will rely on adaptations of the building. Adaptability in buildings in this perspective depends on the ease of performing changes, both technical and functional.

Although mismatches are corrected by small and medium sized adaptations, there comes a time when the mismatch has grown so severe that mere adjustments will not be sufficient. The maximum size of accepted mismatches will vary a great deal. Mismatches will be more readily accepted if there are other qualities which are perceived as giving a positive value.

With such severe mismatches, other alternatives will be considered. The organisation may choose to move to another facility, the owner may choose to find new tenants, or one may choose to do something to the building: demolition or major adaptations.

**Major adaptations – a question of value**

A building goes through major adaptations if it is perceived to have a positive value for its owners and users.



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"Loved buildings are the ones that work well, that suit the people in them, and that show their age and history." Quote Stewart Brand page 209 (Brand, 1994).

If a building is "loved" and considered profitable and usable by its users and owners, it is adapted. This does not mean that it necessarily is "adaptable"; designed and managed to be easy to adapt, but that it will adapt in one way or another, because of its perceived value.

A building is not only *a building*, it is also someone's *property*. In this respect, the property value is one value-characteristic of a building - value of use is the other. This duality was realised by Aristotle, who made a distinction between «oikonomia» - the management of the household as to increase its value to all members of the household over the long run, and «chrematistics» - the branch of political economy relating to the manipulation of property and wealth so as to maximise short-term monetary exchange value to the owner (Brand, 1994). This is also stressed by Bon:

"Economic good may have both use value and exchange value to their owners. This applies to buildings as well" Page 70 (Bon, 1989).

Both value aspects will be important when we consider adaptability, as shown in the figure below.

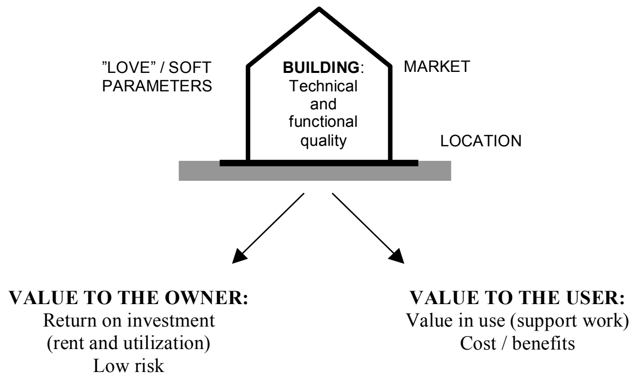


Figure 12. Use value and exchange value.

"First of all, our profit is dictated by location and the quality of our building". Quote G. D. J. Verweij, Wereldhave, survey material.

At one point in time, one reaches what may be called a "major decision point", when the owner will have to decide what should happen to the building. This usually happens after some years of use, when the misfit in the BUR relationship is severe, the building's quality too low, or its functionality and rentability is dropping. The alternatives may be to sell, to demolish, or to adapt the building.

"The crunch for every building comes at the time of the rehabilitate-or-demolish decision, brought on by real-estate pressure or building

> obsolescence – usually both. Much of the time the decision is a close call that could go either way." Quote Stewart Brand page 93 (Brand, 1994).

This is what we call major adaptations, and major construction works will usually happen. In a life cycle perspective, this can be seen as a second life cycle. At this point in time, several parameters influence decisions:

· Market
· Location
· The building's characteristics (technical, functional, and architectural)
· The user's appreciation of the building: "love", image, like/dislike

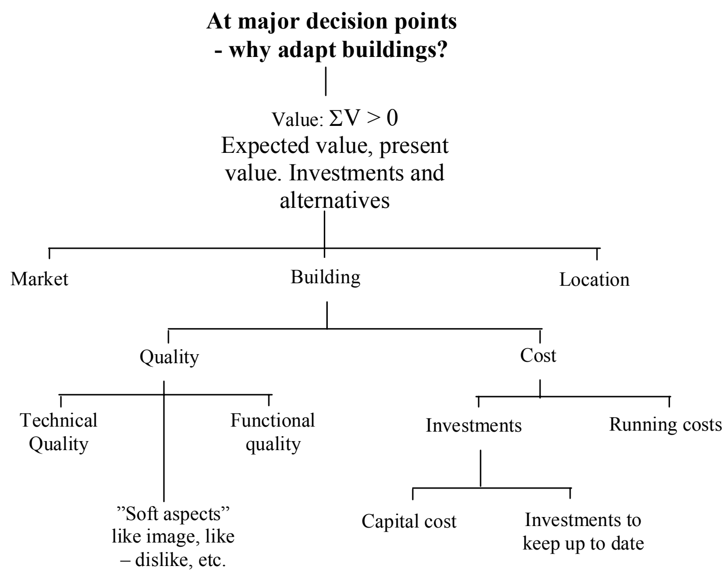


Figure 13. Buildings are adapted if they are perceived to have a positive value. Based on Hans de Jonge's presentation at Workshop Voorburg[2].

The focus on user requirements is a consequence of a buyer's market for real estate. The owners will have to supply high quality facilities at attractive locations. In a good period, when the businesses are making money, they will use more money on real estate. In difficult times, they will not change that fast, but rather try to make the best out of what they have got.

If the building is adapted, it is a result of the perceived value, the costs and inconveniences of adaptations and the alternatives at hand. As we have seen, the building will be reused and adapted even if it isn't "adaptable", if the value of doing so is thought to be greater than the alternatives. This means that when we look at major adaptations, inflexible and unpractical buildings can be adapted and used as well as the ones that are planned to be adaptable. How easy it is to adapt will always, however, be one of the decision parameters.

## 1.3.2 Challenges

The life cycle perspective creates several challenges for adaptability. This perspective helps direct the attention in this work towards buildings and how they are used and created.

**Challenge 3.**

In order to enhance adaptability, much can be gained by designing buildings that will not need as many adaptations (both continuous and major), and that will be easy to adapt when it is necessary to do so. Creating buildings that are physically adaptable throughout their whole life cycle is thus a challenge both for designers and for users and owners of buildings. But physical adaptability is, as we have seen, not the only parameter that will influence the office building's future adaptability. Market, location, architectural quality, and image are other important issues. Creating buildings with use and market values that will make them valuable for a longer period of time, and thus more likely to survive and be adapted through a longer period of time, will thus be as important for future adaptability as physical, flexible building systems. Deciding which solutions to implement and their effect on adaptability at all levels calls for a broad perspective on buildings during their entire life cycle.

**Challenge 4.**

Both continuous and major adaptations will have to be managed in order to align the changes during the life cycle of the building with the developments at the demand side. This is a challenge posed from the earliest phases of the building's life cycle to the use and operation of existing facilities.

This work argues that these challenges are best met by applying a Strategic Approach in the life cycle of office buildings, focusing both on programming and design of new offices and on management and adaptations of existing buildings.

**Challenge 5.**

The most important challenge is probably to be able to learn from buildings in use, and to use this knowledge in designing and constructing new buildings. In order to meet this challenge, this work will examine some real cases and use them together with interviews of people in practice, research workshops and theoretical studies, to develop some theories about how these problems best can be approached. The main perspective is from the designer's and then again mostly from the architect's point of view. But the problems one aims at solving are related not to planners but to users and owners of buildings.

## 1.4 Structure and content

This thesis consists of three main parts: This introduction and the following two chapters present the **problem formulation** and establish how this is studied in this research. The next main part is the discussion of the research model, the Building-User Relationship, the cases and the theoretical framework. This part establishes an understanding of the issues that will be studied as well **as theoretical and empirical input** from literature and cases. The last part presents **the Strategic Approach**, which has been developed in this project, and shows how it could be used in an example. The final chapter, the conclusions and recommendations, ends this part and sums up the whole thesis.

This chapter, the introduction presents challenges in office design and in the life cycle perspective on buildings that the rest of this thesis will attempt to meet.

In chapter 2, the problem statement is presented in the form of a proposition that will guide the further investigations.

In chapter 3, the research methodology and design is presented. This study is explorative and interpretative rather than hypothesis-testing. It relies on an iterative process of empirical and theoretical studies. The research strategy, the research process, as well as the research instruments; interviews, workshops, and case studies, are discussed.

Chapter 4 describes the Building – User Relationship, and presents the BUR model. BUR will be discussed based on theories from organisational theory, as well as from architecture and workplace design. The cause and the nature of the BUR mismatch are also discussed.

Chapter 5 presents the four case studies: Dagbladet, a retrofit for a newspaper. Gjensidige, a new headquarters for a large insurance company. Office XX, a small-scale, general office building and research prototype in use in the Netherlands. And finally, K-bank's large, new headquarters in Oslo.

Chapter 6 develops a theoretical framework on which the rest of the discussion rests. Different approaches to adaptability are presented, and the social-constructivist position and the Strategic Approach used in this are presented and discussed. An iterative, strategic decision-making process is developed, which represents the backbone of the Strategic Approach. Finally, in chapter 6, some of the most important concepts and terms related to adaptability and the building's life cycle are presented.

In chapter 7 the Strategic Approach is presented and developed based on theoretical and empirical input. Issues from the case studies are discussed here, and serve as one source for the development of the Strategic Approach as it is operationalised in the process of managing supply and demand and in the building's life cycle.

Chapter 8, Making space for changes, deals with some of the tools that can be used in the Strategic Approach in order to expand the manoeuvring room, such as scenarios and layering both in the physical, territorial, and functional building order, as well as in the building process.

Chapter 9 presents the Strategic Approach in practice, by applying it to an example.

Chapter 10, Conclusions and recommendations, sums up the Building - User Relationship and the Strategic Approach, and presents the conclusions based on the proposition from chapter 2, the Problem Statement. This chapter also presents some issues for further research and recommendations for implementation in practice.

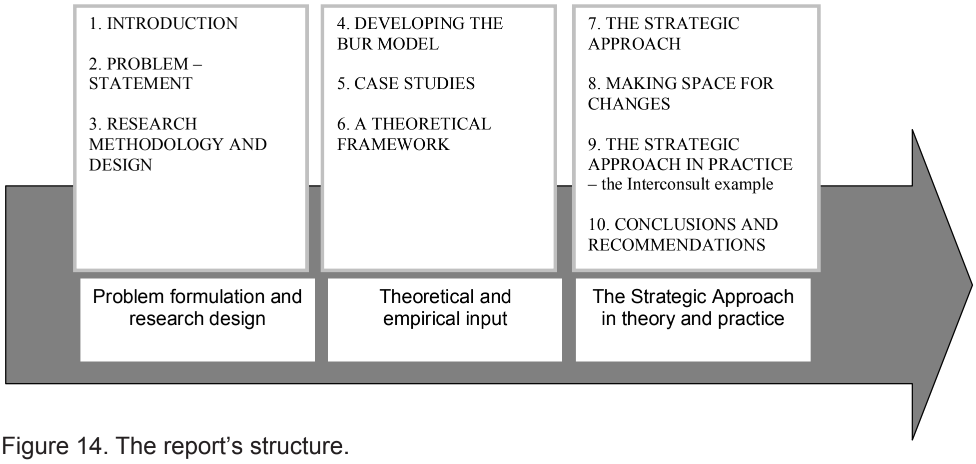


Figure 14. The report's structure.

[1] Transience and volatility are terms used by DEGW at their website: www.degw.com

[2] Workshop Voorburg, 23. April 1998

# Chapter 2
# Problem statement

# 2.1 Objective

The objective of this work is to develop and present knowledge of how adaptability in office buildings can be enhanced. Because the mismatch is dynamic and will change frequently, a Strategic Approach to managing the mismatch between the user organisation and the building is proposed in order to offer a way of approaching these problems.

The purpose of this work is not to develop *a strategy* for adaptability, but to describe *a strategic approach* to achieve adaptability in office buildings. This is important because every situation and project is unique, and it will be impossible to prescribe one "right way" to solve the problem. What is offered is a cognitive model, a "mindset", of the dynamic relationship between buildings and their users (BUR) and a description of a strategic, iterative ecision-making process which can be used in order to address these issues within each context-dependent situation. This decision-making process is operationalised further by showing how it can be used in managing the BUR mismatches and in the building's life cycle, and some tools which can be applied within the Strategic Approach are presented. Finally, the Strategic Approach is applied and discussed in a final example.

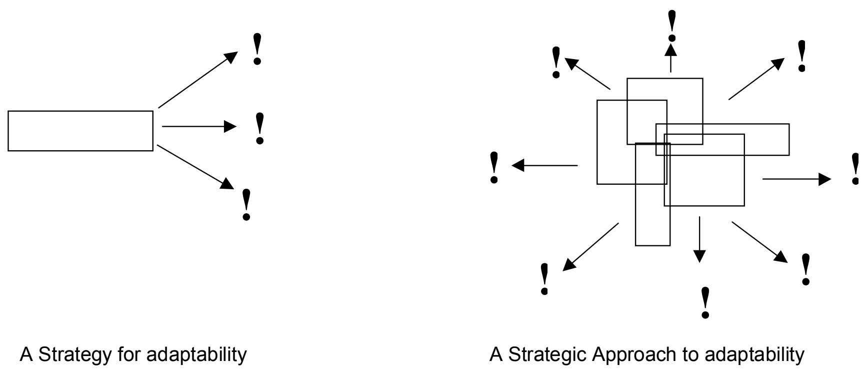


Figure 15. The difference between a Strategy for adaptability and a Strategic Approach to adaptability. A Strategy for adaptability describes one way to approach the problem which has proven to enhance adaptability (example: "Add extra floor-to-ceiling height!"). A Strategic Approach describes a mind set, a strategic decision-making process, some important issues and tools that may be useful. The result from this will be different for different situations and projects. (Example: "In the design phase one issue to consider is the floor to ceiling height. This affects adaptability. One needs to consider the required height for the current situation and for possible future situations. Scenarios can be used in order to explore relevant future situations." ).

# 2.2 Proposition

The nature of this study is more explorative than hypothesis-testing. Still, it is useful to state some kind of hypothesis, or proposition, which serves as a direction for discussion. The proposition is not tested in a deductive way, but is discussed on the basis of empirical and theoretical material. A proposition is a statement about concepts which may be judged as true or false if it refers to observable phenomena (Cooper and Schindler, 1998). Based on an understanding of the Building - User Relationship, and the misfit between demand and supply over a period of time, the proposition is formed.

> PROPOSITION:
> **The mismatch between the building and its user(s) can be managed and the adaptability can be enhanced by applying a strategic approach to the planning and management of office buildings.**

The proposition is discussed and investigated both in theory and by empirical studies of 4 cases. Finally the developed methodology is applied to an example case.

## 2.2.1 Research topics

The main topic in this work is the Building – User Relationship, how this changes over time, and how mismatches can be managed strategically. The main perspective is how planners, architects, and other consultants can deal with problems related to use of buildings during their life-time. The problems one aims at solving is thus the user's, owner's and manager of buildings', and this means that these issues are examined from the perspective of the needs of the user organisation, and of those responsible for procuring and managing office space. The main research topics are:

**The Relationship between Buildings and their Users**

One of the main themes in this work is the relationship between buildings and their users. Different perspectives on BUR and how it changes will therefore receive attention. Because of the continuous changes, mismatches will occur, and this will have consequences both financially, technically, and functionally.

**The Strategic Approach**

This brings us to the main theme in this work: The Strategic Approach to adaptability. In order to manage the mismatch, a Strategic Approach to adaptability is chosen. An iterative, strategic decision-making process is described, based on three inter-related phases: Awareness, analysis and action. This is used later as a methodology to enhance adaptability by applying it in the process of managing BUR mismatches and in the building's life cycle. Some tools to aid the process of managing mismatches and to enlarge the manoeuvring room are also presented; scenario techniques, and the use of redundancy and layering.

### 2.2.2 Scope

Adaptability in office buildings is a broad topic. It is therefore necessary to put some constraints on the scope of this work, which was carried out in less than three years.

**Office buildings**

A lot of interesting work has been done in relation to adaptive organisations and office work and change in general. In this study, only the issues related to the building in some way, will be treated.

This study will concentrate on issues related to office buildings. This means that:
- We will not consider other functions than typical office work and other buildings than office buildings. Change of functions, adaptive reuse, etc., will be outside the scope of this study.
- We will not consider office work which is carried out from other locations than the office building. This means that "home offices", telecommunication, etc. will be outside our scope. This does not mean that this is irrelevant to our study. The fact that some office work can be carried out from alternative locations will affect the activities that take place inside the traditional office building too.

**Actors**

The BUR model describes the relationship between buildings and users. The mismatches in BUR will thus affect users, managers and owners of office buildings. In this work, these groups are the main characters, and this work is *about* them, but it is written *for* those responsible for planning and managing offices. In figure 16, some actors on both the supply and the demand side are shown. This work is written primarily for those responsible for planning and designing offices on the supply side and for those managing real estate and facilities on the demand side. These groups are underlined in the illustration.

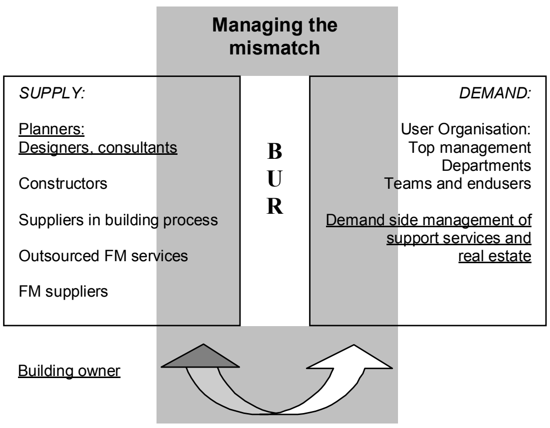


Figure 16. Actors at the supply and the demand side of the Building-User Relationship.

Another important actor, who is usually situated on the "supply" side in the Building – User Relationship, is the building owner, who is financially, strategically, and sometimes practically involved in BUR. Building owners with a long term involvement in real estate will be interested in the management of BUR mismatches. They are the third group of potential users of knowledge about a Strategic Approach to management of BUR mismatches.

In some cases the user organisation is also the building owner. This will usually make stronger and more durable connections between the user and the building. The Building-User Relationship applies to situations both with one long term and stable user and in situations with several users. Planning for uncertainty, which is one of the fundamental challenges in the Strategic Approach, may be just as important developing projects for one known user, which might face dramatic changes, as for commercial projects developed for the market and without known users. This means that a lot of the issues that are interesting for planning and management of buildings with a known user will be applicable for commercial real estate too, but the role of commercial developers that develop projects for sale has not been specifically considered in this work.

The user organisation and its relationship with the building is the main subject in this work, and it is written for building owners, those involved in planning and managing office space at the demand side, and planners and consultants at the supply side. This work is developed at the Faculty of Architecture, and the building with its physical, aesthetical, and functional properties are important issues. The role of the architect will thus be specifically highlighted when discussing which issues can be improved in order to manage BUR mismatches.

**Strategic decisions**

This work describes a Strategic Approach to adaptability. A Strategic Approach will necessarily be concerned with strategic issues and decisions. The Strategic level in decision-making must therefore be identified. In the Building-User Relationship there are at least three different groups of strategic decision-makers: in the user organisation, in the planning and management of buildings, and in managing the relationship between the building and the users.

Seen from the organisation's point of view, the strategic level is its top management, the CEO and the board of directors. Seen from the building side, the strategic decisions are taken by the investor and the planners in the first phases of the building project, and later by building owners. Strategic decisions about the management of the relationship between buildings and users are taken at both these strategic levels, but also by those involved in managing real estate in the user organisation. It is thus difficult to identify *one* strategic decision-maker in the Building-User Relationship.

The Strategic decisions however are easier to identify. These are the decisions that are concerned about long term planning in order to handle uncertainty and to manage changes in the Building-User Relationship. The user organisation's choice to rent facilities instead of building their own building is one strategic decision. The architect's development of the main architectural concept is another strategic decision, and so is the investor's decision to build offices at this specific location. This work will thus focus more on the *strategic decisions* than on the strategic decision-makers, as strategic decisions that will influence the Building - User Relationship is taken by strategic decision-makers in different positions.

It is, however, clear that the Strategic Approach rests on the co-ordination between the different strategic levels. It is par example important for those involved in making strategic real estate decisions that they can co-ordinate those with the user organisation's strategies and expectations about the future. This will be discussed later.

**Project Management**

The Strategic Approach applied in the building's life cycle is described, as well as a layered model of the programming, design, and construction processes. Both issues raise the questions of how the process should be managed in order to ensure that it is carried out with the available resources, on time, and with the right quality. The building process described here will probably put an even greater pressure on information management in the process, and will be quite demanding to manage. Issues like the distribution of responsibility, communication and co-operation, procurement, the contractors' role, risk assessments, etc., will all influence the building process and the possibilities to implement a Strategic Approach to Adaptability. Project Management will therefore probably be vital in order to implementing successfully the Strategic Approach in the building's life cycle. Project Management issues will, however, be outside our scope.

**Measures**

Within a Strategic Approach to adaptability, there are a lot of more operational and practical issues and measures. These are the instruments by which the adaptability developed in the Strategic Approach can be put to work. In one of the initial workshops of this study[1], professor H. de Jonge suggested that these measures could be divided into:

- Measures in buildings
- Measures in use of buildings
- Measures related to finance and contracts.

Some of these measures, especially those related to physical measures in buildings, have already received a lot of attention both in practice and research. Due to time constraints, the specific measures will not be investigated in this project, but some of them will be mentioned when it is appropriate. Still, the successful implementation of decisions made through the Strategic Approach rely on knowledge about the different measures.

[1] Workshop Voorburg, 23. April 1998

# Chapter 3
# Research Methodology and Design

# Research Methodology and Design

This chapter describes the research philosophy and the methods applied in the research. The purpose of this research is mostly explorative, and an interpretative research approach has been used. This means that concepts and theories have been developed during the enquiry. An iterative research process, with empirical and theoretical studies, has been used. The work has been guided by a proposition. Research instruments have been interviews, workshops, and case studies, as well as a final example case study, which is employed to demonstrate the Strategic Approach in practice.

## 3.1 Research philosophy

In order to describe the research philosophy, it is important to define the purpose of the enquiry. In a traditional, positivist research tradition, research is seen as reporting, descriptive, explanatory, or predictive (Cooper and Schindler, 1998):
- Reporting. Enquiry made only to collect and summarise simple data.
- Descriptive. Descriptive studies try to discover answers to questions like: who, what, when, where and sometime how. Its purpose is to describe a situation, not to try to understand it.
- Explanatory. Grounded in theory, and new theory is created to answer why and how questions. An explanatory study attempts to explain the reasons for the phenomenon that the descriptive study only observed.
- Predictive. A predictive study is based on an explorative, but it will not only produce a plausible explanation for an event after it has occurred, but predict when and in which situations the event will occur in the future.

In addition to the purposes explained above, some research projects aim at exploring a certain field of knowledge. Although this study has some elements of both descriptive and explanatory nature, its main purpose is explorative. This means that it aims to explore a certain issue in order to understand it and to develop new knowledge. To prove causal relationships between variables, as in positivist research, will not be the objective of this study.

There exists a lot of theories and knowledge in practice about different aspects concerning adaptability, but there is a lack of theories that try to combine the different issues in the Building-User Relationship in a strategic way. This results in a need for both a construction of theory and enquiries of practice in order to understand the complexity of the problem. The main purpose is to start developing this understanding and to construct theories based on this knowledge. The ambition is to be useful for practitioners in dealing with the problems at hand. In this respect it is normative, although the main purpose is to discuss existing theories and practice and develop new knowledge related to the subject. The goal is that in construction projects and in management of office buildings, this work will provide the practitioners with knowledge and suggest ways to deal with the actual problems. But it will not prescribe one "right answer", as all situations are unique and require different solutions.

Theories from several different fields of knowledge are employed in order to create this theoretical basis, e.g. architecture, technical building sciences, building economics, construction, and real estate management and organisational theory. The development of the theoretical knowledge is done in a dialectic process with the empirical work. An initial case study (the Dagbladet project), the workshops, and the interviews are used as input to the theoretical knowledge building. This approach to research is interpretative.

Positivistic and interpretive scientific traditions are based on different ways of defining and understanding research. In a traditional, positivist, hypothetical-deductive scientific approach, the research process should be carried out as in the following (Robson, 1993):

1. Deducting a hypothesis from theory
2. Expressing the hypothesis in operational terms, which propose a relationship between two specific variables
3. Testing this operational hypothesis
4. Examining the results to confirm or reject theory
5. Modify theory if necessary

A positivist scientific method is suitable for controlled experiments and research which can be carried out in a clear linear sequence and under stable conditions. The method is more difficult to apply when one is dealing with real life situations and processes which change according to the impact made by different real situations and people. It is also difficult to provide a positivist approach when there is a lack of theory on which the hypothesis can be deducted. The interpretive approach offers an alternative:

> A major difference in the interpretive approach is that theories and concepts tend to arise from the enquiry. They come after data collection rather than before it. Because of this, it is often referred to as "hypothesis generating" (as against "hypothesis testing") research. Also, in the interpretive approach, data collection and analysis are not rigidly separated. An initial bout of data collection is followed by analysis, the results of which are then used to decide what data should next be collected. The cycle is then repeated several times. Initial theory formulation also goes on at an early stage, and is successively elaborated and checked as the process continues." Quote Colin Robson page 19 *(Robson, 1993)*.

Positivism aims at finding causal relations between variables, usually by applying quantitative and "objective" methods, and by generalising based on the findings. This work explores the relationship between buildings and their users, how this changes and how it can be managed in order to reduce the mismatches. There are few causal relationships between users and buildings; each situation is unique. Different organisations, people, environments, and processes ensure a great variety of situations, in which generalisation is difficult. Many factors contribute to the result, and the different factors may influence each other in a complex interplay. The interpretive approach is selected in order to be able to deal with this, as it relies much more on the researcher's subjective interpretations and understanding of the phenomena, and is more oriented towards theory building than theory testing (van Meel, 2000). Most of the research which has been done in this field earlier has, in a positivist, engineering way, concerned itself with the physical building. In this work is not only physical adaptability considered, but also the process of making the building, and the functional, social, and organisational aspects of adaptability. In this perspective, we have to deal with actors and decision makers who are acting with "limited rationality", inadequate information, and in highly context-dependent situations. This is difficult within the traditional, positivist research framework of the building industry. The interpretive research approach is chosen in order to deal with this, and accordingly a social-constructivist position is chosen as a starting point for theoretical understanding.

The social-constructivist position involves questions about how artefacts, like buildings, are produced by people in a social process, in order to reveal the processes behind what appear to be objective end products (Berger and Luckmann, 1966), (Bijker et al., 1987), (Klev, 1993). The present is a product of the past, and in dealing with adaptability, the processes are just as important as the product. The process of making the building will also embed meaning in the product, which is important to our understanding of the Building – User Relationship.

### 3.1.1 Studies of practice

During the project, several interviews and workshops were carried out, involving people in practice. The purpose of this has been twofold:
- To generate research questions and a scope which correspond with the need for knowledge in practice and with relevance to practice.
- To collect information and inspiration on how adaptability is dealt with in practice today, and how this can be improved. This is done by interviewing people who are believed to represent "best practice" or at least "good practice".

The main empirical body of this work is these studies of practice together with the 4 case studies. Neither semi-structural interviews or case studies are beyond criticism as research methods. They are very sensitive to the researcher's ability to observe and explore, and will easily be biased by personal preoccupations and blind spots. The knowledge gained from case studies is also limited to the place and time in which the case is conducted. This makes it difficult to generalise from case studies. A case study's external validity (its potential for generalisation) can be increased by replications of the case study (Yin, 1994), but even so, case studies are not instruments suited for generalisation.

Yin defines two different types of generalisation: statistical generalisation and analytical generalisation.

> "A fatal flaw in doing case studies is to conceive of statistical generalization as the method of generalizing the results of the case. This is because cases are not "sampling units" and should not be chosen for this reason". Page 31 (Yin, 1994).

Analytic generalisation, on the other hand, may be used as the method of generalisation. Analytic generalisation means generalising from case study to theory. A theory should be developed prior to the case study and used as a template with which to compare the empirical result of the case study (Yin, 1994).

The case study's main strength is its ability to provide a real situation in which practice can be studied, and contact with real actors who can contribute to the research with their practical knowledge. In this work, interviews and case studies are used for building understanding and new theories as well as for relating the research to knowledge in practice and to real-life contexts, and not for statistical generalisation.

### Knowledge in practice

The knowledge of practitioners is in many cases implicit and difficult for the researchers to get a grip on. One method which is widely used in the building industry as well as in management, is "storytelling". Brown and Duguid names "storytelling" as one of the tools that are used by communities of practice to pass on knowledge, search for new solutions and distinguish between the members of the group and "outsiders". In this way they identify storytelling in these communities as fundamental means of learning. Not all knowledge is explicit. Both Brown and Duguid, and Schön pays a lot of attention to "tacit knowledge":

> "Often we cannot say what it is that we know. When we try to describe it we find ourselves at loss, or we produce descriptions that are obviously inappropriate. Our knowing is ordinarily tacit, implicit in our patterns of action and in our feel for the stuff with which we are dealing. It seems right to say that our knowledge is in our action". Page 49 (Schön, 1984).

So what is that the practitioners know, but can not state explicitly in language? Ehn describes, based on Wittgenstein, three different kinds of understanding and knowledge (Ehn, 1992):

- *Propositional knowledge.* "When you know that something is the case and when you also can describe what you know in so many words". Example: Mont Blanc is 4807 meters high.
- *Practical experience.* "How typographers hold their knife when making up the page in paste-up technology". Example: How the word "game" is used.
- *Sensuous knowing.* "The typically sensuous knowing by familiarity with earlier cases of how something is, sounds, smells, etc". Example: How a clarinet sounds.

Ehn defines practical experience and sensuous knowing as “practical understanding” (Ehn, 1992), page 123:

> “Practical understanding – in the sense of practical experience from doing something and having sensuous experiences from earlier cases – defies formal description. If it were transformed into propositional knowledge, it would become something totally different” (Ehn, 1992).

The purpose of this study is to incorporate some of the knowledge from practice into construction of new theories. Case studies and in-depth, semi-structured interviews with people in practice are means to that end.

# 3.2 Research strategy

This research is carried out as an interplay between studies of practice (interviews and case studies) and theoretical studies. The empirical and theoretical work affect each other mutually. The research strategy has been guided by a proposition.

## 3.2.1 Development of the proposition

Within experimental research, a formal hypothesis is tested by experiments. Such formal hypotheses are not as well suited for explorative studies. As a starting point for this research, tentative hypotheses were developed. Robson defines such tentative hypotheses as “intuitive hunches of what is going on in a situation” (Robson, 1993). The tentative hypotheses were developed through workshops and during the initial work on this study into a proposition, on which this work is based. The proposition is presented in chapter 2, Problem Statement. The difference between a hypothesis and a proposition is described as:

> “The research literature disagrees about the meaning of the terms *proposition* and *hypothesis*. We define a **proposition** as a statement about concepts that may be judged as true or false if it refers to observable phenomena. When a proposition is formulated for empirical testing, we call it a **hypothesis**. As a declarative statement, a hypothesis is of a tentative and conjectural nature.” Page 43 (Cooper and Schindler, 1998).

## 3.2.2 Research process

The initial case study was the retrofit of Dagbladet in Oslo. This is described as one of the case studies in Chapter 5. This was carried out as a research project in 1996/97 together with a preparatory theoretical investigation. These theoretical foundations include knowledge about offices design in general, and of the relations between organisational theories and office design. This proved to be important input to the understanding of the problem in this research project. An earlier research project, called “Architecture and economy”, an investigation of Norwegian office buildings built in the early 1990's focussing on the design and construction phase, project management, and economics, also turned out to be of some relevance to this research.

Based on these experiences, a research framework with a general statement of the problems at hand was developed, as well as propositions and guidelines for interviews and case studies. During the project, the theoretical investigation and the empirical work has mutually affected each other, as the understanding of the complexity of these issues has become deeper during the project.

The presented methodology, the Strategic Approach, was in the final stage of the project applied to a real example, in order to show how it could be used in practice.

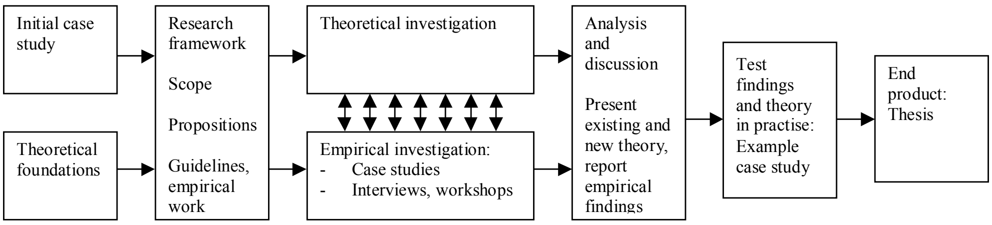


Figure 17. The interpretive research process and strategy used in this project.

In "Case study research", Yin gives the following overview of some possible research strategies based on the form of research question, the required control and if the studied events are contemporary (Yin, 1994).

| Strategy | Form of research question | Requires control over behavioural events? | Focuses on contemporary events? |
|---|---|---|---|
| Experiment | How, why | Yes | Yes |
| Survey | Who, what, where, how many, how much | No | Yes |
| Archival analysis | Who, what, where, how many, how much | No | Yes/No |
| History | How, why | No | No |
| Case study | How, why | No | Yes |

Table 1. Relevant situations for different research strategies (Yin, 1994)

This work focuses primarily on contemporary events outside the researcher's control. It is explorative and seeks to understand how adaptability in office buildings can be enhanced. According to Yin, the case studies are suited for this kind of study.

# 3.3 Research instruments

Research instruments are tools for collecting the necessary data. In this study, different types of interviews, workshops, and case studies are all used in the empirical investigation. The empirical material, transcripts from interviews, case descriptions, etc. are available on request. The cases are described in chapter 5.

## 3.3.1 Interviews

Interviews can be classified, ranging from fully structured to semi-structured and unstructured interviews (Robson, 1993). Most commonly, case study interviews are of an open-ended nature, in which you ask key respondents for the facts of a matter as well as for the respondents' opinion about events. Interviews can also be focused. They are still open-ended, but will follow a certain set of questions derived from the case study design.

In this project, open-ended, semi-structured interviews were used. Predetermined questions were asked, and the responses were recorded in a standardised questionnaire. The questions were based on the initial propositions and theoretical models. The discussion was, however, allowed to follow different directions as the interview proceeded. All interviews were taped and transcripts are available. A list of interviews is found in the attachments.

## 3.3.2 Workshops

The workshops were carried out as open discussions. Participants were people from practice, both real estate and in architectural practise, and from research. Each workshop had between 5 – 10 participants. A short presentation of the research topics have introduced the workshops, but apart from that, the discussions have been open and unstructured. Workshops were taped and transcripts are available. A list of workshops and attendants is found in Attachment 3.

## 3.3.3 Case studies

Case studies are defined as:

> "Case study is a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence." Page 52 *(Robson, 1993)*.
>
> "A case is a situation, individual, group, organisation or whatever it is that we are interested in." Page 51 *(Robson, 1993)*.

In this work the cases are buildings, studied during their briefing, design, construction, and management phases, and the buildings' users and owners. There are 4 case studies, and one example case, which is described later.

In designing a case study one needs (Robson, 1993):
- A conceptual framework, in this work represented by the BUR and the adaptability model.
- A set of research questions or propositions.
- A sample strategy, see "Sample" below.
- To decide on methods and instruments for data collection, see "Methods and instruments" below.

### Sample

The question of sampling is relevant both for the selection of case studies and for the selection of the issues one chooses to study in each case.

Formal sampling is called for in order to be able to generalise from the sample selected to the population of which it comes. This is standard procedure in survey and experimental designs. In case studies statistical generalisation is not the goal, and sampling is more a question of selecting the cases which can shed light on the issues one wishes to study. In multiple case studies, it is sometimes useful to apply some type of formal sampling in order to select the appropriate cases. While surveys and experimental designs call for probability samples, non-probability samples are more likely to be used in case studies. The cases in this study were chosen because they represent buildings in different stages of their life cycle. They were also chosen because they represent some specific point of interest in relation to the theoretical discussion and development of theories. This is purposive sampling, which is a kind of non-probability sampling.

> "The principle of selection in purposive sampling is the researcher's judgement as to typicality or interest. A sample is built up which enables the researcher to satisfy her specific goals in a project. ... The rational of such an approach is very different from statistical generalization from sample to population. It is an approach commonly used in case studies." Page 141-2 (Robson, 1993)

All cases share some characteristics: They are office buildings of medium-to-large size. They have all undergone building (major retrofit or new construction) during the last 10-15 years. There are 4 cases, one of them was carried out in the initial phases of this research. 3 cases are Norwegian and one is Dutch. The Dutch case is selected because it shows the principles of "Open building" very clearly, and because a radical life cycle approach to the project was applied.

The other question is related to selecting the issues to be studied in the cases. One needs a focus, because it is just not possible to study everything. Robson recommends that settings, actors, events, and processes should be discussed when making the selection (Robson, 1993). In this project, the setting is the office building. The main actors are user organisations, real estate managers, owners, and designers. The events and processes which are studied are planning, developing of user requirements, construction, adaptations, and retrofits. In short, the main issues which are considered in the case studies are:

- The building, technically and functional
- Building (or retrofit) process, actors, decisions, and organisation
- Potential strategies for adaptations
- Changes in use, ownership, and tenure
- Adaptations to the building or the organisation
- Other special points of interest in relation to theory and theory building

**Methods and instruments**

Yin defines six sources of evidence in case studies (Yin, 1994). Most of them have been used in this research:

- Documentation (letters, agendas, administrative documents, other studies and presentations of the study objects). This has been one main source of knowledge about the actual buildings.
- Archival records (such as maps and charts, drawings, organisational records, etc). These have been important both to understand the building and its site and the user and owner organisation.
- Interviews. Semi-structured interviews has been the most important source of knowledge, as some key informants in each case have been interviewed.
- Direct observation. Both formal and casual observation of the building and the activities taking place in them has been used. These are, as far as possible, documented by photographs. More formal post-occupancy evaluation, POE (Baird et al., 1996), has been carried out for one of the cases, but this is done as part of another study, although the results have been available to this project.
- Participant-observation. The researcher is not merely a passive observer, but has a role in the case. There is one case study, the Dagbladet case, where the researcher has taken part in discussions during the project.

**Analysis of the case studies**

Yin describes two general analytical strategies for case studies, one relying on theoretical propositions and the other beginning with a descriptive approach to the case (Yin, 1994). In this project, both were applied. The propositions, presented in Problem Statement, were developed after the initial case and the first theoretical investigations. Later they served as guides to both the empirical and the theoretical work.

The descriptive strategy has been used both in case study descriptions prepared during the research and in the final case presentations in this book. The cases are described in order to provide descriptive insight to the researcher and in order to give the readers a possibility of investigating each case themselves. In the case descriptions, the emphasis lies on the objective and descriptive quality of the presentation. Later, in the analysis, issues from the case studies are used in order to investigate further theoretical issues and contribute to theory building.

For explorative purposes, the issues from theory and the proposition are used to analyse the case studies. The issues that are raised in theory are discussed by using the empirical material in order to investigate the use of such strategies in practice and the relevance of the theoretical propositions. In chapter 7 and 8, the cases are used for developing further the Strategic Approach and specific tools, like layering.

### 3.3.4 Example: "The Consultants Inc. project"

In order to explore how the Strategic Approach relates to a real project, it has been applied to a real, but anonymised example; the new Consultants Inc. office building. The case is used to demonstrate how the Strategic Approach may be used in practice, and to summarise the different issues described in the previous chapters. The example has been explored by interviews and with building visits, after the building was completed. The Strategic Approach has not been actively applied in the building by the researchers. Instead, a simulation of the project and of how it might have been if the Strategic Approach was applied to it, was performed.

## 3.4 Validation

In order to judge the quality of the research, it needs to be validated. As we have seen, neither semi-structured interviews nor case studies are made for generalisations. In this work they are used in order to understand practice and develop knowledge about building design, construction, and management and the building-user relationship in relation to adaptability. Validations of research are logical tests by which the quality of the design can be judged. But positivist tests for validity are difficult to apply to the research, because of the nature of study and the data on which it is founded.

There are several aspects to research quality (Yin, 1994), (Robson, 1993), (Cooper and Schindler, 1998):
- Construct validity. Establishing correct operational measures for the concepts being studied.
- Internal validity. Establishing a causal relationship.
- External validity. Establishing the domain in which a study's findings can be generalised.
- Reliability. Demonstrating that the operations of a study can be repeated.

To deal with validity issues in this project, multiple sources of knowledge are used, among them several case studies and theories from different sources and professional traditions. Reality-checks have been used several times during the research, both in workshops and in formal project reviews by the group of supervisors. In addition to this, a final case study is used to check the Strategic Approach applicability in practise.

# Chapter 4
## Developing the Building - User Relationship Model

# Developing the BUR model

The relationship between a building and its users is constantly changing. In the introduction, some of the driving forces behind the changes in office work were presented. These changes challenge the adaptability of office buildings at the same time as the building itself goes through changes related to the building's deterioration and technical decline. The result is that the gap between the initial level of performance in the building and the increased level of expected standard (building quality, user expectations, and legislation) widens as the building ages.

The nature of office work is changing, and organisations develop, shrink, and grow. At the same time the real estate market is changing as well as the users' and businesses' expectations to office buildings.

This puts pressure on the office building to adapt to the organisations' changing needs. While demands are changing dynamically, buildings are more static. The relationship between a user organisation and a building is dialectic; it works both ways. The organisation will respond to the building at the same time as the building is designed and adapted to respond to the changes in the organisation. In the relationship between a user organisation and a building there will always be mismatches and continuous adaptation because of the changes both in the building and in the organisation. This is a challenge both to the owners and the users of office buildings. Changes and retrofits are expensive and will disturb the activities in the building, or make it impossible to let out during construction. The cost of working in an inefficient or inconvenient building is hard to quantify, but more and more organisations focus on reducing the negative and reinforcing the positive influences on business performance. The mismatch between organisations and buildings has serious financial consequences. This is discussed in attachment 2.

Because the Building – User Relationship is changing continuously, most of the time there is a mismatch between what the building can offer and what the organisation requires. This chapter presents the BUR and the mismatch. Later, the main issue is how this mismatch can be managed.

## 4.1 Building-User Relationship (BUR)

There is a dialectic relationship between the occupying organisation; the users, and the building. In this work, this is labelled the Building–User Relationship, BUR. The BUR consists of two subsystems, the building and the user organisation. The two subsystems are dialectically interconnected.

When we are studying the office and the relationship between the organisations and their building, we have to distinguish between *the needs* (requirements posed by the organisation) *and the physical structures which are supposed to answer to those needs* (the building / the facilities). We often call them the demand side and the supply side.

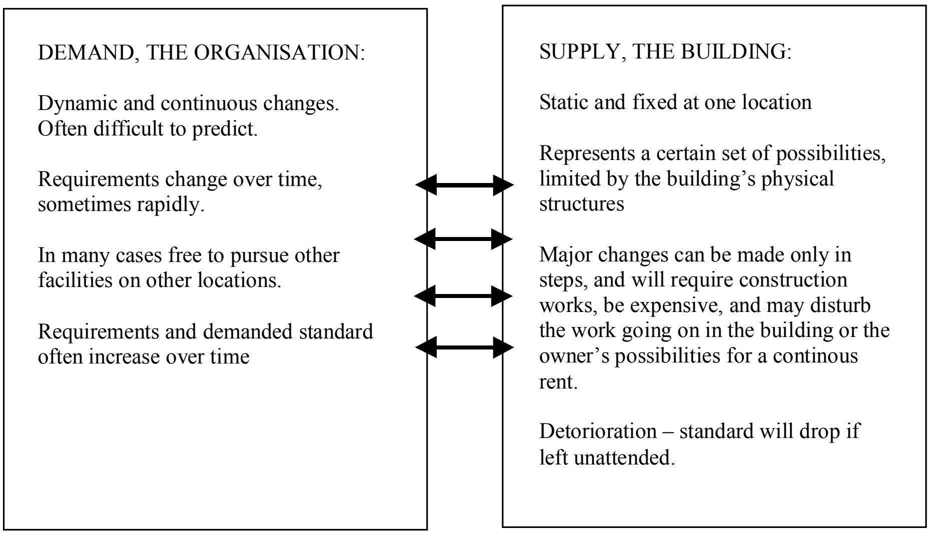


Figure 18. BUR, the Building - User Relationship. The User organisation (demand side), the Building (supply side), and the connection between the two, together make up the BUR model. The demand and the supply side have different characteristics; e.g. dynamic – static, etc.

Figure 18 shows the different characteristics of the two subsystems. The organisation is constantly changing, while the building has a certain set of possibilities which are defined during design and construction. How the two sides change is be discussed in greater detail later, in chapter 6, the Theoretical Framework.

Even though the organisation and the building are very different, and change differently, they will always adjust to each other, and the relations in the BUR will change accordingly. The BUR model is dynamic, not static. The BUR will adapt to the changes which are going on both internally and externally (in the environment). There are a lot of theories on adaptive systems, and they try to explain how complex systems revise and re-arrange themselves in response to such changes. How do the neurons in the brain, the stars in the universe, and the elements in a city arrange themselves? Terry Trickett quotes John Holland (Holland, 1975) in his article "Flexibility in Building Design" and shows that each complex adaptive system is a network of "agents" acting in parallel (Trickett, 1996):

> "In the brain, the agents are nerve cells, in organisations, agents may be individual workers, in towns, agents may be individual households. In all cases "each agent finds itself in an environment produced by its interactions with the other agents in the system." Nothing is fixed because, in complex adaptive systems, each agent is constantly reacting to what the other agent is doing." Quote (Trickett, 1996).

Complex adaptive systems have many levels of organisation. Building elements are made of materials, and make up the structure, the skin, etc. The individual building is part of a block. The block is part of a structure of blocks, which again make up a neighbourhood, which in turn will be part of the city. The Building - User Relationship will also consist of different levels: the individual, the group of individuals and the organisation on the demand side, and the different building levels on the supply side. The actual Building - User Relationship will also be related to the other BURs, as the relationship can be ended or at least changed dramatically by alternative locations or tenants, as the building is only one of several possible buildings, and the organisation only one of several possible users.

The Building - User Relationship is constantly adapting and rearranging itself. Because it is difficult to establish what is the trigger and what is the response, the relationship can best be seen as dialectic. We know that the organisation serves as an impact on the building and that the building serves as an impact on the organisation. The impact is probably not equally powerful both ways, as the organisation's needs is the starting point for any Building - User Relationship, and it is the user organisation that will, in time, move out of the building and end the relationship. This will happen at the point in time when the disadvantages of the relationship outweighs the advantages, and the BUR is broken. But as long as the BUR exists, it will always be a two-way relationship.

> "Design problems are often both multi-dimensional and highly interactive. Very rarely does any part of a designed thing serve only one purpose. The American architect Philip Johnson is reported to have observed that some people find chairs beautiful to look at because they are comfortable to sit in, while others find chairs comfortable to sit in because they are beautiful to look at." Page 56 (Lawson, 1997).

Traditional building design and research have focused on the physical side of the relationship.

> "We must learn to look afresh at the intricate ongoing symbiosis between people and built matter. There are sticks and stones, and there are people living among them: the two are inseparable, though readily distinguished." Page 8 (Habraken, 1998).

There exists some theoretical knowledge on how these systems behave. In relation to the work which is carried out in this project, however, the more applied issues will be the most important. In the following, the main topic is how the relationship has been described in other research projects and in different theoretical traditions. It starts with a glance at organisational theory, and later places focus on other research and theoretical projects which consider BUR from the workplace design point of view.



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### 4.1.1 BUR in organisational theory

Scientific literature on the role of the physical work environment within the organisation as a whole is scarce. According to Eric Sundstrom in "Workplaces, the Psychology of the physical environment in offices and factories", there are three types of theories on organisations, each of which treats relationships between people and their physical work-environment differently (Sundstrom, 1986):

1. Classical theories deal with the formal rules and roles in the structure of organisations, where the physical environment has had a role as it concerns individual efficiency and status. Generally, offices had a minor role.
2. Humanistic theories focus on the human psychological and social consequences of formal organisations; offices and factories represent potential sources of individual dissatisfaction.
3. Systems theories depict organisations as dynamic entities whose components exert mutual influence. Some systems theories have an explicit place for an organisation's internal physical environment, notably the theories of socio-technical systems.

| **Theory of organisations** | **Role of the physical environment** |
|---|---|
| *Classical theories:* | |
| Weber: Formal organisations | Symbols of office * |
| Taylor: Scientific management | Efficiency (economy of motion)Supervision * |
| *Humanistic theories:* | |
| Maslow: Hierarchy of needs | Satisfier of individual's basic needs |
| Herzberg: Satisfiers vs. Dissatisfiers | Potential source of job dissatisfaction |
| Likert: Linking-pin model | (None explicitly stated) |
| Homans: Groups | Proximity and accessibility associated with patterns of interpersonal interaction * |
| *Systems theory:* | |
| Trist: Socio-technical system | Part of the technological side of an organisation (key is fit with social organisation) |

* Implicit in theory

Table 2. Summary of the roles of the physical environment in theories of organisations, after Sundstrom (Sundstrom, 1986).

As we have seen, different directions of organisation theory treat the questions related to organisations' physical environment differently. But as a general rule, with some honourable exceptions like the socio-technical theories, this is a theme which has not attracted much attention over the years.

Sundstrom explores how the workspace contributes to an organisation's effectiveness by distinguishing between three levels of analysis: the individual, the interpersonal, and the organisational level (Sundstrom, 1986). On *the individual level* one finds theories about job satisfaction and individual performance, all of which are a result of both psychological, social, and physical factors at the workplace. *The interpersonal level* of analysis deals with the symbolic qualities of workspaces, influences on face-to-face conversation, and the formation and cohesion of small groups.

On *the organisational level* the effect of the physical workspace may be related to organisational structure, climate, and image. Sundstrom identifies four distinct lines of thought which suggest that buildings mirror the organisations that occupy them (Sundstrom, 1986):

1. Historical analysis of thinking and practice among architects, builders, and designers indicates an implicit acceptance of a connection between the properties of organisation and the features of the building (apparent in e.g. Duffy's work) (Duffy, 1992).
2. In environmental psychology.
3. Systems theories imply that the components of a system tend toward mutual accommodation, moving towards equilibrium within the system.
4. Theories of socio-technical systems suggest that organisations operate effectively only when their technological components, including buildings, operate in concert with their social and psychological elements.

> "All these perspectives imply that buildings reflect the properties of organisations. The two systems theories further imply a dynamic striving toward consistency between organizations and buildings. In other words, when buildings fail to mirror organizations, the discrepancy is thought to impel corrective actions within the organisation. If so, it should be possible to identify features of organizations with parallels in features of buildings!" Page 344 (Sundstrom, 1986).

When it comes to structure, Sundstrom's hypothesis is that each structural dimension of an organisation is reflected in one or more physical properties of the workplace, in a way which makes the physical structure congruent with the organisation. He suggests the relations shown on the next page.

When it comes to climate and image, Sundstrom did not uncover any empirical studies, and his conclusion is that there probably is a connection, but that it, for now, is a matter of speculation.

> "Despite the lack of direct, empirical evidence, it is difficult to deny the potential importance of the physical working environment for an organisation's effectiveness." Page 357 (Sundstrom, 1986).

What we do know is that the organisation, both on an individual, an interpersonal, and on an organisational level will be affected by the building, and that it will, in turn, adapt the building and its workspaces to fit its needs.

In more recent works in organisational theory, the physical aspects are given more attention. An example of this is Pfeffer's "New directions for organisational theory"

(Pfeffer, 1997) where he discusses the lack of attention in earlier works:

> “The effects of physical design on social behaviour remain relatively unexplored in the organizations literature and in related social sciences. … Organizations textbooks and courses typically ignore discussion of either the design of work environments or the effects of physical design on organizational behavior. … One possible reason for the neglect of the topic is that it represents “a problem-centered rather than a theory-centered set of activities.” Page 198 (Pfeffer, 1997)

Attention to dialectical change, flux, and transformation, such as in Morgan’s work (Morgan, 1997) is reflected in theories on the “information age” and its relation to space and time, urban development, and business, par example in (Castells, 1991), (Castells, 2000). One issue that is important for office design is that work is no longer restricted to specific places, but can be performed in a variety of locations. The recent attention to time, space, and place in organisational theory may benefit from a further development of the understanding of the relationship between organisations and buildings.

| Dimensions of organizational structure | Properties of the physical environment |
|---|---|
| Size: the total number of people and net assets | Space: the amount of floorspace in buildings |
| Technology: the extent to which processes in the organisation incorporate technology | Automation: the proportion of space devoted to machinery and equipment |
| Configuration: including numbers and sizes of work-units and the number of levels in the hierarchy | Delineation of work-units: through location, enclosure, and physical boundaries |
| | Differentiation by rank: of groups or individuals, using status markers |
| Interdependence: among work units and tasks, including work flow | Proximity of work-units: adjacent in the workflow |
| Specialisation: the number of different jobs and tasks included in the organisation | Differentiation by job or task: of workareas for work-units or individuals |
| | Enclosure of task areas or workspaces: for specific tasks or jobs |
| Centralisation: of decision-making, authority, and control to the highest-ranking members of the organisation | Uniformity of workspaces: within ranks and jobs |
| | Visual accessibility of workspaces: within subdivisions, for supervision |
| Formalisation of roles: including role-specification, emphasis on status, and emphasis on formal channels | Differentiation by rank: of individual workspaces |
| | Uniformity of workspaces within ranks |
| Standardisation: of procedures and specification of tasks | Rigidity of layout: within buildings and work-units. |

Table 3. Relations between organisations and their physical workspace, after Sundstrom (Sundstrom, 1986).

## 4.1.2 BUR in Workplace design and research

In this section, some works on workplace design and research are presented, which are based on an understanding of the relationship between users and buildings as dialectic.

**Organisational development**

Organisational development can be used as a name for a range of different approaches to organisations, change, and development. Within this tradition, which began in the United States during and right after the World War II, one can find work on e.g. teams, learning organisations, and action research (Levin et al., 1994). The literature on these issues is extensive, but falls outside the scope of this work. One of the more fundamental concepts of organisational development is formulated by Kurt Lewin, who describes organisations as social systems that are subject to counteracting forces; on one hand the stabilising forces, and on the other hand the wish for change (Lewin, 1951). He describes a theoretical model for change (figure 19) that has been fundamental for a lot of thought on organisational development.

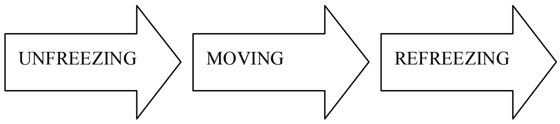


Figure 19. Organisational development. In the first phase one has to impact on the parameters that makes the system stable, one has to unfreeze the situation, before it can be moved, which is the second phase. In the new situation one has to find a new balance, and a new stability will be reached, the refreezing (Levin et al., 1994).

Within literature on new workplace design, it is often advised that the development of a new office concept should be related to a process of organisational development. In relation to Lewin's model, the new office can be used as a new mold in which the new organisation structure can freeze. As part of an organisational development process, the workplace design can be a powerful tool. In practice, unfortunately, we seldom find workplace-making as an integral part of organisational processes. This is shown e.g. in the work of Arge and De Paoli (Arge and de Paoli, 2000). When there is a link between organisational development processes and workplace design and implementation, the new office concept is perceived as much more successful by the organisation and the workers than when this link is missing. An idealised picture of a process where the organisation's challenges is the starting point for an organisational development process and alternative workplace strategies is shown in figure 20.

**Workspace Strategies**

In "Workspace Strategies", Jaqueline Vischer defines the organisation – accommodations relationship, which is literally the same as BUR (Vischer, 1996). She shows how assessments and evaluations of buildings in use can be used to improve the organisation – accommodations relationship. She describes the relationship like a marriage,



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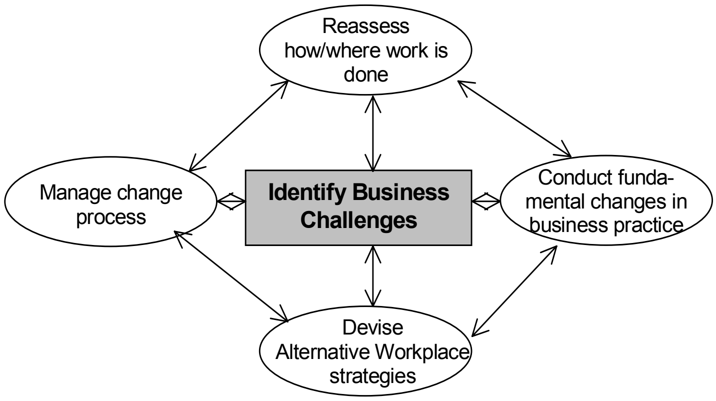


Figure 20. The “Implementation process activity model”, from (Becker and Joroff, 1995).

and states that there are identifiable stages in the evolution of the relationship:
- Finding space
- Planning and design
- Moving in and settling down
- Adaptation and change
- Moving on or out

She stresses that there are different agents or interveners at each stage, and that different decision-makers apply different quality criteria at each stage.

**Exellence by Design**

“Exellence by Design” (Horgen et al., 1999) identifies four dimensions which are important for office work: Organisation, Finance, Technology, and Space. They state that the four dimensions are in a dynamic relationship with each other, and that a change in one demands a change in the others.

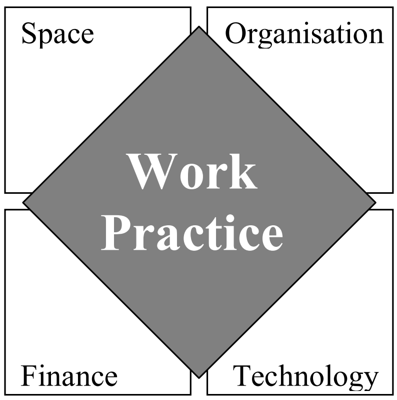


Figure 21. The Work Practice model, after (Horgen et al., 1999).

The main emphasis is on the process of creating workplaces, called *process architecture*. As an approach to workplace making, process architecture incorporates the different stakeholders and their approach to the workplace in a process to rethink the relationship between space, organisation, finance and technology.

This model takes into account the factors which are important to *the work practice*, and ends up with four factors. In the BUR model there are only two factors, and as the building – space and user – organisation factors are similar, one can ask why there are only two. The main point in this work is not to analyse changes in work practice, but the process of adapting buildings and their user organisations to each other. Both finance and technology are obviously important factors when one looks at how work is carried out, but will, within the scope of this analysis, not be the main factors of analysis.

**New Environments for Working**

The idea of a supply and demand model is also present in other research projects. In "New Environments for Working" (Laing et al., 1998), the writers explore the implications of new ways of working for the design of the office through the analysis of the relationships between the work process and the patterns of space use. They analyse the demands of organisations against the constraints and the opportunities of the supply of different building types. They define three sets of variables: work patterns, building types, and environmental systems, and examine the affinities between them. The findings are used to develop a number of rating tables to show the "fitness" of the different systems in relation to each other.

The logic between demand and supply in their research model is shown in figure 22. This work shares the basic understanding of the demand and supply model, but will not try to define "typologies" as in "New Environments for Working". Instead we will try to understand more about the process of matching supply and demand.

| | |
|---|---|
| *DEMAND* | Organisations/patterns of work<br>Time and space use<br>Environmental servicing demands |
| *SUPPLY* | Environmental systems<br>Building constraints for space and servicing<br>Basic building type |

Figure 22. The demand and supply model from "New Environments for Working" (Laing et al., 1998).

**Facilities Management and the Business of Space**

In "Facilities Management and the Business of Space" a lot of attention is given to a supply and demand model, and to the process of matching supply and demand (McGregor and Then, 1999). Figure 23 shows how they imagine the process of reconciliation of demand and supply via a methodology which evaluates demand from a framework derived from business and property needs.

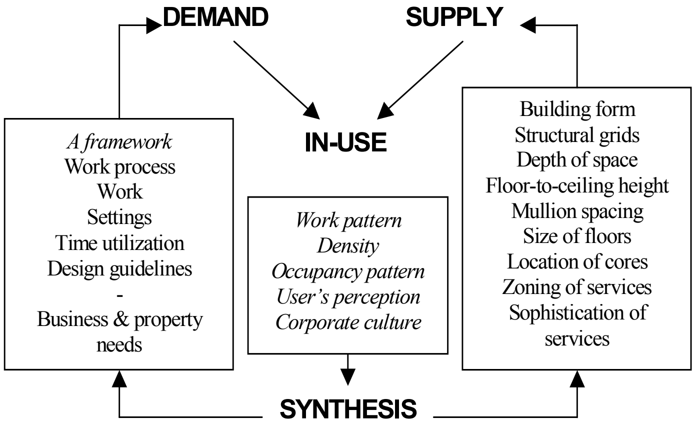


Figure 23. Reconciling demand and supply according to (McGregor and Then, 1999)

### 4.1.3 The mismatch

A situation with a perfect fit between supply and demand is rare. In most cases changes in BUR result in constant mismatches between supply and demand. When one tries to fit the two together it is probably not possible to look for a perfect match over time, so one will have to settle for "satisfactory" solutions.

The mismatch is a result of the intrinsic differences in the different subsystems' potential for change and pace of change. There will always be some kind of mismatch between what the organisation needs and what the building has to offer. The mismatch will vary from situations where there is an "almost perfect fit", where the building will be regarded as very well suited for its purpose, to situations where the mismatch is severe. The acceptable levels of mismatch may vary from situation to situation, and from organisation to organisation, but at some point the mismatch will be so severe that some kind of action must be taken. This work is focused on the management of the change process and on the mismatches.

Managing the mismatch is relevant both to the planning, design, and construction of new facilities as well as the management of existing buildings. In order to manage this dynamic and varying mismatch, a strategic approach can be applied. This is the main theme later in this work.

Figure 25 describes the making and management of a building and the development of the user organisation as two parallel and interdependent processes. The organisation changes constantly, but in the design and construction you have to freeze the supply at one point in time.

One of the main questions must then be about what kind of issues can be decided upon in which phase of the project. This must be part of a strategic decision-making process in programming, design, and construction, as well as in operation and use. This is one of the main themes in the subsequent parts of this work. For now we will focus more on how, in a life cycle perspective, the BUR relationship performs.

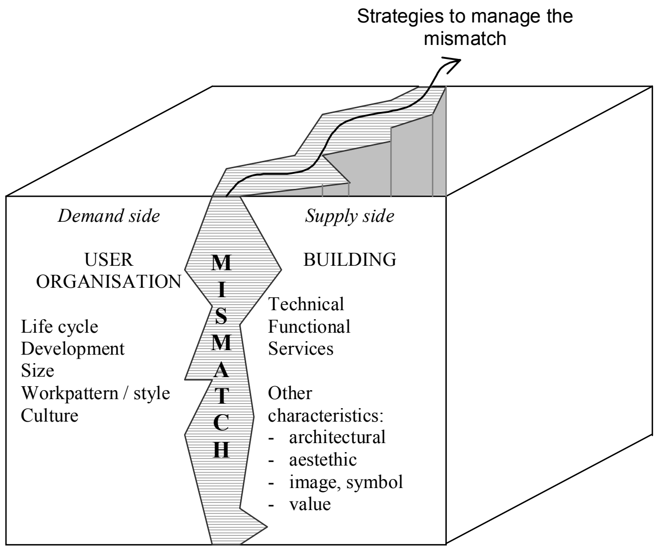


Figure 24. In the dynamic relationship between buildings and user organisations there will always be a varying degrees of mismatches. The mismatches can be managed over a period of time, by applying a Strategic Approach.

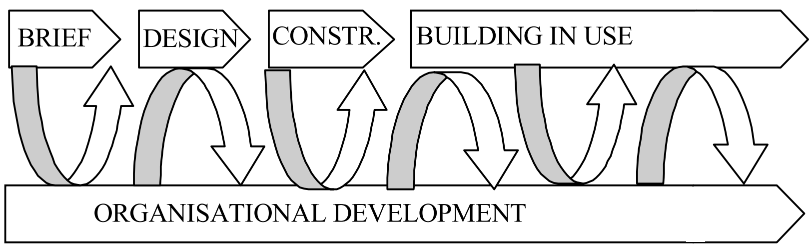


Figure 25. The dialectic process of BUR during the building's life cycle

## 4.2 BUR performance

Real Estate represents huge values, both as assets and as a means of production. Several writers point at real estate as the last under-managed resource in businesses today.

> "...real estate property has become the proverbial albatross of firms striving to compete in the new economic environment. From a physical standpoint, it is immobile, timeconsuming to acquire and modify, and prone to obsolescence. From a financial standpoint, it is relatively illiquid, and costly to acquire, modify and maintain. More importantly, from a managerial standpoint, it is one of the most neglected of all corporate assets and, as such, is typically managed with far less innovative methods than other assets of corporate magnitude." (Duckworth, 1993).

In order to achieve the best utilisation of facilities over time, one needs to optimise the relationship between buildings and their users. In the BUR perspective, buildings are not ends in themselves, but means, whose purpose it is to contribute to the organisation's performance. In this perspective, the building's performance will be defined by how well it serves the user organisation.

> *PERFORMANCE[1] – The degree to which a building or other facility serves its users and fulfils the purpose for which it was built or acquired; the ability of a facility to provide the shelter and service for which it is intended (Iselin and Lemer, 1993).*

To describe the building's value of use, we talk about its utilisation or performance. In many cases this is presented as figures that describe income, return on investment, area efficiency, etc., but value in use is more than that. It is also how well the building supports it users, how well it fits the activities taking place in there, and how well it contributes to its owner's revenue, risk profile, etc. In Attachment 2, some reflections on the financial consequences of the BUR mismatches are presented.

The utilisation of the facility must be viewed over a period of time. One of the problems when one wants to optimise performance, is that this period of time is different for different actors. Some may have a short-term interest in the facility, other may have long-term relations, both as users and as owners of a building. The different actors' assessment of utilisation over their "attention span" can obviously be very different, and their interests will differ a great deal depending on the duration of their involvement. Their strategies to achieve optimum performance will reflect the differences in the duration of their involvement. One example is real estate developers who own and manage their buildings over decades, while others develop them and put them on the market for sale as soon as they are completed. Obviously their criteria for performance over time are different, and the efforts they will put into adaptability in the building will consequently differ.

In order to achieve maximum performance in the organisation, buildings will be adapted as the way we work changes. In some businesses changes happen quickly, and a 3-month perspective is considered long-term. Other organisations change more slowly. Facilities which resist change and are constraints to meeting the organisation's objectives, are great challenges for those involved in real estate management and for general managers of organisations. To meet changing business needs in order to gain optimal performance, user organisations look for increased adaptability in their buildings. This means that improved BUR performance over a certain period of time is one of the most important reasons for looking for ways to increase adaptability.

## 4.3 Summary, the Building – User Relationship

In this chapter the Relationship between Buildings and Users was presented, and different perspectives on the relationship were offered, both from a viewpoint of organisational theory and workplace design. The mismatch that will be present in the BUR when demand and supply change was also discussed.

In the next chapters, a methodology for managing change and for planning for the future in order to manage the mismatch and to enhance adaptability is presented. In order to manage the process between supply and demand and to reduce the mismatch, we need to develop an understanding of the direction and the strategies for the future of the demand side, as well as a strategy for developing the supply side. The interface between the two has to be managed in a long-term perspective. This is the reason for applying a *strategic approach to adaptability*. The strategic approach will later be presented as a "mindset"; a way of thinking about adaptability, as well as a methodological framework for making strategic decisions about future change and adaptability. We will return to this after presenting the case studies.

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[1] PERFORMANCE - Differs slightly from the ISO standard, but is in principle the same: "**Performance –** qualitative level of a critical property at any point in time considered." ISO/FDIS 15686-1, 2000. International standard. Building and construction assets. Service life planning. Part 1 - General principles.

# Chapter 5
# Description of case studies

# Description and selection of case studies

The cases presented in this chapter have been used as empirical and practical means to explore the proposition and the problem statement, and have as such contributed to the development of the BUR model and the Strategic Approach presented later. As part of the interpretive research approach, both these cases and the other empirical material, the workshops and the interviews, have been used interactively together with studies of existing theories in order to develop the knowledge presented in the rest of this work. The cases have not been used for empirical testing.

In this chapter, the 4 cases are presented and issues related to BUR and the building process are described. This is expanded upon in the next chapters, where the cases are used to discuss, exemplify, and sometimes develop advance the methodology in the Strategic Approach.

In the last part of this work, another case is presented. The study of this case (Interconsult) is performed after the Strategic Approach was developed, and it serves as an example of how the Strategic Approach may be used in practice. The Interconsult case is not presented here, but in chapter 9.

The cases are presented in accordance with the following issues:
- Owner and user organisation
- Building
- Workplaces
- Building-user relationship
- Building process
- Adaptability (strategies and/or measures)

The cases in this work were used in an iterative way, and were together with the theoretical material, used to develop the understanding of BUR and the Strategic Approach to Adaptability, as described in Chapter 3, Research methodology and design. The cases are selected because they offer some perspectives on these issues, because of their special relevance, and in order to highlight some specific theoretical issues (like Office XX), or because they represent typical Norwegian offices and illustrate different approaches to BUR and adaptability (Gjensidige, Dagbladet, and Colosseum Park).

**Initial case 1. Dagbladet:**

| | |
|---|---|
| Owner/user structure: | The user is also the owner. |
| User organisation: | Newspaper. |
| Life cycle: | Existing buildings in use. Retrofit in 6 stages. |
| Building, size, location: | 7000 m² retrofitted and 400 m² constructed as extensions to floors 4-6. Several buildings, different ages, central areas in Oslo. |
| Relevance: | Retrofits and flexibility in existing buildings. Description of a long term BUR. A strategic, layered planning process, developed in stages. |
| Methodology: | Participation, observation, documents, and interviews. This initial case was used as input to the formulation of the problem statement. |

**Case 2. Gjensidige:**

| | |
|---|---|
| Owner/user structure: | The user is also the owner. |
| User organisation: | Insurance. |
| Life cycle: | In use, completed in 1991. |
| Building, size, location: | 42,000 m², big office complex, outside Oslo. |
| Relevance: | User participation and an example of a big organisation developing their own head office. Division between strategy, building design, and fitting out of the workplaces. |
| Methodology: | Interviews and written information, documents. |

**Case 3. Office XX:**

| | |
|---|---|
| Owner/user structure: | The owner is a big Real Estate investor. They have two tenants in the building. |
| User organisation: | High-tech firm and architect's office. |
| Life cycle: | In use, completed 1999. |
| Building, size, location: | 2000 m², two storeys, high-tech park outside Delft, NL. |
| Relevance: | The main objective was to design and construct a building which is changeable and flexible, and whose materials will be easily dismantable and possible to reuse or recycle after a life span of 20 years. |
| Methodology: | Interviews and written information. Co-operation on technical and environemental issues with three other PhD students, which perform qualitative and quantitative studies of materials, connections and environemental aspects to LCA and reuse. |

**Case 4. Colosseum Park:**

| | |
|---|---|
| Owner/user structure: | The user is also the owner. |
| User organisation: | Bank. |
| Life cycle: | In use, completed 1998. |
| Building, size, location: | 2 office buildings. Building 1: 11 700 m². Building 2: 18 550 m². Basement: 42 000 m². Central areas of Oslo. |
| Relevance: | Developed as commercial, multi-purpose project, later turned into facilities for the bank. Mismatch between building and the user organisation already before they moved in. Universal layout in all workareas. |
| Methodology: | Interviews and written information, case study material from NBI. |

# Case 1. Dagbladet


The newspaper Dagbladet addresses itself towards Akersgata.

### Owner organisation

Dagbladet is a large, Oslo-based daily newspaper, which occupies and owns an office complex in the central areas of Oslo, Akersgata. Dagbladet's primary goal was to stay in Akersgata, which houses the largest newspapers in Norway. In order to do this they had to adapt the existing buildings, which were far from ideal for flexible, modern offices. In order to cope with this difficult situation, they implemented a flexible and strategic planning process; a layered decision process. What is interesting about the case is that to be able to adapt the existing buildings, they focused on strategic planning and the decision process, and not only on the physial solutions.

### Building

In the 1980's Dagbladet occupied three different buildings: the oldest from the 1890's, the others built during the 1950's, and they realised that more flexible and modern offices and larger areas were necessary. Instead of building a new office building in the suburbs, the newspaper decided to refurbish and extend the existing office-complex in the central areas of Oslo. The newspaper's printing press moved out of the building in 1989, and the newspaper has been produced digitally since 1993. The buildings were ready for an extensive retrofit.

Owner: Dagbladet

Location: Akersgata, Central Oslo

Retrofit, construction: April 1995 - April 1997

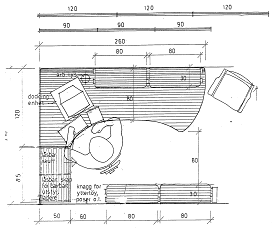
User organisation: Dagbladet

Architect: Hille-Melbye
Project Management: Åke Larson Construction

Workplaces at the "desk".

The main issues in the retrofit was:
- Extension to the 4. - 6. floor
- New, open flight of stairs through all floors
- General upgrades and retrofit of the building-complex

After economic and environmental evaluations, Dagbladet decided to refurbish the buildings in 7 stages (later reduced to 6), with normal daily newspaper production going on simultaneously. The planning process started in 1993 and the first construction stage started in 1995. When the last construction stage was finalised in 1997, 7000 m² was retrofitted and 400 m² constructed as an extension to the 4. - 6. floor.



Individual workplace for reporters, specially designed for Dagbladet by Ellen Hesthaug.

**Workplaces**

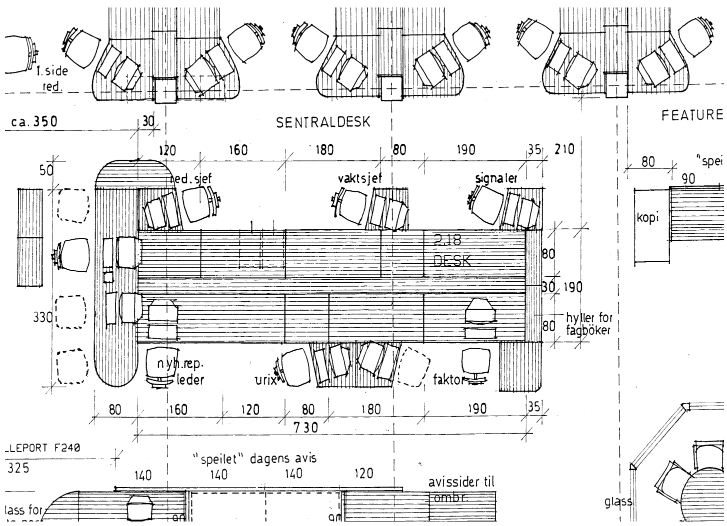
There are different groups and departments in the building. Some are open plan solutions, like the “desk”, and others are cellular, individual offices, like most of the reporters’ offices. In the beginning of the process, Dagbladet discussed the possibilities for implementing alternative office solutions. They decided on more traditional solutions, but the building was designed to be able to handle more innovative office layouts as well.

To create more flexibility, a limited number of interior elements and furniture was introduced. These were specially designed for the project, and the intention was to make it easier to move people and furniture around.

Size: 7000 m² retrofitted and 400 m² constructed as an expansion of the 4., 5. and 6. floor.

Number of floors: 6

Workplaces: 400




Left: The “desk” is the newspaper’s “heart”, and should provide easy access to all information and extensive communication. Everybody needs to see and hear each other.


Dagbladets first building in Akersgata was on the opposite side of the street. In 1954, the slogan "Always ahead" was created as an advertisement on the projected gable of the building (photograph by Sverre Heiberg).

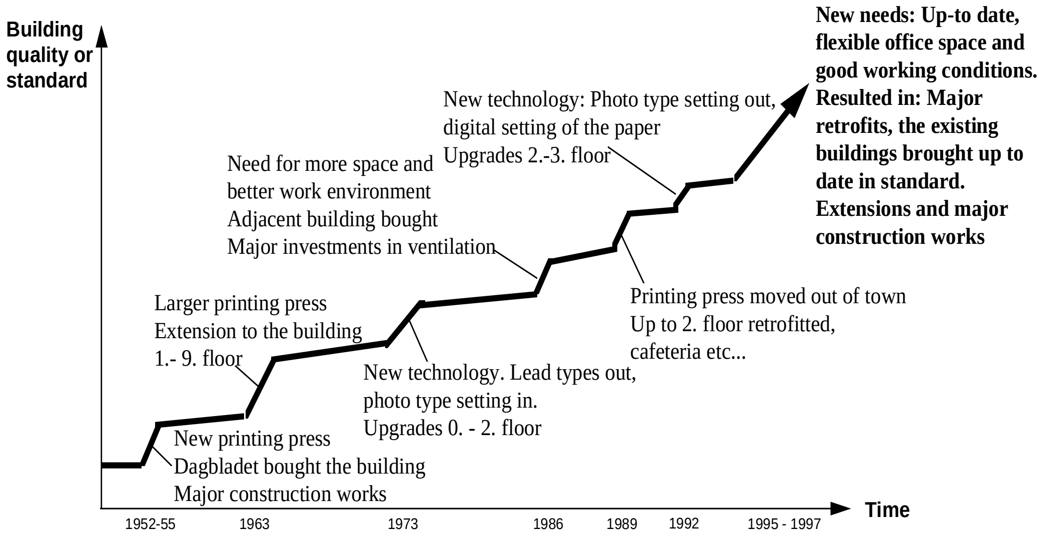
## Building - User Relationship

Newspapers change rapidly. In the production of daily newspapers, all deadlines are short and the work depends upon immediate action when something happens. Compared to the newspapers' time horizons, buildings are far too slow to meet the changing requirements and sudden shifts in requirements.

The newspaper Dagbladet has been located in Akersgata since the 1950's. From the very beginning there has been more or less constant retrofitting and expansion of the buildings. These changes were instigated by new technology in the production of the newspaper and new requirements regarding office work and work environments In a research project conducted in 1996/97, we mapped the retrofits and the changes in the buildings and in the organisation since they first moved to Akersgata. A schematic illustration of the development is shown below.

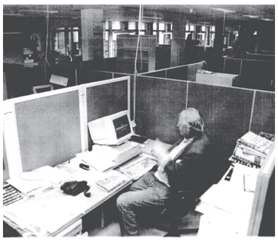
In Dagbladet the different properties of the three different buildings became evident during the renovation. The building from the 1950's was designed to fit the demands of that time as efficiently as possible, and was very area-efficient when constructed. Its ability to fulfil today's demands were, on the other hand, much poorer than the ability of the build-

The development of Dagbladet's buildings in Akersgata.



ing from 1890 (Blakstad, Christiansen et al. 1997). Low floor-to-ceiling heights and narrow modules between the windows were some of the problems that had to be solved by the designers. Even though this was given a lot of thought, and the best possible solutions were implemented, it is still possible to find many evidences of these problems in the new offices: too narrow offices, insufficient space for cabling and installations, and some floorplans suffering from fixed locations of meeting rooms and restrooms for smokers (these require more ventilation). These are examples of how physical constraints in the building limit the possibility for change.

Most of the workplaces were moved at least twice during the construction. This led to a lot of temporary workplaces during the construction period.



Reporters had to work in temporary workplaces during the construction period. These were labelled “Sarajevo” by the workers in Dagbladet (photograph by Jens Barland).

## Building process

Dagbladet decided to refurbish the buildings in 7 stages, with normal daily newspaper production going on simultaneously. This resulted in a very complex construction process, where individuals and departments had to move their workplaces at least twice. The planning of the moves received particular attention. The buildings were divided into smaller spaces, and some of the spaces were refurbished while the journalists and other staff were working in adjacent rooms. The building was a construction site and a workplace at the same time, and great care was taken to minimise noise, dust and other problems.

Dagbladet is a complex organisation: each department possess a great deal of autonomy, and the staff (journalists and administrative support) are very conscious about controlling their own work environment. This is reflected in the space layout and indoor environment and even in the way the refurbishment process is organised. Information to the employees and user involvement was necessary to be able to perform the construction and the daily work in the building simultaneously. The staff were made aware of moves and major construction works in advance, and if something went wrong they knew who to contact for advice. During the construction there were several incidents where departments suffered from unacceptable working conditions, e.g. large amounts of dust in work-areas when parts of the building were taken down. In spite of this, both Dagbladet and the contractors were satisfied with the results, due to good co-ordination and communication between the actors as well as extensive planning.

The R&D-project “Dagbladet” was carried out at the same time as the projects were planned and constructed. The Construction Manager (Åke Larson), Dagbladet and the research institute SINTEF carried out the project. The designers and contractors also participated in the R&D-project. The main objective of the research project was to document and evaluate the design and construction, with emphasis on the process, economics, adaptability, and productivity.

## Adaptability strategy

Cellular office

For Dagbladet there is one objective which is far more important than the others: The production of a daily newspaper! This is an absolute criterion of success. If Dagbladet fails to produce the newspaper, it has destroyed its own "raison d'être". Besides the strategic decision to stay in Akersgata and retrofit the existing buildings, these where the most important objectives of the project:

1. Effective production**.** The lines of production in the newspaper are the major guidelines in the design of the new offices.
2. Internal communication, between individuals and departments who are co-operating in the production.
3. Good work environment. To satisfy the regulations and to ensure a positive impact on individuals' health and productivity.
4. Flexibility. A changing organisation needs physical environments that are able to adapt. The physical limitations for change should be minimised.
5. Accessibility for customers.

For Dagbladet, one way of achieving the desired flexibility in their new offices was to accommodate a flexible design- and construction process. This fact became even more important because the renovation was carried out in 6-7 stages. While one part of the building was being renovated, other parts were still in the design phase. Dagbladet decided to make different plans according to the time span of the decisions involved. The decision hierarchy consisted of three different layers (see also chapter 8.3.6. for details):

- General plan (10-30 years)
- Master plan (3 years).
- Floor/department plans (day to day)

A pilot retrofit was carried out in the first floor, involving the canteen and the advertisement unit (photograph by Jens Barland).

Both the General and the Master plan were accepted by the general management and the employees. During development of the floorplans, there was an extensive user involvement at all levels of the organisation to ensure that the departments' needs were met, and because the departments and end-users were the ones who best could anticipate future changes in their own work. The built-in adaptability was used already during the final stages of the retrofit, as several departments which had moved into retrofitted areas had already changed their office layout. The two highest levels of the hierarchy were decided upon before the construction of the first parts started. The plans for the lowest level – the floor plans – were developed individually for each floor and department. This level can change very quickly, but the flexibility in this layer is dependent on the highest level decisions, which are taken in level 1, the General plan, and level 2, the Master plan.

Construction works, extension to 4. - 6. floor. The façade could not support the extra weight, so a system of internal pillars was constructed (photograph by Jens Barland).

## Adaptability measures

The retrofitting has been extensive, and the flexibility allows for easy, inexpensive and fast changes in the use of space. For Dagbladet, the time involved in changing the space layout is as important as the costs. To be able to change the office layout quickly and inexpensively, the following measures were used:

· Specification of the major communication areas both vertically and horizontally.
· Modular ceiling, internal walls, HVAC, and cabling.

In order to obtain the desired level of flexibility, Dagbladet invested about 5000 NOK/m² in the retrofit (1997). In the future, rearranging from cellular offices to landscapes will cost 200 NOK/m², and rearranging from landscapes to cellular offices will cost 500 NOK/m². The job can be finished in a night or a weekend. In order to make quick adaptations possible, they must not disturb the workprocesses in the newspaper. For Dagbladet, an uninterrupted production process is the most important of all economic considerations.

### Sources, case Dagbladet:

Blakstad, S. H., A. Christiansen, et al. (1997). Dagbladet hovedprosjekt, delrapport 3: Tilpasningsdyktighet i planleggingsprosess og kontorløsninger. Trondheim, Norway, SINTEF STF22 A97562

Barland, J., Blakstad S. H., et al. (1996) Forprosjekt Dagbladets Prosjekt-HUS. Trondheim, Norway, SINTEF STF62 A95024

# Case 2. Gjensidige Sollerud

Owner: Gjensidige

Location: Sollerud, close to Oslo

Start of development process: 1988

Construction period: 1990-1991

User organisation: Gjensidige

Architect: Petter Bogen Arkitektkontor
Constructor: Selmer Oslo AS

Main auditorium

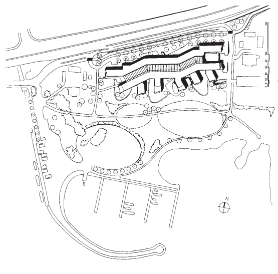
**Owner organisation**

Gjensidige is one of the largest insurance and financial companies in Norway, with customers both in business and in the private sector. Gjensidige consists of several units, each specialising in one segment of the insurance and banking market. The different units all invest capital in Real Estate. “Gjensidige Eiendom” acts as a Real Estate developer and manager for the buildings owned by the corporation. Gjensidige Eiendom is a commercial Real Estate developer, committed to long-term investments in Real Estate as a part of the management of Gjensidige’s assets. These investments have to have a long term perspective and a low level of risk.

**Building**

When Gjensidige in 1988 decided to unite their headquarters and administration in one building, they chose a site close to the Oslo Fjord, only 15 minutes drive from the city centre. Gjensidige’s new headquarters at Sollerud was finished in September 1991. It is a 180 meters long, 7 storey building. Two narrow building blocks (10.8 meters deep) run parallel with a glazed “street” between them. One of the office blocks runs along the main highway, the other faces the sea. The facade towards the highway is covered with stone cladding, while the façade towards the sea is much lighter, with aluminium cladding and more glass. The site is next to the Oslo Fjord, and towards the water additional

blocks are connected to one of the major blocks. The area between the building and the fjord is developed as a public park.



The building is located between the highway and the Oslo Fjord.

The structure consists of concrete elements resulting in column-free office blocks. Every office has an individual environmental control and most of them have operable windows. The building has high-standard HVAC systems.

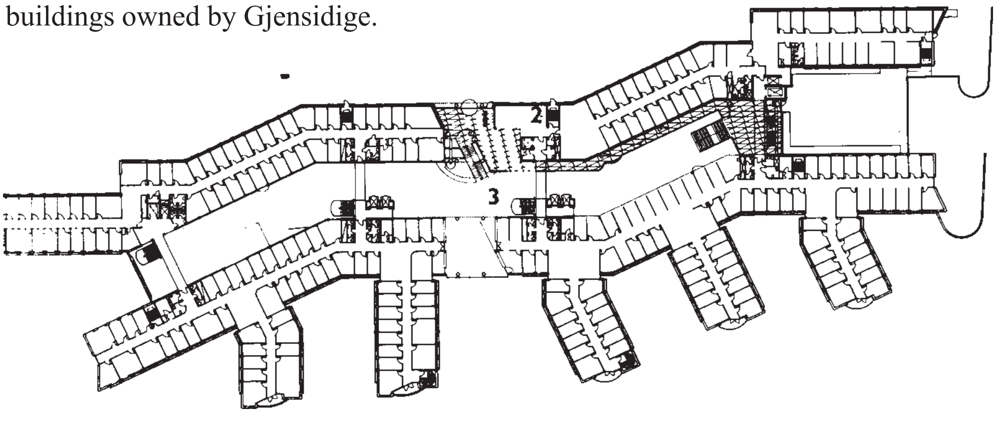
There are several meeting facilities in the building. Connected to the "street" are 6 large meeting rooms and assembly halls. 40 smaller meeting rooms, with room for approximately 10 persons earch, are located throughout the building. There are 500 parking spaces at three levels in the basement. The canteen can serve 540 persons. Other services are a kiosk, a travel agency, and an office equipment supplier. In the basement are sports facilities for the employees, with a fitness centre and showers.

Size: 54 000 m²

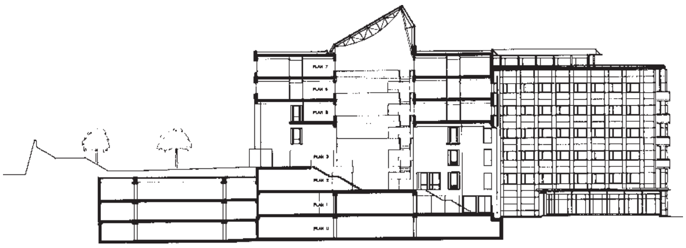
Number of floors: 7

Workplaces:1 200 - 1 480

The building has its own "in-house" Facility Management organisation. They are responsible for operation and maintenance, as well as for services as reception, telecommunications, security, transport, supply, and cleaning. Some of the heavier building maintenance and operation is carried out by "Gjensidige Eiendom", who takes care of this in the buildings owned by Gjensidige.




Plan of typical office floor.



Section through the two main building blocks. The entrance towards the highway is two storeys higher than the exit towards the sea.

Cellular, one-module office.

"The building is designed based on modules. There is a lot of "up and down" with the modular interior partitions. The thermostat is placed on the movable partition, and this means that we need an electrician every time we want to move a wall. … The interior partition modules are beginning to be worn out, and the supplier is out of the market. We managed to buy the rest of his stock when he went bankrupt. But now this is becoming a problem for us. … Standard elements don't fit this system. … We were 800 when we moved in here, today we are 1400. This is solved by subdividing the largest offices. So now most of the elements are in use."

Quote Kai Gustavsen from interview.

**Workspaces**

The office blocks are 10.8 meters deep and consist of a single corridor with individual, cellular offices towards the façades. At the time of construction there were 1250 offices, but the maximum capacity is 1480. They are all cellular and individual with a direct view towards the landscape or the internal "street".

## Building - User Relationship

The main strategic decisions were concerned with building individual, cellular offices for all employees, ensuring good indoor environment, and signalising the company's attitude towards its employees. In addition to this, Gjensidige wanted to appear as a solid company, which built high quality, but simple and without extravagance. These are all issues directly related to the Building-User Relationship, as it expresses the corporations intentions made visible through the building. These strategic decisions made a serious impact on the building's adaptability, as it led to a building concept that was best suited for cellular offices and for an organisation such as Gjensidige.

Another important lesson from the case is the number of moves within the building, and how these organisational changes (moves) make an impact on the building (need for rearrangement of walls and equipment). The Facility Manager estimates that there are about 500 moves in the building every year, and that about 300 of these involve moving walls. Moving walls is expensive, and finding new elements that fit the old system is impossible, see quote.

## Building process

When Gjensidige Insurance decided to build new headquarters close to Oslo, two people from their real estate developer were assigned to carry out and manage the project. The project leader was the head of the Corporate Real Estate unit. The managing director of Gjensidige and the steering committee, together with the project leader were the driving forces behind the project. The steering committee had the formal responsibility. The project had an extensive user involvement, as 6 user groups were working to define user requirements.

One of the first thing the CEO and the Project leader did, was to state their intentions and goals for the project in a short document or brief. This was the **main strategy,** and the project was developed according to this. They went to Stockholm and had discussions with SAS' CEO, Janne Carlzon. This was important for the strategy developed by Gjensidige, and the SAS building is obviously a model for Gjensidige's building. In the strategy, they stated that Gjensidige wanted to appear as a solid company, which took care of their employees but did not waste their clients' money on too luxurious buildings.

Corridors

The **initial brief** stated that Gjensidige wanted the maximum use of the site, cellular offices, and a high quality building with both a good indoor environment and services for the users, as well as emphasising a commercial potential. In this initial briefing phase the steering committee with the CEO and the project leader were the most important actors. The end users were involved at a later stage. The requirements, however, were the same as those developed in co-operation with the users for an earlier project, and based on a user survey.

The architect developed the **design** in co-operation with the project leader and the CEO. Major decisions were taken by the steering committee. The steering committee consisted of 3 representatives for management and 3 from the employees. There were few conflicts in the group when it came to the initial concept and the brief. The employees were in favour of the management's decision to go for cellular offices and the emphasis on work environment. The day-to-day management of the project was carried out by the project leader. In the development of the **brief for the interiors** and fitting out of the building there were several user groups, and they developed and stated their requirements on different issues related to the use and operation of the building. The user groups worked on the initial design, and some of them (like "interiors") continued their work into the detailed design and construction phase.

## Adaptability strategy


The internal street

The main strategic intentions in the Gjensidige case were related to the company culture and image, and the management's wish to meet the staff's preferences for cellular offices. These decisions led to a narrow building, and the main issue in the concept design phase was to create a building shape that would use the site as effectively as possible, and have the largest circumference possible to permit daylight into the cellular offices. Other office concepts were not considered. Today, the building is too narrow to be efficient with other office concepts than the cellular office, except for the end of each "arm", which can be used as teamspaces or open plan offices. Still, the internal communication in the building runs through the corridors, which means that there is a lot of traffic in the narrow buildings. One must therefore conclude that the building is best used as cellular offices. This will, of course, restrict the building's adaptability and possibilities to change to other office concepts and adapt to changing organisational needs.

The possibilities of subdividing the building into self-sufficient units were important to the company, because they saw the building as an investment that would be possible to rent out or sell, as a whole or in parts.


Large, cellular office.

The building process of Gjensidige was layered. The CEO and the Project and Corporate Real Estate managers initiated the project and made, together with the board of directors, all the earliest strategic decisions. In later stages the


The canteen at "street" level

user involvement was extensive. This makes Gjensidige a good example of a strategic, layered building process with extensive user involvement at workplace level.

Another interesting aspect of the Gjensidige case is the CEO's interest and direct involvement in the project. His, and the steering committee's, intentions were to build a representative and employee-friendly headquarters, and this is clearly expressed in the building. Gjensidige is thus a strong example of how an organisation's top management may use a building project as a tool for organisation development and for stating corporate values.

Board room

## Adaptability, measures

At workplace level, a lot of functional and technical issues restrict the possibilities of adaptation. In this case, most physical adaptations are done by moving interior partitions. The walls themselves are easy to move, but moving walls means that a lot of other systems and elements are affected. The electrical installations and the climate control must be taken down and reinstalled. The original carpet continued under the movable walls, but it had to be removed because it wore out quickly. In some offices it was replaced with new carpets which did not continue under the walls. So when a wall is moved, the gap must be covered by a piece of new carpet. The problem of replacing the original wall modules, when they are worn out, has already been mentioned.

### Sources, case Gjensidige Sollerud

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"Arkitektur og økonomi, tre kontorbygg" report by Halvor Westgård. 1995
Interview with Facility Manager Kai Gustavsen, Oslo, April 28., 1998
Telephone interview with Managing Director, Gjensidige Eiendom, Kjell Hande. June 25.,1998
Interview with Managing Director, Gjensidige Eiendom, Kjell Hande. August 19.,1998

# Case 3. Office XX

Owner: Wereldhave N.V.

Location: Delft Tech Park, The Netherlands

Start of development process: 1996

Construction period: June 1998 - March 1999

User organisation: Architect's office (XX)

Architects: Post ter Avest Architecten
Civil Engineering: ABT
Installations: TU Eindhoven
Constructors: BAM

Research project: BOOSTING, TU Delft, TU Eindhoven

The Office XX is the result of a research and development project, carried out in cooperation between the owner/developer, the architects, and several research groups. The main objective of the project was to develop a building which is flexible and dismantable through a expected functional life span of 20 years (XX).

### Owner organisation

The Office XX is developed and owned by Wereldhave. The building is intended to be rented out commercially to small high-tech-related companies. Wereldhave is an international company. In 1998, they were conducting development projects for 500 million NLG in 7 different countries. They state their main reasons for their involvement in the research and development project as:

- Accommodating future change
- Environmental and sustainability issues
- Flexible and secure investment

### Building

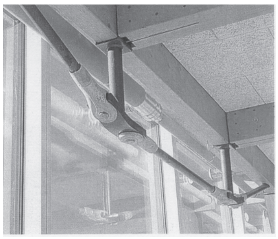
The building is located in Delft Tech Park. The purpose of the park is to house small technological entrepreneur companies. Several buildings, on a relatively small scale, are built in the area, and new ones are currently under construction. Office XX is a two storey building, with a glass facade. The appearance is of a small "glass box", with a simple, rectangular ground plan.

The Office XX was studied in cooperation with Dutch PhD-students. Their main focus has been on the more technical aspects of flexibility; connections, assembly and disassembly, and reuse of materials. Thanks to the following PhD students at TU Delft: Pauline Boediano, Elma Durmiševic and Nelleke Guequierre.



URN:NBN:no-2306

The office is characterised by a hybrid wood and steel load-bearing structure. The load-bearing structure consists of rectangular, laminated wooden columns and beams, joined together with steel hooks and bolts in order to facilitate easy assembly and dismantling. In order to reduce the height of the main beams, they are completed with a steel understain.



Detail of wood and steel structure, wooden columns and bolts.

The building rests on a foundation of concrete piles and a ground floor of recycled concrete on steel joists. The second floor consists of multiplex cassettes, filled with sand and covered with cement bounded slads.

Size: 2140 m²

Number of floors: 2

Workplaces: 80-120

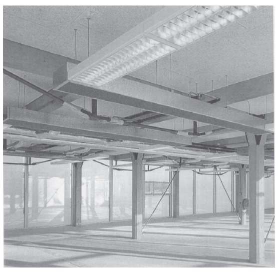
The façade consists of wooden frames with a simple, rectangular shape. The window panels are made as large as possible and contain triple-layer glass. There are no additional, traditional insulation materials.

Floor tiles are made from recycled plastic, and can be rearranged, as they are not glued to the floor. Indoor partitions are made of glass, and are attached to the wood structure and between the floor tiles.

Blinds preventing glare

The glass runs from floor to ceiling, and the glass facade is covered on the inside with semi-transparent venetian blinds (Luxaflex). These are made of fabric, and function as shading and as a part of the climatic façade. The air between the fabric and the glass is sucked into a heat recovery system. Cardboard ducts form the basis of the heat recovery system. The building has some small, operable windows.

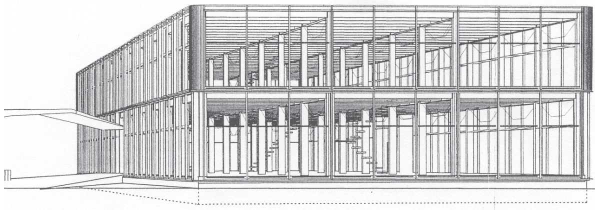
Interior space, ground floor



## Workspaces

XX Architecten occupies the ground floor of the building. Each floor is split in halves. Each side is designed for 20 workplaces. At the moment, 33 persons occupy one of the ground floor parts. The architects moved into the building in March 1999. So far their experiences have been very positive.

Structure



The building is constructed as an open frame structure so that changes in the office layout can be carried out easily. The workplace layout has not been changed yet. Most of the ground floor has an open plan layout with workplaces in an open landscape. Meeting-rooms are enclosed by glass walls, which can easily be moved. A semi-enclosed group space is used by the three partners. On the first floor there are some enclosed cellular offices along the facade on one side.

Partners' office and meeting -room.
XX Architecten

Open plan workspaces, ground floor.
XX Architecten

## Building - User Relationship

The users rent the building from the building owner. The tenants at the ground floor have, however, a first hand involvement with the building and the building process, as they are the architects behind the project. They are very satisfied with the result, and use the building as a reference project.

Some changes have been taking place in the way the building is used: the workspace in each of the halves at the ground floor is designed for 20 persons, but now holds 33 workplaces.

## Building process

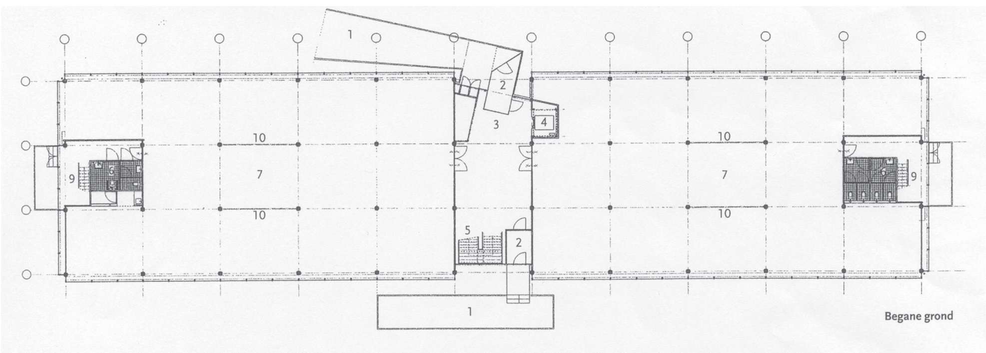
The idea of a flexible and adaptable office building was born when G. D. J. Verweij from Wereldhave and Jouke Post from BOOSTING started to discuss their common interest in flexibility and environmental issues. The development process started in spring 1996. The land was purchased in the beginning of 1998, after two years of research and development. The construction was completed in March 1999.

BOOSTING is a group of architects, product designers and manufacturers of building elements. Their main goal is a more industrialised way of construction, and they are the backbone in the research team, which in addition to people from BOOSTING consists of researchers from both TU Delft and from TU Eindhoven. Representatives from the investor participated in most of the workshops. The contractor joined the team in February/March 1998.

*"We are concerned with the demolition phase. But we are also confronted with sections of the building having to be replaced after 10 years. Materials are dumped in the skip. They have no function anymore, but they are not yet worn out. This costs an awful lot of money, and in the light of that we say that if materials no longer have a function, they ought in any case to be reused or recycled. We have challenged each other to aim at this objective in project XX."*

G. D. J. Verweij from Wereldhave, quote from Project XX video.

Floor plan, ground floor



# Adaptability strategy

**Future use**
One of the reasons for developing the XX concept was to make the building adaptable to changes in future use. Still, the fear of becoming obsolete is a concern for every building owner:

*"Imagine that nobody will use Delft Tech Park as an office park anymore. Even when the building is perfect. We have old cars today that are perfect, but we do not want to use them today. So it is possible that nobody will use Delft Tech Park anymore as office space. Who knows?"*

Quote from interview with G. D. J. Verweij, Wereldhave.

Buildings built 25 years ago stand empty, composed of materials that should last between 75-100 years. This is in conflict with the philosophy of durable building. Jouke Post seeks a solution to this in matching the life span of a building with the length of its functional life. (Project XX video)

"*It came a time when it occurred to us that building for eternity is nonsense. Actually, buildings should not stand for longer than needed, 20 years for example.*"

Quote Jouke Post. Project XX video.

The R&D part of the project was developed in stages over a period of 2 years. BOOSTING arranged workshops where the strategy and ideas were developed. In the beginning, the idea was to develop and design a general and flexible building which would be able to transform from an office into any other function. They wanted a building which could change and transform par example from an office to an industrial building, by removing the first floor. They later abandoned this idea, because of restrictions put on the use of the land.

The next idea was to develop a building which would collapse after 20 years. This would mean that the building and the materials would not have a function after 20 years. But they soon realised that this was difficult, because normal materials last much longer if they are properly detailed and maintained.

### The chosen strategy

The final idea, which is the basis for the development of the XX project, was to build a building where all the materials will be recycled or reused afterwards.

XX stands for 2 times 10. The philosophy behind the building is that the building is designed to last for 20 years. This is motivated by the fact that functions change fast, and the technical lifespan of the building is therefore aligned to a theoretical functional life of 20 years. After 20 years, all parts of the structure and the facade can easily be disassembled, recycled, or reused. This means that all materials, details, and connections in the structure are designed with that in mind in order to make it easy to change and dismantle the building.

# Adaptability, measures

The challenges posed by functional change have led to a strategy where different parts of the building can be easily changed in order to satisfy new user demands. This is most important when it comes to finishes and internal partitions. The main strategy here is straightforward: Easy and cheap to change!

Several measures are taken in order to fulfill the overall strategic intentions:

- The building is designed and constructed to be flexible, dismantable, and removable, by using flexible connections, in such a way that components can be reassembled, changed, and recycled.
- The decision-making is divided into two levels, which correspond with two physical layers in the building: “support” and “infill”. It is emphasised that it is important to keep these layers separate in production and assembly phases. There should be simple interfaces and connections between the different components and layers.
- The materials and components used will be evaluated and chosen according to their environmental efficiency during the lifetime of the building. Expected functional life-span and expected technical life-span are used in order to choose and design the building with the right materials and components.

*“Renovation often has the same price as building new”* (Project XX video).

*“The point of departure was developing a product to last 20 years, involving far less pollution than traditional buildings. Proof of this is underpinned by an Eco-Quantum analysis, where you can see that the building indeed involves far less environmental pollution and uses less energy than other buildings.”* (Project XX video)

### Sources, case XX office

Interview with Gijs D.J. Verweij, Wereldhave N.V., den Haag 29. 6. - 1998

Investment analysis, Kantoor XX, Wereldhave N.V.

“The environmental performance of Project XX improved with the Dutch tool Eco-Quantum”. W/E consultants sustainable building. Bouw nr. 6. 1999

Building walk-through and interview with John van der Gaag, XX Architecten. 27. October 2000

“Project XX - the temporal office”. Project description and drawings. XX Architecten

“Project XX.” Presentation video. Post Ter Avest Architecten, Wereldhave, S.E.V. DPI Animation House

Case study materials and analysis. Pauline Boediano, Elma Durmiševic, Nelleke Guequierre, Siri Blakstad. TU Delft 1998-2000.

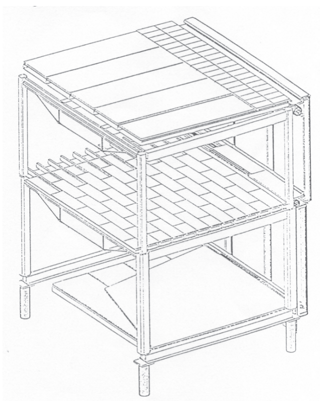
“Milieuvriendelijk, maar niet duurzaam.” Ed Melet, de Architect. March 1999.

“Bouwen voor even.” BouwWereld nr. 4, February 1998. Interview with Jouke Post.

XX Architecten: www.xxarchitecten.nl

The building’s systems and materials, their connections and assembly sequences, are analysed in more detail in the other related PhD-projects.

Analysis of assembly and disassembly sequences. Elma Durmiševic



# Case 4. Colosseum Park

Owner: K-bank

Location: Majorstua, Oslo

Start of development process: 1990

Construction period: 1996-98

User organisation: K-bank

Architect: Niels Torp AS

Interiors: Beate Ellingsen AS

Constructor: NCC

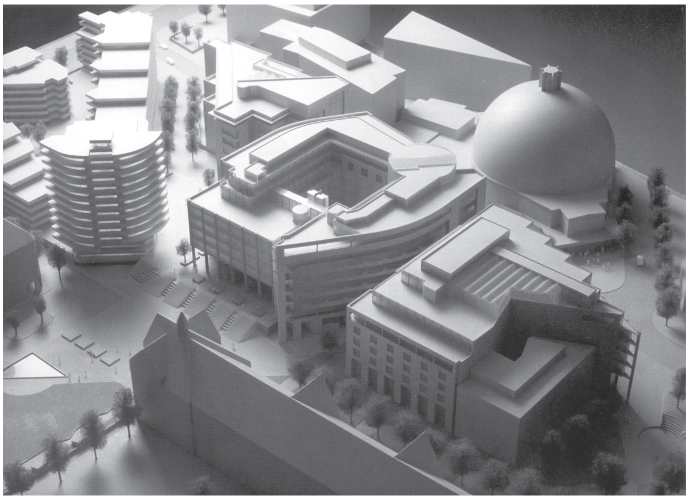
Completed in 1998, Colosseum Park consist of two new office buildings for one of the largest Norwegian banks, *Christiania Bank og Kreditkasse* (K-bank). Together with a third building from the 1980's, they are the bank's headquarters in Oslo. The two office buildings are designed and constructed as general, multi-purpose office buildings, fit to be rented out on the commercial market.

**Owner organisation**

K-bank owns the buildings and is also the user. K-bank was established in 1848, and is today one of the largest banks in the country, with 160 offices nationwide. During the last years, there have been several attempts to merge with other financial institutions. Today, K-bank is part of the Nordea Corporation, one of the largest financial institutions in the Nordic countries. Earlier, K-bank was located at several sites in Oslo, and they wanted to bring all the different departments together under one roof. In the beginning, they planned offices for 1270 people. When they moved in, the number had increased with 170.

**Building**

The project Colosseum Park consists of two new office buildings for K-bank, Essendropsgate 7 and 9. Both buildings are built around a courtyard. One is covered with a glass-roof like an atrium, the other is open. They are both 9 sto-



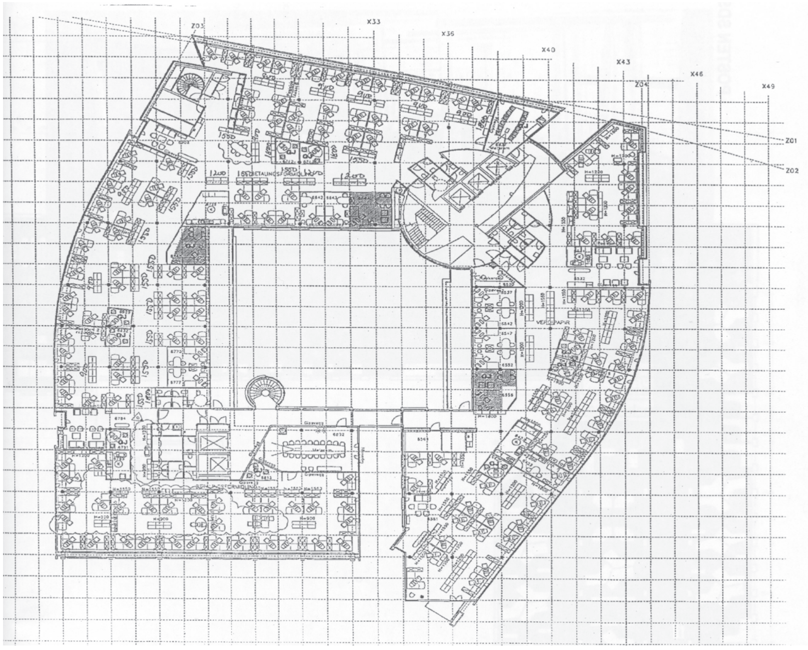
ries high. In addition there is a 4-story underground parking facility, with room for up to 600 cars. In addition to offices, there is some space which is rented out to commercial activities. Both buildings are rather deep (16-23 meters) and are best suited for open plan offices. On most floors, the ratio is 15% cellular offices to 85% open-plan workplaces.

The total number of workplaces in Essendropsgate 7 and 9 together with the next-door building Middeltunsgate 17 (K-bank's building from the 80's) is 2300. During the last two years since K-bank moved into the buildings, 1300 people (in year 2000) and 1000 people (planned for 2001) have been moved around within the buildings. This means that about one half of the employees are moved every year! To handle this extensive churn, K-bank has a group of people who plan and implement the different changes in the building. All moves have so far been done without changing the workplaces or the layout of the building. The universal layout is the same on all floors, and so is the furniture. Only personal equipment and the personal office chair are moved to the new workplace.

Size:
E 7: 11,700 m²
E 9: 18,550 m²

Number of floors: 9

Workplaces: 1440



Plan of typical office floor: Workspaces in Essendropsgate 9.

## Workspaces

Space for rest and informal communication

The workspace is developed as Universal plan offices, with the same layout and the same elements on all floors. Only the ratio of cellular to open plan offices varies between the different departments. This is done to increase the flexibility of the building.

On each floor there is a universal layout, with silent rooms, areas for relaxation and breaks, coffee machines, and mail-distribution. Filing cabinets and shelves divide the open-plan space into several team-spaces, each consisting of 4-12 workplaces. The cellular offices are primarily for managers. The workspaces are personal, and not intended as shared workplaces.

The entire building is defined by a grid of 2.5 × 2.5 meters. Each module can be independently controlled and supplied with air, light, and ICT. The user can control the temperature himself (within ±3 °C), or call the building operations' helpdesk, which can control this centrally from the building management system.

The Norwegian Building Research Institute has conducted a POE of the buildings and an in-depth study of 3 departments (Arge & Landstad, 1999) (Arge, 2000). These studies show that the overall satisfaction with the physical work environment is high in most departments. Nevertheless, a drop in productivity has been reported. The studies were done a short time after K-bank moved into the building, and it is not known if this tendency still prevails. The in-depth study showed that a lot of other factors did influence on the employees' satisfaction with the building, such as the process of relocation, lack of user involvement and limited possibilities for adaptation of the work environment to fit the departments' wishes.

Open workspace

## Building – User Relationship

The bridge between E7 and E9

Facade

The bank management's primary project goals were financial flexibility, area efficiency, and location of all of K-bank's departments at one location. More strategic goals were not developed concerning organisational development in relation to relocation and use of the building.

All floors are developed according to the same universal plan, and local adaptations in each department have only been accepted within the predefined flexibility. Wishes for different use of materials, privatisation of shared silent rooms or rest areas, have all been refused, as it would restrict the flexibility and the possibilities of moving people and departments within the building.

Most departments did not perform an organisational preparation and development process in front of the moving-in. A project organisation which should plan and assist in the moving process was developed, but their interests were mostly logistics and distributing space and equipment for each department within the predefined universal solution.

During the last half year before K-bank moved, the different departments realised what was going to happen, and started to articulate their interests, needs and preferences. Adaptations for special departments, such as post, repro, and cash management, were developed, and an additional 40 million NOK were used to adapt the buildings to their needs. For other departments, with normal office work-processes, no adaptations were accepted, except for some changes in the ratio of cellular to open plan offices.

The lack of preparation in the organisation and the refusal of local adaptations resulted in lack of satisfaction in some departments. But the overall satisfaction with the buildings and the physical work-environment was good.

## Building process

When Kredittkassen built their new offices in Middeltunsgate (1985-89), they also acquired a larger area nearby. They developed a plan for this area, with a mix of commerce, offices, and dwellings. The plan came to a halt because of a bankruptcy in 1991, when only the underground parking was built. In the mid 90's, when the bank's financial situation had improved, they decided to start developing the project again. A new architectural competition was held, and Niels Torp won with a project that consisted of one block of dwellings and three office buildings. One of the office buildings and the dwellings were sold to other developers, and K-bank decided to develop the remaining two office buildings as commercial buildings, intended to be rented out. Only later in the process did K-bank decide to use the buildings themselves.

From the beginning, the project was developed as commercial multi-purpose office buildings. When the bank's board of directors decided in 1995 that K-bank should use the buildings for their own organisation, the main concept and the main strategies were already developed. Multi-purpose buildings with focus on financial flexibility and universal workplace solutions should ensure the needed flexibility. Less attention was given to the fact that the bank itself should move into the building. In order to facilitate the organisational part of the relocation, assistance in the moving process was offered. This was just an offer, and not a mandatory process, and most department managers did not understand the need for such a process. So even though the bank itself was moving into the building, very little input from the users, the bank's departments, was given into the development and construction of the building. Organisational processes to determine best ways of working in the building, development and statement of needs, and preparation of relocating and moving into new facilities, were also very limited.

Atrium

The project was organised with a building committee, which reported to the bank's CEO, and a project group that took care of the direct development of the project. The Corporate Real Estate and the Facility Management organisation was not in charge of the processes. The CREM was, however, a member of the building committee, and during the last two years of the development process, the future head of operation of the building was participating in the project group.

## Adaptability

Financial flexibility has been the most important goal in the project, and multi-purpose buildings were developed as an answer to this. Both buildings, or parts of them, can easily be rented out. The buildings are built to be partitionable, and each floor can be sub-let independently. There is a canteen in each building, and possibilities for separate entrances and receptions. The main strategy to reduce the number of square meters in case K-bank's need for space decreases, is to move out and let out floor by floor in Essendropsgate 9.

The main strategy for flexibility between the different floors is the Universal layout. This means that all floors are more or less identical, and that equipment and furniture are the same everywhere. The universal workplace layout ensures flexibility to move people and equipment around, but limits the possibilities of adapting each floor to the specific needs of the users and the user department.

### Sources, case Colosseum Park


Interview Olav Egil Sæbø, Corporate Real Estate Manager. 12. June 01

Meeting with Kirsten Arge, senior researcher, NBI. 12. June 01

Building walk-through and discussions with Signe Nyland, head of office service department, and Gudmund Nyrud, Senior Vice President, 23. August 01.

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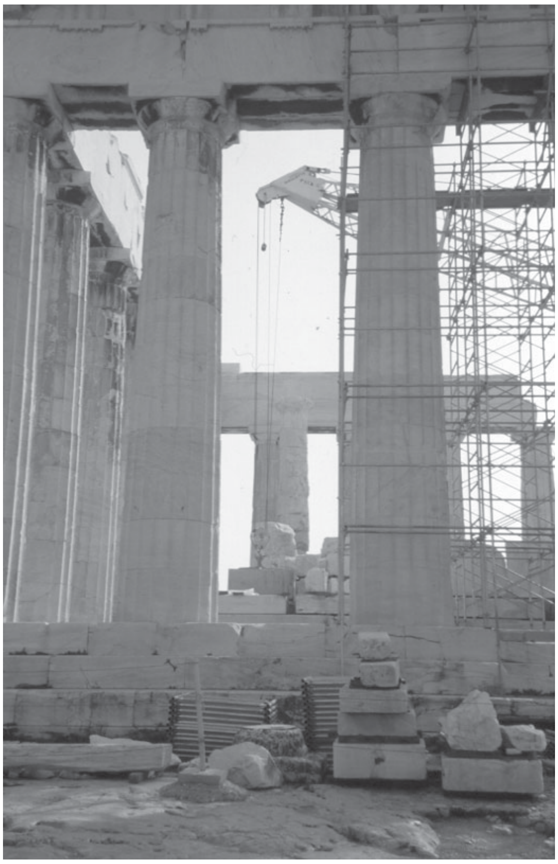
# Chapter 6
# Theoretical Framework



# Theoretical Framework

In this chapter, a brief overview and a critique of previous efforts to improve adaptability in buildings are presented, as well as the social-constructivist position on the subject, which is applied in this work. Next, the rationale for a strategic approach is discussed, and later an understanding of the iterative, strategic decision-making process is developed. The metaphor of design is used to explore and explain the decision-making process. Finally, some main concepts and terms used in this work are defined and described.

## 6.1 Different approaches to improving adaptability

Throughout history, buildings have been erected, adapted, and demolished. Functions inside buildings have changed, and parts of buildings have been reused for other purposes. Buildings have made up larger structures like cities, accommodating constant changes on all levels. In "naturally-grown" structures, adaptations are easy to carry out. Changes are carried out by those in need of new facilities. The structures have built-in principles which ensure that additions and changes are carried out according to the structural elements (Habraken, 1998).

Modern construction has gone a long way from the evolutionary character of naturally-grown built structures. Today, most buildings are built for a specific purpose. They are erected by others than their users. The scale of development and the complexity of the construction and design processes have made the building process a task for professional builders and designers. Most buildings are not built in order to accommodate constant change, but as a specific answer to current requirements and needs. Today, buildings are often a snapshot of a situation, frozen at a specific point in time. But demands will change and thus adaptability becomes an issue. Instead of adaptations as a natural process, adaptability is today something that has to be planned for.

During the last 50 years, adaptability has been on the agenda several times, and with different names, like structuralism, open building, flexibility, modular building systems, etc. In line with the rationalisation of work and construction in the 1950s, Scandinavian architects, like architects all over the world, engaged themselves in studies of modules suitable for different kinds of office work. Rational analyses of different plans and concepts were carried out. A modular approach was chosen in the majority of buildings. Architectural ideals, mostly from the USA (especially Mies van der Rohe's famous Seagram Building in New York City), prescribed structures in steel, curtain walls and lightweight, movable, indoor partitions. In order to improve flexibility, the interior partitions and building modules became the centre of attention. There was a lot of discussion about what was the most appropriate module for offices, and rational analyses of different concepts were carried out. In the brief for a new Town Hall in Malmö the requested module was 0.83 meters. In Shell's new building in Copenhagen, 1 meter was chosen. Both in Sweden, Denmark and Norway, several research projects were carried out to develop a module to support maximum flexibility and area efficiency. Alvar Aalto, on the other hand, argued that "approximately 1 millimeter" was the only acceptable module!

Even though Aalto and several of his fellow architects at the time argued for a different perspective, the rational way to look at buildings prevailed. The different theories of buildings had in common a belief in scientific analysis of functions and technical issues, in order to design a building that is perfectly equipped, in great detail, to fit to a specific function. The same attention was not given to the fact that these functions could change over a period of time.

In the Netherlands in the 1960s, the SAR (Stichting Architecten Research) started to develop a theory for adaptable housing which did take changes and time into account (Habraken et al., 1976) (van Randen, 1992) (Sarja, 1998). This was later known as Open Building. The main principle of Open Building is that through a system of levels; support and infill, one can empower the users at the lowest level and at the same time make the building components suitable for mass production. Similar theories were developed in several countries, as one started to look at flexibility as an important issue related to systems building. The idea was that one could design a system with components that would be exchangeable, and easy and cheap to erect and demolish. The major objective was to facilitate a rational production process, as one wanted to use principles of mass production, e.g. from the car industry. Examples of this are known from Norway (e.g. (Borch et al., 1973)). This is labelled "structural philosophy" to improve adaptability, and was prescribed in public design guidelines for offices in e.g. Sweden (Holter, 1980).

The structural philosophy and Open Building both focus on flexibility by:
- *Standardisation* of components and materials, possibilities for prefabrication
- Modular co-ordination
- Definition of *levels* based on the expected life spans of different parts of the structure

In Norway, work to develop a standard measure and module was carried out in close co-operation with the other Nordic countries, with Denmark taking a leading role. One decided on the standard module of 3M, which is 300 mm. Norwegian national standards were also developed. The standard "Modular co-ordination in construction" was endorsed in 1960 (NS 1000, 1960), and the important 3M standard in 1967 (NS 1001, 1967). The Norwegian Council for Building Standardisation published several guidelines and recommendations (Norges Byggstandardiseringsråd, 1965). Figure 26 shows one example of elements based on the module (Nordisk Byggedag, 1964).

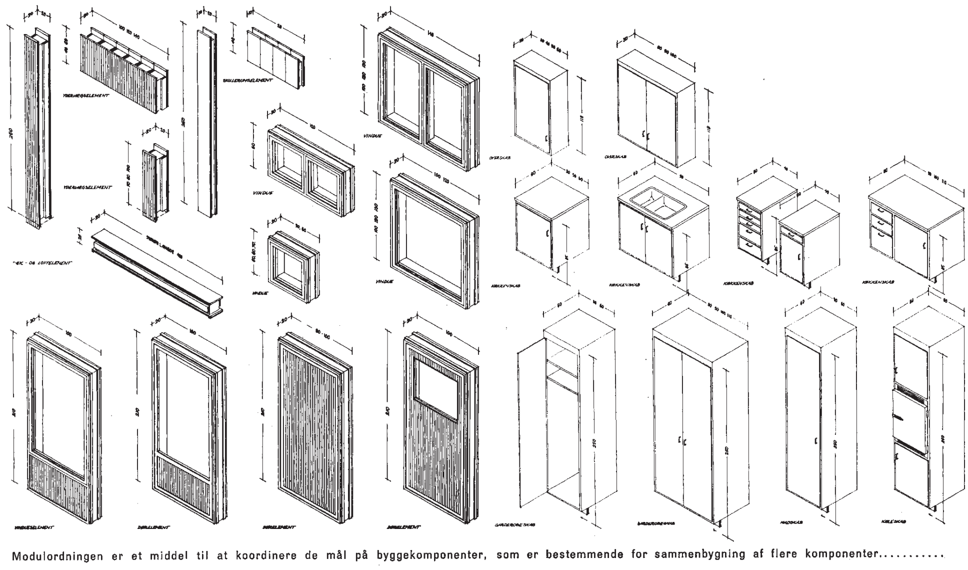



Figure 26. Modular elements based on 3M (Nordisk Byggedag, 1964).

Granum and Hofset at NTH were pioneers in this work, and contributed through their teaching, design guides and through co-operation with product developers and manufacturers (Granum and Hofset, 1969). The standardisation went beyond mere modules, and covered standard products based on functional studies of par example the size and height of office desks, see figure 27. Based on Swedish experiments and analyses, their recommended desk size for office work was 18M. Different systems were developed for offices based on multiples of 3M, see par example figure 28 (Nissen, 1970).

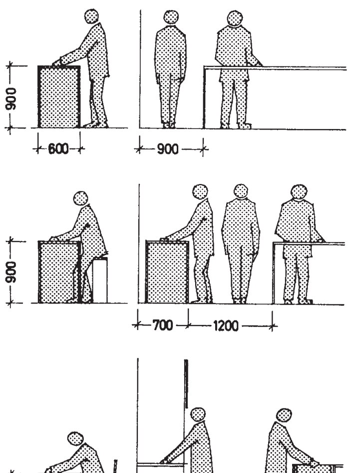



*Figure 27. Studies of measurements for office work* (Granum and Hofset, 1969)

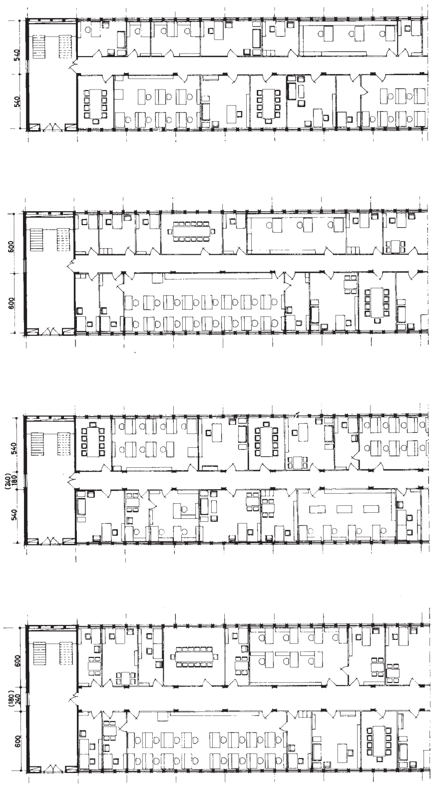


Figure 28. Examples of studies of one or two column structures with different buildings depths all based on 3M (Nissen, 1970).

At the Oslo College of Architecture (AHO), this was developed further into theories on open system construction (Apeland et al., 1975), (Borch et al., 1973). They developed, based on the modular system, standardised elements and rational production logistics in the building process, an open approach to architecture which resembles that of "Open building". In 1977, Bjørn Larsen summarised this work in a survey of practise and theory of open system building (Larsen, 1977). He focused primarily on design of the physical components and the process of fitting them together, but he also reflected on the problems of matching needs and demands with resources and constraints, see figure 29. The possibilities that were explored in order to deal with this were, however, still concerned with physical and functional systems and solutions, and not focused on how this mismatch can be managed.

In the 1980's the building boom put other issues on the agenda, as developer-driven projects aimed at increasing the quantity and decreasing the costs of building. The office buildings were often designed for short-term profit rather than as a sustainable, long-term investment. In Norway this changed after the boom ended in 1987-8, and the activity in the construction industry dropped dramatically. Later, sustainability and environmental consciousness became more important, and planning for the future, both with regards to costs and environmental impact, became an issue. At the

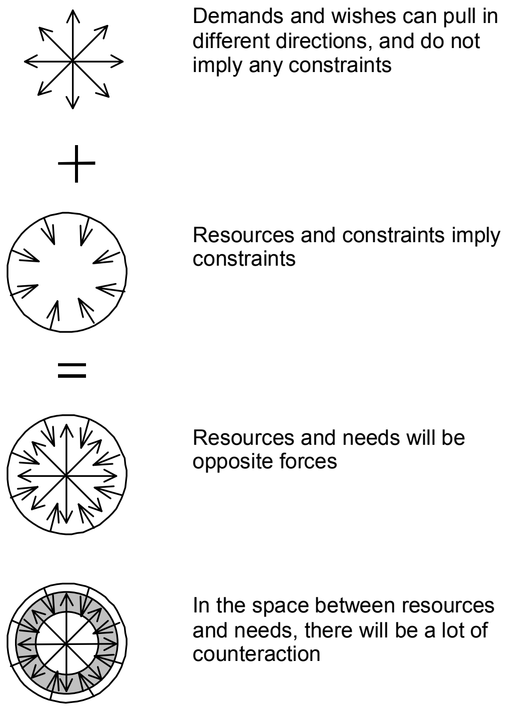



Figure 29. The mismatches between demands and constraints, as presented in ”Open Building Systems – on theory and practice” (Larsen, 1977). This is in many ways a predecessor of the BUR model. The solution in the 60’s and 70’s was to rationalise and optimise the supply side. In the BUR model, however, one aims at optimising the process of matching the two counteracting forces.

same time, a new consciousness of operation, maintenance, and management of buildings appeared (in Norway labelled “Forvaltning, drift og vedlikehold”, FDV). In 1980, RIF (The Norwegian Association of Consulting Engineers) published their “little red book”, the first written publication on this subject in Norway. Later, in 1987, the first publication to aid life cycle cost estimating was published, and the “Life Cycle Costing trilogy” (Bjørberg et al., 1993), which is still in use, was published in 1993. These efforts have helped placing adaptability and life cycle assessment of buildings on the agenda.

As the construction market recovered from the collapse, flexibility suddenly received a lot of attention again. There are several reasons for the reappearance of this issue:

1. Bad experiences with the short-term thinking and low quality buildings of the 80’s
2. Demand driven markets:
    - As businesses struggle to be more flexible, they demand the same of their facilities.

- Cost reductions in all parts of the business, lean thinking.
- New awareness of how environments for work and support functions contribute to the value-creating process in the business.
- Demand for sustainable quality, image-building, and facilities which are representative for clients

3. New construction processes, just-in-time design and construction.
4. Sustainability; energy efficiency and environmental friendly construction.

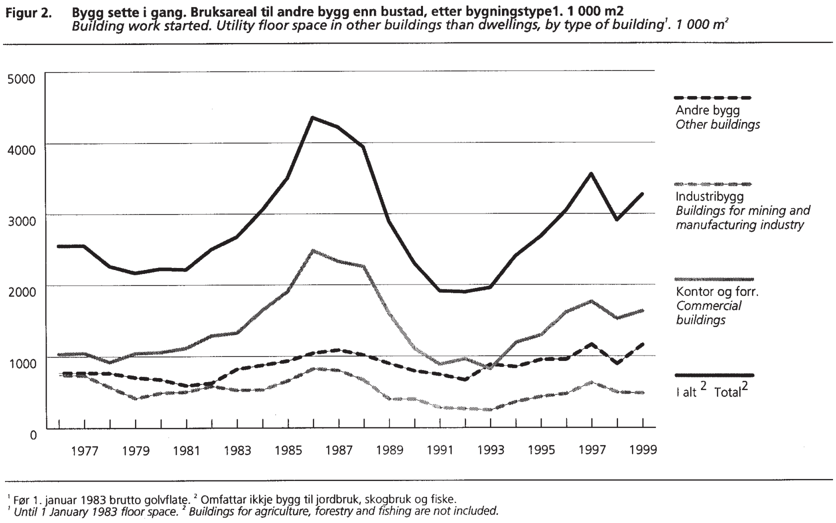



Figure 30. Construction work 1977 – 1999 (SSB, 1999).

In addition to the factors mentioned above, the new demand for flexibility was driven by changes in the businesses that occupy office buildings. In the 1990's we experienced a new awareness of the importance of how organisations are organised in space; the design of the workplace. A huge amount of literature on this subject has been published, see (Duffy, 1997), (Raymond and Cunliffe, 1997), (Tetlow, 1996), (Sims et al., 1996), (Becker and Steele, 1994). In trying to build more effective organisations, office space was seen as one important means. When office space is designed to fit the work process of the organisation, adaptability inevitably becomes an issue, because organisations change, and thus want their workspace to accommodate these changes. This represents a dilemma. At the same time as modern organisations change more quickly, which results in more demands for adaptable accommodation, the workspace is expected to support the organisation, which may mean more custom-made solutions.

Studies have shown that flexibility has been given a lot of attention during the last 50 years, but still the demand for it is as great as ever. One could argue that the design practices and theories mentioned above have proven not to provide the demanded adaptability. Is this due to invalid or inadequate theories, or a lack of implementation? In the following, some problems are discussed which may have contributed to the limited success of these theories and efforts.

### 6.1.1 Focus on flexibility – not adaptability

Traditionally, focus has been on technical flexibility, not adaptability, as a process of managing changes in supply and demand. Flexibility only covers one aspect of changes in buildings. In this work, the term "adaptability" is proposed instead of flexibility. Flexibility is a means of providing technical solutions in such a way that things can be moved around, changed, and replaced within the building's main structure (for a further discussion of terms, see the terminology part later in this chapter). Adaptability is more than flexibility. *Adaptability considers other ways to change the building (by extending it, by supplying spaces that can be used for several purposes, etc.) and it considers how the building is used: how user organisations change their behaviour in the building and according to it, how their demands change, and how these changes can be accommodated within the building or in alternative facilities and/or locations.*

We can say that adaptability approaches the problem from "the top". It is about creating openness and defining possibilities and constraints, while flexibility approaches the problem from the bottom and is concerned with providing solutions. Adaptability is concerned with making room for the unexpected, and to create situations that offer several possibilities. Every approach to adaptability is context-dependent, but one will in many cases leave something to be decided later. Generosity in the things that you expect to last and "easy to change" in places where you expect a lot of changes are typical adaptable approaches, in which flexibility may well be a tool.

| Adaptability | Flexibility |
|---|---|
| Capacity to answer to unexpected changes | Possibility of change within a limited set of alternatives |
| Approaches the problem from "the top": Openness, possibilities, and constraints | Approaches the problem from "the bottom": Solutions |
| Creating manoeuvring room, space to change, both in the building and in the process | To move and adjust according to a predefined set of possibilities |
| Invest in generosity and robustness | Invest in systems - will they be used? |
| Usually low level of specification | Usually high level of specification |

Table 4. While adaptability in this work is viewed as something that approaches the problems from "the top", flexibility is viewed as more solution-oriented, giving possibilities of change within a limited set of alternatives.

Increased flexibility has been the objective for most of the work which has been done in this field, and which has contributed to today's body of knowledge. When one focuses on maximising flexibility, it is easy to forget that there will always be constraints that will inhibit change. Working exclusively with flexibility, tends to result in a focus on how "everything can change physically ". When we talk about the long-term changes in buildings, it is just as important to recognise the constraints to change, the things that define the "framework" inside which change occurs. How these constraints are designed and defined is in many cases just as important as the design of changeable components. Some structures and spaces inhibit certain changes, others encourage them. This has less to do with flexibility than with design concepts, spatial organisation, and the structural robustness.

During design and construction, the possibilities for change are defined. Within this set of possibilities, future changes and developments may or may not occur. The possibilities for flexibility that we have designed may not be used in the future. If one defines solutions to make all kinds of changes possible from day one, one may find, in the end, that they are not utilised, or that other changes are needed. We may have supplied the "wrong flexibility" at the wrong place. Our visions of future changes may have been inadequate, because changes occur in different ways than imagined, and future solutions may make the once so flexible systems obsolete.

In many cases where attempts to focus on flexibility in buildings have failed, it is because it has provided the "wrong flexibility". One example of this is the Philips building in Oslo (1957). Its designers tried to rule out all uncertainty by thorough, scientific analysis of different workspaces, modules, and systems. The structure was supposed to have a long life-span, and flexible interior partitions were supposed to supply the necessary flexibility for future users. In the summer of 2000, the building was demolished because it did not meet the demands of its users anymore. One of the reasons was that the floor-to-ceiling height was too low to allow a new ventilation system that would satisfy today's regulations. The flexibility provided by the building's designers in the 1950's was not what was needed in 2000, and the building could not be adapted to meet today's standards.

Maybe we have overestimated the importance of flexible partitions to adaptability? We know that a lot of organisational changes happen without moving partitions, and that a lot of organisations live with unsatisfactory solutions because the partitions are taken as permanent, even though they were designed to be easy to change. Holter implies that in some cases the partitions are used as a rational excuse not to perform demanded changes (Holter, 1980). On the other hand we know that many organisations ask for more adaptability. The flexibility we have been working to supply may not be the kind of adaptability the organisation needs. Organisations are working differently today, compared to what they did only a few years ago. Changes in information and communication technology, ICT, may be one of the drives for these changes. The result is an even greater demand for adaptable environments; as business changes, so should the office. One architectural firm who has turned this into their "special field of expertise" is DEGW. In "Design for change, the architecture of DEGW", a position similar to this work is described:

> "Flexibility is a very convenient but expensive word that clients often use. For designers flexibility means redundancy, because it implies providing all the features you could possibly think of just in case they may eventually be required. Adaptability is a much better – and much cheaper – term to use because it means including within the design the capacity to add features later: planning for change, rather than catering for anything that might happen. Designing for adaptability forces everyone to join in predicting the future. And because it encourages shared responsibility in the design decision-making process, it tends to lead to affordable solutions. How much adaptability is something that can be calculated after thinking through scenarios of change. To what extent and in what areas adaptability is needed are questions that help inform realistic and sustainable solutions". Page 76 (Duffy et al., 1998).

In this work, the term "adaptability" is used in order to incorporate all the aspects of changes and responsive actions to change. The main point is that it is not enough to look at the technical solutions we can offer in order to change the building. There cannot be a "perfect" answer to a question we have not been able to ask yet! There are at least two reasons for this: one is that we are talking about things that will happen in a future that we can not predict, another is that it implies that we determine the world we live in by technical structures.

### 6.1.2 Technical determinism

Technical determinism can be described as a belief system in which it is possible to find a perfect physical solution to any question. In short, it is the engineers' answer to any problem. From the discussion above, we see that most of the work which has been done to improve flexibility is based on the assumption that technical systems will supply the right answers. We have labelled this "structural philosophy". In a workshop in Voorburg[1] this was one of the main self-criticisms from people involved in "open building". The Cartesian way of looking at the world was named as one of the most important reasons for the lack of implementation of open building principles. Cartesian means connected to the ideas of Descartes, proposing rationalism and a body/mind dualism (Lacey, 1976). In relation to the topics discussed in the workshop, it also implies an approach that will use rational decomposition of a problem into several parts which can be solved independently and later be composed again. The idea is that the situation is a sum of different parts, and that a technical optimisation of all parts will ensure an overall optimisation as well.

It is possible to formulate critiques to this position on several levels. On a fundamental level one can discuss if all the relevant issues can be taken into account in such an approach. Does it count if it can't be counted? Another major critique is that a situation is more than the sum of its parts, and that with this approach one might lose sight of the more important issues. Here, the critique will be focused on the fact that most of the energy has been spent on solving technical issues without taking their relations with other issues into account.

As early as in 1980 we can find a fundamental critique of the structural philosophy in some sources, e.g. in Holter's work (Holter, 1980). She shows that the adaptation of offices is just as dependent on adapting the organisation as on adapting the building, and that the dynamic relationship between organisation and building is complex. Structural philosophy did not take this into account. There is obviously a lot to be gained by applying some of the principles proposed by the structural philosophers. But applying the technical principles is not enough.

This is also noticed by Habraken in his recent work "The Structure of the Ordinary" (Habraken, 1998), where he rejects positivism and stresses that built environments exist in a dialectic relationship with their users and builders, and that the different actors exercise control in the change and transformation processes of physical structures.

> "In observing built environment in a nonjudgmental fashion, we find that forms and formal transformations cannot be explained by inevitability. Given continuous judgements by agents, observed form must be assumed rather to reflect their active selection and rejection of alternatives." Page 11 (Habraken, 1998).

Already in the Open Building theories, we find the seeds of thoughts that transcend the structural philosophy. E.g., the attention to decision levels that correspond with the physical levels, and the fact that some work as idealists, who want to make systems that can be changed from the users' side, in order to provide cheap and good quality housing for people.

Architecture can also display technical determinism, by focusing on buildings as a static product, rather than as a part of a longtime process. Attitudes among architects towards change in their buildings and the trends in architecture both change. Over the years we have seen incentives to develop systems which resemble those of the naturally grown, focus on user participation and empowerment, design theories that prescribe general, robust spaces that can be used for several purposes, and structures which are designed in order to allow changes to happen. This will be discussed later. At this point it is enough to notice that architectural practice also may display determinism, and focus on the building as a static product of the design and construction phase. Some architects even make it a point that the building should not be changed in any way, as if it was a creation, objects of art, that should remain as new throughout history. Some architectural objects are admittedly objects of art, and will not have to be changed, or should not be changed. But for the majority of buildings this is not the case. Less attention has been given in architectural theory to how these buildings develop over a period of time, and how they change. Some of the finest examples of architectural objects have "aged with grace", as they have been adapted and maintained during centuries.

Today, when we approach issues related to flexibility and adaptability, it is not only from the side of supply, designers and constructors, but also from the side of owners and users of buildings. Businesses want adaptability in order to control risk. As the Real Estate Management and the Facilities Management profession has matured, this has become an important issue. Both the Real Estate professionals and the parties in the construction industry will have to answer to the client's (user organisation and owner's) demands for more adaptability.

To sum up: A Cartesian worldview will produce technical answers. This may be useful, but by far sufficient. In order to proceed in the development of adaptable buildings, we will have to focus on other issues in addition to the technical ones. This work will try to contribute to this by looking at both the relationship between a building and an organisation, and at the process of making, using, and managing the building.

## 6.2 A new perspective on adaptability?

A lot of different factors make an impact on how buildings are used and adapted. To understand adaptability we will have to investigate socio-economical, technical, and functional aspects of buildings, as well as the process of making the building. Separately, these topics have been given a lot of attention, but to improve adaptability further, different sources of knowledge will have to be combined. In this work, an additional perspective on offices will be investigated in order to shed new light on these problems, focusing both on the *product* (and how the building answers the requirements posed by the organisation) and on the process, *the construction, use, and management of the product*.

### 6.2.1 A social-constructivist perspective on offices

To shed new light on the complex relation between the office as a product and the process of making the office, theories from "social constructivism" will be introduced. The development of an office building is a complex social process, and when it is constructed, the building engages itself in a process with its users and society as a whole. During the process of making the building, meaning, emotions, and symbols are created in the minds of those involved in the process, and at the same time they are embedded in the product. *The building is thus both product and process*. The social-constructivist approach has been inspired by studies in the sociology of scientific knowledge and organisational theory.

In "The Social Construction of Reality", Berger and Luckmann argue that we, as individuals, shape society at the same time as society shapes us (Berger and Luckmann, 1966). An artefact can not be separated from the process of making it, and it is a bearer of meaning for those in the society where it is constructed. In "Science in Action", Bruno Latour elaborates on this as he puts the emphasis on the process of building argumentation and alliances in the construction process (Latour, 1987). He describes the making of the accepted artefacts and facts as "black boxes", which can be "closed". A lot of other theories are built on Latour's thoughts, e.g. Pinch and Bijker, who argue that the social groups that constitute the social environment play a critical role in defining and solving the problems that arise during the development of an artefact. They introduce, as Latour does, the concept of closure. They also claim that Latour's approach attempts to break down the distinction between human factors and natural phenomena. Both are treated as elements in "actor networks"(Bijker et al., 1987). A quote from an article by Levin can sum up the social-constructivist approach:

> "Development of technology is (...) a social process in which the resulting technology cannot be separated from the actors engaged in shaping it. Skills, cultural knowledge and meaning are constructed as part of the technology. *(Levin, 1997)*".

The building is one example of a technology that is shaped as a social process.

### 6.2.2 Design as product and design as process

A slightly different perspective on this, and one that is more applicable to buildings, is offered by Brown and Duguid in «Enacting design for the workplace». They too subscribe to "social constructivism". But because they are describing product design, they have to deal with the fact that the product will have a life after the process of constructing it. They argue from the perspective of design of functional artefacts, and make a distinction between design as product and design as process. They describe the *process* of design as a form of two-way communication:

> "Ideas, priorities, and goals are debated and negotiated. Misinterpretations, "mind-bugs," and the like manifest themselves and are cleared up." Page 178 (Brown and Duguid, 1991).

But when the process is finished, interacting with it, as a *product*, resembles reading a book rather than having a conversation:

> "And, as with a book, once a product is in the hands of the public, its creator is no longer there to negotiate misinterpretation or control the context in which it is "read". (...) Design as product must deal with external operability, but generally through a form of one-way communication." Page 178-79 (Brown and Duguid, 1991).

So, even if we look at the making of the building as a social construction process, the building as a product must have relevance, function, and meaning to its users and the public, separated from the process. This is important in relation to office buildings, because the physical structures have a lifespan that is usually longer than the relationship with its initial builders and users. At the same time, every building will "learn" and change during its lifetime, responding to different actors and their use of the building.

### 6.2.3 The relationship between a building and its users

Another interesting perspective on offices are the socio-technical theories, which describe the relationship between the users and the workprocesses carried out in the building, and the building itself. In socio-technical theory, the relationship between society and technology is conceptualised as “a seamless web”. In this project, the office is seen as a part of the technology which the organisations utilise. When designing workprocesses, one must also take into account the technology that will be utilised, in our case a building. On example of socio-technical theories applied to architecture and workplace design is Granath’s “Architecture, Technology and Human Factors” (Granath, 1991). This work describes workplace design in production facilites, but the theories are applicable for offices as well.

The socio-technical theories have inspired the understanding of the user organisation and the building as a relationship, BUR, presented in chapter 4, as well as provided some alternative theories on system design presented in the following chapters.

## 6.3 The rationale for a strategic approach to manage BUR

In chapter 4, the Building - User Relationship and the mismatches which will occur in that relationship over time were described. In this chapter, we have so far described different efforts to improve adaptability, and have suggested that this work presents another approach to adaptability; an approach which is based on the understanding of buildings as socially constructed objects. This will shift our attention from the physical properties of the building to the process of making the building, and the decision-processes in the building’s life cycle as well as in the managing of the mismatch in the Building – User Relationship. Because BUR is constantly changing, this work prescribes a *Strategic Approach to Adaptability* as a way to manage and reduce these mismatches. Some reasons for a strategic way of approaching the problems are:

1. Environments and the BUR change continuously and unpredictably. This means that it is impossible to predict the future life of the building and the requirements this poses on the decisions that must be made here and now. We have to offer a way to handle those decisions as a dynamic strategic process, which is responsive to future changes and aims at dealing with the uncertainty.
2. Every project, organisation, building, and environment is unique, so it is impossible to specify a building that will be perfectly flexible and fit for every situation. Nor is it possible to prescribe one method, process, or a “recipe”, that will produce the right result. What the strategic approach offers is a way of thinking about changes in buildings and organisations; a mindset that shows how this can be dealt with in a strategic decision-making process, some tools which can be used, and examples of strategies and measures that can be applied within such a strategic process.

3. Our actions construct the society we live in, and we are formed by the society. This is a dialectic process, and it is the essence of the social constructionist position. A similar mechanism is present in formulating and acting out strategies, as the strategies affect the situation in which they are implemented. When a strategy is implemented, and a decision is made into action, this action will shape the situation in which it is implemented, and in the next run; the strategies to cope with this situation. The strategic process is dynamic. Actions shape the situation, in our case the BUR, which in turn shapes the strategies that are developed to manage the mismatches. The result of the actions might turn out to be very different from what was intended when the decision was made.

Strategy has been defined as:

> *STRATEGY - a plan, method or series of manoeuvres or stratagems for obtaining a specific goal or result (Webster's, 1994).*
>
> *"A strategy is the pattern or plan that integrates an organisation's major goals, policies and action sequences into a cohesive whole. A well-formulated strategy helps to marshal and allocate an organisation's resources into a unique and viable posture based on its relative internal competencies and shortcomings, anticipated changes in the environment and contingent moves by intelligent opponents". Quinn in (Mintzberg et al., 1995).*

Noorderhaven points at four concepts that identify the conditions under which theories about strategic decision-making has meaning; Complexity, uncertainty, rationality and control (Noorderhaven, 1995). In the following, their relation to BUR and their implications for the strategic approach is discussed.

### 6.3.1 Complexity

There are several other parameters that influence design and management of buildings. Thus adaptability will be only one of several issues that must be taken into consideration. In the Strategic Approach, the focus is on how one can plan and think strategically in such a way that issues about adaptability can be dealt with as one of several parameters in the decision-making process. Building processes involve several actors and phases and are rather complex. In relation to adaptability, the building process before completion and the operation and management phase has to be taken into account, as well as the owner and user issues. In the Building - User Relationship, one has to relate to a lot of intangible factors that complicate the picture further.

The complexity of managing the mismatches in BUR demands an approach to decision-making that offers a way to handle the complexity and to determine the way ahead in dynamic, complex situations. A strategic approach offers one way to deal with this.

> "If the situation is very simple, for instance because circumstances

> clearly dictate one particular course of action, strategic decision-making is trivial. However, if the number of variables or contingencies on which the strategy depends is sufficiently large and if there is not one clear overriding factor or criterion, a strategy cannot be said to be determined by its environment. Niels Noorderhaven, page 9 (Noorderhaven, 1995)

### 6.3.2 Uncertainty

The main reason to apply a Strategic Approach is that we are facing situations with a high degree of uncertainty. Office work has gone through major changes lately, and we have probably not seen the end of them yet. The BUR changes continuously, and this, together with the uncertainty posed from society and the real estate market, makes decision-making in building planning, design, and management, a task rife with uncertainty.

The Strategic Approach to the problems is not to prescribe a method to get rid of uncertainty, but to offer a way to manage it by showing how we can think concerning adaptability, a certain way to structure the processes, and some tools and means that may be implemented if suited in that particular process and for that specific situation.

In a building project, the initial ideas about the building evolve into programs and designs, for later to be constructed in brick and concrete. During this process, the ideas about the building moves from vague and responsive to change and development, and into a solid and static building. At some point in time a decision must be made, which will define the outcome and limit the possibilities for future changes. By doing this, one makes a prediction of the future situation as the framework for future action is defined.

> "ALL BUILDINGS are predictions. All predictions are wrong. There's no escape from this grim syllogism, but it can be softened. Buildings can be designed and used so it doesn't matter when they're wrong." Stewart Brand, page 178 (Brand, 1994).

Before construction, buildings are intangible; an idea, a design, a building process, or an image. Once the building is constructed, it will relate to its users and owners as a given physical reality. The uncertainty in these conditions is very different, because in the latter situation, the outcome of the building process is known and is, with its physical presence, something one must relate to. One of the underlying objectives of the strategic approach is to contribute to decisions that will make "space" for future changes to happen within these physical boundaries. Brand labels this "manoeuvring room".

> "The product of skilled scenario work is not a plan, but a strategy. Where a plan is based on prediction, a strategy is designed to encompass unforeseeably changing conditions. A good strategy ensures that, no matter what happens, you always have manoeuvring room." Stewart Brand, page 178 (Brand, 1994).

Such a manoeuvring room is one of the key concepts of the strategic approach when it comes to handling future uncertainty, and it is discussed later in the next chapter.

### 6.3.3 Rational, conscious choices

Strategy is associated with intentionality, where decisions are made and actions performed in order to reach certain goals. Often we assume that decisions and actions are the result of rational choices based on complete knowledge and objective information about the situation. Rationality is often associated with objective optimisation, "perfect rationality".

In the Oxford Dictionary of the English Language, rationality is defined as: "The quality of possessing reason; the power of being able to exercise one's reason". This definition promise reasoning, not optimisation and perfect solutions. In reality, reasoning might be imperfect, e.g. the wrong conclusions might be drawn from the available information, or the information on which the decisions are drawn is imperfect, biased, or incomplete. As humans we have preconceptions, emotions, and values which will be reflected in the decisions we make. Different situations and organisations also have different "cultures" and histories, which will affect the behaviour of the individual decision-makers.

Some argue that one has to distinguish between the rationality of the outcome of the decision-making process and the rationality of the process itself (Noorderhaven, 1995).

> "If imperfect information and imperfect human cognition is assumed, a rational decision-making process (procedural rationality) does not automatically lead to a rational choice (substantial rationality). Conversely, a substantively rational outcome may have been produced by a non-traditional decision-making process (plus a stiff dose of luck)."
> Page 47 (Noorderhaven, 1995)

Even if one abandons the idea of "perfect substantial rationality", one can talk about rationality. In 1958, March and Simon described what is often called "bounded rationality". They argue that rationality is subjective and relative (March and Simon, 1958):

> "For if the rational man lacked information, he might have chosen differently "if only he had known". At best, he is "subjectively" rational, not "objectively" rational. But the notion of objective rationality assumes there is some objective reality in which the "real" alternatives, the "real" consequences, and the "real" utilities exist. If this is so, it is not even clear why the cases of choice under risk and under uncertainty are admitted as rational. If it is not so, it is not clear why only limitations upon knowledge of consequences are considered, and why limitations upon knowledge of alternatives and utilities are ignored in this model of rationality. From a phenomenological viewpoint we can speak of rationality relative to a frame of reference, and this frame of reference will be determined by the limitations on the rational man's knowledge".
> Page 159 (March and Simon, 1958).

There are a lot of other aspects that will complicate the picture further. One is that choices can be both conscious and unconscious, and that the alternatives considered might be unconsciously limited. Choices are also about the decisions and actions that never were made. In modern organisational theory, much attention is given to conflicts of interest, negotiation, and hidden agendas. Such political issues will also affect the rationality of the decision-making process.

These threats to rationality will affect the way we consider decision-making and the nature of the solutions generated within the strategic approach, as we will look at satisfactory, not optimal solutions.

**Satisfactory, not optimal**

Finding an optimal alternative is radically different from finding a satisfactory alternative. An alternative is considered optimal if all alternatives have been compared against a set of criteria and one alternative is preferred, by these criteria, to all other alternatives. An alternative is satisfactory if there exists a set of criteria that describes minimally satisfactory alternatives and the alternative in question meets or exceeds all these criteria (March and Simon, 1958).

> "Most human decision-making, whether individual or organisational, is concerned with the discovery and selection of satisfactory alternatives: only in exceptional cases it is concerned with the discovery and selection of optimal alternatives. To optimize requires processes several orders of magnitude more complex than those required to satisfice. An example is the difference between searching a haystack to find the sharpest needle in it and searching the haystack to find a needle sharp enough to sew with." Page 162 (March and Simon, 1958)

According to both March & Simon and Noorderhaven, this means that decision-makers are no longer assumed to have a complete preference against which all alternatives are tested. They should instead search for an alternative that satisfies a certain set of criteria. In order to achieve this, the decision-making process is viewed as happening in steps and loops rather than as a linear, rational process. Alternatives are generated and evaluated one by one, and the process stops as soon as an option which exceeds the aspiration level is found (March and Simon, 1958), (Noorderhaven, 1995).

In order to find satisfactory solutions one needs to set a satisfactory standard: "What is good enough?" Setting those standards must be part of the strategic approach, as well as deciding on an iterative decision-making process that allows these judgements to be made.

### 6.3.4 Control

If the decision-makers do not have a certain control over the outcome of their decisions, strategic decision-making and action becomes difficult.

> Without control, any pattern observable in a stream of decisions or action … is the involuntary outcome of an interplay of causal forces rather than the intentional result of deliberate actions of individuals."
> Page 11 (Noorderhaven, 1995).

The possibility of controlling the process is important when we talk about BUR mismatches and adaptability, because:
- There are several different interests present, from general management in the user organisation, to Corporate Real Estate Management in the user organisation and Real Estate Management in the building owner's organisation.
- There are several layers of decision-makers present, from strategic management to more operational units, who carry out the operational actions.

One of the most important aspects of the strategic approach is to align these different perspectives, in order to be able to exercise control over the decisions and actions concerning management of the Building - User Relationship.

### 6.3.5 Characteristics of a Strategic Approach to Adaptability

Based on the discussion above, certain characteristics of a Strategic Approach to adaptability have emerged:
- It must be able to handle uncertainty and complexity.
- It will have to search for "satisfactory", not optimal, solutions.
- The decision-making process has to be iterative, with several "loops" in order to find the satisfactory alternative and to adjust to changes.
- A certain set of standards or criteria must be defined in order to judge which alternatives are satisfactory.
- Different interests are present. This must be taken into consideration, and the decision-makers must be able to exercise some kind of control over the situation they are managing.

The Strategic Approach to adaptability can be defined as:

> *A STRATEGIC APPROACH TO ADAPTABILITY – An approach to adaptability and to manage mismatches in the Building - User Relationship based on an iterative strategic decision-making process. The Strategic Approach to Adaptability focuses on strategical issues on a strategic level.*

Several writers (see i.e. (Haugen, 1990)) distinguish the different levels in a Facility Management or Corporate Real Estate organisation as strategic, tactical and operational. It is also important to notice that this has to be related to the levels within the user organisation, as strategies for real estate has to be aligned with strategies for the company developed by general management.

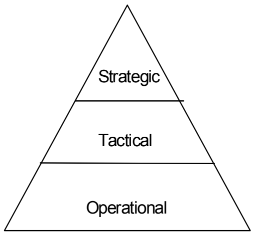



Figure 31. Decisions levels in an organisation

The Strategic Approach is a position – a mindset, a strategic, dynamic way to think. Some tools and techniques can be helpful, but the most important thing is to raise the relevant questions, and incorporate future changes in the decision-making process. An understanding of the dynamics of changes in BUR and the nature of mismatches is fundamental to the strategic approach. In addition to this, a strategic approach has to offer some kind of recommendations for a strategic decision-making process. This is developed and discussed in the next section of this chapter.

Next, one needs tools, methods, or concepts in order to think and work strategically to reduce BUR mismatches. This is presented in chapter 7. Concepts for thinking strategically are presented both for the planning and design phase, as well as for management and operation. In “The Strategy Process”, Henry Mintzberg compares his work to that of a jigsaw or of LEGO (Mintzberg et al., 1995). In his work, he has described a lot of different “configurations” of organisations. One day he realised that up to then, he had expected all these concepts to fit together to make an organised whole, like the pieces in a jigsaw puzzle. His discovery was that instead of expecting a complete picture, he was developing LEGO – bricks that could be put together in several ways, to make up unexpected results depending on the situation in which they were used. The methods and concepts presented here are intended to be used in the same way, as bricks with which one can build a concept-dependent answer to the challenges in the particular situation. These must be related to the overall strategic thinking.

Last, but not least, one needs some measures that can be applied within the actual situation. Some of these are mainly on an operational level, but must be applied within the chosen strategy.

To sum up: the Strategic Approach to Adaptability may consist of:
- A strategic mindset and an understanding of adaptability and the dynamics of the BUR model.
- A recommendation for a strategic decision-making process which can be applied e.g. in the building’s life cycle or in the process of managing the mismatches between demand and supply.
- Some tools to work strategically within that process in order to enlarge the manoeuvring room.
- Some measures which can be applied within the chosen strategy.

The Strategic Approach rests on an understanding of the strategic decision-making process. This will be explored next. Later, in chapter 7, this will be operationalised within the building's life cycle and in managing the mismatches between demand and supply.

## 6.4 Strategic decision-making

The backbone of the Strategic Approach is the strategic decision-making process. During the years, several different approaches to strategy making and strategic decision-making have been described. In this chapter, the design-metaphor is used in order to explore and explain the decision-making process in the Strategic Approach. The decision-making process is described as iterative. For actors in the construction industry, the metaphor of strategy-making as design may be useful, as it is a frame of reference which they are familiar with from their training and practice. In design and construction of new office buildings, strategies and attitudes in design is one very important part of the strategy-making in the project. Thus exploring both strategy-making and design is important in order to improve adaptability. In "In Defence of Strategy as Design", Liedtka describes the "wickedness" that strategy- and design problems have in common (Liedtka, 2000):

> "Horst Rittel[2] first called attention to what he described as the "wicked nature" of design problems. Such problems, he asserted, have a unique set of properties. Most importantly, they have no *definitive* formulation or solution. The definition to the "problem" itself is open to multiple interpretations (dependent on the *Weltanschauung*, or worldview of the observer) and potential solutions are many, with none of them able to be *proven* to be correct. Writers in the field of business strategy have argued recently that many issues in strategy formulation are "wicked" as well, and that traditional approaches to dealing with them are similarly incapable of producing intelligent solutions." Page 12-13 (Liedtka, 2000).

The problem's "wickedness" is similar to the uncertainty that was described earlier in this chapter. Liedtka argues that characteristics from design processes and design theory should be considered in strategic processes as well.

But at the same time as the Strategic Approach must be about solving wicked problems, it is also about imposing more stable patterns of behaviour in changing and dynamic situations. Mintzberg defines five positions to "strategy" (Mintzberg et al., 1995):

1. Strategy as *plan*, some sort of consciously intended course of action, a guideline on how to deal with a situation.
2. Strategy as *ploy*, a manoeuvre intended to outwit an opponent or competitor.
3. Strategy as *pattern*, a pattern in a stream of actions. In this definition, strategy is consistency in behaviour, whether or not intended. By this definition, a strategy can be intended (consciously planned), deliberate (intentions that existed previously are realised) or emergent (patterns developed in the absence of intentions).

4. Strategy as *position*, meaning location and organisation in an "environment". By this definition, strategy becomes the mediating force, or match, between organisation and environment, between the internal and external context.
5. Strategy as *perspective*, its content consisting not just of a chosen position, but of an ingrained way of perceiving the world. This means that all strategies are abstractions which exist only in the mind of the interested parties. This definition highlights the importance of a shared perspective.

In an ideal world, the different positions to strategy will pull in the same direction. In real life, this is not the case. One example is strategy as plan and strategy as pattern, which can be quite independent of each other. The designed or planned strategy developed to enhance adaptability may well be nothing but intentions, as the decisions and actions form a pattern that emerges during design, construction, and use. In order to deal with this, we have to consider both plan, pattern (actions) and the correspondence between them, in order to work strategically to improve adaptability. In the Strategic Approach, strategy can be conceptualised as a course, a steady direction in which to go (strategy as plan), as a pattern that, deliberately or not, emerges as you walk (strategy as pattern), or a perspective on the dynamic BUR and how to deal with this (strategy as perspective). All can be strategic approaches and be appropriate in different situations. Strategy will always, however, be about the future, and therefore about managing change.

> "Strategy itself is really about continuity, not change: it is concerned with imposing stable patterns of behaviour on an organisation, whether these take the form of intentions in advance that become deliberate strategies, or actions after the fact that fall into the consistent patterns of emergent strategies. But to manage strategy is frequently to manage change – to recognise when a shift of a strategic nature is possible, desirable, necessary, and then to act." Page 757 (Mintzberg et al., 1995).

### 6.4.1 Expanding the normative-rational model for decision-making

Theories about the process of design probably appeared in the middle of the 20th century. Design processes were seen as a sequence of well-defined activities, to which scientific method could be applied. Design consisted of two phases: Analysis and synthesis (Liedtka, 2000):

> "In the analytical phase, the problem is decomposed into a hierarchy of problem subsets, which in turn produce a set of requirements. In the ensuing stage of synthesis, these individual requirements are grouped and realized in a complete design." Page 12 (Liedtka, 2000).

In the traditional literature on decision-making a similar kind of process is prescribed. This is a normative-rational model, which is strongly prescriptive and puts an emphasis on rational choice. The decision is made based on analysis of alternatives, where i.e. SWOT[3] analyses are carried out. The rational assumptions behind the model imply that the alternative evaluated as the best will automatically be chosen. Goals are defined in the beginning of the process, and through generation and evaluation of alternatives, one is supposed to end up with one "best alternative", which is implemented in the end of the process.

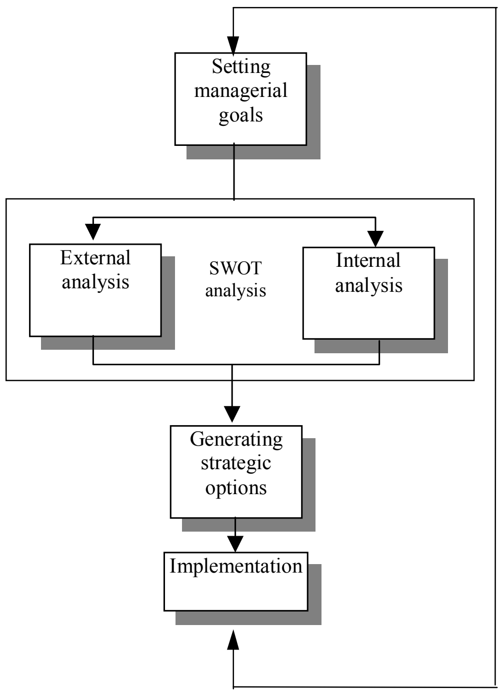



Figure 32. A normative-rational model for strategy making (Noorderhaven, 1995).

Because of the "wickedness" of the problems at hand, these "first generation models" have been under attack. In the literature on strategic planning it received heavy criticism, par example in Henry Mintzberg's "The Rise and Fall of Strategic Planning" (Mintzberg, 1994), and one started to look at alternatives to the normative-rational model (Levin et al., 1994), (Mintzberg et al., 1995), (Dyson and O'Brian, 1998). Michael Porter offers a new approach to strategic management by his focus on dynamics theories, value chains, and value systems (Porter, 1991), (Porter, 1996). Liedtka draws parallels to the developments in design theory, as one started to look for other ways to approach "wicked" problems (Liedtka, 2000):

> "Through argumentation, whether as part of a group or solely within the designer's own mind, the designer gained insights, broadened his or her Weltanschauung, and continually refined the definition of the problem and its attendant solution. Thus, the design process came to be seen as one of negotiation rather than optimization, fundamentally concerned with learning and the search for emergent opportunities." Page 13 (Liedtka, 2000).

Based on Liedtka's theories, some properties of modern design theory will be discussed in order to show how this will form an impact on alternative models of the strategic decision-making process.

### The role of the Hypothesis

Problem-solving in design is based on generation and testing of alternatives. Donald Schön describes the designer (among his study "objects" were architects and urban planners) as someone who engages in a conversation with the situation they are shaping (Schön, 1984). Creative "what if"-hypotheses are put on the table, and the most promising are selected for further inquiry and evaluation. By using "virtual worlds[4]" the designer can evaluate and test the implications of the alternative, and the situation "talks back" by showing how the alternative works within the virtual model, and offering new possibilities which in turn will have to be tested.

> "In the designer's conversation with the materials of his design, he can never make a move which has only the effects intended for it. His materials are continually talking back to him, causing him to apprehend unanticipated problems and potentials. As he appreciates such new and unexpected phenomena, he also evaluates the moves that have created them." Page 101 (Schön, 1984).

The designer continually frames and reframes the problem, until a "satisfactory" solution is found. If we relate this to the discussion of bounded rationality, and the need for satisfactory solutions and some criteria of evaluation of alternatives, we see that in modern design theory, understanding and defining the problem, setting the evaluation criteria as well as finding and testing alternatives, is an iterative process. Lawson describes the design process as a negotiation between problem and solution through three activities: analysis, synthesis, and evaluation (Lawson, 1997). Both in design and in theories on strategy, words like inquiry, argumentation, negotiation, and conversation have been used in order to describe the process of generating and testing hypothesis. This is fundamentally different from defining certain goals upfront, and then generating alternatives which will be tested against a defined set of criteria, as recommended in the normative-rational model.

> "The scientific method then – with its emphasis on cycles of hypothesis generating and testing and the acquisition of new information to continually open up new possibilities – remains central to design thinking." Page 13 (Liedtka, 2000).

Such generation and testing of hypotheses is central to design, and might be the design-metaphor's most important contribution to the understanding of the decision-making process in the strategic approach. The idea of creating virtual worlds, where hypotheses can be generated and tested, will be explored later, e.g. by using scenarios as one tool to aid this process.

### Invention, not discovery

Even if design is hypothesis-driven, the design hypothesis differs from the scientific hypothesis. Design invents what *does not yet exist*, while science deals with explaining what *is*. Rather than using reasoning modes of induction and deduction, design thinking is adductive, using the logic of conjecture; suggesting that something *may be* (Liedtka, 2000). In a design process the "solution" unfolds in the designer's mind as the process progresses. In the beginning, it is tentative, generic, and vague. This vagueness ensures that a whole range of possibilities can be explored on a generic level, before slowly narrowing the scope until the solution is fully developed. This is one of the conditions for development of the "manoeuvring room", providing "space" (both physical and metaphorical) for future choice.

### General versus Particular

Design aims at solving particular, not general problems, as opposed to science which is primarily concerned with general facts and solutions. Working with specific possibilities and constraints, the designer must relate to a specific situation in his search for a particular solution. This has several implications, and Liedtka shows that these are relevant both for designers and strategy makers (Liedtka, 2000):

- "Predictions after the fact", retrospective rationalisation, must be avoided. Future choices cannot be based only on predictions based on facts and knowledge about the past.
- Creative designs/strategies do not passively await discovery, they must be actively sought out.
- An indeterminate process suggests possibilities for great diversity and continuous evolution in the outcomes produced. The idea of a single right design/strategy can stifle creativity.
- Design solutions/strategies are always matters of invented choice, rather than discovered truth, and the judgements will therefore always be open to questions from other parties. This means that other parties must be convinced that this is a good solution. Argumentation and bringing the relevant parties into the decision-making process is important in order to produce collective learning and to enrol others in order to develop the best result and commitment to the solution.

### Values

Choices and decisions involving humans will always be based on the values and preferences of those involved in making them. Even in the objects that are the result of design processes, these values are embedded. As we have seen in the BUR, such values in the physical object must relate to the values of those using and owning buildings. The history of the office building has shown us that both values in design and in user organisations are reflected in office buildings, and that these values change over time.

> "Values drive both the creation of the design and its acceptance. … Designs that embody values and purposes that are not shared – however innovative – fail to persuade." Page 19 (Liedtka, 2000)

**Dialectical**

The designer has to mediate between diverging forces of constraints, contingency, and possibility. The process is dialectic and dynamic, and the goal is “to satisfy and transcend today’s constraints to realise new possibilities”. (Liedtka, 2000).

> “The designer lives in the intersection of often conflicting demands – recognizing the constraints of today’s materials and the uncertainties that cannot be defined away, while envisioning tomorrow’s possibilities”. page 21 (Liedtka, 2000).

### 6.4.2 The iterative strategic decision-making process

In line with the discussion above, the decision-making process in the Strategic Approach to adaptability is not based on the rational, normative model, but on an iterative understanding of the process, with emphasis on negotiation, learning, and the search for opportunities.

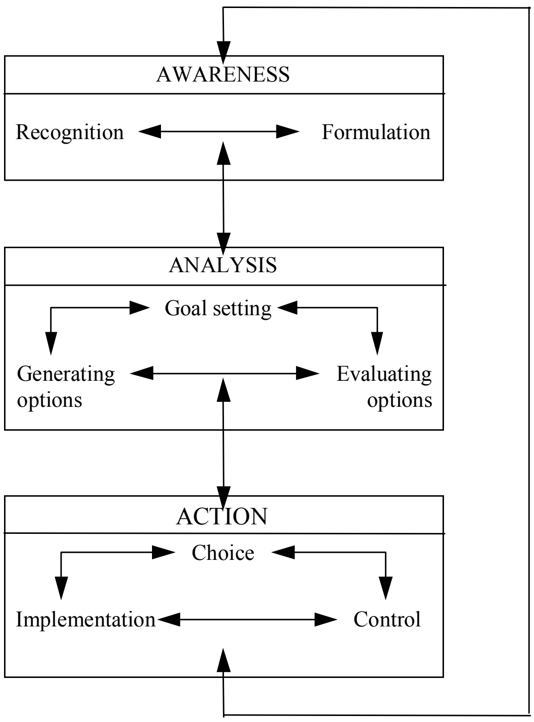



Figure 33. A conceptual model for decision-making, based on the assumption that the process in not linear, but dialectical. The different phases interact, as shown here by loops between the activities and the phases (Noorderhaven, 1995).

In the Strategic Approach, the various steps in the decision process are closely interrelated and the process has an iterative rather than a linear, sequential nature. Later, the different phases of the process will be described in relation to:

- The different phases in the building’s life cycle
- Management of Corporate Real estate

But first, the different phases will be described on a more general level. In the following, the different phases will be described separately, even though they are closely interrelated. Much of thediscussion will be based on "Strategic Decision-making" (Noorderhaven, 1995):

### 6.4.3 Awareness

An opportunity or problem has to be recognised in order for the decision-makers to enter the decision-making process. In the rational-normative model, the recognition phase is not part of the decision process, but acts as a presupposition for it, as the recognition that "something must be done" is already dealt with. In the iterative model, the recognition phase and the formulation of the problem is an iterative process which also interacts with the formulation and evaluation of alternatives.

In the awareness phase, the decision-maker's ability to detect, interpret, and understand signals and situations is vital to the further development of the process. In the recognition phase, a perception of the problem is developed. Noorderhaven points at possible problems with formulating and categorising of problems too early (Noorderhaven, 1995). Because of the interconnectedness of factors in BUR, this must be taken seriously in a Strategic Approach for Adaptability. Something that in the beginning is viewed as a problem of buying new furniture and rearranging desks, can end up as an organisational development project, and vice versa. Narrowing the problem down to a matter of buying desks will limit the possibilities for invention later in the process.

### 6.4.4 Analysis

As opposed to the rational-normative model, goal-setting is part of the analysis phase in the iterative model. The analysis is seen as an iterative process of formulating and evaluating goals and options.

**Goal-setting**

Goals state what is to be achieved and when results are to be accomplished, but they do not state how the results are to be achieved (Mintzberg et al., 1995). Usually "goals" are divided into a hierarchy:

> "All organisations have multiple goals existing in a complex hierarchy from value objectives, which express the broad value premises towards which the company is to strive; through overall organizational objectives, which establish the intended nature of the enterprise and the directions in which it should move; to a series of less permanent goals that define targets for each organisational unit, its subunits, and finally all major programme activities within each subunit." Page 5 (Mintzberg et al., 1995).

Such a goal hierarchy is reflected in the different terms used to describe goals at the different levels. The word "strategy" is used as the pattern or plan that integrates an organisation's major goals, policies, and action sequences into a cohesive whole (Mintzberg et al., 1995). Noorderhaven uses "mission" to describe "a broad statement of purpose, expressing the raison d'être of the organisation, and "goals" and "objectives" as more concrete and specific translations of the general statements in the mission (Noorderhaven, 1995). For the Strategic Approach, it is important to notice that goals are hierarchical. Subsequently, the process of defining them can be hierarchically layered. This is one of the foundations for layering, which is described later. A hierarchically layered process as a strategic tool is discussed later in this chapter.

In strategic decision-making, goals can not be assumed to be given, because preferences are inconsistent and imprecise and change over time. It is difficult to know what one prefers if one does not know what is feasible, thus the definition of goals takes place in close interaction with the generation and evaluation of alternatives.

In line with the concept of "satisfactory" instead of "optimal", decision-makers need a goal concept that enables them to take shortcuts and to economise on information requirements. Noorderhaven labels this alternative goal concept "acceptable level" or "level of aspiration" (Noorderhaven, 1995):

> "Instead of searching for an elusive optimal solution, decision-makers focus on a target stating acceptable levels of achievement in specified dimensions." Page 27 (Noorderhaven, 1995).

The difference between explicit and implicit goals, and conflicting goals between different parties complicates the goal definition process further.

**Generating options**

In the iterative strategic decision-making model, options are not viewed as given (like in the normative-rational model), but as something that has to be found or developed. The search for information is costly and time-consuming, and at some point during the information gathering, the costs must be weighed against the benefits of acquiring extra information. Gathering all relevant information is thus not practically or theoretically possible, and incomplete information will almost always be the case. What is "sufficient" information should therefore be determined, to ensure appropriate information on which decisions can be made.

The nature and complexity of the problem will determine the number of options that must be sought for, and the level of innovation and invention that must be developed. Solutions to the simplest problems will be looked for in the close perimeter from the existing solutions. Such solutions to "small problems" will ensure an incremental, step-by-step process, while more complex problems may lead to a radical redesign of the situation. This is reflected in the concepts of "continuous adaptations" and "major adaptations" in the BUR model.

#### Evaluating options

In the iterative model, evaluation is very closely related to generation of options. Generating and testing the alternatives is part of the same "conversation" or inquiry. If only one alternative is considered (due to time/cost limitations), there will be no use for evaluation. On the other hand, some alternatives can go through several loops of evaluation, further development of the solution, and then back to evaluation. All options can be developed first and later evaluated, or they can be developed and evaluated individually and in a sequence.

There are numerous methods for evaluation. Some are formal, while others highlight the importance of informal evaluations. Some only consider quantitative issues, others try to incorporate qualitative aspects in different ways. Some require numerical analyses and computer simulations, others favour group techniques. The different methods of evaluation fall outside the scope of this work, but in the next two chapters, some methods for determining the decision parameters, such as cost/benefit analysis, life cycle costing, functional analysis, etc., in planning/design/construction and in management, are mentioned.

It is in the process of generating and evaluating options that most tools to assist strategic decision-making are used, such as scenarios, cognitive mapping, risk assessment etc. Some of the most relevant tools for the Strategic Approach are described later, in chapter 8.

### 6.4.5 Action

The need for action is usually the reason for engaging in a strategic decision-making process, as determining which action is "the best" is the major goal in most decision processes. Action consists of three issues: the act of choice, implementation, and control.

#### The act of choice

In a fully rational model, one would expect the option that is selected and evaluated as the best, to be chosen. In reality, this is not always the case. The outcome of the evaluation process may not "feel right" for the decision-makers, and may be rejected in favour of another option (Noorderhaven, 1995). Making a choice is a commitment to action, but avoiding the act of choice will also influence the situation.

> "... we have discussed instances of active decision-making: choice by **commission**. In many cases, however, decisions are made by **omission**: the organization fails to select and commit itself to a particular course of action." Page 33 (Noorderhaven, 1995).

#### Implementation

Making a choice is a commitment to action, but it is in implementation that it transforms from an intellectual to a physical process, which implies the use of resources, time, and energy, and which will really make an impact in the actual situation. This makes the implementation process different from the other phases in the process. Turning decisions into action requires managerial skills, both when it comes to persuading and motivating other actors, planning and carrying out the necessary steps, allocating resources, e.g.

> "… a host of operational and administrative decisions have to be taken in order to implement a strategic decision." Page 34 (Noorderhaven, 1995).

Noorderhaven points at three possible dangers in the implementation phase (Noorderhaven, 1995):
- Top management may lose interest in the decision
- Resistance against the implementation because of conflicts of interest between different groups
- The situation may change so drastically that the decision is not a good solution anymore

**Control**

Implementation and action will change the situation, shifting the balance from the previous situation. Sometimes this produces the result one wants. Other times the result is unwanted, and the situation needs adjustments. This is why, after implementation, some kind of corrective action may be required.

The outcome of implementation needs to be controlled for at least two reasons. One is that one has to ensure that the implementation is actually carried through as intended. Another is that the situation may change, or the result may produce some unforeseen side-effects that must be corrected. This may be the start of a feedback-loop.

In most situations, the process of awareness, analysis, and action is carried out in a more or less continuous series of loops. As the situation changes continuously, the strategic decision-making process will have to be repeated, as it will always fail to produce a result that is "the single right one" for the present and even less so for the future.

### 6.4.6 Learning

As we have seen earlier in this chapter, the bounded rationality of humans was discovered early in the literature on organisational theory. In theories on organisational learning, this is taken one step further. The normative rational process of analysis, decisions, action, and result is changed into an open process description, which reacts on its environment and thus is able to learn and adjust its actions.

The strategic decision-making process can be seen as a series of learning loops. Argyris and Schön point at learning as one of the important aspects of dealing with change.

> "Now in the mid-1990's, it is conventional wisdom that business firms,

governments, nongovernmental organizations, schools, health care systems, regions, even whole nations and supernational institutions need to adapt to changing environments, draw lessons from past successes and failures, detect and correct the errors of the past, anticipate and respond to impending threats, conduct experiments, engage in continuing innovation, build and realize images of a desirable future. There is virtual consensus that we are all subject to a "learning imperative," and in the academic as well as the practical world, organizational learning has become an idea in good currency." Page xvii (Argyris & Schön, 1996).

In his article "Organisational Learning" (Schön, 1983), Donald Schön presents what he calls an operational description of organisational learning as *a shift in organisational theory-in-use mediated by organisational inquiry*. This definition is in line with the theories of Argyris and Schön in "Learning Organisations 2", where they develop a theory about an organisation as a system that is able to learn. They develop their understanding of learning in organisations based on the assumption that there are at least two ways of learning – single and double loop (Argyris and Schön, 1996):

1. Single-loop learning: Instrumental learning that changes strategies of action or assumptions underlying strategies in ways that leave the values of a theory of action unchanged. Thus single-loop learning is organisational inquiry and instrumental learning that leads to improvement in the performance of organisational tasks.
2. Double-loop learning: Learning that results in a change in the values of theory-in-use, as well as in its strategies and assumptions. Thus double-loop learning is inquiry through which an organisation explores and restructures the values and criteria through which it defines what it means by improved performance.

"The double loop refers to the two feedback loops that connect the observed effects of action with strategies and values served by strategies. Strategies and assumptions may change concurrently with, or as a consequence of, change in values." Page 21 (Argyris and Schön, 1996).

Argyris and Schön credit W. Ross Ashby for the distinction between single and double-loop learning:

"Ashby formulates his distinction in terms of (a) the adaptive behaviour of a stable system, "the region of stability being the region of the phase space in which all essential variables lie within their normal limits," and (b) a change in the value of an effective parameter, which changes the field within the system seeks to maintain its stability. One of Ashby's examples is the behaviour of a heating or cooling system governed by a thermostat. In an analogy to single loop learning, the system changes the values of certain variables (for example, the opening or closing of an air valve) in order to keep temperature within the limits of a setting. Double-loop learning is analogous to the process by which a change in the setting induces the system to maintain temperature within the range specified by a new setting." Page 21 (Argyris and Schön, 1996).

The example of the thermostat can very easily be translated into BUR issues, as continuous adaptations is one kind of single-loop learning (the adaptive behaviour of a stable system), and major adaptations require decision processes in order to exercise double-loop learning (changes the space within which the system seeks to maintain its stability). Argyris and Schön describe *inquiry* as the driving force behind organisational learning:

> "… the intertwining of thought and action that proceeds from doubt to the resolution of doubt." (...) "doubt is constructed as the experience of a "problematic situation" triggered by a mismatch between the expected results of action and the results actually achieved." Page 11 (Argyris and Schön, 1996).

One such "problematic situation" could be the mismatch between the actual and the needed performance of the organisation's physical environment. The iterative decision-making process, as we have described it with parallels to design, is an example of inquiry. The strategic decision-making process can therefore be seen as a process of learning and adapting in a changing environment.

### 6.4.7 Summary, strategic decision-making

An iterative, strategic decision-making process is described, which is the backbone of the Strategic Approach. The process is described as an inquiry, with focus on learning. The different phases of the process are described in general. This will have to be operationalised further within the specific situations in which it applies. In chapter 8, the strategic decision-making process is discussed in relation to managing BUR mismatches, and it will be applied in the building's life cycle, because these two issues relate most directly to the BUR model. A Strategic Approach can of course also be applied with the main focus on commercial real estate or other parts of the real estate and building industry. This is, however, outside the scope of this work.

# 6.5 Concepts and terms

In this section, some of the most important terms and concepts used in this work are presented.

## 6.5.1 The office – work, building, or workplace?

The term "office" describes both a particular sort of building and refers to a specific form of work organisation. In his article "The social construction of office space", Baldry defines three different aspects of the office: The office building, the office space within that building, and the office work within that space (Baldry, 1997). In this work, theories about technology have been used, as the assumption is that the workplace can be viewed as part of an organisation's technology. Technology is, in works that highlight the social aspects of technology, defined as (Bijker et al., 1987), (Levin, 1997):

- physical objects or artefacts
- activities or processes: the use of artefacts in order to perform certain tasks
- what people know and do, the "know-how" which is needed to operate physical artefacts

This is also true for the term "*office*". In addition to the three aspects mentioned above, we have to subdivide the "physical artefact", as it is common in architectural theory to look at buildings both as *technical systems* and *technical structures,* and as the *space* that is created inside. Usually, a building is also seen as a *bearer of meaning*, as it reflects the values and priorities of its owners, users, and of the time in which it is constructed. This meaning is socially constructed, and changes over a period of time. From this is it clear that it is very difficult to give a precise definition of "the office". We have to deal with the office as an interplay between the aspects mentioned above, between the social and the physical structures. In the constructivist and process-focused approach, we have to add another dimension, as we see the office as socially constructed, that is *a product of a complex social process*.

The term "office" will have to include all these aspects, and this thesis is written in that spirit. The multiple meanings of the word "office" illustrate the connections between the different layers of meaning, and highlight one of the main topics in the work, the fact that buildings, space, work, and organisations mutually affect each other.

What we conceptualise as "the office" will change over a period of time. Our mental pictures of offices are also highly dependent on the cultural and national context in which we live and work (van Meel, 2000). In the Introduction and in Attachment 2 we discuss, briefly, that the Norwegian office building has changed and developed during the last decade. Today, office *work* is not only limited to an office *building*, as technology makes it possible to work from other places as well. It will, in many cases, be more sensible to discuss "the workplace" instead of "the office building". The workplace is a place where someone works. This can be in an office building, in a hotel, at home, etc. If we focus on the "workplace" instead of the office building it is also easier to see that the physical surroundings is only one of several factors that support work. This work is, however, concerned primarily with buildings, hence the term "office building" will be used.

### 6.5.2 Concepts related to adaptability

An adaptation is an adjustment to changing requirements or environments.

> *ADAPT – to make suitable to requirements or conditions; adjust or modify fittingly. – to adjust oneself to different conditions, environments, etc. (Webster's, 1994)*
>
> *ADAPTABLE – capable of being adapted. – able to adjust oneself readily to different conditions (Webster's, 1994)*
>
> *ADAPTATION – the act of adapting or the state of being adapted. – a form or structure modified to fit changed environment. In biology: any alteration in the structure or function of an organism or any of its parts that results from natural selection and by which the organism becomes better fitted to survive and multiply in its environment (Webster's, 1994)*
>
> *ADAPTABILITY[5] - the ability to change, responding to internal or external changes*

According to this definition, adaptability is not only a characteristic related to the building and its physical systems, but can be applied to everything that is concerned with the match between the office building, its environment, and the work carried out inside it.

In this work, the concept of manoeuvring room is important to adaptability. This has been defined as:

> *MANOEUVRING ROOM – the capacity to change and manoeuvre within a defined framework. This can be both physical (changes within a permanent structure) and figuratively (the range of possibilities within the strategically defined framework of possible decisions).*

The manoeuvring room is limited by certain constraints. The design of these constraints, or the decisions leading up to them, is viewed as one of the main means to determine the adaptability of the building or the system. Every decision which is made, and every wall which is constructed, will define the manoeuvring room within the system in the future. The importance of different decisions must be weighed against the manoeuvring room in the future. One example of a very narrowly defined manoeuvring room is highly overspecified systems, in which only certain components (specially designed and manufactured) can fit.

**Other terms related to adaptability**

*RESPONSIVE - making answer or reply, esp. responding or reacting readily to influences, appeals, efforts, etc. (Webster's, 1994).*

*ADAPTIVE REUSE – conversion of a facility or part of a facility to a use significantly different from that for which it was originally designed (Iselin and Lemer, 1993).*

### 6.5.3 The process of adapting buildings and organisations to each other

Buildings are adapted to their users and the occupants adapt to their buildings. One example of this is shown in figure 34. The organisations demand for space changes continuously, while only a certain amount of space is available at any given moment. The supplied space usually has some built-in spare capacity from the beginning, but within these limits it is constant. The amount of available space can be changed, but this typically happens in steps and will require investments in the facility. This causes a mismatch between the demand for and the supply of space. A perfect fit is rare, and will in most cases be temporary. Most of the time one has to live with changing degrees of mismatches. An optimisation, as in a perfect fit between supply and demand will therefore be Utopian, and the best one can do is to find satisfactory solutions which reduce the mismatch to a minimum. In this work, the process of adapting buildings and organisations to each other in order to reduce the mismatch between them is described. In relation to figure 34, one can picture the process of forcing the two lines together, where adaptability is the supply's or demand's ease of adaptation to each other.

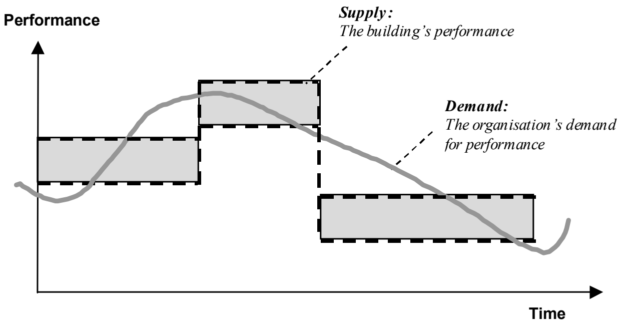



Figure 34. Supplied and demanded area, office space. All the time there is a mismatch, there is a process of fitting supply and demand together. This process relies on the adaptability both on the supply and the demand side.

In this work, a separation between continuous adaptations and major adaptations is made:

*CONTINUOUS ADAPTATIONS – happen as a part of the day-to-day adjustments of the facility. Will happen without any major construction work, if any only of short duration and impact. This is the process of moving people, furniture, and "stuff" around, but also minor physical changes like changing interior partitions, etc.*

*MAJOR ADAPTATIONS – happen when the mismatch is so severe that correcting it will require more serious measures. Major construction work, change of location, acquiring additional space, demolition and construction of new buildings, are all examples of major adaptations, some which will end the relationship between the building and its occupant, the BUR relationship.*

In many cases, people use the word "flexibility" where "adaptability" is used in this work. Bev Nutt uses property flexibility, market flexibility, physical flexibility, operational flexibility, and use flexibility (Nutt, 1999). Virginia Gibson uses both physical adaptability and physical flexibility, but always functional and financial flexibility (Gibson, 1999). Other writers highlight the time-dimension between flexibility and adaptability, where flexibility is about short-term, often potentially reversible changes of low magnitude, and adaptability is a built-in potential for larger-scale changes in the longer term (Leaman et al., 1998).

According to the core definitions of the terms flexible[6] and adaptable, flexibility is about bending something within a certain set of possibilities, and adaptability about changes as a response to external or internal changes. The main focus of this work is the dynamic relationship between buildings and users, and thus the word adaptability seems the most appropriate. In order to reduce the mismatch between the supply of space and the demand for it, a*daptability is the manageability of the mismatch.* The building, the organisation, or both, will be adapted to fit the demand and supply. The term "flexibility" has been dedicated to one of the forms of physical adaptability in the building. Still the terms functional and financial flexibility will be used in order to be in line with the terminology in other works.

Adaptability depends on:
- The use of the building, the user organisation – functional flexibility
- The building – physical adaptability
- Other means to reduce the mismatch, e.g. financial and contractual flexibility

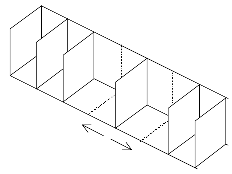
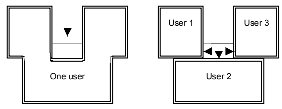
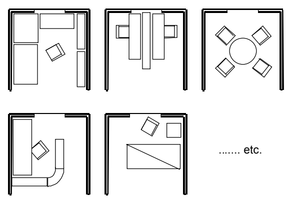
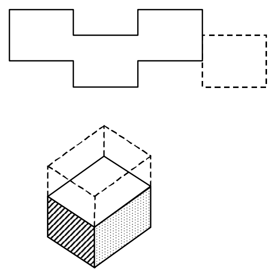
**Functional flexibility**

Functional flexibility is about the organisation's use of space and the space's functional possibilities. The latter are related to multifunctionality, making space for future changes, of loose/tight fit between the activities and the building, etc. When it comes to the organisation's use of space, things like workplace strategies (hot desking, shared workspaces, etc.), varying density, operating hours, and flexible working locations are the main issues.

**Physical adaptability**

Physical adaptability is the building's structural and technical systems' ability to adjust to changes in use, ownership, or environment. Technical and physical adaptability can be achieved by flexibility, partitionability, multifunctionality, and extendability, see table 5:

**Physical adaptability:**

| | | | |
|---|---|---|---|
| Flexible | Dismantable<br>Rearrangable<br>Adjustable<br>Exchangable<br>Alterable<br>Mobile<br>Shapable<br>Modular | The ability to change within an existing main structure. Some built-in possibilities to rearrange, take away, or add elements and systems. |  |
| Partitionable[1] | Disconnectible<br>Zoneable<br>Collective/<br>separate<br>Central/<br>decentral | The possibilities of dividing the building into different functional units. This depends on the functional layout of the building, the relationship between units, accessibility to separate units, etc. |   |
| Multifunctional[2] | Universal<br>Robust<br>Generous<br>Spacious<br>Over-capacious | The properties of a building or system which allow it to be used in different ways and for different functions. This depends on dimensions, both spatial and structural, the internal layout and capacity of the building |   |
| Extendable[3] | Dimensions<br>Layout/building concept<br>Available space<br>Infrastructure<br>Available capacity<br><br>Note also:<br>Selective demolition | The possibility of a building or a collection of buildings to be extended, horizontally or vertically. This depends on available space, the capacity of existing structures and infrastructure, the architectural layout of the building/complex, etc. One must also consider the opposite: the ability to demolish parts of the building. |  |

[1] Partition – a division into or distribution in portions and shares – a separation, as of two or more things Ibid.
[2] Multifunctional - of multiple functions
[3] Extend – to stretch out in various or all directions; expand; spread out in area. (Webster's, 1994. Webster's Encyclopedic Unabridged Dictionary of the English Language. Gramercy Books, New York.)

Table 5. Physical adaptability can be achieved by different means, e.g. flexibility, multifunctionality, partitionability, and extendability. These categories are inspired by “The Language of Flexibility” in Flexis (Geraedts, 1997), but distinguish themselves from that in both terminology and in the understanding and content of several of the terms.

**Financial and contractual flexibility**

Financial flexibility is related to the financial situation and arrangements of owners and users of the building and in the real estate market in general. Contractual flexibility depends on the types and length of contracts and the ruling practices in the market, own/lease strategies as well as on available alternatives (both for owners and occupants).

## 6.5.4 Concepts related to the life cycle perspective on buildings

The building's life cycle starts with an idea or vision and ends with the demolition of the building. In this "cradle-to-grave" perspective the building undergoes large transformations, from an idea, to a design, to a physical structure, and then back to "ashes and dust". Lately, a lot of attention given to the reuse of buildings, components and materials has added another dimension to this, and it therefore make sense to talk about reincarnation and a second lifecycle.

*LIFE CYCLE – The sequence of events in planning, design, construction, use, and disposal (e.g. through sale, demolition, or substantial renovation) during service life of a facility; may include changes in use and reconstruction, (Iselin and Lemer, 1993).*

Lately, the notion of a linear process has given way to that of a circular process. This is discussed in the next chapter.

The main goal in this work is to improve *buildings in use*, but this perspective has implications for planning, design, and construction, so the whole life cycle of the building will be discussed. Still, it is the facilities' performance *in use* that is of major interest to us.

In use, we see that over time the quality and service decline from their initial level as the facility exhibits the results of normal wear, poor workmanship or materials, events like storm or fire, ageing, or a combination of such factors. The life-span of a facility can be described in different ways:

*SERVICE LIFE[10] – The period of time during which a building, component or subsystem actually provides adequate performance; a technical parameter that depends on design, construction quality, operations and maintenance practices, use, environmental factors, and users' and owners' expectations; not the same as economic life or designed service life (Iselin and Lemer, 1993).*

*DESIGN SERVICE LIFE[11] – The period of time during which a building or a building subsystem or component (e.g. the roof, mechanical equipment, plumbing, or sheathing) is designed to provide at least an acceptable minimum level of shelter and service, as defined by the owner; typically depends on assumptions, sometimes implicit, regarding* *satisfactory completion of normal maintenance activities. An idealized service life (Iselin and Lemer, 1993).*

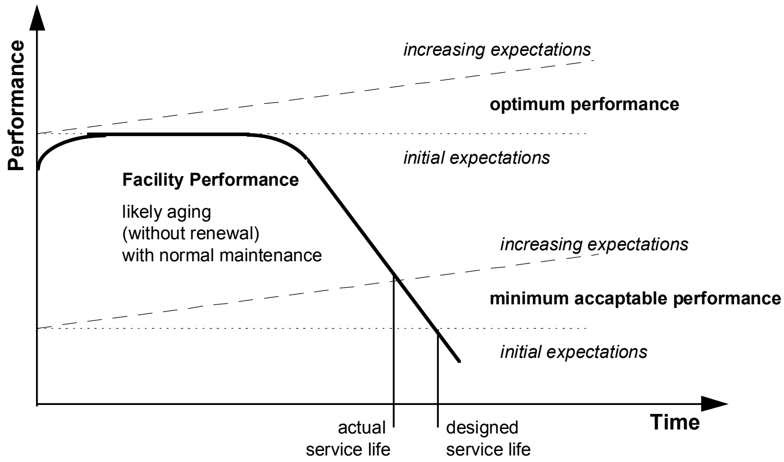



Figure 35. Service life and designed service life, standards and expectations of performance may change with time, after (Iselin and Lemer, 1993).

*PHYSICAL LIFE – The time it takes for a building, subsystem, or component to wear out or fail. The "time period after which a facility can no longer perform its function because increasing physical deterioration has rendered it useless" (Iselin and Lemer, 1993). Physical life equals technical life, which is defined as: "... the time span during which the building meets the technical performance criteria of a given maintenance strategy (Dewulf et al., 2000)".*

*FUNCTIONAL LIFE – The time in which a facility, or part of a facility, serves the functional requirements of its users and owners.*

Functional life-span is related to the use of buildings, while the technical life-span is determined by the technical state of the building. The actual service life of a facility is a result of the balance between supply (technical life-span) and demand (the functional requirements). In some cases, the economical life-span is also seen as a result of this balance between demand and supply (Hermans, 1995). This implies that the economic life-span ends when the functional requirements are not met by the technical supply, which will call for some kind of economic action, par example an investment in a replacement of the malfunctioning component, to bridge the gap between demand and supply. This way of defining economic life is useful when we consider components and building elements which can be analysed separately by economic life costing models, but more difficult to operationalise when it comes to the use and ownership of buildings and facilities in general. In this work, the economic life-span is defined as related to the benefits, or monetary value, delivered to an owner.

*ECONOMIC LIFE – The period of time in which costs are incurred and benefits or disbenefits are delivered to an owner; an assumed value sometimes established by tax regulations or other legal requirements or accounting standards and not necessarily related to the likely service life of a facility or subsystem (Iselin and Lemer, 1993).*

In simple words, this is the ratio between potential income and costs. If there is no return on investment, the economic life of a building is over (Dewulf et al., 2000). The actual time the building is in use is also dependent on the functional and technical characteristics of the building and *its location* in relation to the demand in the *real estate market*. The actual service life will therefore not have to equal the economic, functional, or technical lives (Holter, 1980).

If one examines the relations between the functional, technical, and economic life spans an interesting pattern emerges. Hans de Jonge shows, f. i. in "Successful Corporate Real Estate Strategies" (Dewulf et al., 2000), this illustration of the relationship:

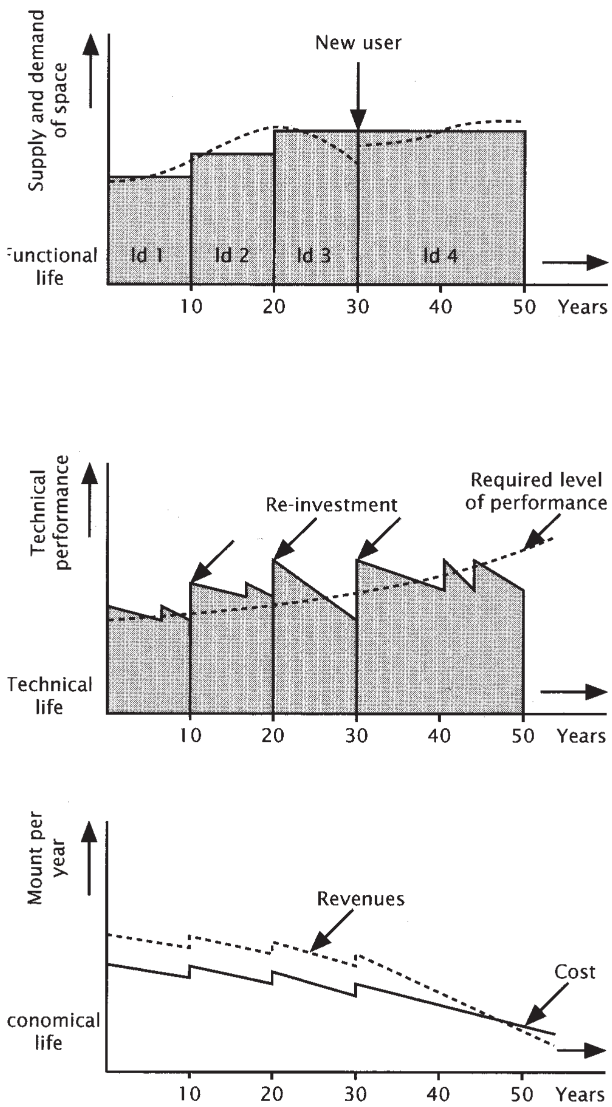



Figure 36 – Relation between functional, technical and economic life of a building (Dewulf et al., 2000).

The *functional life* shows the growth and decline of a user organisation. When there is under-utilisation (in the example after 30 years), a new user organisation enters the building, and the old tenant moves on to another building. When the functional performance is adjusted, reinvestments in the building have to be made. The changes happen in steps. The *technical life* shows the technical performance of the building. The re-investments are aligned with the changes in functional performance. In addition to that, both maintenance and renovation are carried out in order to slow down the deterioration and outdating of the building. The *economic life* is shown in the last graph. Every time there is a change or adjustment in the functional or technical performance, the profit and/or cost graphs will change accordingly.

**Building maintenance and upgrades**

Because a building's technical state is always deteriorating, there is a constant need for maintenance and upgrades. Maintenance, renewal, and retrofitting work to level out some of the performance decline, in order to extend the service life.

*MAINTENANCE – All activities aimed at conserving the condition of an existing building or restoring the building into a condition which is sufficient to fulfil the initial requirements during a requirement period (Hermans, 1995), based on earlier works by Henket and Garaerds.*

*RENEWAL – Substantial repairs and improvements in a facility or subsystem that returns its performance to levels approaching or exceeding those of a newly constructed facility (Iselin and Lemer, 1993).*

*RETROFIT – The redesign and reconstruction of an existing facility or subsystem to incorporate new technology, to meet new requirements, or to otherwise provide performance not foreseen in the original design (Iselin and Lemer, 1993).*

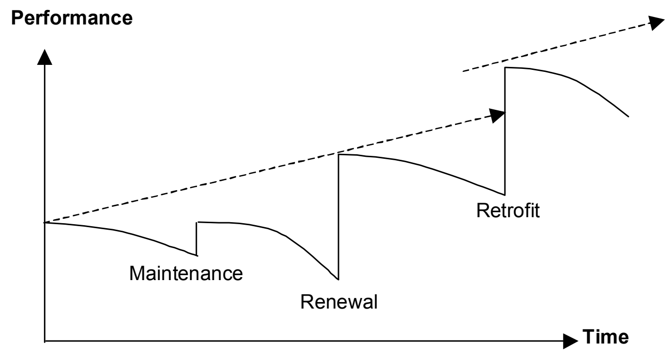



Figure 37. Maintenance, renewal, and retrofits in relation to the building's increasing performance requirements.

The ISO standard uses repair, maintenance, refurbishment, and restoration to describe the different levels of construction works done to a building during its use and operation phase (ISO/FDIS 15686-1, 2000):

- “**Repair** – return of a building or its parts to an acceptable condition by the renewal, replacement or mending of worn, damaged or degraded parts.”
- ”**Maintenance** – combination of all technical and associated administrative actions during the service life to retain a building or its parts in a state in which it can perform its required functions.”
- **“Refurbishment** = rehabilitation = renovation = modification and improvements to an existing building or its parts to bring if up to an acceptable condition.”
- **“Restoration -** actions to bring an item to its original appearance or state.”

The terms used in Iselin and Lemer; renewal and retrofit, describe how the construction works brings the facility up to a standard “as new” or even beyond that. Their definitions are used in this work.

**Obsolescence**

Obsolescence becomes a significant issue when it occurs prior to the end of the *design service life*: the length of time for which a building, subsystem, or component is designed to provide at least an acceptable minimum level of shelter or service, as defined by the owner. The user’s and owner’s expectations change over time as a result of the development of newer facilities, the introduction of new products and increased experience. This shortens the service life.

> *OBSOLESCENCE[12] – The condition of being antiquated, old fashioned, or out of date, resulting when there is a change of the requirements or expectations regarding the shelter, comfort, profitability, or other dimension of performance that the building or building subsystem is expected to provide. Obsolescence may occur because of functional, economic, technical or social and cultural change (Iselin and Lemer, 1993).*

# 6.6 Uncertainty, opportunity, and risk in the project

Some of the most important strategic issues are concerned with reducing risk and to maximising opportunities, and one important part of the ongoing process of matching demand and supply is to assess uncertainty, opportunity, and risk. Theories on uncertainty in projects have changed during the last years, from a focus on uncertainty as risk and possible losses and disadvantages, to a more opportunistic, dynamic view of uncertainty: as possibilities for change. Today uncertainty is conceptualised as both risk and possibility, and every project will have a unique distribution of risk and possibility that will change during the project's life cycle (Husby et al., 1999).

Uncertainty and the possibilities of influencing the project will change during the project's life cycle. The type of uncertainty and its cause will also change during the process. In the beginning of a project everything is uncertain. There is a lack of information about the situation, about goals and missions, and about possible solutions and options. As the project progresses, the uncertainty is reduced, as knowledge about the situation increases and decisions are made. Ironically, the most important decisions in the project are made in the beginning, when knowledge about solutions and consequences is limited and the situation uncertain.

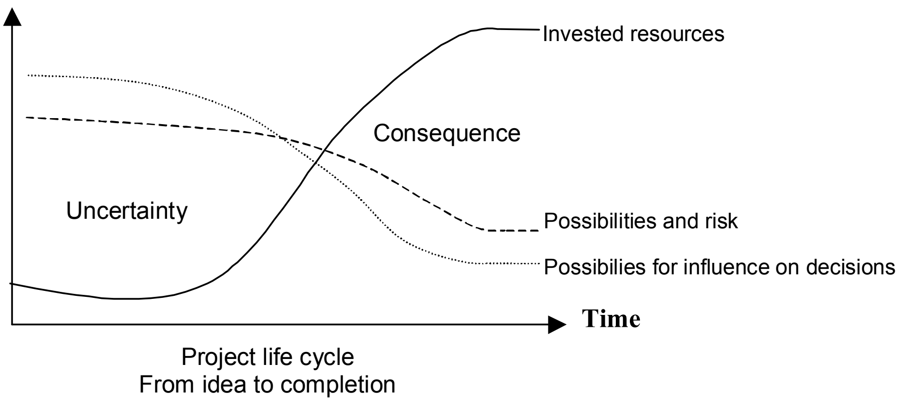



Figure 38. Uncertainty and value change during the project from idea to completion. In the first phases the uncertainty is great, but there are also more possibilities for influencing decisions. The consequences of the decisions made in the process will however be apparent in the last phases of the project. Adapted from *(Husby et al., 1999)*.

Figure 38 shows that when the most important decisions are made in the beginning, when uncertainty is great, the consequences of those decisions only become apparent towards the completion of the project. The uncertainty is reduced through gathering information, planning and design, formal decisions, contracts, and agreements. As the uncertainty level drops, the project becomes more and more defined and real, in physical terms, by design decisions and finally construction of the physical building. Per Eikeland takes this one step further by introducing something which is very close to what is defined as manoeuvring room in this work, which is the potential for change within the process. This is defined by the possibilities and risk-profile, which is dropping more or less parallel to the uncertainty profile, figure 39. (Eikeland, 1999).

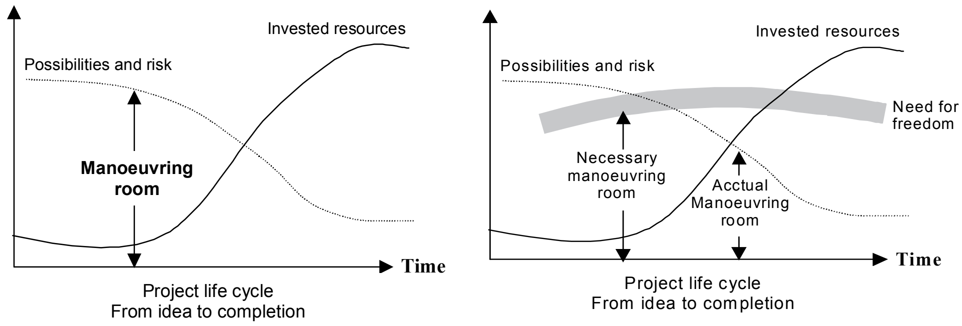



Figure 39. Manoeuvring rom in the project's life cycle, adapted from *(Eikeland, 1999)*.

In every building project, there is a transformation from the organisation's needs, which are stated in a "business language", to the technical and physical language of the designers and builders. By initiating the building project, the organisation is trying to solve a business problem. It enters the briefing process with a picture of what its needs are. The involvement in the building project may help to make the organisation learn and become more aware of its opportunities, which in turn may make it reassess its initial requirements. To implement this into the building process, the user wants as much freedom as possible as late as possible in the process. If we consider the efficiency of the building project in design and production, it is important to make some decisions as early as possible. This means closing options and limiting the scope of later decisions. When layering the brief and the corresponding design development, it is important to decide which decisions must be made and which options can stay open until a later stage in the process.

In order to reduce risk and possibilities early in the project, one can define as much as possible as soon as possible. This results in the possibilities and risk-profile A in figure 40, and it is beneficial for the efficiency in the building process, and it probably makes the process easier to manage. This will, however, determine most of the project in the early stages, where information is limited and the project is still vague and "immature". In projects with more demand for innovation and more focus on project- and organisational development, the possibility and risk-profile will be more like B. In such projects, changes and the need for more manoeuvring room make the process more uncertain, and a high level of uncertainty is present also in the later stages of the process. In such projects some decisions will have to be pushed forward in time. In order to make this work, one needs project management which is able to handle uncertainty, and a way of organising the project to make sure that the timing of decisions and the project development are not hampered by this high level of uncertainty. In order to achieve maximum flexibility, in theory, as much as possible is decided as late as possible. This is of course not possible in real projects, where some decisions have to be made and action taken in order to ensure project progression and realisation. In order to handle this, one needs a method to determine the latest point in the process where the decision must be made and action taken. We know that the Building - User Relationship is constantly changing, and that both the demand and the supply side will develop during the process. The question is at which point one has to "freeze" the supply in order to realise the project. This will be discussed later as part of the theory of "layers".

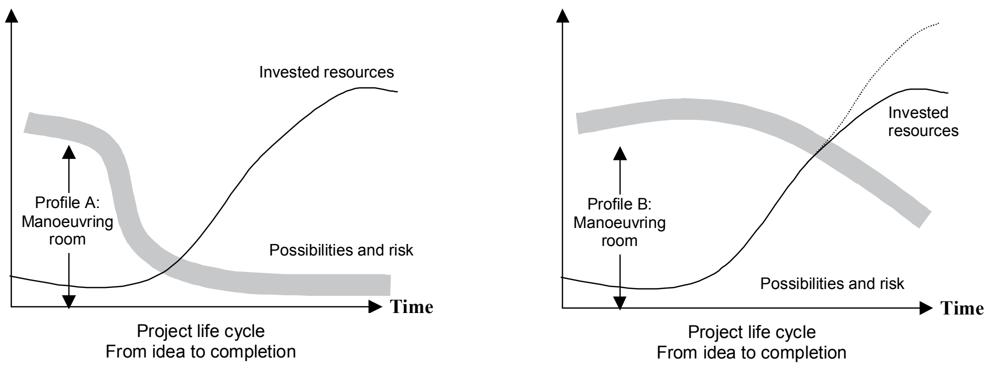



Figure 40. Profile A and B, possibilities and risk.

Profile A imposes more certainty early in the project, and makes it possible to manage a rational, efficient building process. Profile B gives more freedom in the process and will demand more co-ordination in order to manage the process to achieve the desired result within the cost limits. In most cases, the project will be somewhere between A and B, but the awareness of the different profiles may be beneficial when deciding how the project should be carried through and managed. In a project with a low risk and limited possibilities for innovation, a profile like A would probably ensure the most efficient process, both when it comes to costs and time. In a project where the situation is uncertain, and there is a lot of development and innovation in the project, one should expect a profile more like B, and the process should be planned and managed in order to handle this added uncertainty.

In most projects, changes happen during the process, whether one expects a great deal of uncertainty or not. Changes might seriously affect the total cost of the project, both because the scope of the project sometimes grows as one starts to understand its possibilities and complexity, and because changes may mean correcting mistakes and possibly choosing more expensive solutions. Controlling costs and the quality of the project output (the building) becomes more complex under a great deal of uncertainty. Project management under uncertainty will be outside the scope of this work, but is obviously important in order to ensure the right quality and the right product within the cost- and time limits in highly uncertain situations.

Every project has a unique uncertainty profile, and the question is how much manoeuvring room is needed in each project. This will in turn affect how the project is planned and managed. This is a decision that must be made in the beginning of the process. This means that in the initial phases of the project, one has to ask questions about the nature of this specific project, its uncertainty and need for innovation and development, and whether it is a routine project in a stable situation or an innovative and uncertain project in an unstable situation. Most projects are somewhere in between these two extremes. Determining the right manoeuvring room is one very important strategic decision, and the first step in the Strategic Approach.

> … one important goal of strategy formulation is the design of a "purposeful space" – virtual rather than physical – in which particular activities, capabilities and relationships are encouraged". Page 9
> (Liedtka, 2000)

So far, the uncertainty profile has only been discussed for the first parts of the building process, until completion. However, the reason for most of the uncertainties and the demand for manoeuvring room in the process originates from the operation and use phases of the process, and from changing anticipations of how the building will be used. After completion, the building will face as many challenges and demands for changes as during the first parts of the project, but then the possibilities of answering these needs are more limited because changes will have to take place within the existing physical structure. The manoeuvring room is thus strongly limited as soon as some physical parts of the building have been constructed. This makes it important to consider the nature of the physical structures as they will act as "frames" in which future manoeuvring room is defined.

Formal risk assessments may be a part of the analysis which is performed early in the process to determine the level of risk. Usually such assessments deal with financial risk, but other parameters may also be assessed. There is a lot of methodology for such risk assessments and for decision-making and action in uncertain situations, both in the initial phases of the project, and as an ongoing activity aiming at controlling risk during the project's life cycle (Husby et al., 1999).

The Strategic Approach aims at expanding the manoeuvring room in order to increase adaptability and to provide space in which BUR mismatches can be managed.

## 6.7 Summary, the theoretical framework

In this chapter, the investigation of the building-user relationship and adaptability is continued, in order to create a framework for developing the Strategic Approach in subsequent chapters. Historical and current efforts to enhance flexibility and adaptability are discussed. This has helped define this study, as it suggests that it should not only focus on the building, but also on the process of making, using, and managing buildings.

A Strategic Approach is proposed in order to manage BUR mismatches as one way of handling change and uncertainty. The Strategic Approach is a mindset, a way to think about adaptability. The backbone of the Strategic Approach is an iterative, strategic decision-making process, with focus on awareness, analysis, and action.

In the last part of this chapter, some of the key concepts and terms necessary to understand adaptability are presented.

The next chapter, chapter 7, presents the Strategic Approach as it may be used in the building's life cycle and in management of changes and mismatches in supply and demand. In chapter 8, some tools to enhance the manoeuvring room within the Strategic Approach are presented.

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[1] Workshop Voorburg, 23. April 1998

[2] Rittel in: "On the planning Crisis: Systems Analysis of the First and Second Generations", Bedriftsøkonomen, 8 (1972): 309-396

[3] SWOT = Analysis of Strengths, Weaknesses, Opportunities and Threats.

[4] "Virtual worlds are contexts for experiments within which practitioners can suspend or control some of the everyday impediments to rigorous reflection-in-action. Page 162, Schön, D.A., 1984. The Reflective Practitioner. Basic Books, New York.

[5] In Norwegian terminology: Tilpasningsdyktighet

[6] Flexible: – capable of being bent; easily bent. – susceptible of modification or adaptation; adaptable. Webster's, 1994. Webster's Encyclopedic Unabridged Dictionary of the English Language. Gramercy Books, New York.

[7] Partition – a division into or distribution in portions and shares – a separation, as of two or more things. Ibid.

[8] Multifunctional - of multiple functions

[9] Extend – to stretch out in various or all directions; expand; spread out in area. Webster's, 1994. Webster's Encyclopedic Unabridged Dictionary of the English Language. Gramercy Books, New York.

[10] Differs slightly from the ISO standard, but is in principle the same:

**"Service life** - period of time after installation during which a building or its parts meets or exceeds the performance requirements." ISO/FDIS 15686-1, 2000. International standard. Building and construction assets - Service life planning. Part 1 - General principles.

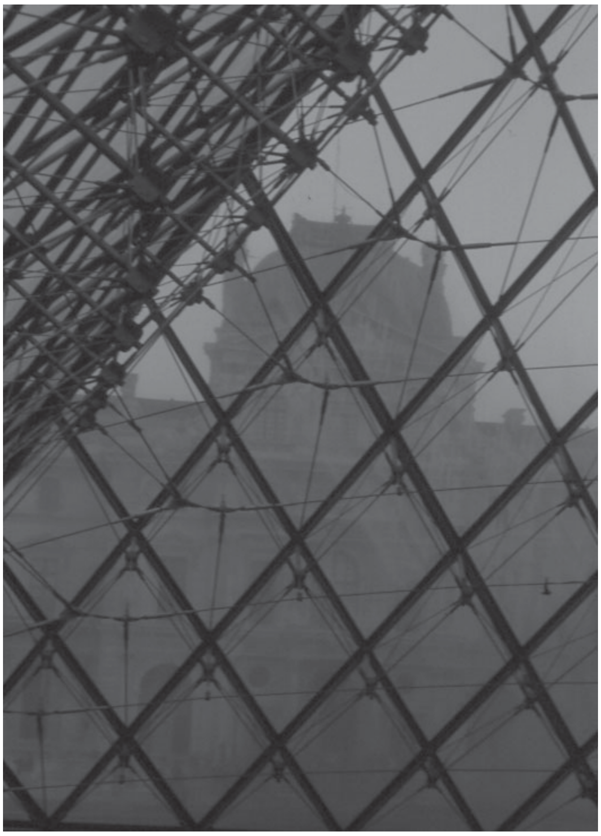
[11] Differs slightly from the ISO standard, but is in principle the same:

"**Design life** = intended service life = service life intended by the designer." Ibid.

[12] Differs slightly from the ISO standard, but is in principle the same:

"**Obsolescence** = loss of ability of an item to perform satisfactorily due to changes in performance requirements." Ibid.

# Chapter 7
# The Strategic Approach



# The Strategic Approach

The Strategic Approach is a way of matching demand and supply in the Building - User Relationship, and of thinking about adaptability and change throughout the building process. The relationship and dynamics between buildings and users has already been described (chapter 4), as well as some theoretical arguments for a strategic approach to adaptability and the development of an understanding of an iterative, strategic decision-making process (chapter 6).

In this chapter, the strategic approach to adaptability, in order to manage changes and reduce mismatches, is presented. This is related to the first proposition of this work:

> The mismatch between the building and its user can be managed and the adaptability can be enhanced by applying a strategic approach to the planning and management of office buildings.

This work deals with the theoretical and empirical investigation of this proposition. While the earlier chapters describe the situation and the problems, and develop theories and models to understand and discuss these issues, this chapter is more oriented towards solutions, and towards operationalising the theories and models described previously. This is done by examining the Strategic Approach, applied in managing mismatches between demand and supply and in the building's life cycle. Issues from the cases are used to discuss the different issues and to continue the development of a methodology to enhance adaptability.

The Strategic Approach, as an iterative, strategic decision-making process, can be applied in a variety of situations. In this work we will concentrate on the issues which are closest related to managing BUR mismatches:

- Issues related to matching demand and supply in the Building – User Relationship in a situation where a user organisation occupies one or several buildings. Use and management phase.
- Issues related to strategic decision-making in the concept, programming, design, construction, and operation/use phases of the building's life cycle
- Tools to assist strategic decision-making and to enlarge the manoeuvring room (presented in the next chapter)

Operational measures which can be used within the chosen strategy will only be discussed briefly in this work, but are still a substantial part of "the Strategic Approach to Adaptability". So is the building owner's and commercial developer's perspectives, which are also outside our scope. A summary of all parts of the Strategic Approach is presented in chapter 10; conclusions and recommendations.

# 7.1 Matching demand and supply

The Building – User Relationship is not only a model for the relationship between one building and one user, but for the general relationship between any building and its user(s). Seen from the organisation's point of view, it starts at the point where a new organisation is born and reaches a point where it needs some space to accommodate its employees and do business, and ends at the point where the organisation does not have any need for space or accommodation anymore. Seen from the building's side, the process of matching demand and supply starts with the building process, but extends beyond the completion of the building and beyond the first Building - User Relationship and the relationship with subsequent users. It survives through major retrofits, extensions, and adaptations. The process of matching the building's supply with the demand is not terminated before the building is finally demolished.

In management of buildings in use, there are several issues that are of importance when it comes to linking real estate to corporate strategies. Some of them are mentioned by Nurse and Roulac, and are summarised in table 6 (Nurse and Roulac, 1993). All these issues may be seen as important for matching supply and demand, but in the following it is the issues most closely related to reducing mismatches in the Building – User Relationship that will be discussed, namely the issues mentioned in point 2, flexibility.

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Alternative Real Estate Strategies:

1. Occupancy Cost Minimisation
- Explicit lowest-cost provider strategy
- Signal to critical constituencies of cost-consciousness

2. Flexibility
- Accommodate changing organisational space requirements
- Manage variability/risk associated with dramatic escalation/compression of space needs
- Favor facilities that can readily be adopted to multiple uses by corporation and others

3. Promote Human Resources Objectives
- Provide efficient environments to enhance productivity
- Recognise that environments are important elements of job satisfaction and therefore compensation
- Seek location convenient to employees with preferred amenities (transportation, shopping, reference, entertainment)

4. Promote Marketing Message
- Symbolic statement of substance or some other value
- Form of physical institutional advertising
- Control environment of interaction with company's product/service offering

5. Promote Sales and Selling Process
- High traffic location to attract customers
- Attractive environment to support/enhance sale

6. Facilitate and Control Production, Operations, Service Delivery
- Seek/design facilities that facilitate making company products/delivering company services
- Favor locations and arrangements that are convenient to customers
- Select locations and layouts that are convenient to suppliers

7. Facilitate Managerial process and Knowledge Work
- Emphasise knowledge work setting over traditional industrial paradigm
- Recognise changing character of, tools used in, and location of work

8. Capture the Real Estate Value Creation of Business
- Real Estate impacts resulting from demand created by customers
- Real Estate impacts resulting from demand created by employees
- Real Estate impacts resulting from demand created by suppliers

Table 6. Strategies for alignment between corporate goals and real estate decisions (Nurse and Roulac, 1993)

Here, a model for the Strategic Approach to manage mismatches between demand and supply is presented, but first a brief look at other models for matching demand and supply.

### 7.1.1 Models for describing demand and supply matches

The match between buildings and end-users can be described as circular, where the building process only is one small part of the process. The predominant parts of the circle describe the operation and use phase, where the Building – User Relationship has to be managed in order to provide the best possible fit. In this perspective, the building process in itself becomes less interesting because of its marginal share in the entire life of the building. The illustration in figure 41 is developed by the Finnish building research institute VTT, in the Vera project (Kiviniemi, 2000).

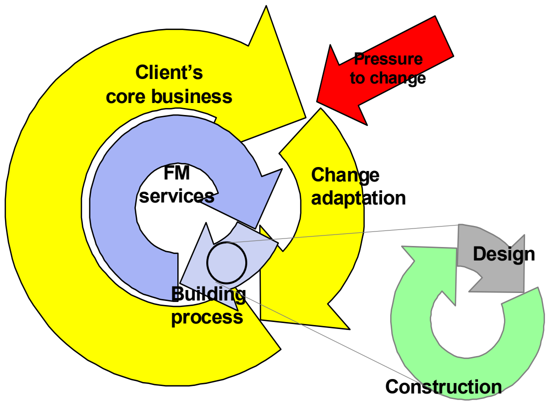


Figure 41. In the life cycle perspective of facilities, the building process is only a very short phase. The rest of the time, the main issues are related to matching demand and supply in the Building – User Relationship (Kiviniemi, 2000).

DEGW also focuses on the match between demand and supply. In one of their models, they demonstrate how the management between demand and supply is a continuous process, where both demand and possibilities for supply are analysed during use. They claim that matching demand and supply is the basis for successful real estate management, and that there is a continuous tension between demand and supply (Blyth and Worthington, 2001), see figure 42. DEGW stresses that adapting the work environment to respond to changes is as much a design as a management issue.

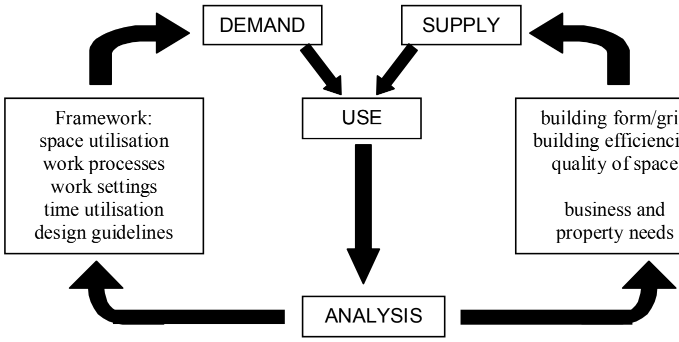


Figure 42. Matching patterns of user demand with building supply by analysis during use (Duffy et al., 1998).

In order to balance the interests of demand and supply, the real estate manager needs to understand where the organisation is heading, where it wants to be, and how it intends to get there. This means that in order to plan real estate strategies, there must be some kind of connection between the user organisation's strategies and the people who are responsible for making real estate decisions.

One formalised system for matching demand and supply is presented by McGregor and Then, as the Strategic Facilities Planning Model, figure 43.

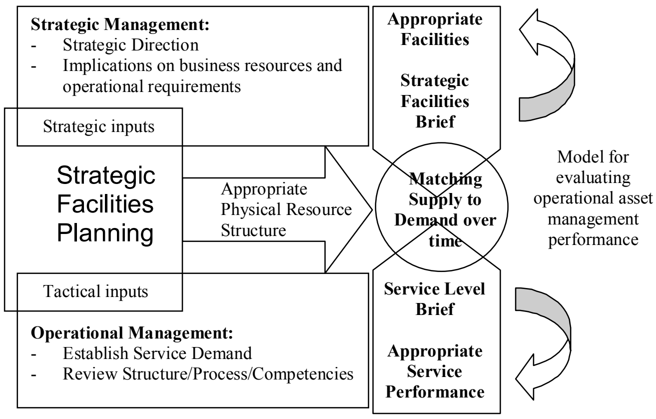


Figure 43. A structured approach to defining needs (the Strategic Facilities Brief and the Service Levels Brief) is used to match demand and supply over time.  (McGregor and Then, 1999)

In McGregor and Then's model two briefs are used to define the important issues and are used as tools to match demand and supply. They are the Strategic Facilities Brief (SFB) and the Service Level Brief (SLB). The Strategic Facilities Brief defines corporate procedures that guide key facility attributes and service performance criteria that are required to fulfil the organisation's objectives as dictated by business plans (McGregor and Then, 1999). The SFB will be influenced by several factors such as:
- the nature of business
- site selection attributes
- the need for flexibility
- the exposure to technological change
- the corporate view of the role of property and support services
- resource commitment and affordability

The Service Level Brief represents the definition of acceptable performance levels with respect to the physical asset base and the requirements for support services as defined by the SFB (McGregor and Then, 1999). The SLB will be dictated by:
- minimising exposures to risks within the workplace
- serviceability of the physical asset base
- protection of the asset value
- promotion of an environment conductive to effective working
- an appropriate procurement strategy
- costs and affordability

The above-mentioned models for matching demand and supply are all valuable, and may contribute to improving the BUR match. The different models may create an understanding of the dynamics in the relationship, and of present important issues that will have to be considered when assessing the fit between supply and demand. This work does, however, focus more on the process of managing the mismatch, and of making decisions. Next, we will see how the Strategic Approach to decision-making can be applied within the process of matching demands and supply.

### 7.1.2 To manage the mismatch

In a Building - User Relationship, there will always be some degree of mismatch. Perfect fits are rare, and they usually only last for a short time. In practice, one will therefore have to live with varying degrees of mismatches. To manage the mismatch is perhaps the most important issue when it comes to adaptability. First, the degree of mismatches has to be assessed, and one has to determine if this is acceptable or not. It is the user organisation who has to determine what is the "acceptable mismatch level", as this can vary according to the type of business, the activities that are performed, etc. Later, the available options for reducing the mismatch must be analysed, and finally, the solutions must be implemented.

The Strategic Approach, with the strategic decision-making process of awareness, analysis, and action, can be applied in the management of demand and supply in the

Building - User Relationship. A practical approach for a management information system consists of:

- the *awareness* of the problem at hand, the situation and the available alternatives,
- a survey of the development of demand and supply as a basis for *analysis*, generation and evaluation of options,
- and finally *action,* in order to make the necessary correcting and proactive steps to improve the match.

The model for a Strategic Approach to manage demand and supply mismatches is presented in figure 44. This model represents a generic BUR, and may describe e.g. a Building – User Relationship in the use and management phase. This is a framework for collecting information in order to conduct a continuous surveillance of the facilities' demand and supply over time. On the supply side, available capacity and performance, possibilities and constraints, as well as expected changes, are mapped. On the demand side, the user organisation's requirements as well as its expectations for further development based on the business strategy are shown. The model is dynamic, and its purpose is to continuously collect and organise information about the match between supply and demand in the BUR in order to implement actions to improve the match.

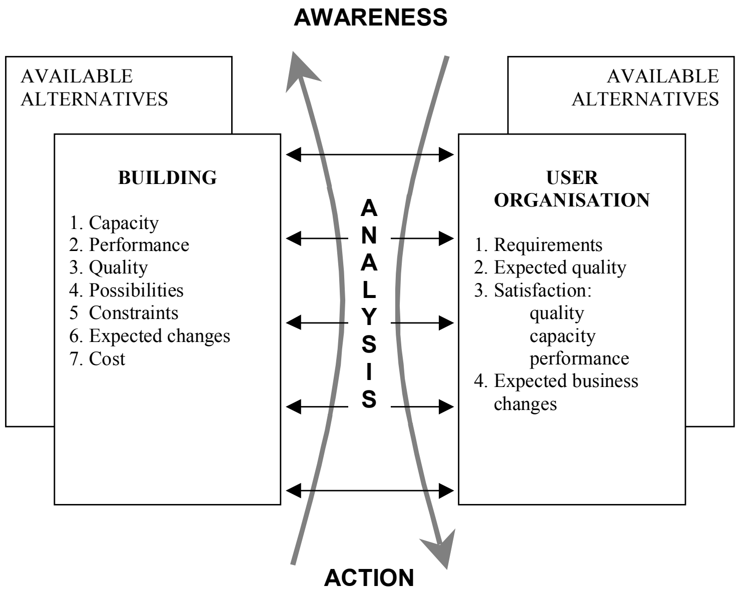


Figure 44. The Strategic Approach to managing mismatches in the Building - User Relationship.

The Strategic Approach is based on an iterative process of awareness, analysis and action. In the awareness phase, the awareness of that "something must be done" can rise from several sources:

- From a poor BUR match and intentions to improve this.
- From expected changes according to the business strategy.
- From an understanding of some potential benefits or as reaction to constraints.

- From the existence of available alternatives.

In the analysis phase, goals are stated. These can be about improving the BUR match according to today's requirements, improving the quality and service level of the building, imposing new standards, cutting costs, changing work-style and work-pattern and creating environments which will support this, etc. The formulation of goals has to be an iterative process with generation of options, collection of information and evaluation of options. In this loop of searching for the best alternatives, the solution is found. The analysis can be supported by Post Occupancy Evaluations and by external consultants, but is usually a task for the Corporate Real Estate of Facility Manager in co-operation with the end-user and general management.

The solutions are finally implemented and put to action. This is usually not a stable state, and new changes will probably occur quite quickly. The circle of awareness, analysis, and action is then repeated. The Strategic Approach to managing BUR mismatches is thus a continuous management activity, and matches the continuous adaptations in the building which we have described earlier.

At some point, one may reach the conclusion that the mismatch between the building and the user is too extensive to be mended. This is the moment when the decision-makers will decide for a new building, relocation, or heavy retrofitting of the facility. This will in some cases result in a new building process, and the Strategic Approach in the building's life cycle may be applied, this is presented in chapter 7.3.

EMPIRICAL DISCUSSION: Matching supply and demand

In the DAGBLADET case, the entire project was motivated by their experiences of trying to manage a steadily increasing mismatch. The major retrofit is an example of a major adaptation performed in order to reduce the mismatch to a manageable size. In the Dagbladet case, this is done by investing in flexible and adaptable solutions and by general upgrading of the building. After the retrofit, the building can be changed as a response to organisational changes, both cheaper and faster than before the retrofit. This makes it possible to manage the misfits. Even before the last phase of the construction was finished, the first changes were carried out.

The building for GJENSIDIGE at Sollerud is only one of several buildings that are used by the company. The Facility Manager is in charge of a huge, never-ending process of fitting the continuously changing departments into the different buildings. As soon as one problem is solved, the corporation will buy a smaller firm, or there will be a merger with another company. This results in a continuous process of moving in and out, replacing old furniture and keeping track of the available resources, equipment, and space. The process of matching available space and resources with the changing demands is demanding, and Gjensidige has its own space planning group that takes care of planning the workplaces. This has to be co-ordinated with ICT and other services.

OFFICE XX has taken a rather radical approach to managing the mismatch, by declaring that the building should be taken apart and removed as soon as it does not fulfil its purpose anymore. This means that when the mismatch is too great, the building will just cease to exist. Until the end of its functional life, the technical solutions, which result in elements that are easy to adapt and reposition, will aid the continuous adaptations which will take place. This will make it easier to manage the mismatch. Another element that makes the building usable and easy to adapt to changes in use, is its simple, robust, and straightforward building concept and layout.

In the K-BANK case, the Universal layout provides a system which is identical in the entire building, and standard elements and layouts makes it easier to move people and departments around. The K-bank is, in the same way as Gjensidige, an organisation with large and dynamic changes, like take-overs and merges. The bank may buy new departments, which earlier were independent businesses. When the building was new, these departments were located in the building and shaped into the K-bank mould by the Universal layout. In this way, the building provides a stable and solid frame in which the changing departments can be assimilated into the company culture. The Universal layout is thus both an instrument for managing the moves and mismatches, and also a way to signal the bank's unity in different departments.

In K-BANK there are areas for informal meetings, rest, and socialising within every department. This rest-area is located next to the mail distribution and the coffee machines. These rest-areas are infrequently used, nor are the "silent rooms" which are located throughout the building. The workspace is dense, and one should expect people to use such facilities to withdraw from other people into the silent rooms or to socialise more informally in the rest areas. But this does not happen as often as imagined. One of the reasons for this is thought to be that the organisation's unwritten rules discourage such informal socialising within the workspace during work hours. The physical office layout makes space for it, but the social rules concerned with behaviour at the workplace do not match the ideas behind the physical layout. K-BANK had a minimum of focus on the organisation and its use of the building before moving into the building, and there has not been much attention to this during occupancy. It is thus reasonable to say that the organisation is not prepared to utilise the possibilities in the physical layout. There is a mismatch between the ideas behind the workplace layout and the organisation's way of working.

### 7.1.3 Summary, matching demand and supply

In order to match the company's business strategies, several different real estate strategies can be applied. Matching the physical demands of the organisation by providing adaptability and a good Building-User match is only one of several issues that have to be considered, but it is an important one. Other strategies include e.g. promoting sales and marketing, promoting Human Resources objectives, and cutting costs.

Mismatches between demand and supply in the Building – User Relationship can be managed by applying the Strategic Approach of awareness, analysis, and action. A structured approach should be used to collect information about the Building – User match. This is a continuous process, which can be used a tool for proactive real estate management.

| Main questions; matching demand and supply | Implications |
|---|---|
| How do we assess the changing needs of the organisation? | It is important to be aware of the organisation's strategies and possible future changes in order to be proactive in assessing needs. But also assessing current needs is important, and this requires a continuous process of stating demands and requirements, and matching them with the available resources. |
| How is current performance evaluated? | Performance can be formally evaluated by POE's or informally by using the knowledge from users and those responsible for space planning. This last option requires a "channel" where the Facility Manager or space planner pick up the organisation's feedback. |
| What is the "acceptable mismatch level" in this situation? | Every organisation and situation will have different levels for what is seen as a good fit, as well as for acceptable and unacceptable mismatches. |
| How do we scan for available options and alternatives? | In some cases a systematic approach to generate options and alternatives, as well as evaluating them together with the existing situation, is needed |

The next part will elaborate on possible reactions to BUR mismatches that are greater than the acceptable mismatch level.

## 7.2 Reactions to BUR mismatches

The Building – User Relationship works both ways. The building impact on the people, and the people impact on the building. This has been stressed several times in this work. Still, we know that there usually are new demands from the organisation's side that challenge the stability in the Building – User Relationship and create mismatches. In case of new requirements and demands, the organisation has several options for reacting. The situation and the available options, seen from the user organisation's side, are shown in figure 45. The awareness of a problem may lead to actions in relation to the building, in relation to the organisation, or in finance and contracts in real estate. In the following, we will not consider the actual measures, but focus more on the strategic decisions that must be made based on these options.

In a situation where the organisation faces this challenge, the different options will be analysed and evaluated in the first phases of the change process. The different options are not mutually exclusive; on the contrary, they will in most cases be interconnected. This means that one will only engage oneself in a building process if one chooses to do something to the building, as the other options will require actions in the organisation or in management of real estate. In most cases, measures from the different categories will be used in combination, and will affect each other. This means that, e.g., a decision to retrofit a building will also result in a programming and organisational development process.

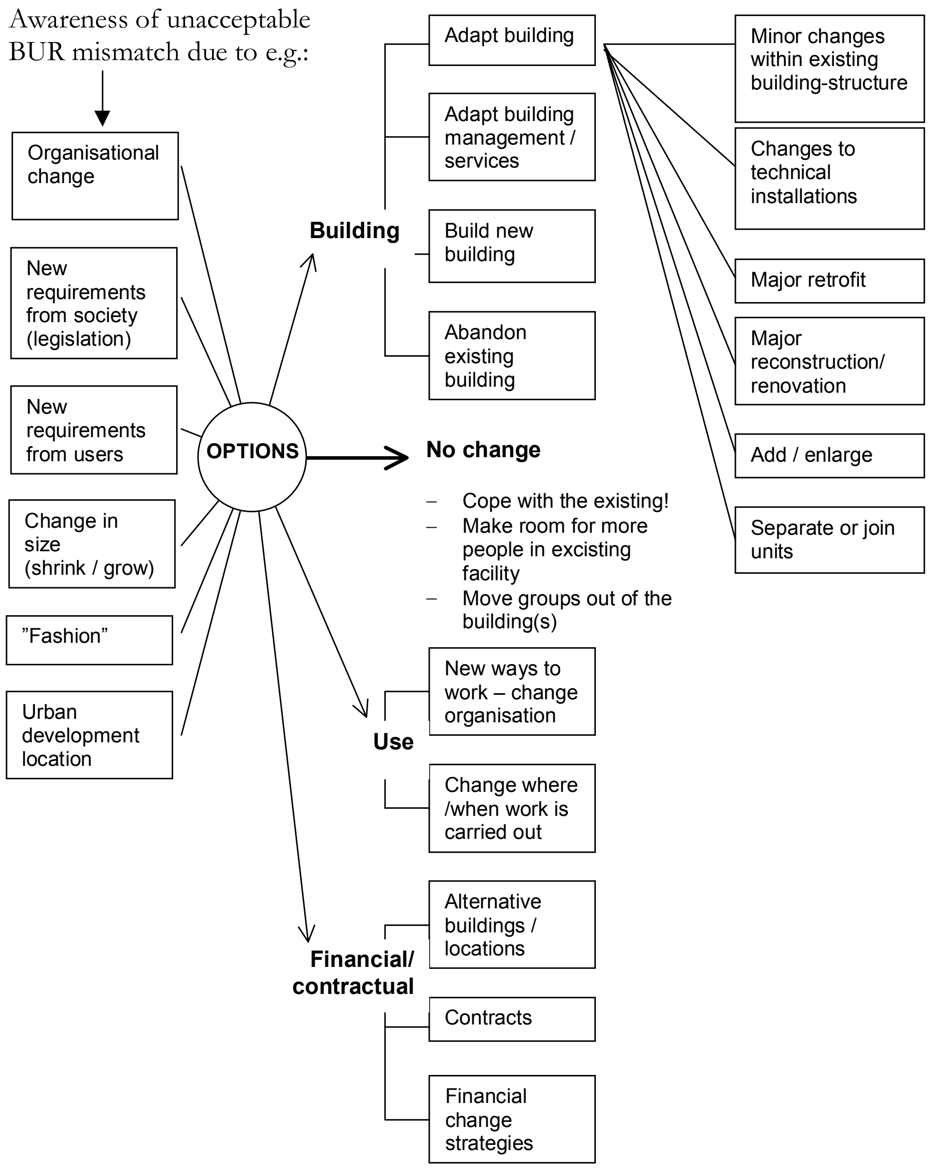


Figure 45. When a mismatch exceeds the acceptable mismatch level, or the challenges facing the organisation leads to an awareness of a problem or a wish to release a potential, this will result in changes in the building, in the organisation, or in finance and contracts for real estate. Making do with the existing situation is one option, and this option is probably the first to be considered. This diagram focuses on the challenges posed by the organisation in the Building – User Relationship. The push for changes may also originate from the building, e.g. because of low standard, technical problems, functional limitations, degradation, or as consequences of a low level of maintenance.

Earlier works have discussed strategies in the different phases of the building process, but never as a part of a strategic decision-making framework. One example of this is Iselin and Lemer's "The Fourth Dimension in Building: Strategies for Minimizing Obsolescence", in which several strategies are described for planning, designing, constructing, and managing buildings, in order to achieve more robust buildings, which are able to accommodate change without substantial loss of performance, are presented.

| | |
|---|---|
| Actions in Planning and Programming | Scanning for trends that may foster obsolescence |
| | Programming for the possibilities of future |
| functional change | |
| | Preparing for design through predesign analysis |
| Actions in Design | Assuring currency of design guidelines |
| | Targeting obsolescence - susceptible building |
| types | |
| | Using integrated building systems |
| | Making flexibility a design goal |
| | Adopting details that enhance flexibility |
| | Unconstrained interior spaces |
| | Accessible service areas |
| | Modularity |
| | Shell space |
| | Using prototypes to test performance |
| | Sizing components to serve demand growth |
| Actions in Construction | Separating procurement of sensitive components |
| | Commissioning |
| Actions in Operations and Maintenance management | Using postoccupancy evaluation in facility |
| | Adapting for reuse |
| | Managing the facilities portfolio |
| | Making do |

Table 7. Strategies for avoiding the costs of obsolescence (Iselin and Lemer, 1993), page 32.

In addition to the strategies mentioned in the table above, the report stresses that specific steps should be taken to assure that the facilities fit the user's needs, and that information should be gathered to improve the effectiveness of the user's accommodation and future needs, as well as the importance of linking strategic planning in the business to facilities planning (Iselin and Lemer, 1993). There are no distinctions between strategic decision-making, tools to assist strategic decision-making, and operational measures, in Iselin and Lemer's report. This distinction is important to "the Strategic Approach" as described in this work. Next, the iterative, strategic decision-making process will be discussed further, related to the different phases of the building process.



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# 7.3 The Strategic Approach in the building's life cycle

In this part the more specific issues of strategic decision-making in the office building's life cycle are presented. We will consider the different phases in the building process; concept, programming, design, construction, and operation/use of new buildings, as well as retrofitting which requires a substantial effort in planning and construction. This work focuses on the relationship between buildings and the user organisation. The description of the process will thus primarily take into account buildings with a known user, not commercial development projects. Some of the same issues will of course apply in commercial development projects, but this is not discussed in this work. The iterative, strategic decision-making process itself is universal, and can be used in any situation which has a great deal of uncertainty. Even some of the more specific principles, described in relation to BUR, may also apply to commercial projects. Par example will parts related to developing user requirements instead take into account general market demands. The Building – User Relationship is not limited to one building and one user, but describes the relationship between a building and its user at any time. Users may come and go, but there is always a relationship between the current user and the building. The Strategic Approach is not a book of recipes, but a list of ingredients. It is up to the decision-makers to decide what kind of situation they are facing, and to pick the relevant ingredients for the dish they intend to serve.

As we have seen in the preceding parts of this work, the pre- and post-occupancy phases of the building's life cycle are closely related and are part of an iterative process, and they can not be viewed as completely separated from each other. Still, it makes sense to describe them separately, because the first phases of the building's life cycle; planning, design, and construction, are in many ways different from the management and operational phase. In the beginning of the process, the building (or retrofitted building) is not yet a physical reality. It is developed through the building process. In the use and operation phase, on the other hand, one can relate to a physical, known object. Other actors are present in the development phases than in the operation and management phases, as it is defined as a "building project" with a related "building process".

## 7.3.1 The Process

The iterative strategic decision-making process which is described in the previous chapter can be applied in the building process in order to reduce BUR misfits. The iterative cycle of awareness, analysis, and action is repeated for every phase of the process.

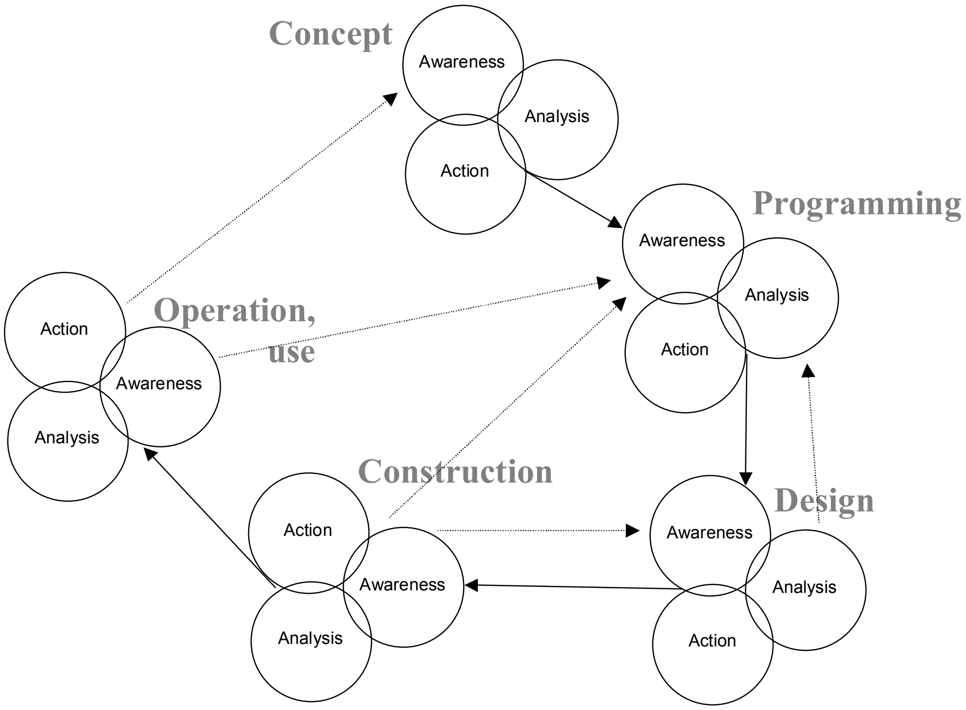


Figure 46. The Strategic Approach to decision-making in the building's life cycle

We know that in the real world, the different phases are highly interconnected, and that in modern construction projects, many activities, like programming, design, and construction may run in parallel. The phases in the process must therefore not be seen as chronological and linear, but as a description of certain activities. The different phases are discussed below with emphasis on the important issues for BUR and for adaptability in general. Later, in " Making space for changes", a model of the building process based on layering of decisions will be presented.

# 7.4 Concept

The building process starts with an idea, vision, or opportunity, or with the awareness of a problem that has to be dealt with. In the concept phase, awareness and analysis of the problem or opportunity at hand is developed, and some conceptual solutions or options are developed. Later these are evaluated and some sort of action is taken or decision is made.

## 7.4.1 Awareness

In the awareness phase, an understanding of the problem, challenge, or opportunity is attained. This may e.g. be an unacceptable level of mismatch in an existing Building –

User Relationship, business challenges, real estate development opportunities, or a wish to invest in real estate.

Different organisations have different expectations to the facility's standard. The limits of acceptable mismatches in BUR will vary from one case to another. Some organisations may choose to relocate because of changes, par example in the number of employees, while others may make the best out of their existing facilities with the same increase or decrease in the number of employees. The "decision-point", where the awareness and understanding of the situation as unacceptable and of that "something has to be done", is therefore dependent of the context and the organisation. Available alternatives, facility standard in similar organisations, type of work, and maturity of the organisation may influence the "acceptable mismatch level".

If the "acceptable mismatch level" is exceeded, one has already entered the "awareness phase". As mentioned, other perspectives may lead to the same awareness and demand for change, such as business challenges, and real estate or financial opportunities or constraints. If one in the awareness phase decides that some kind of action has to be made, then several options are available, as shown earlier in figure 45. In this part, where we consider the Strategic Approach in relation to the building process, only the options that result in measures related to the building will be discussed. These measures will of course most often be related to other measures, but pure organisational or management processes, as well as financial and contractual strategies, will not be considered, except for their interaction with the building process itself.

### 7.4.2 Analysis

During the project inception phase, these early ideas are usually analysed and developed further, by defining the objectives, analysing alternatives, and carrying out investment- and feasibility studies.

**Goal setting**

The most important issue for adaptability at this stage is that an understanding of changes and BUR mismatches is developed, and that this issue is seen as an important aspect both in the process and in the future building. These first stages are very important, because the goals and the visions that are developed at this point define the scope of the possible alternatives later in the process. Defining too narrow limits and specific goals might hinder creative solutions later. But on the other hand; failing to put important issues on the agenda at this point will not encourage attention to those issues later in the process.

Obviously, issues related to matching the intended use of the building with the concept and design are considered in this phase. After all, mismatches in the existing BUR is a very common reason for engaging in a new building project. Commercial developers will in this phase consider possible users and their preferences, as well as the market conditions for the specific kind of building.

One of the most important outputs of the concept phase is an understanding of the objectives and the strategies that will guide the rest of the building process, and the decisions that must be made in the later stages of the process. This is sometimes presented as a strategy document or a statement of goal and visions. But often it is implicit in the decisions that are made, and an integrated part of the actors' understanding of the process and the desired output from it. Formulating adaptability as one of the desired objectives, and a discussion of how this can be achieved, may be the first step towards a better awareness of these issues. This may be the most important individual action in order to enhance adaptability, as it also puts adaptability on the agenda when all other decisions in the project are made.

In line with the iterative understanding of the strategic decision-making process, goals and strategies are developed in an iterative process of setting goals, generating, and evaluating options.

**Generating options**

In every building project, there is a set of options and alternative solutions. One can update existing buildings, move, buy, build a new building, rent or lease facilities, see figure 45. When one chooses, say to build a new building, issues like location, size, etc. have to be decided on. This means that options and alternatives have to be considered at different levels.

At this point it is important to make sure that a sufficient number of very different options are considered. Usually our minds are selective, and we only consider a certain set of options, based on some preconception or on our present knowledge and situation. In order to broaden the scope, one can use techniques like scenarios, cognitive mapping, etc., in order to ensure that different perspectives have been considered.

**Evaluating options**

The processes of generating and evaluating options are highly interconnected, and new options may be revealed as others are evaluated and tested. In order to evaluate as well as generate options, several techniques can be used. Scenario techniques is one such tool, which is described later.

In many cases, there is a need for more formal decision support and tools. In a construction project in the concept phase, the main formal analysis is a financial investment analysis, in which costs and return on investment are estimated. Economical evaluations are repeated throughout the process, with more detail and accuracy as the project materialises, see i.e. (Langston, 1999).

Apart from financial evaluations, other evaluation techniques may be appropriate in the concept phase. Some of them are market analysis, functional and feasibility studies, analysis of alternative locations, studies of alternative concepts for use, and studies of opportunities and constraints, e.g. in (Best and de Valence, 1999), (White, 1993), (Baird et al., 1996).

**The strategic concept statement**

The result of the process of setting goals and generating and evaluating options may be presented as a document or statement that will serve as a basis for the rest of the project. In this strategic statement, the propositions and strategic guidelines for the rest of the project should be presented. Such a strategic statement may consist of the issues that are seen as important for the particular project, related to the building project, to alternative locations, to the state of the market, to the user organisation, or other issues.

One important part of the strategic statement is that this is the first step in the process of matching supply and demand in the Building – User Relationship. This must be an important issue already in the concept phase. In many cases, BUR misfits are the reason to engage in a building process in the first place. If this is the case, it is a natural first step to consider the organisational demands as a starting point for the process. In other cases, the search for user demands and different options must be put more actively on the agenda. In any case, a process where user demands and strategic issues, both for the user and for the building process, are developed and evaluated, is the most important part of the concept phase.

### 7.4.3 Action

The action phase consists of the act of choice, implementation, and control.

**The act of choice**

Based on the available options, and on the evaluations, some options must be selected. Sometimes this is a conscious process, assisted by formal decisions tools, or at least a rational discussion based on some kind of evaluation. At other times, the act of choice is carried through rather unconsciously. Related to our subject, the most important thing is not how the decisions are made, but that one takes into account some of the key issues related to adaptability in the process:

- The future relationship between the organisation and the new building.
- The strategic concept statement, the demands and alternative strategies to meet the requirements.
- The effect of every decision on the Building – User Relationship and adaptability in the future building.

In order to ensure a relation to the general management of the organisation, it is important that the top management is responsible for the decisions, and that the relevant parties are involved. In the case of a developer or investor who develops a project for sale or to be rented out, market analyses and general expectations of the possible occupants and their needs, and changes at the actual location, will be used instead of involvement from the user organisation's top management. As more and more corporate real estate divisions become more market-oriented, this is also often the case when a project is developed for a known user organisation. In some cases, both situations or scenarios will be considered and used as decision criterion.

### Implementation and control

The main contribution from the concept phase is that the main alternatives have been evaluated, and that decisions are made to continue the process according to one of the options in figure 45. If the output of these considerations is to retrofit/refurbish or build a new building, one needs general guidelines on how the rest of the building process should be carried out, and on who is responsible for initiating and managing this process. Implementation of the decisions in the concept phase usually means to initiate some kind of formal programming or briefing process, which brings us to the next step of the building process. During the rest of the building process one may expect some loops back to the concept phase, because of new opportunities or constraints in the situation or because some of the earlier decisions may have unexpected consequences. Both concept, programming, design, and construction phases may be related iteratively to each other. Parallel and interactive work must therefore be expected.

### Output

The main output from the concept phase will be a clear understanding of the alternatives at hand, and a decision about engagement in a building, relocation, reorganisation, or retrofit process.

The outputs of the concept phase may be:
- A higher level of knowledge and understanding of the problems or opportunities at hand, which is the result of the generation of alternatives, evaluation, and decisions.
- A strategic concept statement that consists of the objectives and main strategic decisions.
- A decision that states whether one should build, make do, lease, or retrofit, as well as a decision to enter the next phase of the appropriate process.

> "The building is treated as a strategy rather than just a plan." Stewart Brand. Page 178 (Brand, 1994).

EMPIRICAL DISCUSSION, concept phase:

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In the GJENSIDIGE project, the main strategy was developed as a result of discussions between the steering committee, the CEO and the Corporate Real Estate Manager. They developed a strategy document, in which Gjensidige's main interests and ideas were presented. The main aspect here was to display company culture by taking the employees' work environment seriously. They made the decision that all offices should be individual and cellular, based on a survey in one of their existing buildings and on the general impression that this was the employees' preference. The decision to build only cellular offices and the selection of site limited the possible design concepts, because all offices had to be located along the facade. This resulted in a building volume with a very high ratio of exterior walls, as the design had several narrow "arms" in order to maximise the perimeter. The initial strategy of focusing on user satisfaction by providing only cellular offices was thus responsible for limiting the options in the building design. The narrow building depth is one direct result of this. In this way, the initial strategy resulted in a great deal of constraints to the design of the building and to future use for other office concepts than the cellular office. In this case, the initial strategy was motivated by other issues than adaptability, and the consequence was a less adaptable building.

In the DAGBLADET case the main strategic decision was to remain located in Akersgata. The result of this decision, which was founded in business strategy, not in analysis of the facilities, was that the existing buildings had to be retrofitted, as a part of the building complex was protected by law and could not be replaced by new buildings. The next major strategic decision was to continue using some parts of the buildings while other parts were retrofitted. In this way, one could continue working in Akersgata during the entire process, and one did not have to pay for other facilities during the construction period. The result of this decision was that the construction process had to be carried out in stages, and that people moved around to other parts of the building while construction works were carried out in their part of the building complex. This initial strategic and business-related decision had a major impact on the process and on the chosen solutions. Another implication of this way of considering the existing building complex and its constraints and need for adaptation, was that Dagbladet, based on the problems they had had in adapting the existing buildings, put adaptability first on the list of what they wanted to achieve, so that in the future, the building would allow the offices to be easily rearranged. This was based on prior knowledge of BUR mismatches and adaptations.

In the case of XX OFFICE, the main strategy was to find new ways of saving energy and maximising flexibility. The motivation was financial gains of future application of the knowledge gained in the project. XX was a pilot and research project, and its main purpose was to develop knowledge and to test solutions which might be profitably implemented in later projects. Because of this, its main “business strategy” went beyond the actual project.

K-BANK decided to view their buildings as a commercial project, developing them as commercial objects, fit for the market. This resulted in a lack of orientation toward the organisation as a user, and led to extensive adaptations and changes in order to accommodate the bank’s own organisation when they moved in. The main strategy was to build multi-purpose office buildings, and this strategic decision influenced both the physical solutions as well as the building process, the process of fitting out the building to the bank’s requirements, and the attitude towards changes in the Universal layout.

*Discussion:*

In order to address issues related to adaptability, a strategy or policy statement of some kind may be a good tool which will help focus the attention on these issues during the entire process. We have seen that in the case projects, the first strategic statements have shaped both the building process and the chosen building design. Much is to be gained by examining alternative options at this first stage of the process, and by placing issues related to adaptability on the agenda from the beginning.

Next it is important to notice that strategic decisions at this stage (such as to focus on worker satisfaction and cellular offices in the Gjensidige case) will influence the design and the implemented options in ways that might seriously affect the building's adaptability. Adaptability must therefore be a criterion when the consequences of such strategic decisions are evaluated.

Finally, it is important to consider a variety of future scenarios, not just the market, as in K-bank, or only the one intended for one specific user organisation, as for Gjensidige. In the Waterside project for British Airways at Heathrow, two different scenarios were considered during the entire process, the corporate scheme and the institutional scheme[1], in order to ensure that every decision was valid for both situations.

### 7.4.4 Summary, concept phase

- Awareness and knowledge of the Building – User Relationship and changes and mismatches in this, must be a part of the concept phase.
- A business strategy must be developed in order to ensure that the project is rooted in business needs and development. Alternatively, a market strategy related to market demands must be developed, if there is no specific user involved. In many cases, one would like to consider both specific user and general market demands.
- Different options; build, retrofit, relocate, reorganise, etc., must be considered related to the business and/or market strategy.
- Adaptability must be put on the agenda in the initial phases of the project. This will have consequences both for the way the building process is carried out and on the design and solutions implemented in the building.
- Consequences of other strategic decisions for the project's adaptability must be considered.

| Main questions, concept phase | Implications |
|---|---|
| How do the main strategic decisions impact on adaptability? | The main strategic decisions may limit or enhance adaptability. Thus, adaptability must be one of the issues that are considered when developing the main strategy. |
| Have all relevant options been considered? | Options later in the process are often limited because the relevant questions were not asked in the beginning of the process. |
| How uncertain is the situation? | The level of uncertainty must be assessed in order to know what kind of adaptability is needed and what possible changes one should plan for. |
| How can issues about adaptability be kept on the agenda throughout the project? | In order to enhance adaptability, one must take active measures to ensure that these issues are considered in all later decisions. Expectations must be clearly formulated already in the concept phase, and actively reviewed later in the process. |
| Should alternative futures be considered? | Decisions about using scenarios and other tools to enlarge the manoeuvring room must be considered. |

## 7.5 Programming

The Americans call it programming, and the British call it briefing (Raymond and Cunliffe, 1997). In either case it is the process of developing, understanding, and stating the needs of investors, building owners, user organisations, departments, end-users, and finally the needs of those engaged in operation and management of the building, in order to design and build something that will answer to these needs. Constraints and expectations from the public, formulated as building and site regulations and legislation, will also be part of the program. In *Managing the brief for better design*, Blyth and Worthington defines briefing as:

> … briefing is an evolutionary process of understanding an organisation's needs and resources, and matching these to its objectives and its mission. It is about problem formulation and problem solving. It is also about managing change. Ideas evolve, are analysed, tested and gradually refined into specific sets of requirements. Sometimes these involve modifying the built environment and other times not. Effective briefing begins without preconceived solutions." Page 3 (Blyth and Worthington, 2001).

Blyth and Worthington also make a point out of dividing between "briefing" as a process where options are reviewed and requirements articulated and "the brief" which is the product of that process (Blyth and Worthington, 2001).

The programming phase will differ, depending on from whose perspective it is viewed. From the investor's and owner's point of view, it is the requirements that he has for the final product's use and the possibilities of renting it out to different occupants. Viewed from the user organisation, briefing is about developing and understanding the actual needs of the organisation and putting this into writing to ensure that these demands are considered in the different stages of the process. When the owner and user is the same organisation, or when the future user organisation is known to the investor, these perspectives will be joined, but in other cases they can be quite separate processes, often separated both in time and in responsibility.

In a linear, idealised model of the building process, programming should be carried out after the initial concept phase, and before design and construction. In practice, programming is carried out during a long period of time and in several phases, often in parallel with other activities like design and construction (Eikeland, 1999). A parallel development of requirements and solutions will make programming an even more iterative process, as one will have to balance the requirements from users, owners, and environment with the possibilities for use in the suggested solutions.

Parallel programming and designing is thus not only intended to save time, but to balance the requirements against the possibilities and constraints that are unveiled by the generation and evaluation of physical solutions. It will therefore make sense to talk about a programming or briefing process with distinctive phases and levels. Most

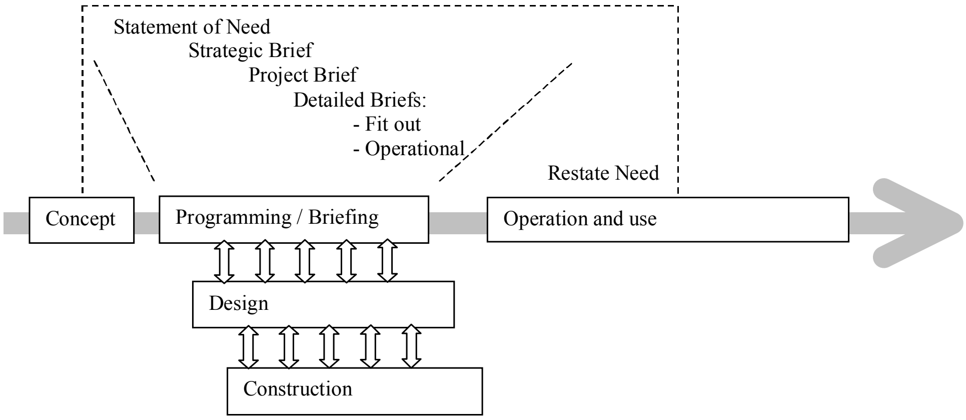


Figure 47. In real projects the programming, design, and construction phases are often observed to be more or less parallel in time. A layering of briefs will therefore be even more important, because it ensures that the necessary decisions about needs and demands are made before solutions are developed and constructed.

systems for briefing are divided into such levels or phases, e.g. (Hershberger, 1999), (Peña, 1987) , or as shown by Worthington in “Design in practice” (Worthington, 1994):

- The Strategic brief: Identify the business case for the design. Assess alternative concepts for meeting the requirements. Set the conceptual framework, budget parameters and critical requirements.
- The Concept brief: After appointing a design team, a brief with the actual requirements can be drawn up.
- The Detailed brief: Specific area or group requirements, to the level of individual staff needs.
- The Facility Management brief.

Raymond and Cunliffe suggests another brief level, the “Project business plan”, before the Strategic Brief. The Project business plan is supposed to state the investor’s objectives, needs, method of work, budget, and timetable, and to justify the project and the use of resources (Raymond and Cunliffe, 1997).

In “Managing the brief for better design”, Blyth and Worthington present a model for the different briefs which will be used in this work, see figure 48. Briefing is also here pictured as a layered process that runs during the entire building’s life cycle, and not as one single phase, limited in time.

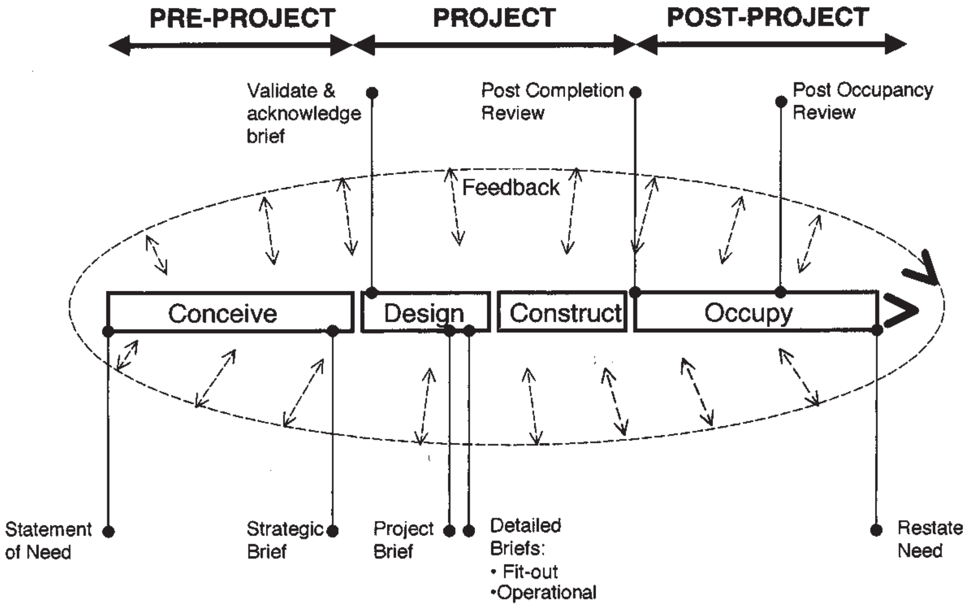


Figure 48. In "Managing the brief for better design", the authors describe three principal stages of briefing: pre-project, project and post-project. In each of the three main stages, there may be several briefing activities, for example both Statement of need and Strategic Brief in the pre-project stage. (Blyth and Worthington, 2001) page 15.

> During the pre-project stage the client defines the need for the project and sets it out in a Strategic Brief. The nature of the business and its objectives are examined and different options are tested, only at the end of this stage is the type of project defined. During the project stage, the design team validates and reformulates the Strategic Brief and produces a design which becomes the Project Brief. The project is then delivered. During the post-project stage the result is tested to see whether it meets the need defined in earlier briefs." Page 15 (Blyth and Worthington, 2001).

The different phases of the brief are concerned with different issues, and will involve different actors. The Project business plan, e.g., is mostly concerned with the investor, and the Detailed brief may be concerned with the needs of the end-user in a specific part of the building. In a layered process with several activities going on simultaneously, the demand for accurate and timely information and the co-ordination between the activities are crucial. This, and other project management issues, fall outside the scope of this work, but is extremely important for the successful implementation of the strategic approach in the building process.

Programming is in essence concerned with developing, understanding, and stating owner and user needs. It will therefore be of fundamental value to the Building – User Relationship in matching supply and demand. This is perhaps the most important issue of the programming phase when it comes to adaptability and reducing BUR mismatches. Another interesting aspect of programming, of particular interest to the scope of this work, is the different layers of phases of the brief, and how this relates to layers in the project, to the different actors, and to time. The layering of decisions, based on a gradual development and specification in detail of the project, is one of the main "tools" that are discussed later in "Making space for changes". In that chapter, layering of the briefing, design, and construction process, is seen in relation to the building's different layers and their expected life spans.

In the following, the most important aspects of programming when it comes to BUR mismatches and adaptability, are discussed as a strategic process of awareness, analysis, and action.

### 7.5.1 Awareness

As we have seen earlier, many writers argue that a building project is an opportunity for organisational development. If this is the case, organisational development has to be put on the agenda in the earliest phases of the project, and at the latest in the awareness phase of programming.

To be able to use the building project as a catalyst for change and organisational development, the focus must not be on stating the demands as they are perceived to be today, but on assessing the whole organisation and how it works. The main focus must be on the organisational development process, and then the building project is used as a means to "unfreeze" the current situation. The primary process will then be the organisational development project, and the development of the actual documents in the brief will be one among many results of this process. Thus, the responsibility for this process should be on the general management of the organisation. Charles Handy shows in his book "The Alchemist" how top manager of British Airways, Robert Ayling, used the process of building a new headquarters close to London, in order to change how BA worked and how the organisation viewed and expressed themselves:

> "Robert is sure that the building has changed the culture of the head office and, eventually, he hopes, of the airline. He can't, he says, lose his temper or rather, when he does, very, very occasionally, everyone knows immediately because it is a place of no secrets. Meetings take place more casually, in the café or on the steps. Communication is hugely improved because people dump into each other in the street rather than in the lavatories – the usual place for informal conversations in such institutions. There are, deliberately, no lifts from the underground car-parks so that everyone has to pass through the street on the way to their work place, meeting people on the way. First names are the norm and no one stands on ceremony – you can't in a village street.
>
> It is all very different from the old offices at Speedbird House which was a "genuinely horrible building". Depressing long corridors were lined with boxes for individual offices. Long, solitary days were punctuated only by the arrival of the tea lady. People met only by appointment so that diaries were completely filled with internal meetings. Your place in the hierarchy was evident from the size and the décor of your individual

> box. It was a dingy, compartmentalized world, which inevitably coloured the atmosphere or culture of the whole organization.
>
> It was one which Ayling was determined to change when he became Managing Director and later Chief Executive. … A visionary architect was found in Niels Torp who had built the head offices of SAS in Sweden, also designed around the idea of a street. Ayling is the first to point out that there were many others involved, particularly Gwilym Ree-Jones and Chris Byron who, at different times, led the project team. They had, as it happened, both been cabin crew managers in their time and were very much "people" people, but it was Ayling who lent his passion to the project and made sure that it would embody his own beliefs and values." Page 65 (Handy, 1999)

In this example, the CEO engages himself in the building project in order to realise his visions for a new company culture and new ways of working. The actual building, BA Waterside, has many features in common with contemporary Scandinavian office buildings, but it was certainly different from other UK offices of its time. What is special about the example, is that the CEO's engagement is so strong, and his intentions so clearly formulated that the building project is truly seen as a tool for change within the organisation. This is rooted in the CEO's own understanding of "the crucial relationship between space and behaviour." Page 65 (Handy, 1999).

In most building projects, there are no ambitions about engaging in a organisational development process, or no understanding of the relationship between space and work, but just a desire to find some accommodation for the organisation. Still, understanding of present and future demands is important in order to be able to state the right requirements in the brief. This will mean that the organisation must go through the process of analysing existing needs, generating future options, evaluating them, and formulating them as requirements for use as "specifications" in the building project. Later, the process of moving into new facilities and rearranging the physical environment is bound to affect the organisation in some way or another. In such cases, the effect on the organisation is just a secondary effect of the building project and not a desired part of an intentional process. The relocation retrofitting process will thus affect the BUR and the organisation's development in any case, but one will miss the opportunity of using this as a part of a desired process of change.

In any case, top management will have to be involved in these first stages of the briefing process in order to commit themselves to a strategic development of the Building – User Relationship. Responsibility for actually carrying out the project, managing and aligning external and internal processes, must be handed down to a project manager. This can be someone in the user organisation, the owner and investor's project manager, or an external consultant.

In many cases, the lack of coherence between expectations and real ambitions between the different actors causes problems later in the process, and dissatisfaction with the finished result. The awareness phase of the programming is very important in order to reduce this mismatch. The understanding of the situation one is trying to solve, and an overview of the different actors' perspectives at this point, may well prevent some of these problems later. The management must be responsible for addressing these issues and for putting the relevant issues on the agenda, engaging the right people in the discussions, and taking measures to ensure commitment to the process at all levels within the organisation.

### 7.5.2 Analysis

The analysis performed in the programming stage is concerned with assessing needs; present and future. In the initial stages of the brief, the Project business plan and the Strategic brief, this is the investor's, owner's, and user organisation's needs, later stages address departments' and teams' as well as individual end-users' needs.

Because the relationship between users and buildings is iterative, every decision about physical solutions in the buildings' sub-system will affect the users' side of the relationship. In a layered briefing process, one must therefore also consider the physical solutions that have already been developed, by analysing both the demand and supply. One is primarily concerned with the match between demand and supply, not by the formulation of demands for its own sake. This is an iterative process between the stated needs and requirements and the solutions that are designed and constructed. Programming is thus not a one-way activity, but is iterative with the generation and evaluation of options and physical solutions.

Developing and understanding user needs is a complex process, where formulation of goals and generation and evaluation of options goes on in several loops, and on several levels. Usually a team is engaged to carry out these processes, sometimes in co-operation with external consultants. As we have pointed out earlier, preferences are inconsistent and imprecise, and change over time. Programming is thus never a one-dimensional exercise, but a dynamic process that will relate both to processes in the organisation and to the other phases of the building process: design, construction, and use.

#### Setting goals

Programming is essentially about setting goals for the project and later operationaling them into requirements. The importance of setting goals may seem obvious, but in reality, goals often remain vague or not properly understood by the different actors in the process. Defining and communicating goals is thus one of the most important aspects of programming.

The benefits of moving from the vague to the more specific are discussed earlier, and it is very important that one does not narrow down the options in the first stages of the process, but ensures that one has room to manoeuvre. Setting goals in the beginning of the process will ensure that one stays focused, but should not prescribe a specific solution. The added value of the programming process is to engage in the process of developing requirements, generating and evaluating new options, and maybe coming up with something better than initially imagined.

> "The brief should be specific enough for decision and action to be taken but flexible enough to encourage exploration of problems, options, and uncertainties." Page 10 (O'Reilly, 1987).

> "Building projects often emerge from an ether of vague decisions and assumptions about an organisations future. Sometimes they are the result of the personal aspirations of a senior manager or just a solution that is assumed to be correct. It is too easy to jump straight to what appears to be the obvious solution and post-rationalise the reasons for adopting it." Page 8 (Blyth and Worthington, 2001).

### Generating options

In order to generate options one needs to gather information about the present situation, possibilities, and constraints, as well as about future potential. According to Blyth and Worthington, the information needed at each stage is (Blyth and Worthington, 2001):

- Pre-project stage: Define immediate and future needs and requirements of the organisation, and assess its resources.
- Project stage: Test key-questions asked in the Strategic Brief and translate them from organisational needs to construction terms. Design options are used to test possibilities.
- Post-project stage: Needs and expectations are verified and tested against the completed project. This is done through post-projects reviews.

When one gathers information, one must keep in mind the possibility of "analysis paralysis", where information overflow may overwhelm decision-makers. The uncertainty and the limited rationality in the process makes it impossible to gather all possible information. One has to settle with a satisfactory level of information. This means that one must actively decide what is sufficient information and what kind of information one wants to gather, in order to evaluate and learn from the present situation, and imagine how this will change. Methods for collecting data include (Blyth and Worthington, 2001): studies of existing records, interviews, surveys of existing facilities, visual surveys, building visits, focus groups, activity surveys, workshops, questionnaires, and simulation.

Based on the information gathered, different options must be considered. Sometimes, the generation of alternatives will unveil unexpected possibilities for users and owners. Thus, the generation of options is an interactive process between different actors, from professional consultants who may aid the process, to top management, investors, building owners, and end-users. Generation of alternatives will most often happen in loops between setting goals, gathering information, and generating and evaluating options.

### Evaluating options

Options will be evaluated according to the formulation of goals and the possibilities one faces. But there will always be an element of uncertainty when evaluating options, because future requirements are difficult to assess. In order to understand the future and assess future requirements, Blyth and Worthington describe five methods (Blyth and Worthington, 2001):

*Projecting from past experience* is to review past performance and extrapolate forward, against an assessment of what might influence change based on past experiences. In a situation with great uncertainty, especially in the form of fundamental changes, such as new ways of working because of ICT, internationalisation, e.g., projecting from past experience may easily result in a program that misses the target. In relatively stable situations, on the other hand, such projections may provide accurate predictions.

*Predicting.* Blyth and Worthington prescribe a specific kind of group process, where formal predictions are developed by a group of people, from experts to managers and end-users, who together build a picture of the future based on past experiences. Other prediction techniques may involve experts and consultants that work on a commission from the client.

*Trend spotting.* In the organisation and its market, as well as in the design of other offices, a lot of new ideas are tested out. People who are insiders in those environments will sometimes have a feel for the upcoming trends. Visiting other buildings and leading organisations, knowing what is going on in the media, as well as seeking out different experts, will be important in order to spot trends. "The skill is to provide antennae to seek out the relevant sightings from today that will influence the direction and success of the company tomorrow." Page 44 (Blyth and Worthington, 2001).

*Scenario building.* To test the resilience of a building strategy, different scenarios can be developed. Usually one develops a set of scenarios in order to shed light on different possible future developments. The scenarios should start from the present situation and extrapolate some issues that are judged as important or crucial. Usually one also develops a 0-scenario, which describes the "business as usual"-alternative. The method of using scenarios in order to create a buffer towards future uncertainty is described further in chapter 8.

*Back casting.* Instead of anticipating the future one can choose the opposite strategy: decide on the future one would like to achieve, and later work towards that goal. One must in this case understand which actions and means are necessary to reach that end.

All evaluation techniques that involve a group of people with interest in the project may help build consensus about goals, options, and decisions in the project. This may be a valuable tool for managing the process further.

By using one of the proposed methods to assess a future situation, one can evaluate the options in a more appropriate context other than according to the present situation. At this stage, formal methods for evaluation of cost and quality of the different options may be applied (Baird et al., 1996; White, 1993).

### 7.5.3 Action

**The act of choice**

Based on an evaluation of options, and on an understanding of the future which is developed, one has to make a choice. In the first programming stages, the choices are usually made by the investor, top management, or Corporate Real Estate Managers in the user organisation. Later, other actors may be involved in decision-making, both external professionals and consultants, Facility Managers, and end-users.

**Implementation and control**

The purpose of programming is to develop requirements that will serve as a basis for design and later for testing of that design. The actual implementation of the brief will thus be to appoint a design team and feeding the requirements to them. In some cases, the programming ends up with other recommendations than "build or refurbish building". They may end up with "make do with what we have". Still, the implementation of the program is putting it to work.

EMPIRICAL DISCUSSION, programming phase:

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In the GJENSIDIGE project, the brief was developed in several stages, from the first strategic statement made by the steering committee and the CEO in co-operation with the Corporate Real Estate Manager. Later, several user groups participated in developing detailed briefs for different issues such as: Space requirements, Interiors and work environment, ITC, Security, Internal services, Operation and maintenance. The most general groups had representatives from the end-users. The more special ones, like ICT and Security, consisted of users with special knowledge in those fields.

In the DAGBLADET case, the whole process was layered, as the construction was carried out in several phases. This means that requirements also were developed in stages. The layered decision process in Dagbladet is described later. Another interesting aspect of the Dagbladet case is the management of the user organisation's processes, of formulating strategies and requirements, moves, and development of the final solutions. A project leader managed the project. The project leader's time was almost exclusively dedicated to the building process. He/she was employed in Dagbladet, and had special interests related to the project (actually, there were three different project leaders during the project). An extensive end-user involvement and a large information program was implemented, and "everybody", from the ordinary end-user, to union representatives and department management were involved at some level.

The brief for the OFFICE XX was rather special, because this was a research and development project, where new solutions were developed and tested. The main requirements were related to developing and testing new concepts. The main idea behind the building emerged early, as they decided from the start that “functional life = designed life”. The rest of the project is developed according to this statement.

In K-BANK the first parts of the programming phase were related to the main strategy: to develop multi-purpose office buildings. No special requirements for K-bank were developed, because the whole idea was that the buildings should fit any user. Thus, the design team and project management developed the building according to general requirements for contemporary offices. The end-users’ and departments’ partaking in the programming process were very limited, because the main idea was to apply a Universal layout that was identical for all departments. Derivations from the norm were only accepted for special departments with very special requirements. This resulted in mismatches between the departments’ wishes and the solutions that were applied.

The process of formulating needs and later translating them into requirements for design and construction is a process that in some cases is performed by architects as the first step towards developing solutions. In one of the interviews, architect Dik Spekkink describes one of the advantages of engaging the architect for this job. His main point is that this will help the client. He describes an iterative process between programming and design and between client and architect[2]:

> We have the experience that it is difficult for the clients to express their needs. To make a good design, that can stand for some years, you have to put in a lot of effort to get the functional requirements right. They know what they do, but to translate this into requirements for a building is very difficult for most clients. So we have to help them.
> …
> One of the things that have been emerging in the last years, and we have done some research on it, is about which steps we can take to make the requirements. There are some translations from users’ needs to performance specifications. The users can’t make that.
> …
> I think that is one of the things that are developing now. Not only to think about what they are doing now, but also to think about what they need in the future. We try to determine together with them: “What are your expectations for the future? Will you grow, will you consolidate or will you become smaller? What will change in the processes in that building? What are your expectations for the future?” It is always very hard for people to determine. It is always very vague. Even two years is very difficult.
> …
> We always ask for a vision, not for very hard data. What is very helpful is to have a vision of the future. That helps us a lot. Later we can work on that and we can develop alternatives, alternative solutions.
>
> So you start with some hard data and a vision. This should give you information enough to make the first step; to design some alternative solutions. Seeing that, the client “grows” into the project, so to speak. And he starts to realise what he really wants. This is a very “gradual”

process. This is one of the reasons that we think it is very important that an architect should have very close contact with the user whenever possible.

The architect will not always be involved at this stage, some even suggest that he shouldn't. Either way, the process of evaluating and generating options starts already here, and continues throughout the project. The development of requirements is related to adaptability both because it determines the fit between demand and supply, but also because it has the potential to start the process of assessing changes and future needs and solutions. This may be the first step towards looking more strategically at the next phases of the process; design and construction.

## 7.5.4 Summary, programming

- Programming is the most important phase when it comes to developing a good match between demand and supply.
- In the programming phase, there is a potential for organisational development in relation to the building process.
- Top management must be involved in decision-making in order to ensure align-

| **Main questions, programming phase** | **Implications** |
|---|---|
| Is the building process anchored in the organisation's strategies and in the top management's visions? | In order to provide the right adaptability, the user organisation's strategies and its expected future changes must be considered. Alternatively, typical user organisations in the commercial marked may be considered. |
| How will the user and owner's specifications for the building be developed? | Developing, understanding, and stating owner and user needs is of fundamental value to the BUR and in matching demand and supply. |
| How can the programming process be layered? | Layering the process is important both to the process of developing user requirements and for the manoeuvring room in the process. |
| Can the building or the building process be used as tools for organisational development and to encourage change and adaptations within the organisation? | If the building and the building process are seen as catalysts for change, this will encourage a more dynamic way to view the building and the actions within it. This may encourage adaptability and possibilities for changes in the future. |
| Who should be involved, and at what level? | Involving the right people is crucial. The right people are both those who are formally responsible (management), and others, who are familiar with the organisation and the work in such a way that they can contribute to the development of requirements and assess expected future demands. |

ment between corporate strategies and the program for the building process.
- A programming process should be layered. The first stages will be about formulating needs and developing alternatives. Later this must be translated into requirements for the designers and builders, and eventually one must evaluate and test the proposed design and solutions before and after construction.
- Future development must be assessed in the programming phase, to ensure that the solution developed has some potential to handle future changes.
- Programming is an iterative process that interacts with different actors and with all the other phases in the building's life cycle.

# 7.6 Design

In "Architecture, Technology and Human Factors", Granath describes design as both problem solving and decision-making.

> Problem solving involves defining the problem(s), defining objectives and outlining alternative courses of action. Decision-making is a matter of evaluation and choices among alternatives." Page 65 (Granath, 1991).

Some issues from modern design theory were discussed earlier as a metaphor for strategic decision-making. It is thus not a surprise that the structure of the strategic approach, with iterative processes between awareness, analysis, and action, fits the design process especially well. The main theme here is not the design process itself, but the issues which have to be considered during the design phase that impact on the Building – User Relationship and the adaptability in the building.

## 7.6.1 Awareness

The architect is of course not the only actor in the design phase, but because his sketches define the building and start the design development, some thoughts about the architect's design attitudes and approaches are presented in order to illustrate some issues of the awareness phase.

In relation to the scope of this work, there are at least two important issues in the awareness phase and the architect's first steps towards developing a design:
1. His attitudes and approach to design. The consequences of the different design attitudes can be made more open by putting such issues on the agenda. Some of them have been identified below, but the list is far from complete. These themes and quotes are chosen only to illustrate how important the architect's attitude towards growth and the user organisation is for the final adaptability and the Building – User match. It is not a complete analysis of the total architectural approach to different positions.



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2. The awareness phase is the initial step towards developing the design, and in the awareness phase the project is investigated and maybe the first sketches are made. The process of design is based on a development from the vague in the awareness phase to the more specific. The most important thing is perhaps to leave enough time for the awareness phase in order to give enough space for the first parts of the design process. The ideas developed at this point are probably the most important in the life of the building.

> As long as the guiding image is still developing it remains tentative, generic, vague. This vagueness, however, is by no means a negative quality. Rather it has the positive quality of a topological shape. As distinguished from geometric shapes, a topological shape stands for a whole range of possibilities without being tangibly committed to any of them. Being undefined in its specifics, it admits distortions and deviations. Its pregnancy is what the designer requires in the search for a final shape." Quote R. Arnheim (Arnheim, 1992), also quoted in (Liedtka, 2000).

Work in the awareness phase is based on input from programming. The program has to state clearly what the clients' expectations are when it comes to adaptability and BUR issues. This is important both for the architect's work, and for all the other actors involved in the design phase. All actors go through a similar awareness phase in the beginning of their commission. To learn to know the team and to communicate with the client to uncover his needs, expectations, and aspirations, are also important issues in the awareness phase.

The development of the design will go through stages from awareness to analysis, generation, and evaluation of options, and loops back again. It is important to leave time for this process. Today, design and construction is usually done more or less in parallel. This leaves little time for development and for growing awareness. One way to provide the needed manoeuvring room in the process is by defining plan layers that correspond with the development of the design and the construction of the building. Layering is described later.

The designer will, in the awareness phase, consider the available sources of data and inspiration; the program, the site, different magazines, and other buildings in the same genre, e.g. This, together with his previous design experiences, knowledge, and his attitudes to architecture, is the starting point for developing the design. Such design attitudes, or different architectural approaches, are often part of the architect's "vocabulary", and will to some extent define his attitude towards change and planning for the future. Some of the design attitudes that are important to consider when it comes to adaptability and reducing mismatches in the Building – User Relationship, are shown below. They are meant as illustrations of different approaches to architecture and how this will impact on the design process, adaptability, and BUR match in the future building, not as categories into which different architects should be divided. An architect's approach to design and architecture is of course more nuanced and consists of more than just this particular issue.

### "Architecture as frozen music"

Architecture has been described as "frozen music". Although a powerful and poetic image, it also carries a strong message about stability and endurance without changes, of idealised architecture as frozen. This means that one views a piece of architecture as a complete and perfect product, not a dynamic object which can change and adapt.

> "Lingering fragments of Modern Movement ideology – the powerful idea, for example, of gestalt which Gropius used to emphasise the totality of the building task – continue to provide some kind of intellectual underpinning for the persistent architectural habit of attempting to coin each new building as the complete, timeless expression of a single mind." Page 41 (Duffy et al., 1998).

Other actors in the building process have similar static views of the building, e.g. contractors, who often optimise the construction process and have little interest in the possibilities for change later.

### "Let my creation live it's own life!"

Architects and other designers put a lot of themselves into their design, and their artistic competence lies in creating something with both functional and aesthetic qualities. For most architects, total control of the situation in order to make everything work well together, is the ultimate goal. Still, the building is handed over to users, and they start changing it. This will challenge the creator's patience and sometimes create agony, because things will not be used as intended. The intended completeness and beauty of the building is tampered with or destroyed.

> «Actually, this is the part which is hard for me, when I finish a project. It now belongs to somebody else, it belongs to the clients, the users, they start to do things to it, and I have to sit back and keep my mouth shut as they use the building in the way they see fit. I always hate this part!»
> Frank Gehry[3].

### "Prescriptive and liberating"

Some architects are very interested in how time and use change their buildings. Several architects study the relationship between the permanent frames, which can be used to shape a situation and in which changes may happen. The architectural challenge will then be to decide which frames and guides they should provide, how and where, and the relation between the permanent and the fluent, the long- and the short-term, and between design by the architect and adaptations by end-users. The permanent structures will then provide guides to which changes may happen. It will be both prescriptive and liberating, as F. Duffy views the architecture of Herman Hertzberger in the Dutch office building Centraal Beheer:

> "… the architect's proposition that architecture should be both prescriptive – in the sense of establishing a strong overall sense of order, and liberation – in the sense of allowing all the end-users to create their own preferred kinds of environment within a structure." Page 36 (Duffy, 1997).



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## Design for change

The high rate of change in society and in buildings has led to some designers using the potential for change as ideals for their design, and applying functional and aesthetic change capacity as one of their main design issues:

> "I believe that many architects misjudge the private needs of buildings. The rate of change in society – and you can pick the computer or whatever you want as a symbol – makes long term prediction impossible and inflexible building unreasonable. A set of offices today may be an art gallery tomorrow. A perfume factory may switch to making electronics. What we can do – and this is the key to much of my work – is to design buildings that allow for change, so that they can extend their useful lives." Quote Richard Rogers[4].

## Evolutionary growth

Ideals about evolutionary growth can be found both in vernacular architecture and in more recent architectural "styles" like Structuralism. One architect that has based his architectural philosophy of concepts of evolutionary growth is Christopher Alexander. In his "Pattern Language" and in "The Timeless Way of Building", he presents a system for design based on growth and change.

> «There is one timeless way of building.
>
> It is thousands of years old, and the same today as it has always been.
>
> The great traditional buildings of the past, the villages and tents and temples in which man feels at home, have always been made by people who were very close to the center of this way. It is not possible to make great towns, beautiful places, places where you feel yourself, places where you feel alive, except by following this way. And, as you will see, this way will lead anyone who looks for it to buildings which are themselves as ancient in their form, as the trees and hills, and as our faces are." (Alexander, 1979)

Alexander promotes «organic order», and suggests a «meta-plan» – a philosophy by which a facility can grow in an evolutionary fashion to achieve the needs of its occupants (Alexander, 1977), (Alexander, 1979). The meta-plan has three parts:

- a philosophy of evolutionary growth
- a set of patterns or shared design principles governing growth
- local control of design by those who will occupy the space

## Tools for a company?

Lately there has been a lot of attention in office design to buildings as an investment in production, and as such, as a tool for a company in performing its work. Support of work-patterns, company culture, and image are some of the services that companies would like their buildings to provide. The architecture of DEGW (Duffy et al., 1998) is based on these ideals, and the Norwegian architect Niels Torp has also had success in this field with his buildings for e.g. SAS and British Airways.

> "How do you create the best tools for the company you are designing for? How do you make sure that the building you are designing for them doesn't turn into a millstone around their necks,, hindering their development, bogging down their routines, binding the structure of their organisation and its identity for ever more? An office building is the framework around a large or small group of people who, with the focus on the company's future growth and development, are to work together – in groups and preferably in the same direction – towards the same goals. An office building is at its best a catalyst for communication between its occupiers in a way that both unites them and promotes individual identity. It communicates the company's goals and methods – as defined at any time by the management – to the employees." Niels Torp, page 49 (Torp, 1997)

According to this, the designer must be able to understand the processes of the clients' organisations, interpret their needs into physical form which aims at promoting the desired qualities, such as encouraging communication between people at different levels and departments, bringing people together, supplying space for formal and informal meetings, etc.

### 7.6.2 Analysis

**Goal setting**

The goals for the design process should be stated in the program. Usually there are many, and sometimes conflicting, goals. Conflict of interests between what is stated in the program, the possibilities of the site, the constraints from regulations, and the goals of some of the actors, may occur. This calls for negotiation and for multicriteria decision-making. Usually, this is part of the creative problem-solving process of design, but sometimes a more structured approach in order to solve conflicting interests is necessary. Inger Andresen at NTNU developed one such Multi-Criteria Decision-Making Method for solar building design in her PhD-thesis (Andresen, 2000). Other examples of multicriteria decision-making is "open design" (van Gunsteren and van Loon, 2000) and other systematic approaches to decision-making in design (Kirk and Spreckelmeyer, 1988).

The most important thing for adaptability is to realise that there are several, sometimes conflicting, goals, and that one has to negotiate and compromise to solve these conflicts. Adaptability is one of several goals that should be reached during the process, and sometimes it suffers from lack of attention due to other, more pressing issues. Thus, it is important to have adaptability in mind when defining goals and setting standards.



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## Generating options

Earlier, the "wickedness" of design problems was discussed. Blyth and Worthington describe Louis Kahn's attitude towards generation of design options. For Kahn, the entire process from beginning to end was creative, and only when it was complete did one know what the specifications were.

> "Louis Kahn, the inspirational American architect, suggested that only when the building is complete, do you know what to design. The complete building for a perceptive client and designer becomes the "sounding board" to learn what the next should be." Page xi (Blyth and Worthington, 2001).

Kahn says that one only knows what to build after one has finished the building. Still, in the design process, specifications for the building are developed. The architects usually substitute mental experiments for physical ones, by generation and evaluation of options.

> "… a building, once constructed, cannot be easily changed, and so learning through experimentation in practice is undesirable. This is the ultimate source of "wickedness" in such problems: their indeterminacy places a premium on experimentation, while the high cost of change makes such experimentation problematic. As in business, we know that we might be able or be forced to change our strategies as we go along – but we'd rather not. This apparent paradox is what gives the design process – with its constructive forethought – its utility. The designer substitutes mental experiments for physical ones. In this view, design becomes a process of hypothesis generation and testing, whose aim is to provide the builder with a plan that tries to anticipate the general nature of impending changes." Page 15 *(Liedtka, 2000)*.

Architects generate design options in many different ways. This is not the main theme here. Instead some architectural strategies, on a conceptual level, and their consequences for adaptability and potential to give room for changes, are discussed.

In his book "How Buildings learn", Stewart Brand defines three different ways for buildings to relate to change (Brand, 1994):

1. *The low road.* These are buildings that can be easily changed. They are not prestigious buildings, but simple, spacious and robust structures. Sometimes low road buildings are run down, so every change is likely to be an improvement. In this group we find buildings that are easy and honest, and made after the principles of "minimum specification level", so that only the essentials are designed, the rest is left to the users.
2. *The high road.* These are buildings with a lot of prestige and strong architectural identity. They are sometimes difficult to change, but with their high quality and great symbolic value, they will be used in spite of their limitations. These buildings have such a strong personality that the users forgive them for not being able to adapt to changes. Instead the users adapt to the possibilities within the building. Such buildings are town halls and historic monumental buildings, old univer-

sities and libraries. But also modest buildings will fall into this category if they manage to become of historic value or be part of an environment that reflect past times. Nostalgic value will then make even modest buildings "high road". Examples of this are from such different environments as the protected mining town Røros in Norway, and the canal-houses in Amsterdam.
3. *The no road.* These are buildings which resist change and which do not give the sense of place, quality, or history as the other categories do. Brand puts most of the new office buildings into this category, both "award winning architecture" and typical developer-driven speculative projects.

Both high and low road buildings are likely to adapt to changes. Brand's main message is that to be adapted and used for a long time, buildings have to provide some qualities that the users want. For low road buildings this quality is their ease of adaptation and their unprestigious usefulness. For high road buildings it is the quality and identity they give to their users and the public which will buy them forgiveness for not being easy to adapt. The no road buildings will provide neither of these possibilities. They are difficult to change and the users show little forgiveness in their relation to the building.

> "Why have old buildings lasted? Generally they were not built with change in mind, yet they have been able to accept new uses. Perhaps they are robust enough to withstand people knocking holes in them, or they have sufficient capacity and space to accommodate a variety of demands. Research shows that many buildings have survived because they become loved and stimulate innovation in use. Their constraints have provided freedom. Research suggests that the "look" or "image" of a building might be one of the factors behind old buildings which are successfully adapted. Not only might something that looks stimulating find a sympathetic user, but local authorities may insist on keeping a building for its image." Page 45-46 (Blyth and Worthington, 2001).

A building's image may be one of the main reasons for a building to be adapted and used. This is also supported by Nutt and his fellow researchers at University College in London (Nutt and McLennan, 1996). Based on the same research, Kincaid reports that the apparent constraints of existing buildings often turn out to be easily overcome, it the financial constraints allow it:

> "It was evident from our Case Studies that designers, particularly architects, were much less constrained by the characteristics of the adapted building as found than might have be assumed by casual observation. … Physical constraints in adaptive reuse can usually be overcome if essential but financial factors and planning may represent absolute constraints."

This shows us that the physical hindrances usually can be overcome if this is financially possible. What is financially advisable depends on the quality of the building and its value at the market. This may be an argument to put more emphasis on developing buildings that are attractive objects both to buy and hire than optimising the building's physical adaptability. Such issues must be assessed in the design process. Other issues that have to be considered are the general principles of enlarging the potential for physical change in the building. Different design strategies can be applied:

- The building, or parts of it, can be extended or subdivided.
- The building can be divided into layers that can be changed separately.
- All elements and connections between parts can be designed in a way that makes them possible to reposition and change.
- One can add redundancy, both functionally and structurally, in order to make the building more robust and enhance its possibilities for different kinds of use.

Some of these measures will be described later. In the history of architecture, we find these measures being used in different ways and in different times, interpreted and reinterpreted for different styles and ideals. Some examples are shown below. This is not intended to be a complete guide to the available options, but meant as examples to illustrate some of the design strategies that will affect adaptability.

**Separation of services and the building**

In Lloyds' building in London, the main strategy was separating the services from the building's usable space. Instead of a dark core in the building centre, there is a huge atrium, and big, continuous, well-serviced office floors are freed from shafts, elevators, etc. (Duffy, 1997). Because the services are all outside the building skin, they are easily accessible. When services are being renewed, the space within the building is not affected by the construction work. This is essentially the same idea as at the "Centre Pompidou" in Paris.

Picture 59. Lloyds of London, Richard Rogers Partnership. Page 32 (Duffy, 1997)

A similar strategy, but with a glazed courtyard that protects the services from the weather, is used in the ELA building at the NTNU campus in Trondheim. The services are protected inside the atrium, and the floor-to-ceiling height could then be reduced to fit the existing, older buildings in the building complex.

Picture 50. ELA, Gløshaugen, Per Knudsen Arkitektkontor. Photograph by Anne Grete Hestnes.

### Addition of structural elements

Structuralist architects view design as a process of searching for basic, underlying structures. Within a highly structured or ordered framework, they may use addition of basic forms, like the rectangular box, or matchbox, see figure 51, to create a whole. Such an additional structure is easy to extend or change.

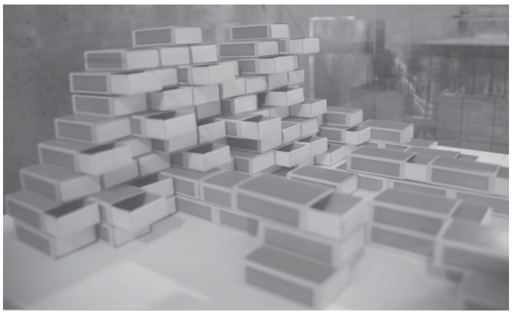

Figure 51 and 52. "Matchboxes" from exhibition NAI, Rotterdam, October 2000 and Habitat, Montreal, Canada. Architects: Moshe Safdie and Associates

One of the most well-known Norwegian structuralist projects is the office buildings at Høvik for Veritas, figure 53.

### Open and closed forms

Building forms can be open or closed. Some projects are designed in such a way that extensions are a natural next step. Others are designed as a complete form, which is very hard to change.

Figure 53. Norske Veritas, Høvik, 1976, architects Lund & Slaatto.

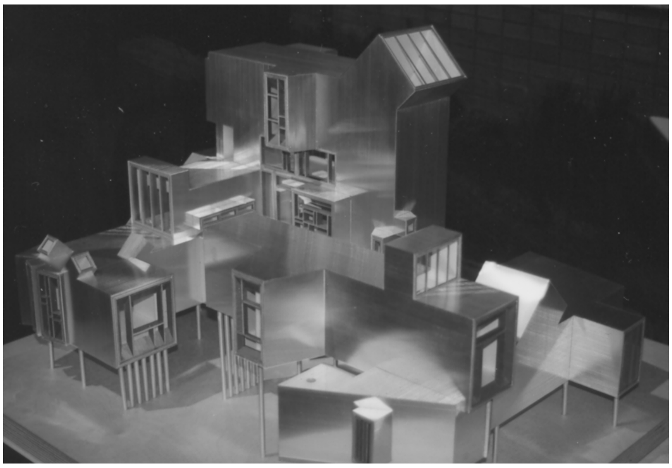

Figure 54. Designed to be extended. FOBA Katsu Umebayashi, from “Towards Totalscape, Contemporary Japanese architecture”, NAI, Rotterdam 2000.

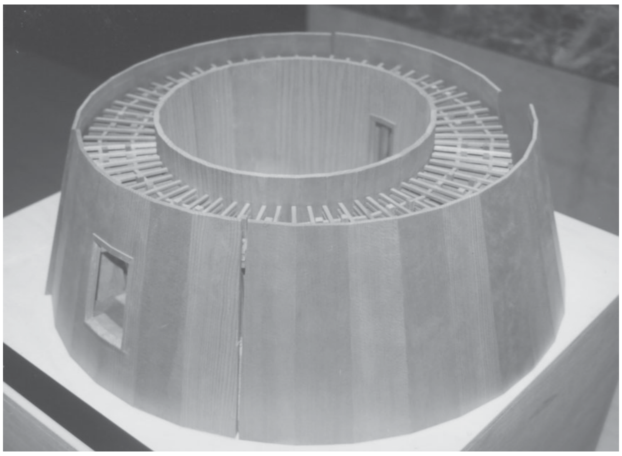

Figure 55. A circular, closed form resists extensions. Tadao Ando. Museum in Wood from “Towards Totalscape, Contemporary Japanese architecture”, NAI, Rotterdam 2000.

**Built for disassembly**

In line with the "open building" approach, some buildings are designed in such a way that their elements can be disassembled and changed. Office XX, described in the case studies, is an example of this strategy, with parts that can easily be assembled and disassembled.

**Robustness**

Some buildings have the robustness, both functionally and structurally, to accommodate different functions during their lifetime. Figure xx, on the next page, shows one example of this.

On a more general level, robustness is also a way of coping with uncertainty. Robustness is about manoeuvring room, both in the process, and in the product: the building. To ensure that the building is robust, one can add redundancy, which will enlarge the future manoeuvring room.

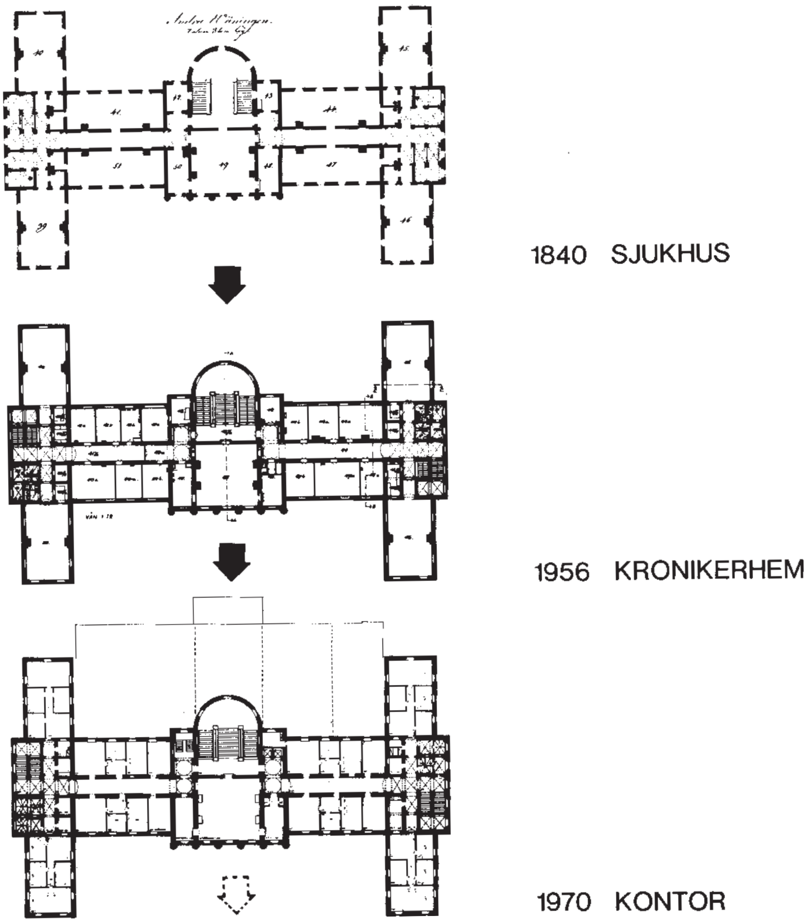


Figure 56. Originally a hospital, later used both as a nursing home and as offices. Stockholms Garnisonssjukhus. Built between 1817 and 1834. *(KBSrapport, 1973)*.

On the process level, a strategy can be made more “robust” by ensuring that it is valid in different situations, par example by applying a scenario analysis. In socio-technical theory, two different approaches to add redundancy are presented; the redundancy of parts, and the redundancy of functions (Trist, 1981), (Ketchum and Trist, 1992):

> «In the first, the redundancy is of parts and is mechanistic. The parts are broken down so that the ultimate elements are as simple and inexpensive as possible, as with the unskilled worker in a narrow job who is cheap to replace and who takes little time to train. The technocratic bureaucracy is founded on this type of design» (Trist, 1981).

> «In the second design principle, the redundancy is of functions and is organic. Any component system has a repertoire which can be put to many uses, so that the increased adaptive flexibility is acquired. While this is true at the biological level, as for example in the human body, it becomes far greater at the organizational level where the components – individual humans and groups of humans – are themselves purposeful systems. Humans have the capacity for self-regulation so that control may become internal rather than external. Only organizations based on the redundancy of functions have the flexibility and innovative potential to give the possibility of adaptation to a rapid change rate, increasing complexity and environmental uncertainty» (Trist, 1981).

For offices this means to add something “extra”, in order to make the building structurally and functionally sound. This can be:

- Functional redundancy. Spaces and rooms that can be used for different purposes due to their spaciousness and proportions. Generous entrances and communication routes, etc.
- Technical redundancy. Extra capacity in structural and technical systems will make it possible to change their use and still be within the limits of what the system can handle. It will also mean that the different parts of the system can substitute for each other. This will make the system less vulnerable to changes and adaptations.

To add redundancy is in many ways the opposite strategy of tailor-made and area-efficient, “optimised” solutions. It is to design more robust structures and spaces, which are able to handle surprises and new uses.

Adding redundancy will form an impact on investment costs, but may prove beneficial in the long run, because it has the potential to increase the building’s value in use and for different users at the market.

> “A constant challenge facing designers is the unending battle between risk and value. Designers add redundancy into buildings to make them structurally sound, protect them from earthquakes, keep the rain out in the severest of weathers: they manage risk by adding in redundancy – extra features which are rarely, if ever, used. On the other hand, value engineers come along and strip out what they perceive to be costly

> redundancy, often without the rest of the team being able to defend the decision! What is important, and this is what design brief management is about, is having the right form of redundancy left after the battle. The big question for both clients and designers is what redundancy to leave in the building." Adrian Leaman in (NBI, 1997).

> "If you skin space down to just efficiency, you won't have built in a lot of intrinsic value, which often is in old buildings. I mean, increasingly what we are trying to do is to find measures of redundancy because we realise that we are shortchanging the value of space because we are looking at just one dimension of it, and that's utility. We are not building in value in terms of characteristics, which is increasingly what the organisations was are talking about here are asking for now. They don't want just utilisable space, they want space with character, space which suggests to them what they could do. It is the built-in redundancy which most often allows that. Flexibility, adaptability, comes from space that make you want to do things in them." John Worthington in (NBI, 1997).

### Evaluating options

In design, the principle of satisfactory solutions, not optimal, will always apply, because design is about taking different interests into consideration and finding a solution that will satisfy them in the best possible way. Evaluation of options can thus be a difficult task, and will usually be done repeatedly, between new rounds of generating options and negotiating between different stakeholders.

One of the most important things to consider when it comes to adaptability is the co-ordination between different actors and designers of different sub-systems. Usually a design group consists of architects, structural engineers, mechanical engineers, etc. These people will have to agree on a solution which in the best possible way satisfies the demands from different parts of the system. Co-ordination between systems is especially important when we talk about systems for integration between the different parts in such a way that they retain a capacity for change later. In order to make this work as intended, the systems must be considered down to the very details, because overall adaptability often fails because one does something that "shortcuts" the intended flexibility at a lower level. In many projects this fails because of lack of co-ordination between the different actors in the design and construction phase.

In "The Building Systems Integration Handbook", Attar shows how failure to integrate may happen because of gaps in the building process (Rush, 1986). He views this both as a problem of gaps in the building delivery process, and as gaps between professional design disciplines. Together, these gaps produce "operational islands", see figure 57. Communication is described as the key to better integration, both between professions and between the actors in the different phases of the project.

Formal methodologies for evaluation in the design phase includes LCC methodology, which has been developed into an efficient design tool during the last 15 years in Norway (Bjørberg et al., 1993). Today, the Governmental Building Agency (Statsbygg)

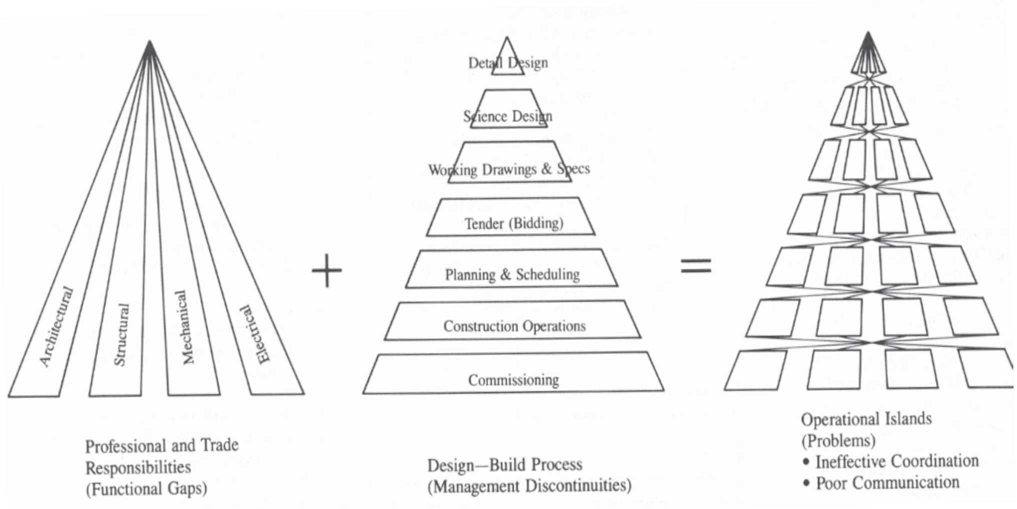


Figure 57. Poor performance and lack of integration in buildings may be ascribed to gaps in the building process combined with gaps in responsibility between disciplines. Illustration from (Rush, 1986).

demands LCC calculations for all of their projects at the earliest stages of the design process. This is becoming more usual for other clients too. This means that the designers have had to learn the methodology, and are familiar with this way of thinking today. This may be an incentive for considering the long-term effects of the design decisions, both in financial and in other terms.

Other forms of evaluation may include formal project reviews, when the designers, the client, and the project manager as well as possible end-users meet to formally approve of the design at certain points during the process.

### 7.6.3 Action

The design process can be divided into two different parts. The first part is iterative, problem-solving and the other is more concerned with producing documentation and solving lower-level problems (Eikeland, 1999).

### 7.6.4 The act of choice

In a building process with parallel design and construction, some choices will have to be made early in order to start construction. It is then important that the consequences of these decisions for adaptability and for the match between buildings and users are properly evaluated and understood. We know that changes later in the process usually will push limits to a maximum. One should especially notice the decisions that in some ways limit future changes. Layering may provide guidance and support in this process in order to give more manoeuvring room in the process.

### Implementation and control

The design is implemented in the construction of the building. Usually this happens more or less parallel in time, and sometimes the drawing goes directly from the architect's printer to the construction site where the bricklayers are waiting for their instructions! Most of the time, however, the drawings and other specifications are produced according to a pre-defined plan to give enough time for control before the plan is put into action. Both designers and the construction manager will continuously overview the work at the site, and production of drawings and specifications, implementation, and control is an iterative and continuous process.

During the process changes will occur, and this is probably one of the largest challenges designers and constructors have to face. In order to reduce the number of costly and time-consuming changes, professional management of the process and the predefined layered decision-process may be valuable.

EMPIRICAL DISCUSSION; design phase:

The main design objective in the GJENSIDIGE case was to accommodate the necessary number of cellular offices. This resulted in a narrow building with several "wings". This choice seriously limited the future possibilities for accommodating other types of offices. The architect was involved from the earliest phases, when he assisted Gjensidige with feasibility studies at the site, and throughout the entire process. His contract was for one phase at the time, but the co-operation with the client went very well, and the contract was always extended.

In the DAGBLADET case, the architect took care of the retrofit related to the building, and an interior designer was engaged to design the interiors, special furniture, and develop the plans for adaptation to the different departments and floorplans. The main architectural issues in the retrofit were:
- The new systems for internal communication, with a large, open internal flight of stairs.
- Extension of some floors in order to achieve building blocks with approximately 20 meters width, which can be used for several different office types.
- Floors and ceilings continue under and over the partitions. This required specially designed solutions to achieve the needed attenuation of sound transmission.
- Definition of the main horizontal communication routes in each floor, and ensuring that within this defined framework, different functions could be rearranged and changed.

The design of the OFFICE XX was rather special, because the design was developed as a research project, with a team of architects, building consultants, HVAC engineers, and researchers. The different ideas were simulated and tested in prototypes. The main design strategy in the Office XX was that the designed life should equal the functional life of the building. One expected the functional life to be about 20 years. All materials and components must therefore be designed to be recycled or reused after 20 years. This was a huge challenge, which required special actions both in the use of material and in detailing and connections. Alternative materials were used, such as sand and cardboard.

For K-BANK, the main goal was to design multi-purpose office buildings. This resulted in buildings which were general and in line with the market's preferences, and which utilised the site as effectively as possible. The first plan for the site was abandoned when the project was put on hold due to financial problems. When the bank recovered and decided to start the project again, a new architectural competition was held. The main architectural strategy was that the building should be multi-purpose and have universal layout in order to increase the adaptability and the possibility of moving people around and to let out the buildings or parts of them.

The buildings are rather deep, with atria providing daylight in the central parts of the buildings. One atrium is rather small and covered with a glass roof. It provides space for an elevator and parts of the canteen. The other atrium is larger and is not covered. The deep plan provides possibilities for different kinds of office layouts. There is a canteen and several entrances in each building, enabling them to function as two separate units as well as one larger complex.

### 7.6.5 Summary, design

- Design is both a problem-solving and a decision-making activity that involves a lot of different actors, and that involves mediating between a lot of conflicting goals, interests, requirements, possibilities, and constraints.

| **Main questions, design phase** | **Implications** |
|---|---|
| Will the designers' attitudes promote change? | If the designers' goal is to develop something that is static and difficult to alter, this will usually seriously limit adaptability in the building. Design approaches which deal with change can ensure that the concept and the fundamental structure in the building is adaptable. |
| How does the proposed building relate to change? | Buildings which provide ease of adaptation and usefulness, and/or provide some qualities that the users want that will buy them "forgiveness" from users and owners, will be the most successful ones over time. |
| Does the proposed architectural strategy allow future changes to happen? | Different design strategies will affect the future possibilities for extending and subdividing the building, changing functions, applying other office concepts, etc. |
| How do decisions limit future change? | All decisions will limit future change at some level. This must be evaluated and viewed in relation to the needed adaptability. Where, how, and when is adaptability limited? |
| Is the integration between actors and phases taken care of? | Integration between the phases must be taken care of in order to counteract the development of "operational islands" communication between the actors. Failing to do so may result in reduced adaptability, because a decision at one level is not carried through at another level. |

- Communication and integration between the different actors and phases of the project is important to successfully implement the different strategies and solutions.
- The design attitude or architectural approach may in many ways define the project's attitudes towards change, adaptation, and user involvement.
- Design strategies that will influence later capacity for change include, e.g.: high road and low road solutions, technical and functional layering, flexible integration of parts, and added redundancy.

# 7.7 Construction

The construction phase is not so much a process of awareness, analysis, and interaction as the phases described previously. It is more like a rational, linear production process. Some parts of the design process and the construction are more rational production processes than problem-solving processes, and should probably not be described by the same iterative model (Eikeland, 1999).

Changes during the construction process are difficult to handle and expensive to carry out, and thus usually unwanted. This is one reason to plan and manage the logistics between production of specifications (design) and construction. Layering in order to enlarge the manoeuvring room is one strategy for aiding this process. Today, it is usual for some contractors or suppliers to make specifications for parts and components, something that previously used to be part of the designer's work. Often detailed specification of parts are developed by suppliers, and it is then important to ensure that this is in line with design strategies, in order to encourage change and easy replacement of elements and components.

In most projects, the situation changes during the construction period. In most office buildings, the time needed for construction is rather limited, but in larger projects and other types of buildings (e.g. hospitals), needs will change during the time it takes to construct the building. Handling this is a huge challenge in project management and construction. One thing is to handle the different changes to what is already built or decided, which to some extent will happen in most building projects, but a more fundamental problem is related to the logistics in the construction process viewed together with the development of requirements and solutions (programming and design). These constant changes may be a strong argument for applying a layered process, where the most long-term elements are constructed first and the more changing layers and parts are developed in steps much closer to completion. This is discussed further in the next chapter.

One of the main issues in the construction process that affects durability and adaptability of the building, is the quality of work and materials.

| Main questions, construction phase | Implications |
|---|---|
| How are changes handled? | Changes affect the contracts, responsibilities, and costs in the project. A methodology to keep track of changes, responsibilities, and final decisions is required. |
| How does one handle developments that happen during the construction period? | This is a question of what must be decided, by whom, how, and when? |
| How does one handle communication and information flow between suppliers, designer, and constructors? | In order to ensure that solutions are applied according to the defined strategies for adaptability, co-ordination and integration between different actors and different phases is vital. |
| Which quality of work and materials are we expecting? | Quality and the choice of materials will affect the lifetime of elements and layers, as well as the visual and aesthetic quality and thus the value of the building. |

# 7.8 Operation and use

The design and construction phases produce the building. During the rest of its life cycle, the building will be used and adapted until it finally becomes obsolete and is demolished. The operation and use phase is thus different from the other phases. Because it is much longer in time, it is concerned with use and not creation, and its primary actors are owners, Facility Managers, and users, not professional suppliers in the building industry.

As soon as the users have moved into the building, one will begin to see how well it works according to the users' needs, and according to the performance criteria set in the program. Blyth and Worthington recommend a formal Post Project Review, in order to test the result to see if it meets the needs defined in the earlier briefs. They differentiate between three forms of feedback: Evaluation of the process of design and construction, evaluation of the product (the building as hardware), and evaluation of performance, which considers how the building supports the organisation's performance. This Post Project Review is important because it creates feedback to the building process and an opportunity to learn from practice. But it will also be important because it is the beginning of the user organisation's awareness of what they can expect from the building, its performance, its limitations, and its strong and weak sides.

There are, in principle, two different adaptation processes in operation and design. One is the day-to-day or month-to-month adaptations; continuous changes. The other is major changes, which is the adaptations that happen when the building is not meeting the user's or market's standard or when it is facing obsolescence. In these cases one may enter a new building project or a major retrofit. The two types of adaptations require different actions and must be handled differently. There are issues that are more important for the continuous changes than for the major changes. For major adaptations, the building's financial value and possibilities in future use are the main issues. For continuous adaptations, it is more the day-to-day adaptations and the process of managing BUR mismatches which are important. Both kinds of adaptations will, however, benefit from a "proactive" strategy to management, which is in line with the strategic approach that requires constant awareness and analysis of the situation.

There are many issues in this phase that form an impact on adaptability, but the continuous process of matching demand and supply, which is described earlier, is probably the most important. Changes occur in the organisation which will have consequences for the building. These have to be detected, and adaptations have to be managed and planned. The distribution of control and the different activities in building operation and management is far outside the scope of this work. The main thing at this point is that someone has to be responsible for managing BUR mismatches. This is not only about adapting the building as soon as new requirements are discovered, but also to anticipate and plan such adaptations in advance. This is the difference between a proactive and a reactive strategy.

Buildings in use should also go through the strategic decision-making process with awareness, analysis, and action. During occupancy, evaluations, like Post Occupation Evaluations (POEs), may be performed. Their primary goal is to check performance, assess possibilities, and serve as a reminder for the organisation of the possibilities and constraints in the Building – User Relationship. Most often, an evaluation is carried out as an assessment in the analysis phase, and will serve as a point of departure for later adaptations in the building in use.

In "Design for Manageability", Bordass and Leaman point at four different strategies for buildings in use (Bordass and Leaman, 1995).

The diagram should be seen as an integrated system, including both physical (top half) and behavioural (bottom half). On the horizontal axis, there are context-free attributes to the left. These are features that can be applied to the building more or less independently of their operation, including passive, technical features and habitual behaviour. On the right side are context-dependent attributes that need to be tailored to suit the needs of the occupants, and that will need regular attention in operation of the building.

Bordass and Leaman's diagram shows how one has to view strategies to meet user demand as an interplay between services and operation and built-in technical features. Different systems belong in the different parts of the diagram. In "Fit and forget", one can find passive features, such as structural stability, fire compartmentation, and other features that will not be altered with a change of operational and use context. These features should be made unnoticeable, and are predominantly the designer's territory. In the "Implement and change" quarter of the diagram, occupants have to deal with

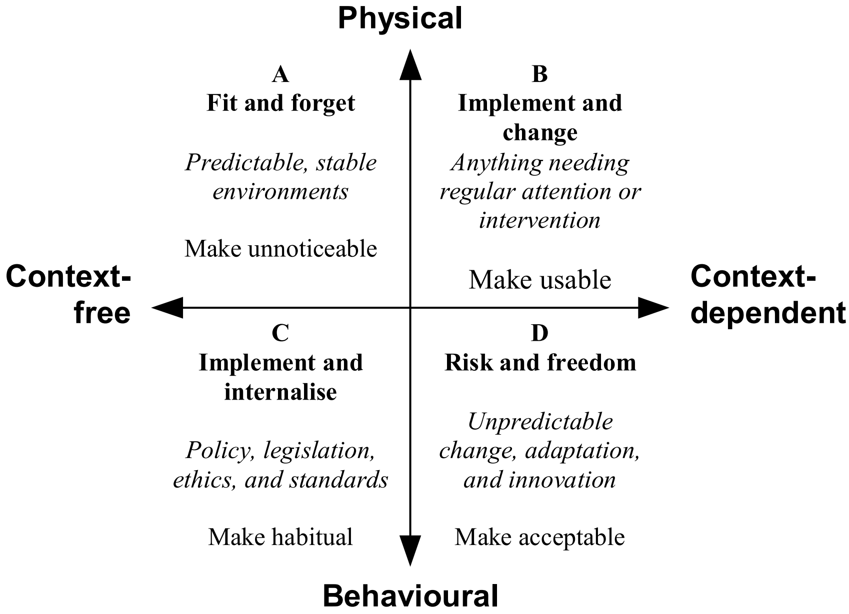


Figure 58. The diagram shows 4 general strategies for occupancy and operation of buildings (Bordass and Leaman, 1995).

the systems provided by designers, and to adapt them to ever-changing demands. These features should be made easy to use. In the "Implement and internalise" part of the diagram, all the context-free user issues, such as ethics and standards, are placed. These are ingrained in social structures, and work best if made habitual. The last category is "Risk and freedom", where most of the risk is located. These are features that have to be tailored to the occupants and to changes in the users' way of working, and which are context-dependent.

One of Bordass and Leaman's main messages is that the interplay between organisational and physical building features is complex, and that everything that is straight forward should be done as simple as possible in order to concentrate the efforts at the places where things are most likely to go wrong.

This also means that one has to view buildings, services, and the management of buildings as a whole. Different ways of servicing the organisation and supporting their business is just as important for adaptability as the capacity to change the building. Adaptability in use is just as much a question of adapting the use and supporting changes as it is about moving walls and changing buildings. This requires a professional Corporate Real Estate and Facility Management organisation. Most of the work that has been done in these professions during the last years has been related to different ways of relating to these questions.

EMPIRICAL DISCUSSION; operation and use:

In the GJENSIDIGE project, the Facility Manager reported that there were about 500 moves within the building every year, and that 300 of them involved moving walls. There are about 1200 workplaces in the building, so this means that every cellular office is, in average, physically altered every 4 years.

In the DAGBLADET case, one of the major goals in the retrofit was to reduce costs and time of future adaptations. Dagbladet estimates that putting up and taking down elements after the retrofit costs about 1/5 – 1/10 of the costs for earlier adaptations. But the most important thing is that it can be done quickly, in a night or during a weekend. This means that the disturbance of the daily production is limited. In an organisation such as Dagbladet, which is changing very fast, and where future changes are driven by forces that are hard to predict, this new capacity for inexpensive and quick changes are very important, and it will make the newspaper more fit to perform its task and adapt to changes in its business.

Changes in the OFFICE XX are also easy to perform, as all elements can be taken apart and moved around. The modest scale of the building means that the tenants are more in charge of their own adaptations, and the workplace layout is developed by the user organisation and changes according to new requirements when needed, without too much professional assistance.

During the years that K-BANK has occupied the buildings, almost 50% of the people have been moved around within the building every year. The bank did not expect this high churn rate. During planning and construction, they expected the situation to be more stable once the buildings were completed. The goal was to locate all departments in one building complex, and this, together with the expectations of new ICT that would diminish the need for physical “closeness”, was thought to solve the problems related to internal churn. This turned out not to be the case. Today K-BANK has developed a small organisation with 2-3 people who deal with allocation of space and equipment and are responsible for relocation of people and departments within the buildings. Since all furniture and all workspace layouts are the same, the only things that are moved are the personal equipment and each employee’s personal chair.

In K-BANK, the department manager is responsible for reporting new demands and requirements for each department. For large projects, it may take 1 to 1½ years from when the needs are reported to when the changes are carried through. These requirements are handled by the “office service” department, but it is a group of senior managers who decide on the final solution and who prioritise between different interests. The main focus is on dealing with the present needs, not so much on strategic use of space. A project group is established for each moving project, consisting of people from ICT, security, the building operations, and the office service group which co-ordinates the project and is responsible for contact with the user departments.

### 7.8.1 Summary, operation and use

- Evaluations must be performed: Post Project Evaluation to provide feedback to the building process and Post Occupancy Evaluations as a part of gathering information about the facility and its performance in order to reduce BUR mismatches.

- The Strategic Approach with awareness, analysis, and action continues in the use and operation phase, but is now part of the day-to-day work to create a better match between buildings and users.
- There are different adaptations in the operation and use phase; continuous adaptations, and major adaptations that will require major actions in order to update the building. The two adaptation processes must be handled differently, as they have totally different characteristics. Both will however benefit from a proactive strategy for use of space and match between buildings and users.
- In the relationship between users and buildings, different strategies to improve manageability of BUR can be applied. Some features are best "fit and forgotten", while other demand a more active strategy.
- It is not only the building and its capacity for change that will determine the adaptability in use and operation, but also how the building is used, the services, and the FM function which supports the user organisation.

| Main questions; operation and use | Implications |
|---|---|
| How well is the BUR management prepared for continuous changes? | The management's resources and attitudes towards day-to-day changes are vital for its ability to perform well. |
| How are the organisation prepared for major adaptations? | The building's value and possible other locations and users must be considered in order to be prepared for a major challenge that will result in major construction work, change of tenant, or change of location. |
| What are the organisation's strategies and plans, and how will they affect the BUR? | Knowledge and participation in the business strategy-making is vital for a proactive strategy to adaptability in use and operation. |
| How well does the building match the organisation's needs today? – And tomorrow? | A continuous monitoring and evaluation of the match and the expected changes is required to be able to manage the mismatches |
| How will the physical building play together with the building services and support in order to facilitate adaptations? | Not only the physical supply, but also services and support will determine the BUR match. Sometimes one can make do with a difficult solution for a while if the support is good. Robust physical solutions, on the other hand, may require less attention and service. |

[1] Interview with Øyvind Neslein, Niels Torp Architects, London, November 1993, as described in study trip report from Department of Building Technology, NTNU, Trondheim, 1993.

[2] Interview with architect Dik Spekkink, EGM Arkitekten. 17. June 1998. Dordrecht, The Netherlands.

[3] From "Twister" by Mark Isitt, Scanorama, March 1998.

[4] In Caplan L. 1988. *«Profiles: An architecture of possibility».* The New Yorker. November: 47 - 96.

# Chapter 8
# Making space for changes

# Making Space for Changes

As a part of a strategic approach in the building process and in matching supply and demand in buildings, one needs some tools or techniques in order to enlarge the "manoeuvring room", which describes the "space" in which possible solutions exists. In this chapter, some tools to aid decision-making in the Strategic Approach are presented. Two different tools are described in more detail; scenarios and layering.

In the previous chapter, the manoeuvring room is described as a collection of possibilities. These possibilities can be both virtual (as a collection of possible decisions in the process) and physical (the collection of possibilities within a building, the building's capacity to accommodate changes). The manoeuvring room is concerned both with room to manoeuvre in the process, and with potential capacity for change in the physical building. In this chapter, tools to support decision-making, as it is described in the previous chapter, are presented.

> "If people begin with certainties they will end with doubts. But if they are content to begin with doubts, they shall end up in certainty". Francis Bacon. Quoted in (Husby et al., 1999).

## 8.1 Tools to support decision-making in uncertain situations

One can find a lot of different methods to aid decision-making in uncertain situations. Some of them aim at anticipating future trends and risks, others provide knowledge about present situations or prescribe a process to generate and evaluate ideas and aid decision-making. Categorising them can be difficult, because one methodology often deals with several different aspects, and there is a great deal of overlap between the methodologies. Furthermore, some focus on group techniques, others are individual techniques or are analyses based on interviews with key actors, while other again are theoretical analyses, usually done by experts. In order to present an overview of some of the tools, they are here grouped into the categories presented below.

**Mathematical and statistical tools to analyse risk and uncertainty**

Traditionally, risk and uncertainty have been assessed by statistical analysis of probability. These are still widely used tools, and the developments in information handling capacity supplied by computers have opened up possibilities for far more advanced, fast and detailed analyses than before.

- Statistical and mathematical analysis of financial issues and of the real estate market, often based on extrapolation of existing data or on statistical predictions.



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- Calculation and simulation of probability. One example is “Monte Carlo simulations”.
- Sensitivity analysis of important factors.

### Tools for financial analysis

There is a large number of tools for financial analysis, costs, benefits, and value. Some of them are:

- Investment analysis
- Cost-benefit analysis
- LCC, Life Cycle Costing

### Tools for anticipating the future

There are several approaches to anticipating the future. One approach is to try to predict one future situation, other techniques focus on exploring several future situations.

- Predictions based on statistical material and developments over time.
- Predictions made by expert or groups, par example by Delphi Technique, a method of obtaining expert opinions and consensus by means of a series of anonymously answered questionnaires. Or by Nominal Grouping, a combination of decision-making techniques in which group members meet face to face to generate and vote on ideas concerning a particular problem (Hitt et al., 1989).
- Scenario analysis. Scenarios is not a tool for prediction, but a way to anticipate the future, and to evaluate current and future options and situations against different images of a future situation. The Scenario technique will be described later in this chapter.
- Trend spotting, based on individual experience and “a hunch”, or more formally, based on advice from professional actors.
- Analysis of predictability and impact of certain issues may help defining the critical uncertainties. This analysis may be part of a scenario process (Dewulf and van der Schaaf, 1997), (de Puy and van der Schaaf, 2000), or it can be used as a tool to determine the most critical factors in any decision-making process.
- Analysis of probability and utility of certain key aspects of the project may help define where the major risks and opportunities are (Samset, 1998).

### Business Modelling

Organisations can be modelled in different ways and for different reasons. In “Tools for anticipating the future”, some methods that focus on modelling possible futures or uncertainties associated with future situations were presented. This category contains tools that focus on understanding and mapping the present situation in businesses, in order to use this as a basis to discuss how processes can be improved. Such models can be descriptive, normative, or prescriptive, and they can focus on modelling processes, products, or organisation (responsibility, roles, and knowledge) (Hansen et al., 1999).

- An analysis of Strengths, Weaknesses, Opportunities, and Threats (SWOT) is the methodology presented in most works on Strategic Planning. A SWOT analysis can be used to determine the organisation’s current state and future potential.
- Methods that focus on modelling processes, activities, or roles, such as Business

Process Re-engineering (BPR), Ernst & Young process analysis, Systematic Technique for Role and Interaction Modelling (STRIM), Role Activity Diagram (RAD) (Hansen et al., 1999).
- Models that focus on structuring information and constructing systems, such as Structured Design and Analysis Technique (SDAT) and System Engineering (Hansen et al., 1999).
- Methods that focus on “doing the right thing”, such as Total Quality Management (TQM), Quality Function Deployment (QFD) (Hansen et al., 1999). Total Quality Management is an approach that requires a continuous process of improvement. It is primarily a collection of management techniques that focus on the client and the client’s satisfaction. Quality Function Deployment also focuses on the client, and is a tool for raising consciousness and improving production processes. The most important tool in QFD is “the quality house”, which is a tool used to identify and rank the client’s needs and to establish goals and determining product properties.

**Building evaluations**

Building projects can be evaluated at all stages of the building process, from the first concepts to evaluations of existing buildings in use.
- Project reviews are usually carried out during the building process at different milestones in the process. Usually the issues considered include financial, functional, and technical performance, but other issues such as environmental issues and issues related to durability and quality may also be considered. Which issues one should focus on must be determined early in the process, and should be related to the projects goals. In order to improve adaptability, issues concerning adaptability must of course be evaluated in the project reviews.
- Post Occupancy Evaluation (POE) is a collection of techniques for evaluating of buildings in use. There are several ways to perform POE, and different reasons for doing so. Usually one wants to know how the building is performing in practice, and to compare this to the goals and standards developed during the building process, against company standards, or as a part of a benchmark with other buildings. POE can be part of the user organisation’s or building owner’s continuous improvement process, and will be an important tool for monitoring the Building-User Relationship as a part of the continuous process of awareness, analysis, and action which is described as the Strategic Approach to improve adaptability.

**Planning methodology**

In order to enlarge the manoeuvring room in the process, several tools can be applied. Some of them are:
- Successive, incremental planning (“trinnvis-prosessen” in Norwegian) is a collection of working methods, planning techniques and tools, to handle uncertainty in the project management (Klakegg, 1993).
- Logical Framework Approach (LFA) is an approach to the planning of large projects, often used in international aid projects. The main goal is to shed light on

different perspectives belonging to different groups. This is done through a structured participatory process (Hansen et al., 1999), (Andresen, 2000).
- Value Management is a further development of value analysis. Value Management focuses on how good value can be achieved by applying a process that runs through the entire project, carrying out functional analysis by a series of creative interdisciplinary team work, in order to establish value criteria for the project.
- "Layering" of the process. This is discussed later.

**Tools for aiding creative problem solving**

Tools for aiding creative problem solving, both individually and in teams, are important for coming up with good ideas and solutions. Such techniques include:
- Methods to generate ideas: Brainstorming techniques, etc. (Hansen et al., 1999).
- Methods to solve problems, e.g. Creative Problem Solving (CPS) (Hansen et al., 1999).

**Tools for visualising the future**

One of the main problems when working with future solutions is that most people find it hard to visualise the various options. For "normal" end-users, both architectural drawings and financial analyses are hard to deal with without some tools for translating them into models and concepts that they can understand. *Storytelling* is one tool that can be used to stimulate people to visualise and understand complex situations. For physical solutions, both interiors, spaces, buildings, or urban context can be visualised by:

- Sketching and drawing
- Model building (both virtual and physical architectural models)
- Virtual Reality

Recent developments in 3D modelling has opened up for new possibilities of constructing visual models that are inexpensive and easy to alter in order to simulate different solutions. This can be taken one step further by introducing the time dimension. In recent years, some work has been done to develop tools and knowledge of 4D models, combining three-dimensional architectural models and the fourth dimension, time [1]. The goal is to be able to simulate dynamic situations over time. The development in virtual models is likely to make visualisation easier in the future.

As we have seen, there is a large number of possible tools available. Even though the list above is far from complete, it gives an idea of the different tools which can be used by decision-makers in different phases of the decision-making process. In accordance with the basic ideas behind the Strategic Approach, namely that it should be flexible and be possible to adapt to different projects and situations, *one set* of tools for analysis will not be offered. The right tools must be chosen for each situation.

Several of the tools mentioned above can be used in the analysis phase of the Strategic Approach. The process of performing the analysis, especially if this is based on discussion between several people in a group, will itself be valuable and contribute to both the generation of ideas and to a common understanding of the problems and possibilities. It is important that the decision-makers are able to use a methodology with which they are familiar, or get assistance from other professionals.

Scenarios and layering are described further in this chapter. The Scenario technique is a tool which is suited both for analysis and for use in the awareness phase. It is thus especially well suited in the Strategic Approach in order to manage future BUR mismatches. Layering is a concept which may be applied both to physical, functional, territorial issues as well as to planning methodology; a layered process.

## 8.2 Scenarios – alternative futures

Scenario analysis is a technique that is occasionally mentioned in literature about office planning and uncertainty, see (Blyth and Worthington, 2001), (Brand, 1994). Sometimes the word "scenario" is used as a description of a decision-process where two or more possible future situations are considered. A proper Scenario analysis, however, includes a process of assessing uncertainties and trends, and building stories about the future and the relationship between different futures and the present situation. Decision-makers invent, and later consider, several stories of equally plausible futures, in order to research future uncertainty and bring understanding from which present decisions may benefit.

Michael Porter's definition from 1985 describes scenarios as:

> "an internally consistent view of what the future might turn out to be – not a forecast, but one possible, future outcome" (Porter, 1985).

A Scenario analysis is a planning and decision-making tool, with which one can shed light on a hypothetical future situation. The Scenario technique is not a tool for predicting the future, but for analysing, anticipating and preparing for an uncertain future (Schwartz, 1996), (Ringland, 1998), (Brand, 1994), (de Puy and van der Schaaf, 2000), (Dewulf and van der Schaaf, 1997), (Husby et al., 1999).

> "The Scenarios are a tool for helping us to take a long view in a world of great uncertainty. The name comes from the theatrical term "Scenario" – the script for a film or play. Scenarios are stories about the way the world might turn out tomorrow. Stories that can help us recognize and adapt to changing aspects of our present environment. They form a method for articulating the different pathways that might exist for you tomorrow, and finding your appropriate movements down each of those possible paths. Scenario planning is about making choices today with and understanding of how they might turn out." Page 3 (Schwartz, 1996).

### 8.2.1 The Scenario process

In "Scenario Planning", Ringland traces the history of the Scenario technique back to the 1950's (Ringland, 1998), and presents several different methods for working with scenarios. One of them is developed by Global Business Network, and is presented in "The art of the long view" by Peter Schwartz. The book describes the scenario analysis as it was developed by Royal Dutch/Shell, and later used in several large international corporations. This version of the Scenario analysis includes the following steps (Schwartz, 1996), (Brand, 1994):

**1. Identify focal issues or decisions**

Those that are going to lead the scenario process start with interviewing the major players in the organisation or in the project. The goal is to identify the major issues and the key decisions they are facing.

**2. Key forces in the local environment**

The next step is to list the key factors influencing the major issues and decisions stated in the first step. What will make them a failure or a success?

**3. Driving forces**

The next step is to identify the driving forces in the macro-environment that influences the key factors. The main question is: "What are the forces behind the micro-environmental forces identified in step 2?" Usually one goes through a checklist of social, economical, political, environmental, and technological forces.

According to Brand, typical driving forces for a building include changes in technology, in the neighbourhood, in the economy, and in tenant use (Brand, 1994). This is in line with Blyth and Worthington, who claim that typical scenario variables include (Blyth and Worthington, 2001):
- Speed of growth and change
- Mix of staff and alternative patterns of work
- Alternative mix and balance of functions
- Changes in use and uptake of technology
- Change of ownership, political agenda, or cultural expectations

Step 3 in the scenario process; identifying driving forces, is usually the most research-intensive. It relies on efforts to search for trends, changes, and possible innovations, which is usually very difficult to anticipate.

**4. Rank by importance and uncertainty**

It can be useful to determine which forces are pre-determined, and which are highly uncertain. This is important in order to determine what is inevitable and what is unpredictable and still a matter of choice. The two different types of driving forces are labelled "predetermined forces" and "critical uncertainties", respectively. To determine which type of driving forces one is facing, the key factors and driving forces can be ranked based on their importance and uncertainty. The goal is to identify the factors or trends which are the most important and most uncertain.

Figure 59 shows one example of an analysis of uncertainty and importance. This scenario analysis is performed by BMVB at TU Delft for the Dutch Governmental Building Agency (GBA) (de Puy and van der Schaaf, 2000), (Dewulf and van der Schaaf, 1997).

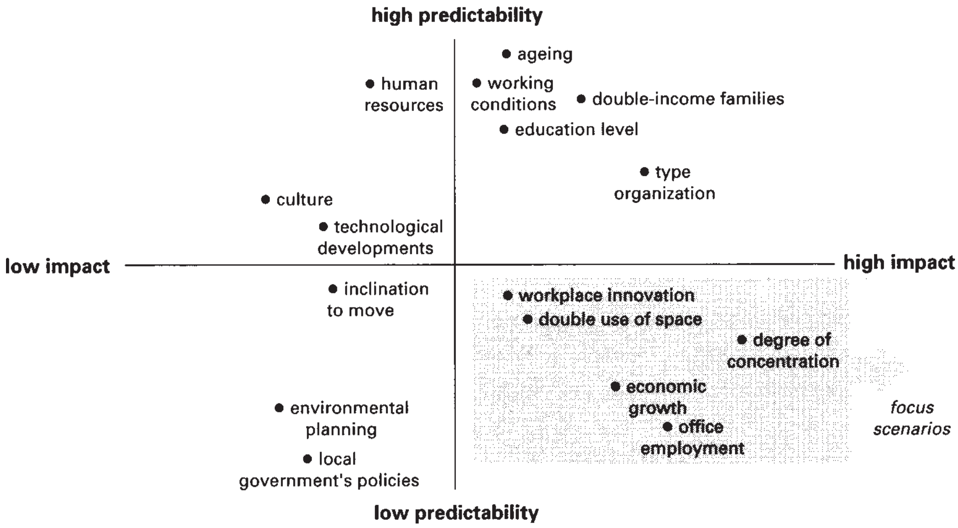


Figure 59. Driving forces in the GBA scenarios. Source: (de Puy and van der Schaaf, 2000) page 90. The driving forces in the lower left corner are the critical uncertainties, which will have the main focus in the scenarios developed for GBA.

## 5. Selecting scenario logics

Working with the critical uncertainties, the group's next step is to identify different scenarios, different basic plot-lines. This process is like composing a plot, a logic, or a pattern that ties together the elements in the system. The scenarios should explain how the driving forces might plausibly behave. The same set of driving forces may behave in different ways in different plots. The scenarios should explore two to four of these alternatives, based on the plots that are considered as the most important, the most challenging, or as Brand puts it: "The goal is to develop scenarios that are both plausible and surprising – shocking in fact". Page 182 (Brand, 1994).

It is usually helpful to show the driving forces that are considered "critical uncertainties" as a spectrum (along one axis), or as a matrix (along two axes), or sometimes as a volume (with three axes). This may help identify different scenarios by combining different extreme values of the critical uncertainties.

## 6. Fleshing out the Scenarios

After determining the logic, the skeleton of each scenario, the scenarios must be described and made believable by adding detail, colour, and texture. The key factors and trends identified in step 2 and 3 should be given some attention in each scenario.

Doing this, one must not underestimate the power of the narrative, as storytelling can be an efficient tool for painting a complete picture of the scenarios. When important questions about the future are too complex and imprecise to be imaged by tables, graphs, and numbers, the language of stories and myths may be useful. "Scenarios are myths of the future", says Schwartz (Schwartz, 1996).

Another important issue is naming the scenarios. The name should communicate the scenario logic, and be vivid and memorable. A good name may be easier to remember, and may serve as an important tool for communicating the message to different people in the organisation. This is one way of ensuring that the different scenarios become part of the vocabulary in the organisation.

In “How Buildings Learn”, Stewart Brand describes a scenario process for a film and television production company (Brand, 1994). The company was expanding, and had to consider renovating or expanding their studios and offices. The two main driving forces were identified as company size and market turbulence. Their four scenarios were constructed, based on combinations of the two driving forces, see figure 60. The participants in the scenario process all agreed that the “Spanish armada” scenario was a danger that should be avoided, but the remaining three scenarios were seriously considered. It was clear that the company wanted to become “Art Commandos”, but they realized that they had to make decisions that would enable them to survive in both  the “Boutique” and “Gorilla” scenarios as well.

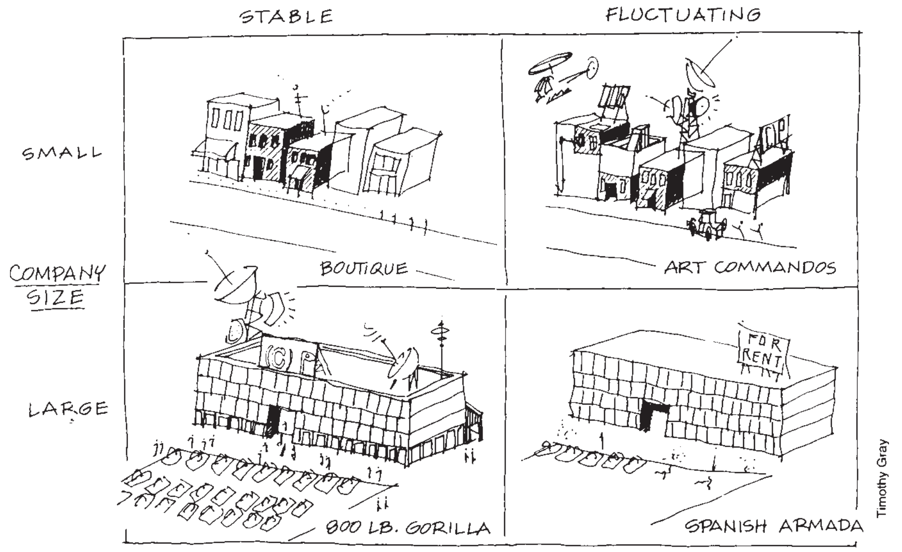


Figure 60. Scenarios for a production company, shown as a matrix of two driving forces: company size and market turbulence. Page 184 (Brand, 1994).

The result of this particular scenario process was that they decided to make the best out of the excisting building, instead of building a large new headquarters. The existing building was examined in order to determine the possibilities for expanding and subletting it. Further on, they decided not to develop designs around special effect technologies, but rather go for some relatively inexpensive changes that would make project co-ordination easier. They decided to retrofit the building in stages, and came up with a plan for which parts of the building should be completed, and which should be left unfinished but usable. The renovation was then done in stages according to the developing needs.

**7. Implications**

After developing scenarios, one must once again return to the focal issue, or the important decisions which were the starting point of the scenario process. Schwartz suggests that some important questions are addressed, such as:

- How will the main decisions look in each scenario?
- Which vulnerabilities were revealed?
- Is the decision or strategy robust across all scenarios, or does it look good in only one or two of the scenarios?

The main question thereafter is how the decision can be made more robust, or if this qualifies as a high-risk gamble. The ideal situation is to develop a strategy that will accommodate every scenario. This is usually difficult. One approach is to make the strategy more robust or viable in a variety of futures. Another approach is to decide on an "adaptive" strategy. This must be alert to changing events in order to adjust quickly. This is again dependent on indicators used to determine in which direction one is moving. This is the next step in the Scenario process.

**8. Selection of leading indicators and signposts**

The final step is to identify some indicators in order to determine which of the scenarios is closest to real life. Sometimes this is obvious to everyone involved, but other times one needs to know what to look for in order to monitor in which direction things are moving. The first organisation to identify a change will gain competitive advantage, and be better prepared to change its strategy according to the unfolding situation.

### 8.2.2 Participants

Alternative scenarios can be composed through panels of experts or through focus-groups of users (Blyth and Worthington, 2001). In Brand's description, the Scenario process, step 2 – 8, is performed by a group of key actors; decision-makers and their advisors, on a two-day session, gathered on a retreat far away from their daily activities (Brand, 1994). He also emphasises the importance of communication and implementation of the knowledge and insight that is the result of this session as soon as the group members return to their organisations.

### 8.2.3 Scenario technique used to reduce BUR mismatches in office buildings

Scenarios is a tool well-suited for addressing BUR mismatches, and it can be used both to clarify future needs, as information on which decisions can be made, and as a part of an ongoing process of assessing the situation and the changes at hand. But most importantly: it can be used to make strategies more robust. The Scenario technique makes it possible to assess several possible futures, and develop strategies and act according to the set of possible futures, instead of fixing the attention on one expected future situation, see figure 61.

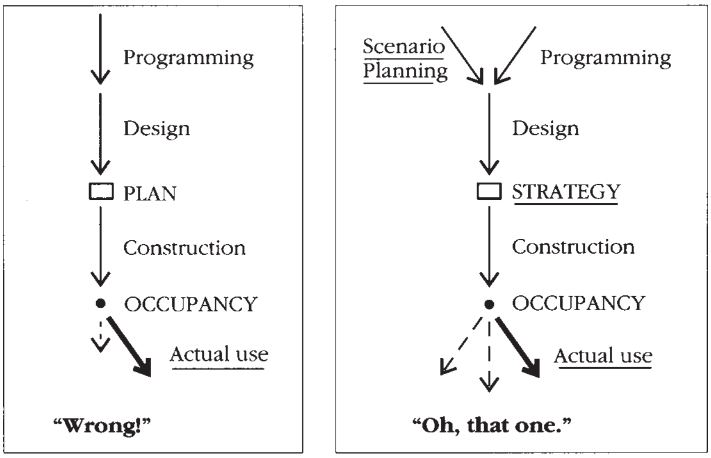


Figure 61. Source page 182 (Brand, 1994). The illustration shows how a more robust strategy will be suitable in a variety of future situations.

In order to reduce BUR mismatches it is important to be able to consider both the supply side and the organisation's needs as well as the interactions between them. The Scenario technique is well suited for this, because it allows several factors, at different levels, to vary simultaneously.

The Scenario technique can be a good tool to use within a strategic approach. It is perhaps most valuable in times of major decisions, or when formulating the main strategy. This means that it can be used both in the earliest stages of a building process, to aid main decisions about future use of the building, "major adaptations", relocations, etc. Another well-suited situation for applying scenario analysis is when developing the main real estate or portfolio strategy. There are examples of scenarios being used to choose between physical solutions (par example (Geraedts, 1997)), but usually the scenario technique is used for more strategic decision-making in complex and uncertain situations and environments. For decisions on a lower level, usually pure alternative analysis are used, considering the probability, cost, and benefits of different alternatives over a period of time.

The scenario technique is typically used when one faces a major challenge, such as outgrowing one's present facilities, or in case of sudden need to relocate, e.g. because of mergers with other companies. One example of the use of scenarios in the design of a new building is British Airways' Waterside, where all design decisions were checked against two different possible scenarios: that BA would use the building themselves, or that it would be rented out or sold, completely or in parts [2]. The two different scenarios were labelled "Corporate Scheme" and "Institutional Scheme".

> In a world of uncertainty, the strategy for a future building should be sufficiently robust to cope with a variety of directions the organisation might go." Page 44 (Blyth and Worthington, 2001).

## 8.3 Layering

Layering is a method and a way of thinking that will enlarge the manoeuvring room in the building process, as well as contribute to enlarging the potential of change in the building. is to introduce a hierarchical structure in the building process, decisions and development and construction of building parts, based on an understanding of the physical building as a collection of layers with different characteristics, different change rates, and expected life-spans. Levels can only be understood in terms of change, according to Habraken, as quoted in an article by Cuperus (Cuperus, 1993):

> "The concept of "level" came to play an important role in our work. In daily conversation there seemed to be little understanding about its use. Yet I was concerned that a firm determination of what constitutes a level within our methodological context was elusive. When asked, some argued that levels was a matter of form, its scale, its parts, its spatial organisation. Others thought it had to do with action: with responsibility, control or function. Thinking about it I found it only possible to give a satisfactory and adequate answer in terms of change. In change form and action meet, without this concept the concept of level relative to the built environment remains ambiguous." (Habraken, 1983)

In order to design and construct the building, some sort of layering is usually applied in most building projects. This is because of the complexity and scale of a project, and the need to break it into more manageable and buildable sub-units. In order to enhance manoeuvring room in the process and create more capacity for change within the completed building, it is important how these sub-units are defined and used. How the levels are defined must be considered, as well as their relationship to each other and how they relate to change in the process and in the building. Habraken's work is important to the understanding of levels. Since the 1960's this has been developed into what is known as "Open Building", but it has also influenced other ideas about the building and its layers, such as the thinking of DEGW (Duffy et al., 1998). One of the most important concepts in Open Building is that buildings are divided into levels. According to Habraken's definition an element is of a higher level if (van Randen, 1992), (Habraken, 1983):

- A change in the underlying level causes no alteration on the higher level
- A change on the higher level causes an alteration on the lower level.

> "Levels ensure that while change reverberates downward, it is contained upward. The city block provides continuity. It is the stable backdrop against which buildings transform. The building's form, in turn, remains constant during interior renovation and repartitioning. Lower-level configurations transform more easily – and therefore with greater

> frequency – than higher-level configurations. The lower the level, the higher frequency of change; conversely, the higher the level, the more severe the reverberations of any change, and the less often it will occur. This asymmetry guarantees a measure of stability for the whole." Page 43 (Habraken, 1998)

### Quick and slow changes

In a hierarchical system, the slow components will dominate the system, and will represent the stability in the model. Slow layers resist change, and limit changes to the more rapid layers. The system's adaptability is thus both a result of:

- the appropriateness of easy-to change components in the layers that change most quickly
- that the possibilities for change is supplied at the place where it is required
- that a layer with rapid changes can change without interfering with a slower layer. This means that they must be as independent of each other as possible, and that the elements that link the different layers and components together must allow changes in the more rapid layers to happen without serious consequences in the slower layers.

The quick processes provide originality and challenge, the slow provide continuity and constraint. Buildings steady us, which we can probably use. But if we let our buildings come to a full stop, they stop us. … Slow is healthy. Much of the wholesome evolution of cities can be explained by the steadfast persistence of Site." Page 17-18 (Brand, 1994)

But changes don't just happen, they happen for a reason. While the physical structures are constraints for change, the demands for change come from the users, the owner, or from the society. The question is who controls the different layers, and who can make decisions about changes and carry them out? In "The Structure of the ordinary", Habraken elaborates on this by discussing change frequency and control in the different layers (Habraken, 1998). He claims that each layer is related to three structures:

- Form, the physical order. "… engages the built environment as part of all physical matter".
- Place, the territorial order. "... encompassing control of space, reflects territorial behaviour observable among all living creatures".
- Understanding, the social order. "... built environment assumes common understanding among agents. To a large extent, such understanding is about judgement. It creates the recurring themes and variations that we see in patterns, types and systems. These reveal a third and cultural order, based on the consensus among agents".

In the following, the physical order and its relation to layers will be discussed, as well as more functional layers. Understanding and control of changes in the different layers will also be discussed, as a layered building process is presented.

## 8.3.1 The physical layers

The building can be divided into layers according to function, life-span, control, and technical differences, as well as from an intention of rational and manageable building processes. All these will in some way have relevance to adaptability and change in buildings. Usually one divides in accordance to expected service life and function. The different layers form a hierarchical building system.

> *A hierarchical building system: A building system consisting of hierarchical subsystems where each part of a lower level belongs to only one part of the upper level» quote (Sarja, 1998)*

Physical layering is a measure, and this is defined outside the limitations of this work. In spite of this, physical layering is discussed here. This is because physical layering is one of the principles behind layering in the process, and because physical layering can be seen as a more general principle; a way to think, not only as an actual measure.

In "Open Building" theory, three layers are defined: tissue, support, and infill, as described by the OBOM (Open Building Ontwikkelings Model) group in their presentation folder:

> "The concept of levels is the central idea of Open Building. Three levels of decision-making are distinguished, being tissue, support and infill. They are separated, yet co-ordinated. The town fabric (tissue level) is of a higher level than the building blocks positioned within the town fabric. Buildings can be demolished and rebuilt, while the town fabric stays the same. Within building blocks a distinction can be made between the support and the infill. … The concept of levels can be explained by looking at the doorframe, the door and the doorknob. We can replace the door without effecting the doorframe, however it will replace the doorknob too. Three levels and their relationships can be distinguished. The doorframe is of a higher level than the door, because it is not affected by changing the door. The door is of a lower level than the doorframe, because if the doorframe is replaced, the door needs to be replaced too. The hinges represent the co-ordination between the levels of decision-making. This co-ordination problem can be simplified by looking at the hinges as a intermediate system between two levels."
> Quote information folder, OBOM Group, Delft, the Netherlands, 1998.

Another well-known hierarchical system of layers is "the 6 S's", as presented in Stewart Brand's "How buildings learn"(Brand, 1994). The following discussion of the different layers is based on Brand's categories, but the definition of certain layers may differ from his presentation in "How buildings learn". Brand indicates an approximate life-span for each layer. In the following this is differentiated in order to understand the different forces that affect the actual life-span: technical, functional, social, and economical. The different characteristics of different elements within each layer will also be discussed. A short summary of the different layers; changes, technical, and functional life-span as well as social and financial issues is presented in table 8.

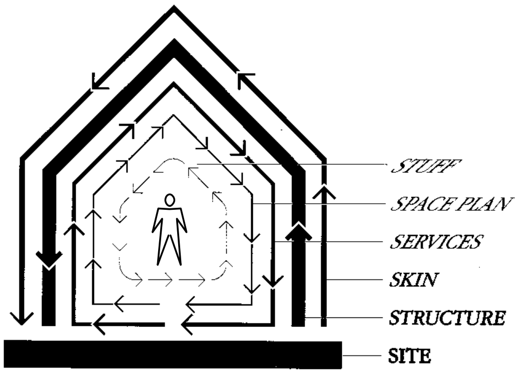


Figure 62. Stewart Brand’s six S’s divides the building into six layers according to life-span and function (Brand, 1994). The man represents Souls, and is added by the author, and is not part of Brand’s original model.

Because of the different life-spans and the different speed of which elements and layers are changed and replaced, the distribution of costs during the building’s life cycle is very different from that of the initial, capital costs. Investments in layers with a high change frequency add up and become much higher than investments in slow layers. Over fifty years, the changes within a building cost three times more than the original building. This is schematically shown in figure 63.

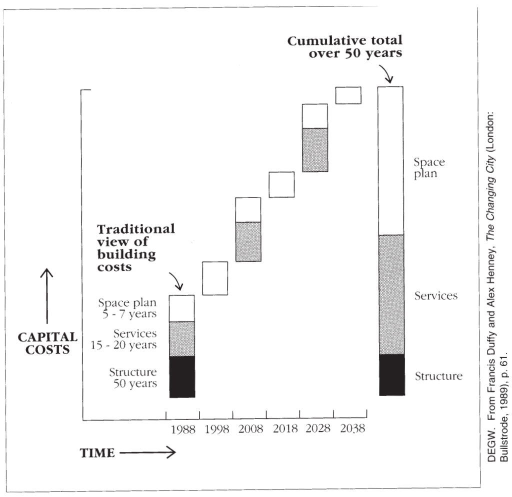


Figure 63. Total costs over 50 years, from (Brand, 1994).

> Add up what happens when capital is invested over a fifty-year period: the Structure expenditure is overwhelmed by the cumulative financial consequences of three generations of Services and ten generations of Space plan changes. That’s the map of money in the life-cycle of a building. Francis Duffy, quoted in (Brand, 1994).

## Site

According to Brand, the site is more or less eternal, at least the geographical setting or location is. In reality, changes happen both in communications, regulations, city structure, and type of use. So even if the site is eternal, its use, constraints, and possibilities will change. Studies in urban transformation shows that the physical structure often is more resistant to change than use patterns, which may change quite quickly.

"Studies show that use is the most changeable element of an urban plan, while the physical form is relatively stable, resisting change. Changes in function do not necessarily entail changes in form, and already built-up areas will absorb new functions by densification, rather than replacing existing structures." Elin Børrud, page 20 (Børrud, 2000)

Changes in urban (or suburban) development as well as changes in society, both on a regional and national, maybe even on an international level, will change the attractiveness of the site, as well as its possible use in relation to financial return on investment, both for the owner and the user organisation.

## Structure

Foundation and load-bearing elements are usually the parts of the building with the longest life-span. They are also difficult and expensive to change, so they are the part of the building that will be more or less untouched during the building's life cycle. According to the expected service life at the location, the structure will last the lifetime of the building, according to Brand, typically from 30 – 300 years. Changes to structure may happen during the building's life cycle, but are then usually part of an extensive retrofitting and reconstruction of the building.

Because it is the backbone of the building, and defines the building's shape, the structure will in many ways define the overall adaptability of the building. Blyth and Worthington points at 4 important characteristics with the structure (or shell, as they call it) that greatly influence the building's adaptability (Blyth and Worthington, 2001):
- Floor-to-floor height, and its effect on the servicing strategy, air conditioning, cabling distribution, and the ability to take advantage of natural ventilation and light. Insufficient height will limit the options available to the user. If the floor-to-floor heights are too low this will have an effect on the distribution of services in relation to communication routes (corridors) at each floor. In par example the Dagbladet project, one had to define the communication and distribution routes. These are fixed, and serve as a grid that the other functions must rely to. The floorplan is thus only flexible within the defined pattern that these create.
- The shape and configuration of the building affects the depth of the building and how the different parts are linked together. This determines how the building can be used and subdivided. The shape of the building also defines which office concepts it can accommodate.
- Different floor depths allow different space planning options. Floor depth will also impact on daylight and access to an outside view.

- The building's structural (column) grid is important, as it defines the grid into which different floor plans must fit. The grid defines both the distribution of services and ICT systems, control zones as well as the possibilities for internal partitions.

**Skin**

The skin is the building's external surface, and its primary function is to keep out weather and regulate temperature. It also determines how much daylight is let into the building, and has an important esthetical and social message, as the building's face outwards. Some use the word envelope when they talk about the building's skin. Both the facade and the roof are parts of the skin, and they have different functions as well as different technical problems and solutions.

During the last years, innovations to the skin have often been related to its importance for the energy consumption of buildings.

Usually we expect structure to have a longer life-span than skin, but in some rare cases this is reversed. If there are reasons to protect the facade of the building, i.e. because it represents an outstanding piece of architecture or because it is protected, due to age, rarity or its context. The skin may be kept, but the rest of the building will be taken down and reconstructed behind the original facade. This is one example of other forces that restrict and promote change in the layers, not for functional or technical reasons, but for social and economic ones.

**Services**

Services is not really one layer, but a system that consist of several layers, with different characteristics and life-spans. In "Flexis", Rob Geraedts divides services into layers related to its location: City, building, wing, floor, and unit (Geraedts, 1997) (Geraedts and et al, 1996). Another way of dividing services was developed in the Dagbladet project, and is presented in Tore Wigenstad's doctoral thesis, where he divides services into 5 main layers (Wigenstad, 2000):
- Inlet (main entry)
- Main installation (the plant)
- Vertical pathway (risers, shafts, etc.)
- Horizontal pathway (roof, ceiling, floor, etc.)
- Local installation (zone, room, desk, etc.)

The different functions and the different technical solutions will of course have very different life-spans. Local adaptations, technological innovations, and changes in use may result in local installations that become obsolete over night, while main entry and the main arteries, both horizontal and vertical, are more difficult to alter and will have a much longer life-span both technically and functionally.

Not only do the services differ in layers, but also in function. It is only in general, theoretical phrases that it makes sense to talk about "services" as if they were a conform group or coherent system. In reality, this category contains everything from computer cabling, wireless phones, elevators, heating and cooling, air-conditioning, power supply, safety and security systems, etc. The conclusion from this is that services is not one layer, but a variety of different systems with different functions and different life-spans.

The services are "the working guts of a building" (Brand, 1994), and because new demands may require the entire system to be replaced, buildings that have services that are highly integrated in other layers may risk demolition because they are too difficult to change. The co-ordination of services with the other layers will therefore be one of the major issues for improving the building's capacity to accommodate change.

Some of the services, like air supply, are regulated in Norway by official norms, the Building Act, technical regulations and work environment standards. The norms demand much higher performance and capacity today than they did only 30 years ago, and many older buildings fail to satisfy these new demands. Upgrades and retrofitting of services is thus one of the most important worries of building owners today. The impact of services on the building's life cycle costs is increasing, and much of this is due to the raised expectations to building services today. In a new building, about 40% of the capital costs are related to services (Wigenstad, 2000). A Norwegian benchmark by Norsk Nettverk for Næringseiendom in 1993, shows that 50-60 percent of the money spent on maintenance every year is used on services (Wigenstad, 2000). A similar percentage is found when we look at costs to develop the building to a higher standard (retrofitting).

**Space Plan**

This is the interior layout, walls, ceilings, floors, doors, etc. Changes will depend on the frequency of change within the user organisation and with the length of contracts, and new tenants moving in and out. The lowest level, space plan and stuff are the ones who are mostly changed because of new demands, not because of technical deterioration. According to Blyth and Worthington, the space plan, which they call scenery, "*match the detailed user requirements, addressing issues of organisational change, personal identity and corporate identity*". Page 46 (Blyth and Worthington, 2001)

The technical life-span of the space plan layer varies from short-term, like carpets that wear out because of use, to long-term, like floor tiles in natural stone that will last the lifetime of the building. And from the short life-span of mobile partitions, which are frequently rearranged and wear out quickly, to the long life-span of solid walls, which are only painted now and then.

It is often the social forces and functional changes which require changes in the Space plan, not the technical life-span in its self. The functional life-span of the space plan is closely connected to the social and economical life-span, because changes in demand, which will affect the functional life-span depend on social and economical parameters, like length of contracts, type of user, etc. In the interviews, one building owner and developer claims that they use one years rent to update a facility to fit a new user (reference interview Steinar Manengen, KLP Eiendom). The majority of these changes happen on space plan, but some also on the Stuff level. Changes in technical services will increase the cost of changes even more, but do usually not occur between every change of occupant. The frequency with which users are changed, and the changes within each user organisation that require changes on Space plan level, will thus heavily affect the costs of running and upgrading a facility.

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Both the interviews and the case studies report challenges in practice at the Space level.

In the Gjensidige case, they had problems replacing the mobile partitions because they were not produced anymore, and could not be replaced with other types without changing the entire system. This demonstrates how dependent one is on changes among one's suppliers if the design limits the choices of elements of short life-span to one particular system. It also shows that even within the Space plan level, there are several systems and layers that have to be co-ordinated and integrated. The interior partitions should fit in their sockets and into the modular grid. They should be designed not to interfere with the carpet, the ceiling, the air supply, or the power switches and outlets. This sounds basic, but in practice one often runs into problems with such integration and co-ordination of different elements and systems, even within one layer (reference: interview with Brydøy & Homelien, NORDIA). This co-ordination between parts depends both on design and selection of elements and on the integration of the different designers, constructors and suppliers.

In the Dagbladet case, changes on the Space Plan level continuously made before the major retrofit started. One of the main goals of the retrofit was to make changes easier to accommodate within the existing facilities. In order to achieve this, they invested in the space plan layer in order to reduce both the cost and the rapidity of future changes. Adaptability and flexibility in the short-term is often concerned with the Space Plan layer.

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### Stuff

Stuff is all the user equipment, furniture, and household appliances. These are the things that move around daily, weekly, or monthly, and which are closest to the user and his needs. The life-span of Stuff depends on the type of equipment, its quality and use.

> "Furniture is called *mobile* in Italian for good reason." Page 13 (Brand, 1994)

Some stuff can be manipulated by the end-user with relatively little effort, and Stuff is therefore the most important layer for daily interaction in the Building – User Relationship. At Stuff level, some organisations allow their workers to fit out the office space as they please, while others apply a strict policy, with identical "corporate" workplaces. In these two extreme situations, the control over the Stuff layer is placed differently, from a centrally controlled work-environment to an end-user controlled environment.

One strategy which allows for day-to day adaptations at the lowest level, is to give the end-user a mandate to adapt his or hers own work environment. In order to achieve this, the Stuff layer must be allowed to "float" according to individual and group needs. This requires enough and robust space and a structure that defines the boundaries to which changes can be made.

> ".. office workers like to move their furniture much more than they're allowed to in most work environments where the space plan and management are too restrictive, or the furniture is too heavy. Constant, searching micro-adjustment is both empowering and adaptive. The boundary of a workgroup will flex back and forth between local and organisational needs." Page 217 (Brand, 1994).

Another strategy is to supply identical, complete workspaces, a universal solution that is the same everywhere, and in which people can be moved without much adaptation. This places the responsibility for the work environment, for changes, upgrades, moves, etc. in the hands of a professional facility manager.

This is the case in Colosseum Park, where Universal layouts are used throughout the building. A professional FM is responsible for all aspects of providing the workplace, from space planning to control of temperature and provision of services in the building.

Office concepts will of course impact a great deal on the Stuff layer. In a universal footprint solution with shared workplaces, the equipment, the furniture, the actual room, and the control of the Stuff layer will be different from a cellular, 1:1 workplace solution, which again is different from a large landscape where everyone has their own desk.

**(Souls)**

The users are of course not a technical layer, but the organisations, teams and individuals that occupy the building will interact with the building's different layers. This is why Souls have been added to the original 6 physical layers to illustrate how people interact with the physical building hierarchy.

Souls are everybody working in office buildings, but Souls also represent the organisation's needs as a whole. End-users usually interact with the Stuff level, while organisations interact with the higher levels in the hierarchy.

> "You could add a seventh "S" – human Souls at the very end of the hierarchy, servants to our Stuff." Page 17 (Brand, 1994)).

Souls are affected by the building, and buildings are affected by Souls. This is the essence of the Building – User Relationship. Very often the drivers for change within the building comes from the user's side, from Souls, and the building has to reply to meet these challenges.

A common interpretation of the volatility in today's organisations is that souls change quickly, while buildings change slowly. Organisations may change quickly, but social structures and people may also be conservative.

> "… there seems to be an underlying assumption that the physical world is less flexible and more conservative than the social world: the organisation changes very rapidly and the city very slowly. It may be just the opposite. I think we should not assume too rashly that either family structures or political structures or institutions are very flexible and the physical environments very inflexible. The opposite may be the case, in fact. There is a huge conservatism about social structures." Tom Marcus in (NBI, 1997).

The table below summarises some of the properties of the different "layers":

| | Changes | Expected technical life-span | Functional life-span | Social and economic life-span |
|---|---|---|---|---|
| Site | Environment and neighbourhood may change, as well as economical possibilities and constraints. Changes in use. | Physical location – eternal. | Use and context will change. | The context, regulations, and social perception of a site will change and its economical potential accordingly. |
| Structure | Major alterations will affect structure. Deterioration. | Usually as long as the building's lifetime. 30 – 300 years? | Usually as technical life-span, but major alterations may require changes prior to end of use. | Depends on structure's ability to satisfy different social changes and financial expectations. |
| Skin | Esthetical changes due to changing demands for appearance. New technical possibilities, as well as new materials.Energy- and environmental issues.New demands for windows and daylight, also in relation to use.Subject to wear and tear by agents like weather, pollution, etc. | Dependent on material and technical details and maintenance. Examples: Brick has a long technical life-span, usually far beyond the building in which it is used. Wood will have to be replaced every 20-30 years, and maybe painted every 5 years. 10-50 years | The skin's function is to keep out weather and to regulate the indoor environment. How long it can sustain these functions depends on materials and the design of the facade, as well as the expected levels of comfort within the building. | How long it is able to maintain its esthetical function depends on social and economical parameters.Image, as expressed by the facade will play an important part of the buildings perceived value on the real estate marked and therefore its economic life span. |

| | | | | |
|---|---|---|---|---|
| Services | Services is not one layer, but a system consisting of several layers. Changes on each level may differ both when it comes to cause and impact.Changes are often due to new and raised demands, not only technical deterioration. | Depends on which layer. Central systems, 20-30 years. Local, user level, may wear out much faster. 2-20 years | Will depend on which part of the services, as some change slow (e.g. air supply) and other fast (e.g. ICT).Functional life-span depends both on quality and level of functionality as well as changes in demand, such as technological innovation and raised expectations. | As changes often are a result of new and increased demands, social factors play a major role in defining when changes are necessary. As changes in technical services tend to be expensive, the cost of upgrades are vital to the facility's profitability, and thus its economic life span. |
| Space Plan | Changes are demand driven, caused by organisational changes, new workplace concepts, moves within the building and tenants moving in and out. | Technical life-span depends on selection of materials, maintenance, details, co-ordination of different elements and systems, and use of the building. 1-50 years | Functional life-span depends on change patterns within the organisation. In some cases, changes in space plan are going on continuously, due to churn and changes in workspace. | The social and economical life-span is both related to the organisation and its use of the building, and to the owner, who will have to change space plan to attract new tenants, before new occupants will move in. |
| Stuff | Some Stuff will be moved around almost constantly, while other is more permanent.Changes due to new requirements for users, to technical innovation and wear and tear of materials and components. | Depends on type of equipment. In relation to the other layers, usually short technical life-spans. 1-15 years | Functional life-span relies on new demands and innovations that make the old Stuff outdated.Usually short life cycles. | Social and economic life-span is more or less the same as the functional life-span, because parts will be replaced if they do not fulfill their function, socially or economical. |
| (Souls) | Changes and new demands at three levels:<br>- Individual<br>- Team – group<br>- Organisation<br><br>Each with its own way to relate and interact with the building. BUR | | | |

Table 8. Changes in the different layers, and their technical, functional and socio-economical lifespans.

Brands model is an expansion of DEGW's 4 S's (Shell, Services, Scenery, and Set), see figure 64. (Duffy et al., 1998). Other, similar versions include Blyth and Worthington's 7 Ss: Site, Shell, Skin, Services, Scenery, Systems (information and computer systems), Settings (day-to-day rearrangement of furniture) (Blyth and Worthington, 2001)

A concept called "Shell and core" is often used, especially in developer-driven projects. In a Shell and core project, one designs and builds the building shell and its cores, the exterior walls, the core of elevators, bathrooms, shafts for services, etc. (Duffy et al., 1976). The rest is left to be fitted out in accordance to the user organisation's needs and wishes.

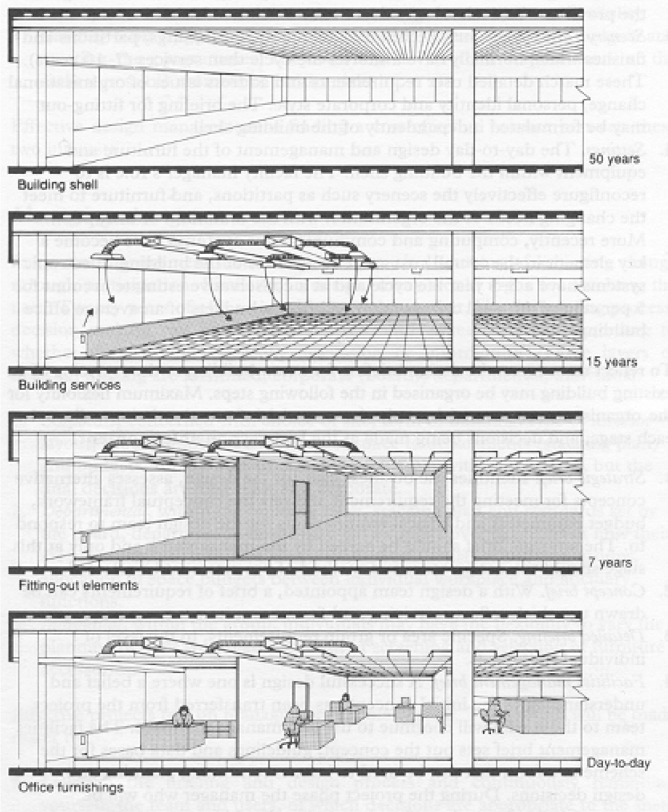


*Figure 64. Shell, Services, Scenery, Setting as presented by DEGW. "The different layers of the modern office building each have their own life cycle which must be incorporated into the final design".* (Duffy et al., 1998), (Spedding, 1994).

We have seen a similar division in recent Norwegian projects. One example is the case Kredittkassen, where one can observe a subdivision of the project, into a "building project"; structure, skin, cores, services, and an "outfitting project"; interiors, like space plan and stuff. A similar division can be observed in the new Telenor building in Oslo (Arge, 2001). The two processes run parallel to each other. The initial outfitting project is just one in a long row of outfitting projects running during the building's life cycle, within the limitations and possibilities of the building project, structure, skin, and core.

It is not the number of layers that is important to adaptability, but the concept of layering, the pace of change, and the co-ordination of change between layers. The appropriate number of layers, and their relation to each other, must be decided for each project, according to its complexity, uncertainty, expected changes in use, and how the building process is organised and managed. In Open Building, one usually defines three levels, Tissue, Support, and Infill. In "The Structure of the Ordinary", Habraken takes a broader perspective; incorporating the city layers as well as the building, and divides the layers into nominal classes, configuration, and the space within the configurations.

| | A. Nominal Classes | B. Configuration | C. Space within |
|---|---|---|---|
| 6 | Major arteries | City structure | Neighbourhood |
| 5 | Roads | District | Block |
| 4 | Building elements | Building | “Built space” |
| 3 | Partitioning | Floor plan | “Room” |
| 2 | Furniture | Interior arrangement | “Place” |
| 1 | Body and utensils | | |

Table 9. Habraken’s identification of levels, as classes of physical parts (A), as configurations of such parts (B), or as the kind of space resulting from the placement of configurations (C) (Habraken, 1998).

By defining the space within each layer, Habraken takes the concept of layers one step further. The spatial functions at each level is related not only to function and use, and therefore to the Building – User Relationship, but also to territory. Who are affected by changes on which levels? Who decide which actions should be taken, and what changes should be made at each level?

Layering may provide possibilities for manoeuvring room in the process, and ensure that changes in the building during operation and use can be carried out as effortlessly and painlessly as possible. Changes in layers with short life-spans should be carried out without disturbing layers of longer life-spans. Reducing friction between the layers requires special thought when deciding which technical solutions and materials should be used, which in turn requires close co-operation between the different parties in the design and construction process. To shed more light on how the model of a layered building can be used to enhance adaptability, two concepts will be discussed further:

- the different principles for integration of parts in a system
- the minimum specification level

### 8.3.2 Integration of parts

In order to be able to alter and change parts of the building, one needs to consider how the different elements are integrated or connected, and the sequences in which they are put together and can be taken apart, assembled and disassembled. The different layers with different change rates must be allowed to be altered and changed without disturbing other layers, systems, or elements.

In the *Building Systems Integration Handbook*, Rush presents the different possible connections between two elements within a physical system. Parts can be integrated as remote, touching, connected, meshed or unified.

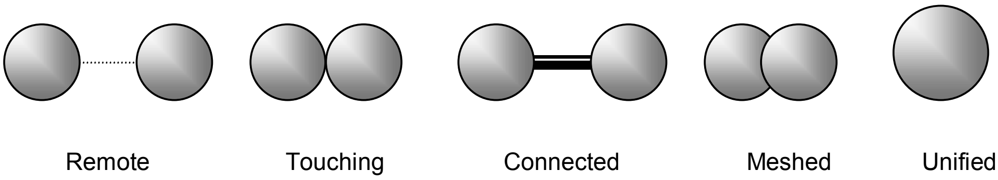


Figure 65. Possible ways to integrate two objects *(Rush, 1986)*

The dependability and the sequence of the elements is as important as the type of integration. Much work has been done in developing knowledge about sequences and dependability between elements. Open building, industrialised construction, modular standardisation, e.g., are all dealing with aspects of this, see par example (Rush, 1986), (Kendall, 1998), (Sarja, 1998). This work has been going on for many years and the knowledge is rather well developed. Building elements and systems have also been developed with this in mind, and are now used in most projects. One example of how an analysis of connections between building parts looks like is shown in figure 66.

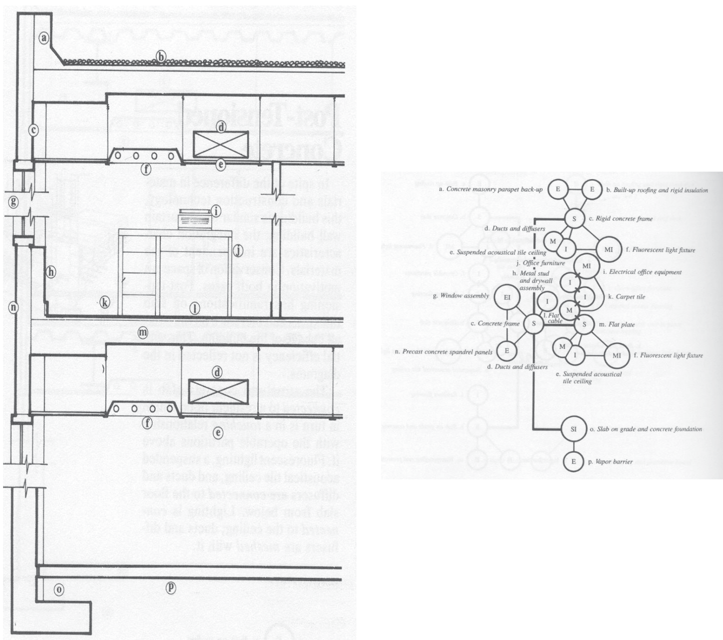

Figure 66. An example of detailed analysis of integration between elements in an office building. From the Building Systems Integration Handbook, page 350 *(Rush, 1986).*

One of the cases, *Office XX*, is an example of how integration and co-ordination of parts has been the primary design objective. Office XX was designed with change and disassembly in mind, and all connections are therefore carefully designed in order to make this work. XX is a research and development project, and has therefore been able to carry this idea out all the way through the design and construction process. In many other examples, we can observe that even when the goal is flexible building systems and connections, it can be hard to implement the ideas in practice. Both *Dagbladet* and *Gjensidige* are examples of that. This may be because successful implementation requires co-ordination between all elements and layers as well as between the people who plan and construct them, even when this happens at different times during the process. Or is it because full flexibility is too expensive in relation to the expected added value of future flexibility, which one does not know if one needs? In most cases, some measures to ensure connections that will reduce friction between layers and elements are implemented, e.g. modular interior partitions are more or less standard elements in most office buildings in Norway.

Optimising the flexibility of connections is one very important strategy to improve flexibility and adaptability in the building. This has received a lot of attention, as in the Open Building tradition. This is not described here in greater detail. Instead, other less known strategies are presented.

### 8.3.3 Minimum specification level

All things that have been decided, designed, and later constructed will limit future changes, or in other words: will only allow for changes within their constraints. The walls and systems that are constructed are designed to allow some kind of future change, but to allow all kinds of changes is not possible. Thus, to construct physical building parts will limit the type of future changes which are possible. The more specially designed and specialised, the more "finished" and complete, the more prior decisions will limit future change, or more precisely: only allow the kinds of changes that are planned for. Very specialised solutions will also make the process of making changes more difficult, because it may involve special knowledge, special products and labour, as well as large financial investments. Thus, it is important to discuss the appropriate level of specification, both in the building as a whole, and in each layer and element.

> "You cannot predict or control adaptivity. All you can do is make room for it – room at the bottom. Let the mistakes happen small and disposable. Adaptivity is a finegrained process. If you let it flourish, you get a wild ride, but you also get sustainability for the long term. You'll never be overspecified at the wrong scale." Page 174 (Brand, 1994).

What is a possibility in one phase or layer can be a constraint in the next. As soon as a decision is made, it will limit the options throughout the rest of the process. Thus, a discussion about adaptability will have to be related to the concepts of specification and freedom. Within the constraints, defined by the specifications, changes may be allowed to happen by allowing freedom and letting the most volatile layers "flow" within the constraints of the slower ones.

The term "minimum specification level" is from socio-technical theory, and is described as (Trist, 1981):

> «Only the essentials are decided a priori: as much as possible is left open to be decided at later stages, even when the plant is already in operation. The principle allows the progressive involvement of those concerned – at all levels. The barriers between planners and implementers are reduced. Design and operation are seen a continuos process». (Trist, 1981).

The idea of a minimum specification level is related to the idea of layers, but in many ways its message is the opposite of the one developed by analysis of connections and detailed design of systems in order to allow the different parts to be readily assembled and disassembled. Instead of defining the "right" sequence, the minimum specification level leaves decisions to be taken in a later stage of the process, often by the people who interact with the building.

> "... what we find here is a new approach to the problem of design which is no longer concerned with the complete detailed specification but with minimal specification. The main reason for this approach was a concern with systems that can learn and that can adjust themselves to environmental changes. Adjustment, learning, and creative and intelligent behaviour require minimally:
> - internal variability to create alternative response patterns
> - the testing of alternative response patterns and evaluation of the outcome
> - selection of the most appropriate response
>
> This is one of the lines of development that led to the study of autonomous systems. What was made clear at this stage was that variability, and thus making errors, was not a bad thing and that, on the contrary, systems must have sufficient potential and mobilizable internal variability and mechanisms for the self-correction of error in order to be able to adjust to a variable environment". (Herbst, 1974).

The minimum specification level should promote local adaptations and corrections within a generous frame. This can be compared to building a stage for a theatre. The stage has to be spacious and simple in order to serve different scenographies for different plays. The office building has to allow the same freedom, and offer a stage for different organisations and office concepts. The idea of minimal specification means that simple and robust is better than overspecified and designed for perfect fit. And that evolutionary change, at a low level, may ensure that the building is adapted to fit the demands of its user organisation, simply, unpretentiously and fast. In some cases this might be an appropriate strategy for a Building – User Relationship.

In many of Stuart Brand's examples, there are buildings that are so "loosely" designed and robust that the end-user physically and practically exercised control over their own workplaces. This usually happens in modest, unambiguous facilities (Brand, 1994).

> Office Buildings are organizational hardware, and since many organisations are redefining themselves as "learning organizations," the design question is: how can buildings aid organizational learning? One answer might well be: by aiding local adaptivity. Small groups adapt more quickly and accurately than large groups, and individuals are even quicker than that. Smart organizations, therefore, push control of space as far "down" the organization as they can." Page 173 (Brand, 1994).

The case for minimum specification level implies that the end-user and user organisation exercise more control over their own facility. This brings us to another dimension of the building hierarchy: The territorial order.

### 8.3.4 The territorial order

People relate to the space around them, and as we have seen with the physical building layers, different stakeholders either control or/and interact with the different layers. According to Habraken, territorial order is concerned with people – space interaction, both when it comes to control and territory. The territorial order is also hierarchically organised.

> "Layering also reflects how a building relates to people. Organisational levels of responsibility match the pace of levels. The building interacts with individuals at the level of Stuff; with the tenant organisation (or family) at the Space plan level; with the landlord via the Services (and slower levels) which must be maintained; with the public via the Skin and entry; and with the whole community through city and country decisions about the footprint of volume of the Structure and restrictions on the Site. The community does not tell you where to put your desk or your bed; you do not tell the community where the building will go on the Site…." Page 17 (Brand, 1994).

At the highest levels, the management in the owner- and/or user organisation is in control, and it is the user organisation that displays and expresses its territory by using the building. At the lower levels, groups and individuals exercise more control and are able to adjust and adapt their environments from day to day. In the socio-technical theory, the individual's possibilities to exercise control over his work process, workplace, and work environment is seen as an advantage that will ensure local adaptations and development. This is in line with the ideas of Christopher Alexander, who promotes the idea of evolutionary growth in built structures, and organic order in which the building will evolve by local adaptations at user level, where solutions are decided upon and implemented. Mistakes and corrections are important to the idea of evolutionary design, and ensure a development towards a better fit between demand and supply.

> "At each level of scale, it is those actually using the space who understand best how it can be made/altered to have the character of being conductive to the work, and this group should be given sole control over the space both in the physical definition of territory… and by giving the group power over placement of furniture, purchase of needed items, decorations, etc. Thus an individual has control over his/her own workspace; the workgroup has control over the group working area but not over the individual workspaces; the department has control over its space but not over the workgroup spaces, and so on.
>
> Therefore we suggest using materials and structural systems which invite change and allow changes to accumulate, gradually fine-tuning some areas to the real human needs that exist there. Other arrangements, for which the need might become obsolete, would disappear over time. (But the space that housed them might retain faint traces, a pentimento, of their previous use.)" Quote Christopher Alexander, from an unpublished text "Office Patterns", quoted in (Brand, 1994).

One strategy of achieving better adaptability in the relationship between users and their buildings is to delegate the power to influence the environments to end-users. The opposite strategy, which also may improve adaptability, but in a completely different way, is to supply identical workstations which the users have minimal control over, in order to facilitate easy moves and prevent people from putting their mark on each workplace. Between these two extremes, there are many different possibilities. This shows that the different strategies to improve adaptability are as much rooted in the intentions and culture of the user organisation and the properties of the actual building than in rational, general methods that will produce better adaptability. There is not one single way in which to solve this dilemma, but several correct answers and fits between users and workplace. In order to achieve better adaptability, the options and their consequences when it comes to the organisation, the building and the management of the facility, must be discussed, and the appropriate strategy for the actual situation developed.

---

In the GJENSIDIGE case, the distribution of control over the different layers can be seen very clearly. On the top level, the choice of site and of building concept, the CEO and the Corporate Real Estate Manager were responsible for the decisions, of course in agreement with the board of directors. At the lower level, such as space plan and stuff, the users took part through user groups, and exercised a good degree of influence on the selected solutions. The building is designed to give the individual as much control as possible over his or her own office cell, and light and temperature, and even the sunscreens, can be individually controlled for each office. In addition to individual control, the building manager may exercise central control when necessary. The end-users, individually or as a work group, may not, however, rearrange their workspace on their own, but operate within the space plan designed and supplied by the facility managers. This is of course done in co-operation with the end-users, but is not the end-users' responsibility.

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The distribution of power between the facility manager and the end-user over the actual workplace varies. Franklin Becker describes three different types of facility management organisations after their control. His main point is that organisations are different, and that they change over time, from “Loose Fit” and a focus on operational activities, to Tight Fit with focus on control or Elastic Fit, an integrated, strategic FM function (Becker, 1990).

| **Loose Fit** | **Tight Fit** | **Elastic Fit** |
|---|---|---|
| Ad hoc | Central Standard | Central Guideline |
| Minimum Information | Maximum Information | Selected Information |
| Minimum Control | Maximum Control | Selected Control |
| Service | Cost | Cost & Service |
| Reactive | Reactive | Proactive |
| Tactical | Tactical | Strategic |
| Unplanned Diversity | Planned Uniformity | Planned Diversity |
| Negotiated Decisions | Dictated Decisions | Consensus Decisions |

Table 10. Model for Facility Management functions, which will in turn affect the distribution of control of the workplace between endusers, facility managers and general managers (Becker, 1990).

In software development projects, teams are born, grow, and die extremely quickly. In *«Peopleware, Productive Projects and Teams»*, DeMarco and Lister describe how such projects should avoid facilities run by Tight Fit FM organisations. They call them “the Furniture Police”:

> The head of the Furniture Police is that fellow who wanders through the new office space the day before your staff is supposed to move in, with thoughts like these running through his head:
>
> «Look at how beautifully uniform everything is! You have no way to tell whether you’re on the fifth floor or the sixth! But once those people move in, it will all be ruined. They’ll hang up pictures and individualize their little modules, and they’ll be **messy**. They’ll probably want to drink coffee over my lovely carpet and even eat their lunch right here...»
>
> This is the person who promulgates rules about leaving each desk clean at night and prohibiting anything to be hung on the partitions except perhaps a company calendar. The Furniture Police at one company we know even listed a number for spilled coffee on the Emergency Numbers decal affixed to every phone. We were never around when anyone called that number, but you could probably expect white-coated maintenance men to come careening through the halls in an electric cart with flashing lights and a siren going ooogah-ooogah.” (DeMarco and Lister, 1987).

In order to provide the space for an extremely fast changing software project, they advice the project manager to find rough and spacious facilities, which the team can occupy and shape according to their needs in a less prestigious way, and with a direct relationship between end-users and the facility. According to the authors, this ensures adaptability, a good fit between users and workplace, and it gives the employees a feeling for group territory, which they view as important in short-term and fast changing teams.

In the building process, different actors will have different control spans in which they are responsible for decisions. Blyth and Worthington identify 4 different levels within the user organisation (Blyth and Worthington, 2001):

| | |
|---|---|
| Corporate | Image, cost |
| | Size, space standards |
| | Configurations – type of layout |
| | Location of department – stacking |
| Departmental | Relationships – block plan |
| | Degree of enclosure |
| | Space budget |
| Group | Style of work |
| | Detailed layout |
| Individual | Workplace |

Table 11. 5 territorial layers within the user organisation, after (Blyth and Worthington, 2001)

Because organisations are different, so is the distribution of power in the territorial hierarchy. Different organisations and teams will thus relate to their space differently, and different strategies must be provided in order to achieve the adaptability that is demanded in the different situations.

### 8.3.5 A hierarchy of functions

Within the building, defined by the technical layers, there is a level of functional layers, or rather; a functional structure. This is also in many cases organised hierarchically from public to private, from outside to inside, from specialised functions to general functions, etc. This functional structure is the architectural “concept”, and its main purpose is to organise functions and physical requirements in a coherent and well functioning design. There are some features of the functional structure that will seriously affect adaptability, especially the organisation of common and specific functions in relation to work areas, and the communication system within the building. This functional structure is described generally in Figure 67, based on a conceptualisation by Veldhoen and Piepers (Veldhoen and Piepers, 1995).

A hierarchical functional structure can be applied on different levels, from the whole building to one floor or work area. In Telenor’s new buildings at Kokstad and Fornebu, three functional layers have been defined (Arge, 2001):

- Common services (reception, meetingroom, café, etc.)
- Special services (training centre, customer centre, etc.)
- Work areas

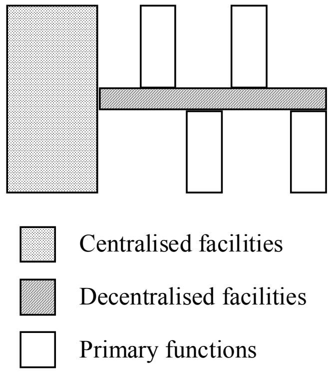


Figure 67. A functional structure based on the location of centralised and decentralised functions and area for the primary function (Veldhoen and Piepers, 1995).

Telenor's building at Fornebu is in many ways based on the experience of Kokstad. Here they were even more focused on a structure that would reflect ideas about flexibility and adaptability and new, team-based ways of working. The new building is organised as a "tree", and each leaf is one workgroup space, suitable for a medium sized workgroup. These group spaces are linked together in a tree structure. Each workgroup area is intended for 30 workplaces, each 10 m² in average (Arge, 2001). Within the general workgroup space several different configurations should be possible, from individual to team based workplaces, for short- and long-term projects and teams. Some internal support functions are connected to the workgroup areas. In the program Telenor prescribes 200 work group areas, of 375 m² each.

On the next functional level, they defined something called work-area, which is a collection of workgroup areas that share some service- and support functions. Special and common services as well as areas for communication, technical services, e.g., are more centrally located. Altogether, this functional structure resembles a tree. Each workgroup space can be outfitted as desired. Telenor Fornebu is under construction at the moment (2001). One design group is working on the building. Parallel to this, another team develops the interior-project. Even though the generic workspaces have been designed with optimal adaptability and flexibility in mind, there is tension between the ambitions in the interior project and the possibilities supplied in the building structure. The amount of uncertainty in the project is huge, and one does not know at the moment how many people will move into the building, where they will work, or how. But the overall structure of the building makes planning in incremental steps possible, because the outfitting of one workgroup space does not necessarily affect other work-areas. Under the high degree of uncertainty in the project, the functional structure, which is hierarchically organised, provides the needed freedom, but yet structure sufficient to handle this situation. In an organisation like Telenor, they expect these changes to continue just as rapidly after construction, in the use phase. The functional structure thus defines the possibilities for functional flexibility both during design and construction, and later in use and adaptation to future needs.

Studies of the functional structure of the building is part of the architect's evaluation of options in the concept design process. One example of this is presented by DEGW for their commission at Broadgate in London, see figure 68. Several issues are important when establishing the functional structure, and a robust building concept that can handle change and adaptations. Some of them are:

- Building geometry and depth of floors, which will define possible office solutions as well as access to daylight. Capacity to change between cellular, team offices, landscapes and other office concepts.
- Location of support areas, hierarchically organised.
- Location of circulation, both centralised (entrance, reception, main distribution) and decentralised in the work-areas.
- Location of cores, shafts and ducts for services as well as the concept for services.
- Capacity of workstations, enclosed offices and support zones.
- Views and orientation in the building.
- Possibilities of subdividing the building into independent units.

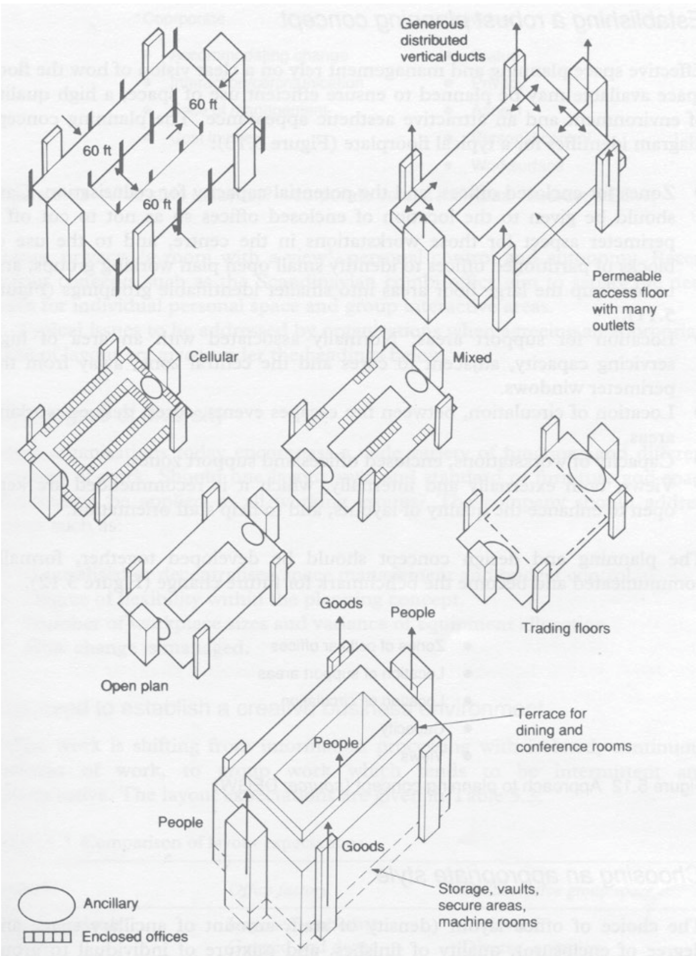


Figure 68. Concept diagram for Broadgate, DEGW (Worthington, 1994).

As in the other hierarchically organised levels, changes in the functional layer occur most rapidly at the lowest levels; office floor, work-area, and individual workplace. Changes at workplace level can happen all the time, but also work-area and office floor experience frequent changes in some cases. At floor level, the major design-issues to improve adaptability are distribution of heat, air and other services, cabling, major communication routes, open or enclosed corridors, and the location of more stable functions such as bathrooms and kitchenettes. One example of this is from the case DAGBLADET, where communication lines on each floor, services, special functions (like rooms for smokers with better and separate air supply), and meeting rooms were defined in the overall plan. Within these constraints, the floor plan can change according to changing demands. The major challenge was to decide what should stay fixed and what should be allowed to float on each level.

### 8.3.6 The layered building process

The Strategic Approach is based on an incremental, strategic decision-making process. Earlier, it has been described how this can be used in the building process. The strategic decision-making process is based on development and implementation of decisions through three interactive phases: awareness, analysis, and action. Earlier, a layered programming process has been described, and the layered building process is based on this. One of the main objectives of a layered building process is that the manoeuvring room can be enlarged, by pushing decisions further into the process. To postpone decisions like this requires a structured approach in order to ensure that one does not lose either control or the possibility of managing the process. A layered process does not mean that everything is “floating”, but that everything is decided and implemented in its own time, according to a defined plan.

A layered building process is related to the physical building layers, the functional layers and the territorial layers described earlier. The other important issue is the logistics of the building, and especially the construction process. The foundations have to be built before the structure, which in turn has to be constructed before the floors are tiled. This, together with awareness of life-spans and durability, will result in a building process where some decisions are made, and elements are designed, developed, and constructed before others. This is normal in every construction project. The main contribution from the layered and strategic approach to the building process is that one has to recognise and be aware of the time-dimension both in construction and in the use and operation phase. This encourages more conscious decisions and solutions and a more structured process.

> “Thinking about buildings in this time-laden way is very practical. As a designer you avoid such classic mistakes as solving a five-minute problem with a fifty-year solution, or vice versa.” Quote F. Duffy in (Brand, 1994), page 17

When we divide the process into layers, each of these can be developed and worked out separately according to the development of the project. Long-term and strategic decision-layers can be decided upon early, and will create a framework in which the other layers can be developed. The detailed content of the different layers can differ and be project-specific, and so can the number of layers.

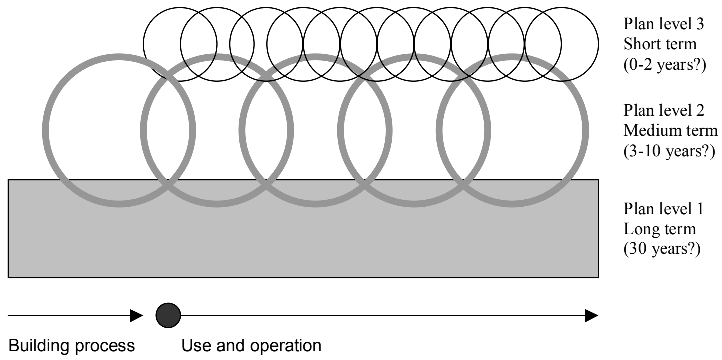


Figure 69. The concept of a layered building process. Some decisions are taken early, others later in the process. Some plans have a long-term perspective, while others are intended to be short-term. Usually decisions about long-term, and thus more durable parts, are taken first. Long-term decisions have to be made at the lowest, most permanent level. Within the limits of the long-term plan, more rapid responses to changes can occur. At the top level, e.g. the floor plan or work area, adaptations can be made from one day to the other.

Some of the aspects that have to be considered at each level of the plan are:
- Actors and decision-makers
- Technical specifications
- Functional specification
- Stage in the planning process
- Period for which the plan is valid

In the layered building process, the design and construction process start with the long-term layers and end with the short-term layers. The layers should match the logistics of the building process, the decision levels in the owner and user organisation, and the technical and functional life-spans of different levels.

> "The 6-S sequence is precisely followed in both design and construction. As the architect proceeds from drawing to drawing – layer after layer of tracing paper – "What stay fixed in the drawings will stay fixed in the building over time," says architect Peter Calthorpe. "The column grid will be the bottom layer." Likewise the construction sequence is strictly in order: Site preparation, then foundation and framing the Structure, followed by Skin to keep out the weather, installation and Services, and finally Space plan. Then the tenants truck in their Stuff." Page 17 (Brand, 1994).

Some kind of layering can be observed in most projects. Often this is most clearly demonstrated by the separation of buildings and interiors. This can be observed, e.g. in the Telenor projects (Arge, 2001), and in the K-BANK case. Another way to layer the process is described by Eikeland, in the project "The Integrated Building Process"

(Eikeland, 1996). This is based on the logistics of the construction process and the technical layers of the building, and consists of 6 levels and subprojects, see figure 70.

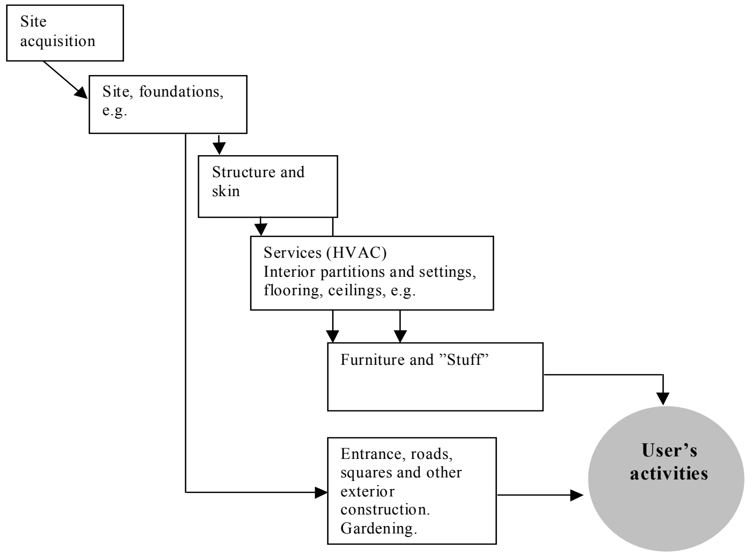


Figure 70. A layered building process as illustrated by Eikeland in "The Integrated Building Process"-project. (Eikeland, 1996)

In this process, one must expect all the 6 subprojects to have a separate internal process of formulating requirements, generating and evaluating options as well as construction of the chosen option. In addition to this, there must be some kind of co-ordination between the different subprojects. They are clearly not separate projects, but parts of the same process, whose goal it is to provide facilities for a user organisation's activities. If one takes into consideration the different physical layers, the activities that will have to be performed (brief - design - construction) and the time dimension in the building process, one can create a matrix which shows the different parts of the projects and their position in time, figure 71.

As described in "The Strategic Approach to decision-making", the development of options will take time. Development of client/owner/user requirements will take place in interaction with generation and evaluation of options during the process. A layered building process gives room for this, because only certain things have to be decided early, while the others gradually evolve during the process. This gives freedom to the evaluation of options and to evolve one's consciousness about the project and its possibilities and constraints in order to find better solutions. But at some point one has to make a decision. Demands develop all the time, but at some point during the process one has to freeze the supply. This requires a structured schedule for the process, as well as professional project management. Managing the process and handling the information flow is not within the scope of this study, but will obviously be very important in a layered building process. Someone has to take responsibility for the whole project and make sure that it is coherent and consistent.

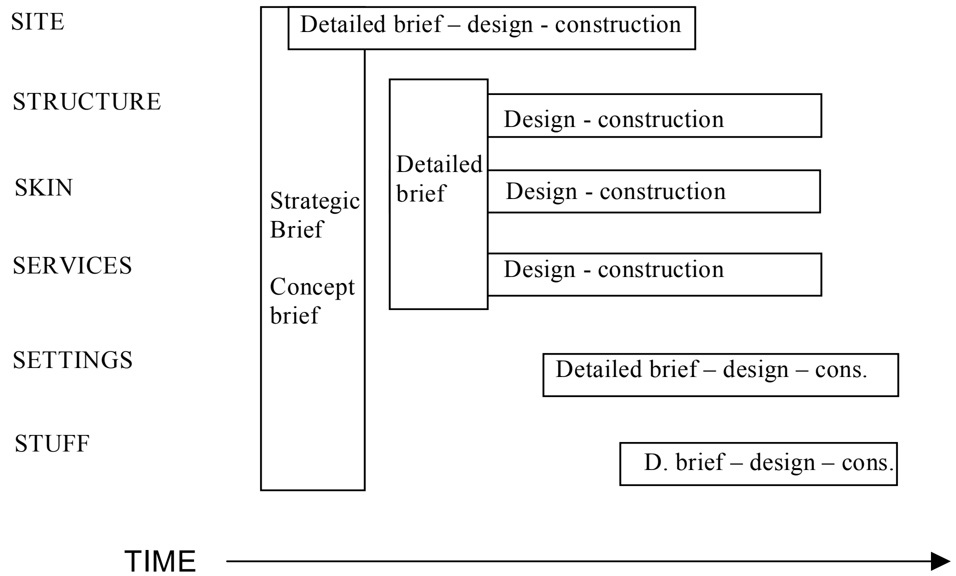


Figure 71. In a layered building process, each sub-project will go through the different phases of the building process; briefing, design and construction.

One of the main arguments against applying a layered design and construction process is from modern design theory, where one emphasises the fact that designers "jump" between the different layers in developing the design. Architects will develop their design through an interaction between the definition of problems and the generation of options, at different levels: From the building form and relation to the site, to functional distribution within the building, design of individual floors, selection of materials, and technical details. If the possibility of "jumping" between layers is inhibited by rigid definition of phases and layers in a "chronological order", the designers' work can be seriously hindered.

Another problem related to layering of the process and the design is that one sometimes decides to procure designers only for a limited part of the process, and later invite different designers to bid for the remaining phases. This means that the designer's time invested in understanding the project and the process is wasted, and that another designer, who is not familiar with the choices and decisions already made, will complete the design. Layering, done like this, will increase the risk of fragmentation of the project, and important information may be lost. To some extent, each phase and layer is a separate project, but it is important that someone has the overall picture of the project and the development of the design.

> "The segregation of interior design and architecture is pointless and destructive. Here in Norway, it would appear to be the practice to treat interior design as a separate discipline. As an architect, you are suddenly confronted by the fact that your rooms are to be interpreted

> and brought to completion by another. … Of course we form the interior when we form the house. We give colour and tactile values to the room when we build the walls, we stage-set the atmosphere when we plan where to put the windows. … In our office, the interior designer and architect are both participants in the same continuing process that endures for the life of the project." Quote architect Niels Torp, page 117 (Torp, 1997)

In a building project, one has to handle a lot of information. The greatest challenge when managing layered building processes is to manage the flow of information, to ensure that important information is not lost, to co-ordinate and integrate activities and actors in the process and ensure that the project is consistent and the different layers interact well.

## EMPIRICAL DISCUSSION

For DAGBLADET, one way of achieving the desired flexibility in their new offices was to accommodate a flexible design- and construction process. This fact became even more important because the renovation was carried out in 6-7 stages. While one part of the building was being renovated, other parts were still in the design phase. In order to do this, the two highest levels of the hierarchy were decided upon before the construction of the first parts started (Blakstad et al., 1997). The plans for the lowest level – the floor plans – were developed individually for each floor and department. This level can change very quickly, but the flexibility in this layer is dependent on the highest level decisions, taken in level 1, the General plan, and level 2, the Master plan.

**Level 1 - General plan**

| Contents | Functional specifications | Technical specifications | Participants, actors | Time frame |
|---|---|---|---|---|
| Strategic decisions<br><br>Specification of demands | States the importance of flexibility<br><br>Defines the vertical communication, location of stairs and lifts<br><br>Defines a pattern for main horizontal communication paths<br><br>Defines fire sectioning<br><br>Defines and describes accessibility (for customers and for the disabled)<br><br>Defines the location of specific functions such as main computerroom, filing, library etc. | Gives a record of loadbearing possibilities in the different buildings and floors<br><br>Defines future shafts<br><br>Specifications for acoustics and noise control<br><br>Specifications for materials: floors, ceilings.<br><br>Gives specifications for the modular partitioning system<br><br>Specifications/descriptions of lighting, services and information technology & communication | Professional assistance: the Architect.<br><br>Corporate top management, CEO<br><br>Project leader<br><br>Steering committee | 30 years |

**Level 2 - Master plan**

| Contents | Functional specifications | Technical specifications | Participants, actors | Time frame |
|---|---|---|---|---|
| Locations within the building and functional demands | Location of departments in relation to each other to improve interaction and workflow<br><br>Location of some special functions<br><br>Demand specifications for some of the functions, area, number of people, etc. | None | Professional assistance: the Architect.<br><br>Department managers<br><br>Union representatives<br><br>Project leader | 3 years |

**Level 3 - floorplans**

| Contents | Functional specifications | Technical specifications | Participants, actors | Time frame |
|---|---|---|---|---|
| Floorplans with offices and interiors | Floor layout<br><br>Offices for each department and individual<br><br>Final location of meeting- and smokers rooms (within the limits of the masterplan)<br><br>Office furniture and equipment | Interior partitions<br><br>Local technical services<br><br>Materials, colours, finishes | Professional assistance: the Interior Designer<br><br>End-users<br><br>Department managers<br><br>Project leader | 3 months |

Table 12. Layering of decisions in the Dagbladet case.

## 8.3.7 Summary, layering

Layering is presented as one way to handle uncertainty and expanding the manoeuvring room by hierarchically defining parts and functions with different change rates and which have to be decided upon at different times during the building process.

The physical building can be subdivided into layers according to the different subsystem's technical functions and life-spans. Together, the layers form a hierarchy. In order to promote adaptability and change, the different layers should be:
- Designed and constructed for a loose integration of parts, for easy connection and disconnection between different layers and elements.
- Designed with a minimum of specification, in order to leave some manoeuvring room for later changes at a low level.

Layers have a territorial aspect. Different actors relate to and control different layers. The building possesses control of the highest levels, the end-user of the lowest level. The distribution of control in the territorial hierarchy promotes different adaptive strategies.

Functions are also organised hierarchically in the building, from centralised to decentralised functions. Because changes occur more frequently on the lowest level, it is an advantage when it comes to promoting changes that changes on the lowest levels can be performed without interfering with the higher levels or with the other low level functions. Office space is such a "low level" function. It does not mean that it is less important, just that it is the lowest part of the functional structure. It should be possible to change one work-area without interfering with the rest. The building should also be possible to subdivide, to function as separate units.

Based on the understanding of technical, functional and territorial layers, a model for a layered building process has been presented. A layered building process should be organised in order to match the logistics of the construction process, while providing manoeuvring room for the development and understanding of requirements and the search for satisfactory solutions.

[1] Research done at CIFE Stanford University: http://gaudi.stanford.edu/4D-CAD/INTRO-4DCAD.HTML, and by NTNU in "Samspillet i Byggeprosessen": http://samspill.interconsult.com/

[2] Interview with Øyvind Neslein, Niels Torp Architects, London, November 1993, as described in study trip report from Department of Building Technology, NTNU, Trondheim, 1993.

# Chapter 9

## Example, the Strategic Approach in practice

The Strategic Approach, as it has been presented in the previous parts of this work, has become rather extensive. It may be helpful to show how it can be used in practice. Due to limited time, it has not been possible to test the Strategic Approach during a real construction process. This example study of a real project, a new, medium-sized office building, was performed after the building was completed, so results from the research are not implemented in the example. Instead, a description of the real sequence of events is compared to an idealised version of the example; a simulation of a Strategic Approach to the "Consultants Inc. project". The description is loosely based on a real case, but has been anonymised. While analysis and scientific exploration has been the goal in the case studies in chapter 5, this has not been the objective in this case. The example is only used to illustrate a project and a process. The description is based on only a few interviews and impressions of the example, not on real scientific analysis.

This chapter begins by describing the Consultants Inc. office building, the main problems and challenges that Consultants Inc. and the building's owner faced, and how these were solved. Next, the idealised example is constructed, using the main questions formulated for each phase in the Strategic Approach, and applying some of the tools that are described in the previous chapter. In the last part of this chapter, potential benefits from applying principles from the Strategic Approach are presented.

## 9.1 The Consultants Inc. office building

Consultants Inc. moved into a new building in 2001. The building is of moderate size: 9 000 m² and 5 stories high. Consultants Inc. occupies 4 floors in the building. The building is located in an area which is under extensive redevelopment, and which has already got several office buildings, a large shopping centre, restaurants and entertainment, as well as a large number of dwellings.

The building was originally planned for 180 persons and approx. 6000 m². Later, but still quite early in the process, the number of workplaces was increased to 250. One worked to make the building more area-efficient and ended up with 23-24 m² pr. workplace. Today the building is not as efficiently used, and the area efficiency is thought to be 28-29 m² pr. workplace in Consultants Inc.'s part of the building, which currently houses 150-160 persons. Another tenant is moving in on the top floor. While the majority of workplaces in Consultants Inc.'s part of the building are cellular offices, the top floor will be totally open, with team-based workplaces.

Technical installations, services, and the internal partitions are based on a 2.4 m module. All cores, service functions, and meeting rooms are located in the core of the building. This makes the rest of the office space quite flexible, and the space can be used and subdivided in many different ways. The depth of the building makes different office layouts possible. The main access to each floor is through a large internal flight of stairs, and the building can be subdivided floor by floor, even if it works best for a single user. The reception and canteen are located at the ground floor and can be shared by different tenants. The underground parking garage can be used for other parts of the building (there is some space for retail at street level).

From the beginning, Consultants Inc. had visions about new ways of working, and the program that was presented for the architectural competition highlighted the importance of a building that could work with different layouts; both open, cellular, and more innovative office concepts. During the first phases of the project, leading persons within the company had visions about how they could carry out a user involvement process aimed at developing more innovative office solutions. The idea was that each department should be allowed to participate in the development of their own offices, in order to provide them with a solution that suited their way of working and their culture best.

Most of Consultants Inc.'s employees are engineers, and most of them preferred cellular offices. They were used to cellular offices from their old buildings, and considered this as the "normal" office concept for members of their profession. The ideas about more innovative, open solutions were met with some resistance. In order to meet this resistance, one decided to let the departments participate in the development process. No department was to be forced into a solution that they did not want. Because the company is a result of a merger between several different firms, there was a lot of uncertainty among the employees about the future and the different departments' place in the new company structure. This is probably one of the main reasons for not pushing the employees further in a direction they did not want. The decision to build cellular offices in most of the building was not made until about halfway into the construction process. Satisfying the employees was seen as more important than implementing new ways of working and yet another process of change in the organisation. Each department made the final decision about its own workplaces and office layout.

Because the building was supposed to answer to a variety of workplace solutions, a lot of attention was given to the building geometry in order to make it as multifunctional as possible. The building is rather deep; 17 m, and is most area efficient if used with open solutions, or with a mix of open and cellular offices. Today, most of the workplaces are cellular, and only some sections are open. The high degree of cellularization resulted in long corridors and lots of undefined space in the middle of the building. This is in some departments used for informal meeting spaces, but most often for filing and storage. The open workareas are located at each end of the building.

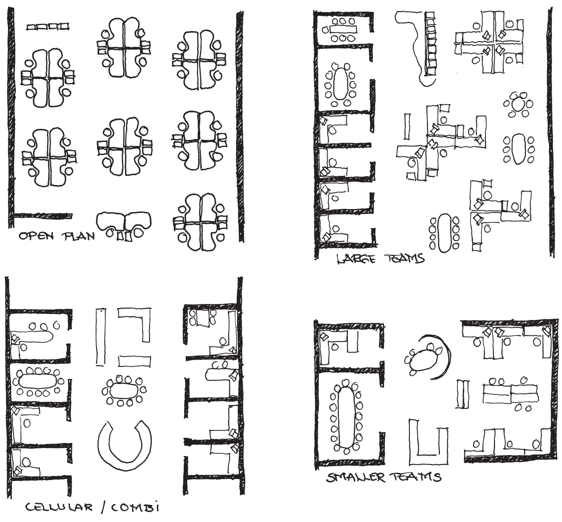


Figure 72. Generous building depth and the simple rectangular plan are strategic design decisions made in order to answer to requests for an adaptable building that could accommodate different workplace solutions. This illustration shows some of the workplace options within the building.

The building is of good quality, has a central location and generous dimensions, and will probably prove to be a good long-term investment for its owners. For Consultants Inc. as a user, however, it is quite expensive to rent. Although they are satisfied with their new facilities, they are probably about to realise that they will have to make more efficient use of space than the present quite generous usage.

### 9.1.1 Main challenges and important goals

Consultants Inc. is the result of a merger between several smaller firms. Before the merger, these firms offered different consulting and engineering services, they had different structures, different management and cultures, and worked at different locations. Today, Consultants Inc. has a large number of local offices, throughout Norway and abroad. The decision to co-locate the offices at this location, was a strategic decision which was taken in order to build a unified culture and profile after the merger.

So the main goal in the project, as well as the first challenge, was to bring together the different parts of the new organisation, and to present an image of the new firm to the public, to customers, and partners. So far the experiences with the building have been positive in this respect. After they moved in together, the different parts of the firm have become much more familiar with each other. One has started to build a more unified company culture, and potential benefits and rationalisations from the merger are beginning to emerge. Moving together was the main strategic BUR decision, and it has proven to be important in building the new, unified Consultants Inc.

The other main challenge was related to the relationship between the organisation and the building (BUR), and how one envisioned work to be carried out in the new building. Consultants Inc. is a traditional organisation with traditionally oriented employees, but both the top management and some parties within the organisation had visions about more innovative ways of working.

The third challenge was related to the actual development and construction process. Consultants Inc. was engaged in a development project which aimed at testing out better ways of co-working in the construction industry, based on partnership, open contracts, and focus on clients and their needs. Thus, Consultants Inc. also had goals connected to how the project was carried out, and they were engaged as consultants as well as users.

### 9.1.2 The process

The project started with the merger, and with an awareness of the need for a facility that would bring the whole organisation together under one roof. An analysis of different locations and of space standards and cost in different possible locations was performed, as well as a user survey among the Consultants Inc. employees, addressing work environment and workplace expectations and requirements.

After this, one began looking for available space in existing buildings. But one could not find space that fulfilled Consultants Inc.'s requirements. This resulted in an inquiry for offers from different real estate developers and owners at different locations. The offer from one large real estate developer was selected. This meant a central location, at a site which was under redevelopment, and which later turned out to be a new commercial and recreational centre in town. Soon after, one invited different architectural firms to develop their plans for the area. The building, as it was built, is very much in line with these first suggestions.

During the first phases of the project, one discussed the future of knowledge work and innovative office facilities that would support this kind of work. This was important input to the architects' competition, and has in many ways put its mark on the building. A large, internal staircase was ment to encourage informal meetings and interaction. So were several local, informal meeting spaces, kitchenettes, and formal meeting-rooms which are scattered around the building. During the process, Consultants Inc. changed its top management. The original intentions to address new ways of working in the building met a lot of resistance from different groups, departments, and end-users, and one decided not to pursue these ideas further. Most of the departments spent little time questioning how they would work in the future, but instead only required the number of workplaces and offices they needed based on their preferences and earlier experiences. The result was that most departments are now working in cellular offices, as they were used to from their old buildings.

The lease contract between Consultants Inc., as a user, and the building owner, was not only based on cost pr. m², but also on a percentage of the building cost. When Consultants Inc. participated in the building process and raised demands that would have cost consequences, they would in the end pay for these themselves through increased rent. In this way, much of the power to make decisions was transferred to the user organisation, because they would also be economically responsible for the outcome. The contract span was 10 years.

Development, design, and construction were based on ideas about a more integrated building process. The main idea was to develop a project based on trust, co-operation, and integration between actors, and better flow of information between the different phases in the project.

Consultants Inc. is responsible for operation and maintenance of the building, and has their own building operations manager and janitor. Cleaning and catering are outsourced.

# 9.2 The Strategic Approach

Here, the Strategic Approach will be demonstrated by simulating how this approach could have been used in the Consultants Inc. case. The 4 main issues are:

**1. Knowledge and awareness of the relationship between the building and the user organisation.**
The most important issues in order to enhance adaptability are to acknowledge the bilateral relationship between a building and its user organisation, and how this changes over time. This is important also in cases where the user organisation is unknown. In such cases it is more important to look at buildings as objects which relate to a user, than to look at the actual relationship between a user and a building. A perspective on buildings as objects for use and change will result in buildings which are more sensitive to user demands and changes in demands and requirements, and which can be adapted according to changes in use. In the Consultants Inc. case, however, the user was known during the entire process, and participated in development of the building.

**2. The continuous process of matching demand and supply.**
The relationship between the building and the user must be managed. Changes in both demands and supply must be addressed, and the mismatch resulting from such changes must be addressed. In the Consultants Inc. Case, the organisation had a relationship with several different buildings prior to moving into the new building. These relationships were managed in different ways. As a result of the merger, there was a need for more than minor adaptations. The situation was assessed, and one realised that this was a major decision point, and the time for a major adaptation. In this case, this process resulted in a decision to end the former Building – User

Relationships, and start afresh with a new building which could accommodate all departments at a single location. They decided to enter a building process. This brings us to the next step in the Strategic Approach, a strategic iterative way of working in the building's life cycle, from the decision to build until use and operation of the new facility.

**3. The Strategic Approach in the building's life cycle.**
The Strategic Approach in the building's life cycle, from concept to operations and use is described as a decision-making process, which is iterative between awareness, analysis, and action. The discussion of the Consultants Inc. case is based on the main issues in the different phases and on the main questions presented earlier, in chapter 7.

**4. Tools to support decision-making.**
Here, scenarios and layering are discussed in order to show how Consultants Inc. could have benefited from applying such tools.

The actual measures in the building, in use, and in financial and contractual issues, are only addressed briefly. Such measures are important for enhancing adaptability, but fall outside the main focus in this work, which is on issues primarily related to BUR and strategic decision-making.

## 9.3 Knowledge and awareness of BUR

Several of the original companies who became Consultants Inc. were originally housed in buildings which the company or some senior partners owned. They felt connected to their buildings, and the facilities represented the common values within the organisation. They were robust, but modest buildings, with little attention paid to image and trend. In each organisation there were engineers who had been part of building the company and acquiring the buildings. The buildings were thus more a common property, shared by the employees, than professionally managed real estate.

The result of this was the absence of a strategic facility management/corporate real estate function. There was little professional knowledge of real estate and of office facilities, and no knowledge of the strategic relationship between buildings and users for their own organisation as a user, although (or perhaps because) most of the engineers work with building-related technical subjects in other projects.

In the beginning of the project there were strong intentions about using the new building as a strategic tool to develop the new organisation. A lot of work was put into developing knowledge about new ways of working in office buildings, but this was never really implemented in the process. This served as input to the concept stage, but later in the process the main focus was on developing technical solutions, reducing cost, optimising use of space, and the more innovative ways of carrying out the construction process. The intentions of using the project and the Building – User Relationship to develop the organisation and consider new way of working were thus more or less lost during the process.

This resulted in less attention on the Building – User Relationship on a strategic level, and more on the operational issues in the construction project. Still, there was attention from the end-users and departments which were involved at the appropriate levels. They were, however, not challenged to assess new ways to work and utilise the building.

If the Strategic Approach was to be used in the process, one would have depended on some parties with interest in and knowledge of BUR, the potential for the organisation, and how BUR changes with time. One would also need the organisation's general management to have visions, knowledge, support, and "drive" to carry out such a process. Since the attention to this was limited, the conditions for applying a Strategic Approach were simply not present.

To apply the Strategic Approach in the Consultants Inc. case, the following issues must have been present:
- The organisation's top management must have been engaged in the process and committed to thinking dynamically about organisational development and the new building.
- Organisational strategies must have been related to strategies for the building project.
- Knowledge and interest of the potential and changes in BUR must have been present within the organisation or in some support and/or real estate functions.

# 9.4 Matching demand and supply

The continuous process of matching demand and supply started in the original buildings. An ongoing process of matching demand and supply to each other and handling changes was carried out in all the separate buildings. At one point in time (due to organisational changes – the merger), Consultants Inc. was faced with a situation where the mismatch was too large to handle within the present facilities. They faced a major decision point that would result in major adaptations, relocation, or construction of a new building. They chose to relocate all departments to a single location, and start developing a new building. This was a strategic decision aimed at improving the business by supplying space in which the different groups could be unified. It is thus an example of how BUR can be used strategically. The process of developing and constructing the building is discussed in the next part. Here we will look at how the Strategic Approach could have been used to match demand and supply in the old facilities and in the new building after moving in.
As stated earlier, for the Strategic Approach to have been applied successfully, Consultants Inc. should have stated a corporate real estate strategy and related this to the organisation's overall strategy. Within the limits decided by the corporate real estate strategy, a continuous decision-making process of awareness, analysis, and

action should have been performed. This relies on some kind of professional function within the organisation that takes care of corporate real estate, or at least is responsible for buying these functions in the market.

The process of awareness, analysis, and action was earlier illustrated as:

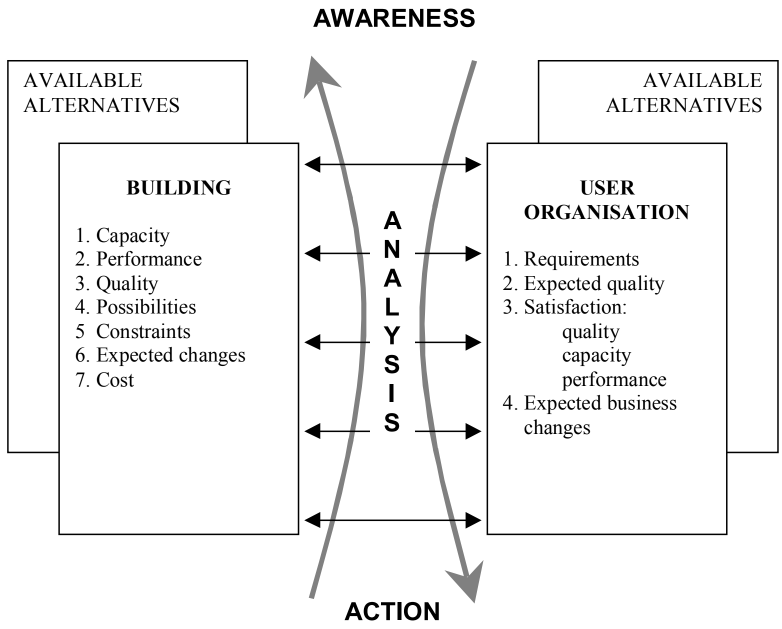


Figure 73. Matching demand and supply

In Consultants Inc.'s case, the Strategic Approach could have been used to define a structured approach to assess the building(s) and the user organisation/departments. This information would have to be analysed, and actions to reduce mismatches or realise potential benefits should have been performed. Information about the building(s) could be:

- Capacity
- Performance
- Quality (also deterioration and need for maintenance, repair, and retrofits)
- Possibilities (unrealised potential)
- Constraints
- Expected changes
- Cost
- Available alternatives: new building, lease another building

This is information that most professional building owners/users could collect with relatively little effort, provided that they have a professional building management and operation function. Relating this to the "demand side" requires more knowledge

of buildings' functions and planning, and of the organisation and its strategies and future development. In order to analyse present and future needs one must know:
- Requirements
- Expected quality
- Satisfaction (quality, capacity, performance)
- Expected business changes

Thus, the process of matching demand and supply will need professional, strategic management, and it seems fair to say that the organisation must acquire at least some of this knowledge from within itself. Some skills and services can also be leased from professional service providers in the market.

In order to collect more information, some tools could be implemented to aid the decision-making process, e.g.: building evaluations, user surveys, work environment studies, searching the market for available alternatives, etc.

In chapter 7, the main questions related to the process of matching demand and supply are thought to be:

**How do we assess the changing needs of the organisation?**
A possible answer in the Consultants Inc. case: By implementing a system for gathering information about the building and the user, and by applying different tools to collect additional information if necessary.

**How is current performance evaluated?**
A possible answer in the Consultants Inc. case: By building performance evaluations and knowledge and closeness to the user and their day-to-day problems.

**What is the "acceptable mismatch level" in this situation?**
A possible answer in the Consultants Inc. case: Some organisations can accept a high level of mismatch, others almost no mismatch at all. This must be decided in each situation. In Consultants Inc.'s case, the organisation is rather robust, although quite traditional, and it would probably adapt to a large variety of situations.

**How do we scan for available options and alternatives?**
A possible answer in the Consultants Inc. case: By knowledge of the market and the user organisation.

For the Strategic Approach to be implemented in Consultants Inc.'s case it would require:
- A strategic corporate real estate function
- Relation between real estate and the organisation's strategies and development
- A system for collecting and analysing information about the building and about the use of the building
- A strategic decision-making process based on **analysis** of this information, the

**awareness** and knowledge of the organisation's problems and development, and **actions** performed to reduce mismatches and realise potential in the BUR.

# 9.5 The Strategic Approach in the building process

When Consultants Inc. was created by a merger between the different companies, the mismatch between Consultants Inc.'s requirements and demands and what the former buildings could supply was too large. They decided to realise the potential for better development of the organisation under the same roof, and to enter the process of relocation and possibly building a new building. The main benefit was to be located together, and the resulting possibilities for unifying the different cultures by working together in the same building. From a business point of view, this seems to happen in the new building, and is a positive result from the relocation process.

In the following, the questions for each phase of the building's life cycle, presented in chapter 7, will be asked to show how the Strategic Approach could have been used in the building process.

## 9.5.1 Concept phase

In the concept phase, there is a growing awareness of the situation, and an analysis of problems or opportunities is performed. Options and alternatives may be generated and conceptual solutions developed. In Consultants Inc., a survey of options and requirements were performed, potential buildings were evaluated, and offers from developers collected. Based on this, the decision to build at this location was made. This decision is discussed later, as part of the proposed scenario analysis.

In the Strategic Approach, it is recommended to develop a strategic concept statement, which consists of the objectives and main strategic decisions. This could have been beneficial in order to state the more long-term strategies and goals for the project and to align the strategies for the building project with the organisation's strategies and an anticipation of the future. Scenarios could have been developed to aid in this process.

**How do the main strategic decisions impact on adaptability?**
The main strategic decision was related to relocation under one roof. This was a strategic move aimed at unifying the different parts of the organisation. More long-term strategies about changes in the constructing industry and in consulting and engineering work, how office work may change in the future, and what kind of firm Consultants Inc. will be in the future, could have been addressed more clearly. In case of a future strategy that aimed at more people located in other parts of the country, growth or reduction in number of employees, the length of the contract could have

been discussed. Today Consultants Inc. has committed themselves to a 10-year contract. Is this in line with the organisation's future strategies for offices at this location?

A scenario technique could have been used to address these issues and to aid the decision-making process at this point. This is described later.

**Have all relevant options been considered?**
Making do with the former buildings, extending and adapting the former buildings, building a new building, and leasing space was considered.

**How uncertain is the situation?**
The Norwegian building industry is changing, and Consultants Inc. is one of the first firms to grow to such a large scale for consulting firms. This makes the future situation for this kind of organisation uncertain. Consultants Inc. does on the other hand possess professional knowledge that will be in demand. The problem is that we do not know how future construction projects will be carried out, and thus it is hard to predict the structure of different firms and Consultants Inc.'s place in the future situation. The future financial stability and profit is also uncertain as a result of this.

The office in this town may also be less important in the future, as a large part of the organisation is located in elsewhere in Norway, including the top management.

Perhaps one could conclude that the situation was more uncertain than Consultants Inc. assumed? This would have been important for the rest of the building project, which would have been seen as more uncertain. This could have resulted in more attention to risk and uncertainty and how to deal with these.

**How can issues about adaptability be kept on the agenda throughout the project?**
The project management and Consultants Inc.'s management were responsible for putting these issues on the agenda and making sure that they would stay there. In a building project where other issues tend to attract a lot of attention, this must be done by stating adaptability as one of the important project goals.

**Should alternative futures be considered?**
In the Consultants Inc. case, one could have benefited from applying tools like scenario-planning. This is described later.

### 9.5.2 Programming

Programming is the process of developing, understanding, and stating the needs of investors, building owners, departments, end-users, etc. An important part of programming is to analyse the constraints as well as the possibilities in given the situation.

In the Strategic Approach, focus must be on development of user requirements, in order to optimise BUR both in a short and in a long perspective. If desirable, the development of user requirements can be seen as part of an organisational development process. The other main issue in programming is to ensure that one makes specifications that will result in a building that is adaptable and usable in the long term.

**Is the building process anchored in the organisation's strategies and in the top management's visions?**
Consultants Inc.'s management was committed to the project, but the ideas about the project changed during the process, from the first idealised versions to the more operational, cost, and quality focus later in the process. There could have been more focus on how the organisation's strategic intent could be implemented in the project.

**How will the user's and owner's specifications for the building be developed?**
This was done rather traditionally. Each department, represented by their managers and some end-users, was responsible for stating the department's goals. Little attention was given to development of the departments' way of working in relation to the building. Many of the requirements were formulated as requirements for a number of cellular offices and computers.

Consultants Inc. could have utilised the development and move process to aid the organisational development process, and to support the unification process between the different groups within the organisation.

**How can the programming process be layered?**
The main strategic and business plan should have been developed first, the project brief and the more detailed briefs later. In the Consultants Inc. case, most of the statements of needs were already developed at the time of the program for the architectural competition. Later, more detailed technical issues were developed, but the main functional requirements and the ideas about new ways of working were stated in the program for the competition. Later in the process, these issues did not receive the same attention.

Chapter 9.6.2. shows how layering could have been used in the process.

**Can the building or the building process be used as tools for organisational development and to encourage change and adaptations within the organisation?**
For the Consultants Inc. case, one of the most important things was to bring people together under one roof. In the beginning of the project, thoughts about how Consultants Inc. should work in the future were discussed, but were later dropped. Thus, the development and move project was not utilised in order to change the organisation, apart from the unification of the different sections, which has worked rather well.

**Who should be involved, and at which level?**
The strategic management of Consultants Inc. should have been involved at the strategic level. People with knowledge of Consultants Inc.'s use of facilities and real estate should have been involved in managing the process and applying the main strategies and approach to solving the problem. Departments and end-users should have been involved in order to develop the best possible plan for how the building should be used. Chapter 9.6.2. describes territorial layers and who should be involved at which level.

Consultants Inc. approached the project more as consultants than as somebody participating in developing their own workplaces. The focus was more on developing a robust building of good technical quality, than on working with the user organisation to ensure that the potential benefits were utilised.

### 9.5.3 Design phase

Design is both decision-making and problem-solving. In the Strategic Approach, the architect's, and of course the other designers', attitudes and approach to architecture is highlighted. Different architectural strategies, different ways for the building to respond to change, are also important in order to ensure adaptability. Another important issue is the design strategies which are applied in the building. Some of these are presented in Chapter 7. Layering and robustness are two such strategies.

**Will the designers' attitudes promote change?**
The main architectural concept was based on the idea that the building should accommodate different office layouts. This was very important for the architectural firm that designed the building.

**How does the proposed building relate to change, and does the proposed architectural strategy allow future changes to happen?**
Among the issues that will have to be considered are:
- Robustness and flexibility in different layers of the building, see chapter 9.6.2. on how layering can be used.
- Building geometry, depth of floors, floor-to-ceiling height
- Location of support areas, communication, cores, shafts and ducts, technical services and support
- Workspace capacity, possibility of different office layouts
- Possibility of subdividing the building into independent units

**How do decisions limit future change?**
This is a question that must be asked for every design decision. One example can be the choice of internal partitions and the structural grid. In the Consultants Inc. building there are preinstalled possibilities for internal partitions every 2.4 meters. There are standardised systems for interior walls and partitions. This means that internal partitions

can be moved around and that they can be replaced when needed. One example of a design decision that would have limited future change is to choose non-standardised elements. Another example could be the distribution of fresh air in the building. Does this work with different office layouts?

All design decisions should be checked in this way, against their future impact on adaptability.

**Is the integration between actors and phases taken care of?**
Every consultant needs to co-ordinate his work with the other consultants and the constructor. This means that the teams should be organised in such a way that interaction between different actors and between different phases of the project is possible. Integration in the building process is one of the main intentions for several research- and development projects Consultants Inc. is involved in. Thus, this was a major issue in the project.

### 9.5.4 Construction phase

The main issues related to adaptability in the construction process are to ensure quality and to handle changes. The way the construction process is organised is important, related to the development of requirements and solutions, especially today where programming, design, and construction may run in parallel. The Consultants Inc. project was a pilot case to test these kinds of questions, and to improve interaction in the design and construction process. This means that these issues were taken good care of in the project.

**How are changes handled? How does one handle developments that happen during the construction period? How does one handle communication and information flow between suppliers, designer, and constructors? Which quality of work and materials are we expecting?**

These were major questions both for Consultants Inc. and for the building owner. The contract between Consultants Inc. and the building owner and between the owner and the constructor and consultants has already been mentioned. The main ideas were related to making it possible for Consultants Inc. to impact on the product, and for the different parties to interact in order to produce a better product more efficiently.

### 9.5.5 Operation and use

The new building in operation and use is of course a situation similar to that described in "Matching supply and demand" earlier. The strategic decision-making process which is described is also applicable when the new building is completed, and a new Building – User Relationship is established. Some additional questions can be asked, as this is a situation where one moves into a building after a construction process.

**How well is the BUR management prepared for continuous changes?**
In the concept, programming, design, and construction phases, there should be a user organisation which is engaged in developing user requirements and demands and envisioning the best ways to utilise the building. There is a big potential in maintaining the interest in these issues also through the operation and use phase, because there will always be adaptations later. Then, the knowledge which is developed about the organisation and about the building's potential during the process will be valuable in the future matching of demand and supply.

**How are we prepared for major adaptations?**
Knowledge from the building project must be maintained and stored in order to know the building's potential adaptability and the adaptive strategies that are built into the physical structures during design and construction.

**What are the organisation's strategies and plans, and how will they affect the BUR?**
This issue should continue to receive attention even after the building is completed, because attention to the organisation's strategies and plans for the future will help the ones responsible for managing changes to be proactive, instead of waiting for orders after changes have been implemented.

**How well does the building match the organisation's needs today? - And tomorrow?**
This assessment is part of the ongoing strategic evaluation in the awareness, analysis, and action model for matching supply and demand.

**How will the physical building play together with the building services and support in order to facilitate adaptations?**
The physical building, the use of the building, and the building services and operations, are all important elements for enhancing adaptability and to help reducing mismatches during operation and use. This is again an argument for a competent facility and real estate management.

## 9.6 Tools

In the previous part, the most important issues in order to apply a strategic approach were presented. In order to enhance adaptability, certain tools could have been applied in the Consultants Inc. example. Here the *scenario technique* is discussed, which is a tool to aid decision-making, and *layering*, which is a concept that can be used both in decision-making and in the functional and physical structure.

### 9.6.1 Scenarios

A scenario process in the Consultants Inc. example may have resulted in the identification of the two focal issues:
- The integration of the different organisations into one
- The need for a building that could bring the departments together

For Consultants Inc., the first issue was obviously the most important. As a result of a merger between several consulting firms, they faced the necessary integration of the different parts of the organisation, both across professional barriers, between different cultures which existed in the original companies, and between a large number of geographically dispersed locations. The second issue was merely a means to reach the goal of integration at one of the locations.

Key forces in the local environment could be:
- The development in the construction industry and possibilities for a larger consulting company to make sufficient profit to promote long term survival.
- Changes in consulting work and the structure of the construction industry

And the driving forces included:
- Potential profit
- Integration and building of a company culture
- The development of the market and the construction industry
- Location
- Growth or consolidation
- New ways of carrying out consulting work (e.g. interdisciplinary teams, partnerships)
- New possibilities and new workstyles due to ICT, work innovations
- Access to qualified and skilled workers

These factors can be categorised based on their predictability and impact,.

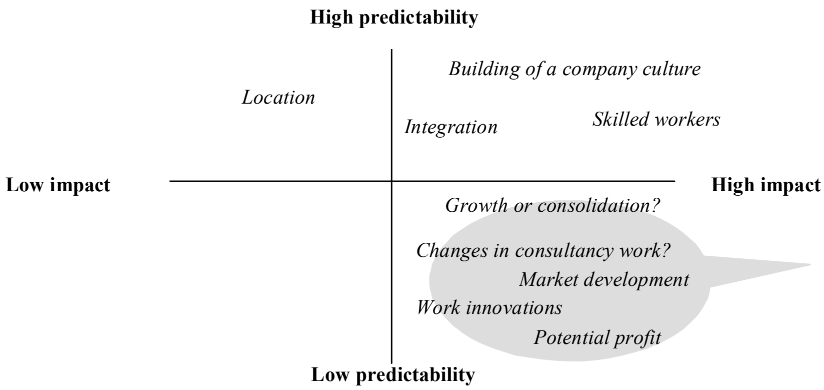


Figure 74. Driving forces in Consultants Inc.'s assessment of the future.

Based on the driving forces and a discussion about the possible futures for Consultants Inc., 4 scenarios could have been constructed, the two main axes being profitability/ cost and possible changes in workstyle:

| | | | |
|---|---|---|---|
| **WORK INNOVATIONS**<br><br>New ways of working. Projects and teams. Partnering. More ”flow” and changes. Work less limited by physical location. Flexible work powered by advanced ICT | high | **”BPR”**<br>Less possibilities for profit enhances efforts and development of new ways of working. Smaller units, flow and flexibility. Work less related to space and prestigious buildings | **”Fabulous”**<br>Nice possibilties for profit. A prestigious race to develop and use new workstyles and new technology. |
| | low | **”Hard times”**<br>Less possibilities for profit within the construction industry. No extra resources to develop new ways of working. More control, focus on reducing costs | **”Corporate castle”**<br>Good possibilities for making profit in the construction industry. Less incentives to change workstyle. It works very well as it is. |
| | | low | high |

**PROFIT**
Possibilities for profit within the market for a consulting firm of Consultants Inc.’s size

Figure 75. Scenarios for Consultants Inc.

The next step if one wanted to use the scenario technique on the Consultants Inc. case, would be to discuss the importance of each of the 4 scenarios on different decisions in the building project. As an example, four different issues, of different importance and on different levels, will be presented here. This is to illustrate how the scenarios can be used to aid decision-making. The arguments are constructed to illustrate the process.

## A. To own or to rent:

| | “Hard times” | “BPR” | “Corporate Castle” | “Fabulous” |
|---|---|---|---|---|
| Implications | Focus on occupancy costs. To reduce the number of square meters. Possibilities to move to less prestigious locations and buildings | Flexibility, different locations, less need for a centralised office | Prestige and identification with the company important. Long-term perspective | Possibilities for a high-quality headquarters technologically advanced. But also signals of flexibility less limited to one building and location |
| “best” decision | Rent | Rent | Own or long-term contract for rent | Rent |

Table 13. Type of lease or ownership.

The result corresponds well with the actual decision made by Consultants Inc., namely to rent the building.

**B. Location:**

| | "Hard times" | "BPR" | "Corporate Castle" | "Fabulous" |
|---|---|---|---|---|
| Implications | Functional and inexpensive | Easy access for flexible workersPhysical and virtual space. | Visible and prestigious | In an area with rapid development. Modern and fashionable.Physical and virtual space. |
| "best" decision | (must be related to some alternative locations) | (must be related to some alternative locations) | (must be related to some alternative locations) | (must be related to some alternative locations) |

Table 14. Building location.

It is difficult to discuss the issue of location without relating it to some real alternatives. Compared to the location chosen by Consultants Inc. for their building, the three last scenarios support their decision. The location is easily accessible, fashionable, and going through a rapid development. It is meant to become a busy commercial area in a few years. The site for the Consultants Inc. building is prestigious and visible. In case of "Hard times" it is not inexpensive, but it has a potential for more dense usage of the building, which will result in more efficient use of money.

Both "BPR" and "Fabulous" implies more innovative use of ICT, and in both cases the relation between the physical and the virtual space and the location could have been discussed.

**C. Office building typology, workspace layout:**

| | "Hard times" | "BPR" | "Corporate Castle" | "Fabulous" |
|---|---|---|---|---|
| Implications | Area efficient, traditional | Flexible, area efficient | Focus on user satisfaction, prestige, traditional | Flexible and modern based on advanced ICT. Individual freedom. |
| "best" decision | Small cellular offices, no extra functions or services. | Free address, project spaces. | Individual cellular offices, high level of services, informal meeting spaces. | Individual workplaces in open or team-based layouts. Supports and encourages distance work. |

Table 15. Workplace solutions.

The offices as they are fitted out today resemble the "Corporate Castle" more than the other possible scenarios. But the building is designed to make different workspace layouts possible, and all 4 scenarios may fit into the physical structure as it is designed and constructed. Again "Hard Times" will possibly be the situation which is hardest to live with in the building.

**D. Main staircase, internal vertical communication in the building:**

| | "Hard times" | "BPR" | "Corporate Castle" | "Fabulous" |
|---|---|---|---|---|
| Implications | Functional and cheap | A flight of stairs that "gets the work done", no extra "added value" | Prestigious focus on internal communication and representation to visitors | Efficient, encourages interaction and facilitates informal meetings and communication. Works as a focal point to bring the departments and different floors together. |
| "best" decision | Small and efficient, no extra space | Small and efficient, no extra space | Spacious, with informal meeting places. Central and visible location in the building | Efficient and small, but visible and with space to encourage interaction. |

Table 16. Main staircase.

The internal vertical communication within the building as it is today is much in line with the two last scenarios; "Corporate Castle" and "Fabulous". It may still be the right choice, but if one had performed a scenario analysis of the decision, one had perhaps been more aware of the consequences of this decision. Design decision must, in any case, be compared to the logic behind the design and must be weighted against other issues in design, such as the internal communication in the building as a whole.

The different scenarios could have been used to aid decisions in different phases of the project, and for discussing possible future situations to raise consciousness about strategies to meet the future. One of the main benefits from a scenario process is the participation of the involved parties, to utilise their knowledge and to develop a common understanding of the situation and the future. This is hard to simulate in this constructed example, but would have been an important issue in real life implementations of a scenario process and the Strategic Approach.

## 9.6.2 Layering

As a tool to aid decision-making, it is particularly the layering of the decision-making process that is interesting, but it is closely related to the other dimensions of layering; physical, functional, and territorial layering.

**Main principles for the Consultants Inc. example, physical layers:**
- Separation of layers according to life span and frequency of changes
- Extra capacity and robustness in slow and durable layers
- Generous floor-to-ceiling height
- Flexible, cheap, and easy-to-change elements in fast and short-lived layers

**Main principles for the Consultants Inc. example, territorial layers:**
Responsibility of space and use of space distributed in the organisation at three levels:
- Corporate: Strategic responsibility of overall BUR, as well as image, cost, size, space standards, layouts, and stacking of departments in relation to each other. Building level.
- Department, group: Relationship between work and space plan. Ownership of space. Workgroup level.
- Individual: Personal control and identity. Workplace level.

**Main principles for the Consultants Inc. example, functional layers:**
- A well-defined hierarchy of functions
- Well-functioning internal communication and access
- Making sure that the building can function as a whole, and if necessary as separate functional units

**Main principles for the Consultants Inc. example, a layered process:**
The layered process is based on the hierarchies in the physical, functional, and territorial layers. Based on this, and on the logistics in the building and construction process, the building process can be divided into steps in order to structure the decision and development process and to increase the manoeuvring space in the process. The steps of the process are defined by:
- Actors and decision makers (territorial layer)
- Technical specifications (physical layers)
- Functional specifications (functional layers)
- Stage in the planning process
- Period for which the plan is valid

In Consultants Inc.'s case the process was divided into several stages. In the first stage, the main ambitions for the project; location, rent/own decisions, size, and project organisation were decided upon. Based upon this, an architectural competition was held, in which the main building concept was developed. Later, an open contract was developed between the constructor, the building owner, and the future user organisation.

Thus, the building process was already layered, and the possibilities to impact on decisions were secured by a special contract that gave both the owner and the future user possibilities to develop the project successively. The user organisation would have to pay rent according to the money spent during the process; thus they would feel the consequences of decisions made in the process.

## 9.7 Potential benefits?

By which main issues could Consultants Inc. have benefited from implementing a Strategic Approach?

- By more awareness of how the organisation can benefit from consciously using the Building-User Relationship in order to support the organisation in its work.
- By stating adaptability as one of the main goals.
- By focusing more on the strategic decisions and the user organisation, in addition to on operational and technical issues and on cost control.
- By defining goals and carrying through the process with involvement from the appropriate levels within the organisation.
- By using scenarios to understand the consequences of decisions on different possible future situations.



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# Chapter 10
# Conclusions and recommendations

# Conclusions and recommendations

During the first phases of this work, it was discussed if the result of this research should be a “cookbook”, with recipes for different “dishes” which would produce a result with better adaptability. This idea was abandoned, and the Strategic Approach, as it is presented here, is more about knowledge of how to cook, the main techniques for making different dishes, knowledge about kitchen appliances and tools, as well as a list of ingredients that may be used in the final product.

It has been stressed that this is not a book about a strategy (a recipe) for adaptable office buildings, but a strategic approach to office buildings that may enhance adaptability (knowledge about how to cook). Because this approach involves practically “everything” that has to do with offices, planning, construction, use, and management, the scope has become rather broad. A good chef needs to know both theory and practice and be experienced enough to know which flavours work well together. He also knows his customers and their taste and preferences. In this work, however, it has been necessary to limit the work to one of two main focal areas. The first focal area is the Building- – User Relationship. This means that the focus is on buildings as objects for use. The other main focal point is strategic decision-making, both in the building’s life cycle and in the management of Building – User Relationships.

In the problem statement, this project’s goal was stated as:

> “The objective of this work is to develop and present knowledge of how adaptability in office buildings can be enhanced. Because the mismatch is dynamic and will change all the time, a Strategic Approach to managing the mismatch between the user organisation and the building will be proposed in order to offer a way of approaching these problems.”

Knowledge about the Building-User Relationship and how this changes is presented in chapter 4. The main theoretical issues related to adaptability in office buildings are discussed in chapter 6. How BUR and adaptability is handled in practice is described in case studies in chapter 5. A Strategic Approach is described in order to manage BUR mismatches in chapter 7 and 8. Finally, the Strategic Approach is shown as it could have been applied to a real example in chapter 9.

## 10.1 Conclusions

The proposition that guided this work is:

> "The mismatch between the building and its user(s) can be managed and the adaptability can be enhanced by applying a strategic approach to the planning and management of office buildings."

The studies have suggested that a Strategic Approach can be beneficial in order to reduce BUR mismatches and enhance adaptability. This is an explorative study, and the focus is on describing an approach, not testing it. But the investigation of the case projects and the theory from different theoretical directions support the proposition and proves the Strategic Approach to be useful to manage BUR mismatches and enhance adaptability.

Through empirical and theoretical investigations, the proposition is shown to be plausible, and applied to a real example it is demonstrated how it could be beneficial for managing the Building-User Relationship and improving adaptability. The main purpose of this work is not to show how much adaptability can be enhanced by using the Strategic Approach. Every building and user organisation is unique, and because adaptability has different importance and characteristics in different projects, and because there are no objective measures to assess long term adaptability by in BUR, the measurement of qualitative improvement in adaptability is not the goal in this work. Instead it aims at demonstrating how a Strategic Approach can be used in order to manage BUR mismatches and improve adaptability qualitatively.

The main results are:

**1. – that a Strategic Approach based on an understanding of the dynamics in the Building-User Relationship, and a strategic decision-making process has been developed, as well as some tools and methods which can be applied within a Strategic Approach. Some of this is developed in this project. Other issues are based on previous works, but used within the framework, the Strategic Approach, developed in this project.**

**2. – that a Strategic Approach is shown to be important and beneficial in order to improve adaptability in office buildings.**

The Strategic Approach will be differently applied to different projects. Its main purpose is to present necessary knowledge of the importance of managing BUR mismatches, to provide a strategic decision-making process, and to provide some tools that can be used to aid decision-making. Actual measures that can be applied within each project are only discussed briefly in this work. A summary of the different parts of a Strategic Approach is presented in table 17. It is also demonstrated in the previous chapter, applied on the Consultants Inc. example.

Table 17. A summary of the Strategic Approach:

<table>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">1. A ”MINDSET” AND KNOWLEDGE OF THE DYNAMIC BUR<br><br>How buildings change and how they affect user organisations<br>How user organisations change, and how they impact on buildings<br>How the relationship changes over time, and creates a continuous mismatch<br>How a Strategic Approach to adaptability can be used to manage the mismatch</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">2. A STRATEGIC, ITERATIVE DECISION-MAKING PROCESS<br><br>A way of thinking, through an iterative process between:<br>- Awareness<br>- Analysis<br>- Action<br><br>This strategic and iterative decision-making process can be used in different situations and contexts:</td></tr>
<tr><td colspan="3">2.a. The Strategic Approach to managing BUR mismatches</td></tr>
<tr><td>A continuous iterative process</td><td>Awareness<br>Analysis<br>Action</td><td>- How do we assess the changing needs of the organisation?<br>- How is current performance evaluated?<br>- What is the “acceptable mismatch level” in this situation?<br>- How do we scan for available options and alternatives?</td></tr>
<tr><td colspan="3">2.b.The Strategic Approach in the building’s life cycle:</td></tr>
<tr><td>Concept</td><td>Awareness<br>Analysis<br>Action</td><td>- How do the main strategic decisions impact on adaptability?<br>- Have all relevant options been considered?<br>- How uncertain is the situation?<br>- How can issues about adaptability be kept on the agenda throughout the project?<br>- Should alternative futures be considered?</td></tr>
<tr><td>Programming</td><td>Awareness<br>Analysis<br>Action</td><td>- Is the building process rooted in the organisation’s strategies and in the top management’s visions?<br>- How will the user’s and owner’s specifications for the building be developed?<br>- How can the programming process be layered?<br>- Can the building or the building process be used as tools for organisational development and to encourage change and adaptations within the organisation?<br>- Who should be involved, and at which level?</td></tr>
</table>

| | | |
|---|---|---|
| Design | Awareness<br>Analysis<br>Action | - Will the designers' attitudes promote change?<br>- How does the proposed building relate to change?<br>- Does the proposed architectural strategy allow future changes to happen?<br>- How do decisions limit future change?<br>- Has the integration between actors and phases been taken care of? |
| Construction | Awareness<br>Analysis<br>Action | - How are changes handled?<br>- How does one handle developments that happen during the construction period?<br>- How does one handle communication and information flow between suppliers, designer, and constructors?<br>- Which quality of work and materials are we expecting? |
| Operation and use | Awareness<br>Analysis<br>Action | - How well is the BUR management prepared for continuous changes?<br>- How are they prepared for major adaptations?<br>- What are the organisation's strategies and plans, and how will they affect the BUR?<br>- How well does the building match the organisation's needs today? And tomorrow?<br>- How will the physical building play together with the building services and support in order to facilitate adaptations? |
| 2.c. The Strategic Approach applied in Commercial Real Estate * | | |
| Process | Awareness<br>Analysis<br>Action | |
| 2.x. The Strategic Approach applied in other BUR-related situations* | | |
| Process | Awareness<br>Analysis<br>Action | |
| | | |
| **3.** TOOLS FOR ASSISTING STRATEGIC DECISION-MAKING | | |
| - Mathematical and statistical tools to analyse risk and uncertainty*<br>- Tools for financial analysis*<br>- Tools for anticipating the future (<u>scenarios</u> are described in more detail)<br>- Business Modelling*<br>- Building evaluations*<br>- Planning methodology (<u>layering</u> is described in more detail)<br>- Tools for aiding creative problem solving*<br>- Tools for visualising the future* | | |

| | |
|---|---|
| **4.** ADAPTIVE MEASURES*<br><br>Adaptive measures are actions, solutions, and principles than can be applied within the strategic decision-making process. These are context dependent and must be decided for each new project. | |
| 4.a. Measures related to the building*<br><br>(physical adaptability) | - Flexible, partitionable, multifunctional, extendable<br>- Buildings, materials, components, elements, connections<br>- Low road / high road buildings<br>- Separation of layers<br>- Disconnectible, attention to assembly sequences and connections<br>- Design strategies: additions, evolutionary growth<br>- Open and closed forms, redundancy and robustness |
| 4.b. Measures related to the use of buildings*<br><br>(functional flexibility) | - Adjust organisation to building's possibilities<br>- Adaptive use<br>- Innovative Office solutions<br>- Making do<br>- etc. |
| 4.c. Measures related to contracts and finance*<br><br>(financial flexibility) | - Lease / own<br>- Length of contracts<br>- Taxes<br>- Sources of finance<br>- Financial risk<br>- etc. |

* = Only discussed generally in this work

## 10.2 Theoretical material

Theoretical material from different "bodies of knowledge" is used in this work. Planning, architecture, construction in general, and organisational theory are the most important. Due to the multi-disciplinary problems discussed in this work, theories from different traditions are woven together in order to create a more complete picture of adaptability than the more technically or economically focused works in this field. The dangers of combining different theoretical bodies of knowledge in dr.ing projects are numerous, and the result may well end up as something that falls outside acceptable professional boundaries. In this case, the issues studied can only been understood by approaching the problem from different professional angles. The multi-disciplinary approach is therefore justified. All input from different theoretical perspectives is treated as much in line with its internal consistency as possible, to avoid some of the pitfalls of the multi-disciplinary approach. Still, the text is written by an architect, and therefore mostly from an architect's point of view.

The BUR and the Strategic Approach, as they are presented in this work, are based on existing knowledge from different sources, but this knowledge has been restructured and used to define the BUR and the Strategic Approach in a new way.

# 10.3 Empirical material

The empirical material consists of cases, interviews, and workshops with people in practice and in research.

## 10.3.1 Cases

4 cases are studied in this work. The main purpose of the cases is to contribute to the understanding and development of a Strategic Approach and understanding of BUR in real projects. They have served as input to the Strategic Approach and as empirical information to discuss the different parts of the approach. But they have not been used for empirical testing.

Each of the cases in this work has a very different approach to adaptability. Thus, they have very different profiles and drivers for change, and they have contributed to the development of this work in different ways. Their main contributions are:

| | Main issues: |
|---|---|
| Case 1. Dagbladet | New technology and new workpatterns and how this is taken care of in a long term Building – User Relationship. Focus on retrofit which aims at improving adaptability to make future changes easier to carry out.Retrofit process, layered. Strategic concept statement, involvement from management and end-users at the appropriate levels. |
| Case 2. Gjensidige Sollerud | Large corporation which builds its new headquarters based on organisational needs and image as well as end-user involvement and comfort.Involvement from general management, strategic concept statement. A layered process.How churn and changes are handled. |
| Case 3. Office XX | Strategic statement: Life span of 20 years!Focus on technical solutions that will enhance adaptability. |
| Case 4. Colosseum Park, E7 and E9 | Commercial thinking in corporate real estate. Real Estate investment was the main goal. A business project which was developed to be multi-purpose, for any user. Later adapted to K-bank’s needs. High level of churn, almost half of the employees are moved every year. |

Table 18. Main issues in the case studies.

### 10.3.2 Interviews and workshops

The interviews and the workshops were used to give input and direction to the Strategic Approach and to the understanding of the Building-User Relationship and adaptability in general. Different people have participated; real estate developers, architects, researchers, facilities managers, and corporate real estate managers. A list of participants and respondents is presented in Attachment 3.

The main contribution from the interviews and workshops is that they have provided practical and theoretical knowledge and real situations that have helped defining the Strategic Approach. They have been invaluable in rooting this work in real problems and understanding of practice.

### 10.3.3 The “Consultants Inc.” example

The example is used to demonstrate how the Strategic Approach can be used in practice. The main contribution from the example is to summarise the Strategic Approach and to show its usefulness in real projects. The example shows that the project could have benefited in several ways by applying the Strategic Approach.

## 10.4 The need for adaptability in the future

The last years’ focus on change and flexibility in business and in society in general makes it hard to imagine that there may come a time when “change” is not as positively valued by organisations as it is today, a time when stability is the goal. Maybe that time will never come. We do know that there will always be changes at some level. But there is no way of telling if the present focus on change, and change as a positive asset in organisations, will prevail.

It is hard to imagine the need for adaptability to be less in the future than it is today. Even in a situation with less changes and more traditional office solutions, there will always be changes, reorganisations, growth and decline, moves within the building, etc. Ideals and trends in office design, different office layouts, and workplaces will shift. So even within a more stable situation and more traditional offices, there will be a lot to gain by more knowledge of how to improve adaptability.

The most likely development is that the offices of the future will be diverse, both when it comes to location and to office layout. New ideas about organisations focus on flow, and new technology creates new possibilities when it comes to both how and where we work. In this situation, there will probably be more focus on change and on adaptability. Buildings will always to some degree be durable and slow, and in a more volatile situation, there will probably be more attention to use and management of real estate in this situation of constant changes and flow.

## 10.5 Challenges for practice and issues for further research

Through theoretical and empirical studies, a further understanding has been developed of the Building – User Relationship, and of adaptability in relation to this. A Strategic Approach has been presented and discussed as a way to manage BUR mismatches and to enhance adaptability. These studies have shown that the Strategic Approach can be used to manage the mismatch in the BUR. Through investigation and development of the Strategic Approach, several aspects have been shown to affect adaptability and the Building – User Relationship. The cases illustrate some of these issues, but they also make it clear that there is a lot to be gained in practice today by applying a more strategic way of thinking about the BUR. This is also shown in the Interconsult example, where the Strategic Approach was applied to a real project.

Further studies are, however, necessary to determine how this affects the long-term adaptability in the Building – User Relationship. This will require experience with implementation in several projects and longitudinal studies on how this influences the BUR over a longer period of time. This will be a natural next step to further develop a Strategic Approach to adaptability.

To develop the Strategic Approach further, one will have to implement and test the approach in practice, and at the same time follow and evaluate the results in more research-based projects. The challenges for practice and the issues for further research may be summarised as:

- Implement in real projects and collect experiences in order to develop the Strategic Approach further

- Research to determine the long-term effect of the Strategic Approach on adaptability, especially knowledge about cost/benefit in a longer perspective.

- Further develop the Strategic Approach by incorporating other tools to assist decision-making and to develop a more complete set of measures, in the building, in use and in finance and contracts.

- Develop more practical guides for designers and building owners/managers.

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# Attachments

A. 2

# Attachment 1
# Norsk sammendrag

Denne doktorgradsavhandlingen, *En strategisk tilnærming til tilpasningsdyktighet i kontorbygg* (A Strategic Approach to adaptability in office buildings) er gjennomført ved Institutt for bygningsteknologi, Fakultet for arkitektur, plan og billedkunst ved NTNU i perioden 1997 – 2001. Arbeidet i doktorgradsprosjektet er en del av Norges Byggforskningsinstitutts strategiske instituttprogram *Bygninger i et livsløpsperspektiv*, finansiert av Norges Forskningsråd.

Hovedmålsetningen med dette arbeidet har vært å utvikle og presentere kunnskap om hvordan man kan oppnå en bedre tilpasningsdyktighet i kontorbygg. Tilpasningsdyktighet er viktig for å oppnå et godt samsvar mellom brukerorganisasjonens behov og det bygget kan tilby. Forholdet mellom brukerorganisasjonen og dennes behov (etterspørsel) og byggets evne til å tilfredsstille disse behovene (tilbud) er i dette arbeidet kalt for bygg-bruker-forholdet (BUR = Building – User Relationship). I ethvert forhold mellom en brukerorganisasjon og et bygg vil det over tid være et avvik mellom det bygget kan tilby og det brukerorganisasjonen har bruk for. Dette avviket er i denne avhandlingen kalt ”mismatch”. Avviket oppstår allerede i planleggingen og fortsetter gjennom byggets livsløp, men kommer spesielt til syne i bruksfasen. Avviket vil variere gjennom byggets livsløp. I ethvert forhold mellom bygg og bruker vil det være en grense for hvor mye avvik som kan aksepteres. Denne tålegrensen er forskjellig for ulike brukere og situasjoner. Før eller senere vil imidlertid avviket overstige tålegrensen. Når tålegrensen er overskredet vil det bli gjort tilpasninger i bygget, i måten bygget brukes på, eller i kontrakter og finansielle forhold. Det er ulike typer tilpasninger. Noen dreier seg om dag-til-dag tilpasninger, noen er små og store ombygginger, og noen er større rehabiliteringer og ombruk av bygget. Større tilpasninger skjer når det er stor avstand mellom det bygget kan tilby og det brukerne etterspør. I tillegg til større tilpasninger er det også kontinuerlige, mindre tilpasninger som foregår mer eller mindre uavbrutt gjennom byggets livsløp.

I motsetning til mange av de tidligere arbeidene innenfor dette feltet, er denne avhandlingen ikke så mye fokusert på fleksibilitet som på tilpasningsdyktighet. Tilpasningsdyktighet er her definert som ”evnen til å tilpasse seg som en følge av indre eller ytre endringer”. Tilpasningsdyktighet forstås dermed som mer overordnet enn fleksibilitet. Tilpasningsdyktighet er beskrevet som evnen til å tilpasse seg endringer også utenfor det som opprinnelig var planlagt, og handler om å skaffe seg ett rom for handling, både fysisk, i bruk og i prosessen. Fleksibilitet, på den andre siden, er en av flere måter å oppnå tilpasningsdyktighet på. Fleksibilitet handler mer om endring innenfor forhåndsdefinerte muligheter og løsninger. Andre måter å oppnå fysisk tilpasningsdyktighet på, og som er beskrevet i denne oppgaven, er generalitet og elastisitet, og det å tenke lagdeling og robusthet i løsninger. Et annet punkt som skiller dette arbeidet fra mye av det som tidligere er presentert om endringer i bygg, er at denne avhandlingen er mer basert på en sosiokonstruktivistisk innfallsvinkel til problemet, og på forståelsen av et sosio-teknisk forhold mellom bygninger og deres brukere, enn på tekniske løsninger.

Den viktigste grunnen til å studere tilpasningsdyktighet i kontorbygg er de endringer vi har sett i kontoret i løpet av de siste 100 år. Disse endringene forventes å fortsette, kanskje til og med å akselerere. Dersom man ser på kontorbygghistorien er det klart at det har vært store endringer i kontorbyggutforming, kontortyper, og utforming av arbeidsplasser. Ulike kontorkonsepter kan endres, men selve kontorbygget er mer varig, og vil måtte tilpasse seg nye, og for oss ukjente, måter å organisere kontorarealet på. Derfor vil de fleste kontorbygninger møte svært forskjellige krav i løpet av sitt livsløp. De vil derfor måtte tilpasses. Noen bygninger er lettere å tilpasse enn andre, men det som til syvende og sist avgjør om bygget blir tilpasset er hvorvidt verdien av å tilpasse bygget til ny og fremtidig bruk er forventet å være større enn kostnadene av å tilpasse det, og at det ikke eksisterer alternativer som synes å ha en større verdi. I denne sammenhengen må man ta hensyn til både finansiell verdi og bruksverdi.

Det er nettopp byggets bruksverdi som kommer klart til uttrykk i forholdet mellom bygg og bruker (BUR). Dette forholdet er beskrevet som to-veis, det vil si at begge sider gjensidig påvirker hverandre. Når organisasjonen endrer seg, kan det hende at bygget må endres som en respons på den nye situasjonen. På den andre siden vil også organisasjonen tilpasse seg de muligheter og begrensninger som ligger i bygget. BUR skal ikke nødvendigvis bare beskrive forholdet mellom én brukerorganisasjon og én bygning, men kan også beskrive et forhold mellom bygget og en tilfeldig bruker, flere påfølgende brukere, eller én organisasjon og flere bygninger. Kontinuerlige og større tilpasninger vil forekomme uansett, og de samme hovedprinsippene som er beskrevet for BUR kan benyttes også for situasjoner med mange brukere og/eller bygninger.

Fordi BUR er i kontinuerlig endring vil det alltid være et avvik mellom det bygget kan tilby og det brukeren etterspør. Dette avviket varierer over tid. For å bedre samsvaret mellom bygget og brukeren er det i denne avhandlingen foreslått en overordnet, strategisk tilnærming for å håndtere dette avviket (to manage the mismatch). Denne tilnærmingen baserer seg på en strategisk tankegang for å håndtere usikkerhet og framtidig endring.

En tilnærming for å håndtere framtidige tilpasninger må baseres på planlegging og beslutningstaking under usikkerhet. Dette krever en forståelse av retning og utvikling på etterspørselssiden (brukerorganisasjonen), så vel som en strategi for utvikling av tilbudssiden (bygningen) og ledelse av samspillet mellom dem. Videre må interaksjonen mellom de to ledes og vurderes i et langsiktig, strategisk perspektiv. Som et svar på dette er det i dette prosjektet foreslått en strategisk tilnærming til tilpasningsdyktighet.

Denne er basert på en strategisk, iterativ beslutningsprosess. Som en metafor for å beskrive og videreutvikle denne prosessen har designteori vært benyttet. Dette innebærer en beslutningsprosess der man baserer seg på en interaksjon mellom problemforståelse, analyse og handling.

Hovedingrediensene i den strategiske tilnærmingen til tilpasningsdyktighet er:

1. En tankegang, eller situasjonsforståelse, som er en måte å forstå endringer i bygg-bruker-forholdet (BUR) på. Denne tankegangen inkluderer kjennskap til organisasjonen og til bygningen og hvordan de endrer seg og gjensidig påvirker hverandre.
2. En strategisk beslutningsprosess, basert på en iterativ prosess mellom problemforståelse, analyse og handling. Denne beslutningsprosessen kan brukes i ulike sammenhenger. To situasjoner som er spesielt relevante i forbindelse med tilpasninger og BUR er beskrevet i denne avhandlingen: (a) generell ledelse og håndtering av tilpasninger og avvik i BUR (for eksempel i en drifts- og brukssituasjon), som er en kontinuerlig prosess der man tilpasser bygning og brukerorganisasjon til hverandre, og (b) en strategisk tilnærming igjennom byggets livssyklus, fra initiativ, konsept, programmering, prosjektering og bygging til bruk og drift.
3. Noen verktøy som kan benyttes i en strategisk beslutningsprosess. Slike verktøy kan brukes for å vurdere usikkerhet, for finansielle og økonomiske analyser, for å forutsi framtidige endringer, for å evaluere bygninger, for å strukturere planleggings- og byggeprosessen, for å visualisere løsninger eller for problemløsning generelt. I dette arbeidet har to verktøy blitt nærmere beskrevet: Scenarioteknikk og lagdeling.
4. Tiltak eller konkrete løsninger som kan benyttes i: (a) bygget, (b) i ulike måter å bruke bygget på, (c) i finansiering og kontrakter, for å bedre tilpasningsdyktigheten. En helhetlig gjennomgang av alle mulige tiltak ligger utenfor rammene av dette arbeidet, men noen tiltak er beskrevet der det er naturlig, for eksempel i beskrivelsen av designstrategier og i beskrivelsen av lagdeling.

Denne studien er i hovedsak eksplorativ, og en interpretitativ forskningstilnærming er blitt benyttet. Dette betyr at konsepter og teorier har blitt utviklet gjennom undersøkelsene i prosjektet. Empiriske og teoretiske studier er gjennomført parallelt. De empiriske studiene er gjennomført ved hjelp av intervjuer, workshops og casestudier. I tillegg er det utviklet et eksempel som skal vise den strategiske tilnærmingen i praksis.

4 cases er presentert:

1. Dagbladet. En større ombygging av Dagbladets bygningskompleks i Akersgata, med flere bygninger av ulik alder og tilstand. I dette prosjektet var hovedfokus på en lag- og fasedelt ombyggingsprosess, med mye brukermedvirkning og med økt mulighet for fremtidig endring som en av hovedmålsetningene.
2. Gjensidiges hovedkvarter på Sollerud. Ferdigstilt i 1991. Bygget er hovedkvarter for et større forsikringsselskap og bank. Hovedfokus i prosjektet var på

strategiske beslutninger om bedriftens verdier som skulle komme til syne i bygget og med en utstrakt grad av brukermedvirkning.
3. Office XX er et nederlandsk case. Bygget er resultatet av et forskningsprosjekt der man har eksperimentert med ulike tekniske og materialmessige løsninger som skal bidra til at bygget lett kan endres, og til at hele bygningen skal kunne demonteres når det ikke lenger er behov for den.
4. K-banks to nye kontorbygg på Majorstua, Colosseum Park. Bygningene er utviklet som et generelt kontorbygg, med vekt på at det skal være et kommersielt kontorbygg på utleiemarkedet, og med lik, universell planløsning i alle etasjer og avdelinger for å gjøre det enklere å flytte medarbeidere internt.

Til sist i avhandlingen er den strategiske tilnærmingen illustrert i et eksempel. Formålet er å vise hvordan metoden kan benyttes i praksis, med en beskrivelse av eksemplet og en simulering av hvordan en strategisk tilnærming kunne ha vært brukt i prosjektet. Neste steg er å teste den strategiske tilnærmingsmåten i et virkelig prosjekt for å lære mer om hvordan den kan tillempes til praksis.

Hovedresultatene fra arbeidet er:
- At en strategisk tilnærmingsmåte, det vil si en strategisk tankegang med kunnskap om endringer i bygg-bruker forholdet, en strategisk iterativ beslutningsprosess og noen verktøy som kan brukes i en slik strategisk beslutningsprosess, er beskrevet. Deler av materialet er utviklet i dette prosjektet, og noe av det er satt sammen på nye måter.
- At en strategisk tilnærmingsmåte har vist seg å være både viktig og nødvendig for å bedre tilpasningsdyktigheten i kontorbygg.

# Attachment 2
# Some reflections on the financial consequences of the BUR mismatch

In this attachment the Building - User Relationship will be explored further as the financial consequences of mismatches in BUR will be discussed. The reasons for improving adaptability are obviously that changes are expensive, and that mismatches are costly both for the user organisations and for the owners of office buildings.

## 1. The financial consequences of the BUR mismatch

In order to understand the economic realities in the Building – User Relationship, one needs to develop an economic model that takes both income and costs into consideration during the building's entire life cycle. Models used to calculate the Life Cycle Costs of buildings have received a lot of attention, and in Norway, the methodology was developed and put into use in the beginning of the 1990's (Bjørberg et al., 1993). The models are important contributions to understanding the economics of buildings over a period of time, but the methodology only takes into account costs related directly to the building. The benefits andincomes are not part of the model, nor is the fact that the building is a means for production, which contributes to the work that takes place in it. In a life cycle economics (LCE) model both the building and the user's income and costs are taken into consideration. LCE models take the issues about a financial life cycle beyond that of investing in physical building structures, as the traditional LCC calculations only show a small part of the entire picture.

The financial consequences of changes in the BUR-relationship are perceived differently from various actors' perspectives. Taking both income and costs into account for both users and owners illustrate these different perspectives, see figure A.1. For the user organisation the most important financial aspect of real estates is that the benefit, value of use, and the performance of the organisation must be seen in relation to the costs, rent. For the owner, the income is the sum of all the tenants' rent, and the cost is his expenses and investments involved in keeping the building fit for the market.

For the purpose of investigating financial issues in a life cycle perspective, one needs to take into account both expenses and incomes, and both the building and its user organisation. The building is its owners' financial object, and its part of the system will be represented by its owners' in- and output. The four different perspectives of the model called Life Cycle Economics are shown in figure A.3. Before we describe the LCE-model in detail, it is important to note that the life cycle and the duration of interests in the building may vary considerably, se figure A.2.

| | User organisation | Building (building owner) |
|---|---|---|
| Revenue Income | The user organisation's productivity and profit | Rent<br>Utilization |
| Costs | The organisation's costs:<br>- Salaries, etc.<br>- Office equipment and furniture and ICT<br>- Service<br>- Costs related to workspace: rent, etc.<br>- Relocations | Capital investments<br>Facilities Management<br>Operation<br>Maintenance<br>Upgrades / retrofits |

Figure A.1. Different perspectives in life cycle economics.

In "Building as an economic process", Ranko Bon writes about the economic time horizon:

> "How far should we go, however? The answer is conceptually simple: we should consider the life cycle of an economic process, including all the underlying building activity. All relevant inputs and outputs will thus be accounted for. Naturally, this refers to the economic, not physical life cycle, as the only requirement concerning the physical durability of capital is that it extends beyond the economic horizon of an economic agent.

In an economic model related to BUR, it is important to bear in mind that the economic life cycle of the various actors vary, and may not correspond with the physical life cycle of the building.

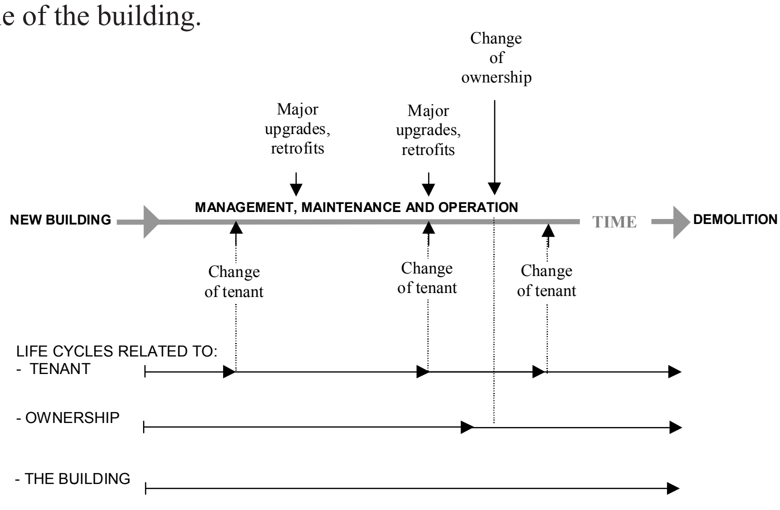


Figure A.2. Financial life cycle perspectives vary according to the actors' roles and the duration of their involvement in the building. The building's lifecycle, the tenants' and the owners' involvement based on (Bejrum and Lundström, 1993).

## 1.1 The Life Cycle Economics model

The Life Cycle Economics model takes into account both sides in the BUR-model: the building and the user organisation, as well as both incomes and costs. This will provide a conceptual model in order to understand the different financial issues related to BUR.

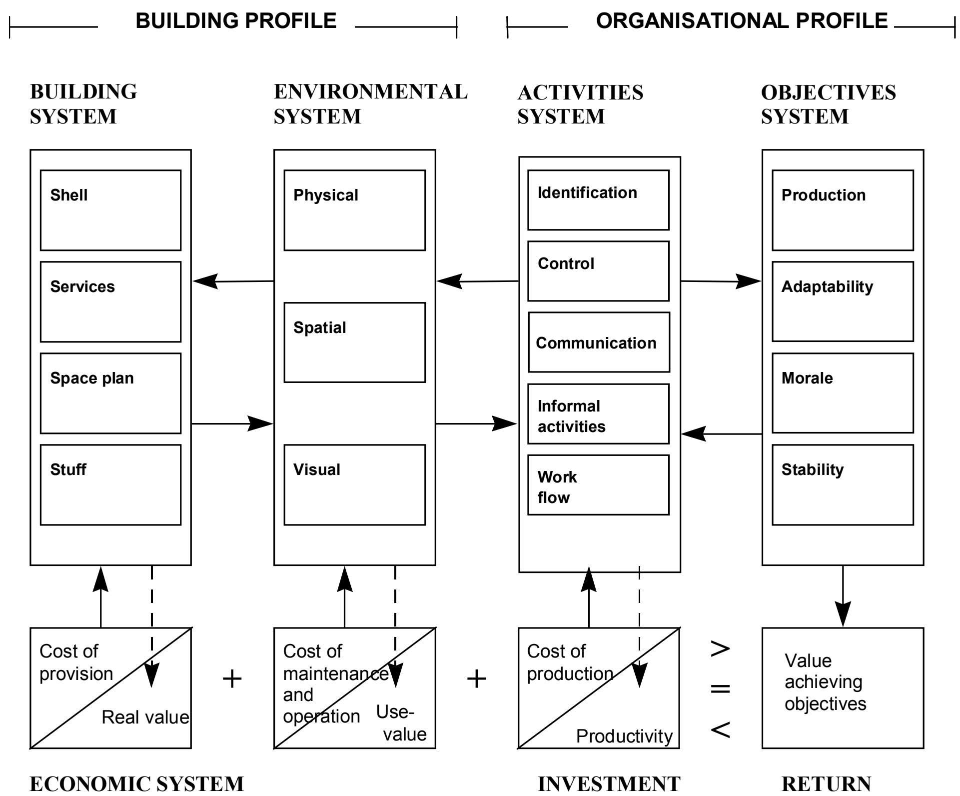


Figure A.3. The Life Cycle Economics model corresponds with the financial perspectives of BUR. The figure shows the building's and the user organisation's performance criteria, and their relations to financial parameters. The building system is seen as a part of the total value system of an organisation (Andresen and Blakstad, 1997) based on (Markus and Alexander, 1997).

The LCE-model consists of 4 subsystems, two on the building side and two on the organisation side. On the building side is *the physical building,* divided into layers[1], and *the work environment*, physical, spatial and visual. This corresponds with the supply side in the BUR-model. On the demand side is *the activities system*, which represents the activities and the structure in the organisation and *the objectives system,* which represents issues related to production, morale, the organisation's ability to adapt to its environment, etc.

The last section describes the economic part of the model. It takes into account the costs (above the line) and income (below the line) of the different systems in relation to each other:

| | Building | | Work environment | | Activities | | Objectives |
|---|---|---|---|---|---|---|---|
| Costs | Cost of provision | + | Cost of maintenance and operation | + | Cost of production | > = < | Value achieving objectives |
| Income | Real value | | Use-value | | Productivity | | |

Table A.1. Life Cycle Economic model

In order to avoid suboptimisation in the building process and during operation and management of the building, it is important to understand the relations between the different parts of the LCE-model. It is, however, very difficult to quantify and calculate the different aspects. Its main contribution is as a conceptual model used to understand the different financial aspects of a life cycle perspective. This model will be used in order to discuss some financial aspects of the BUR-model.

### Contribution to productivity

One of the main purposes of the BUR model is to relate the building to the organisation's objectives. But will the building have any effect on the user organisation's productivity?

There has been a lot of discussion about the building's and the work environment's contribution to productivity. In most cases this has resulted in general theories that are hard to prove empirically. In some cases, for example when it comes to the effect of temperature (Wyon, 1986), numerical models have been developed, but as long as this only applies to a small part of the model, and only to aspects which are of minor interest to the overall production in the user organisation, optimisation based on these aspects is of insignificant value. So the first problem one runs into is that it is hard to quantify the contribution of each of the factors that affect productivity. The other problem is that it might be difficult to measure productivity, especially in office buildings, where the production output is hard to measure both when it comes to quality and quantity.

The capital investment in buildings (building costs) is approximately 60% of the annual costs of the building (capital costs, management, maintenance, and operation) This again is only about 10% of the total, annual running costs for the user organisation (Andresen and Blakstad, 1997). This means that the capital investment in a building may be profitable if it results in a decrease in running cost for the organisation (e.g. reduced sick leave) (Hansen and Lysne, 1997) (Hanssen, 1997). The effect of an investment in the construction phase is rather small compared to the total financial budget of a corporation. In theory, this is probably the case, and one might argue that there is an even greater potential for improvements in looking at the organisation's income, not costs. In order to increase productivity one has to design work environments which support the organisation, the teams, and the individuals in such a way that they work better together, are more creative, etc. This is difficult to measure, but must be a concern for the organisation's managers when they buy or lease facilities. This is important to the BUR, and is an interesting aspect of adaptability, as it concerns the how the building fits the organisation and how the building contributes to the production going on inside it. These mattersis, however, are outside the scope of this work. In this perspective, buildings are investments and means of production. Their contribution must therefore be judged in relation to their users' productivity. Thus, poor adaptability will, theoretically, result in less productive workspaces.

**Interruptions to daily production**

Both relocations and adaptations in existing facilities, moves within the same building, etc., will disturb the user organisation's activities. Construction works in the building at the same time as one is trying to do "business as usual", will result in noise, inconvenient temporary solutions, unsatisfactory working environment and sometimes several moves within the building as the construction works proceed. In one of the case studies, the Dagbladet project, this was the main reason for investingin greater physical adaptability in the building. Faster, cheaper, and easier adaptations will, hopefully, result in more painless change processes.

The stress on the organisation, the cost of moves and temporary solutions and possible productivity losses, will always have to be weighed against the benefits of relocations or upgrades.

**Low utilization**

While the main objective for the user is how well the building serves its purpose, return on investment is most important for the owner. The building's utilisation over its life time, or at least during the owner's attention span, is vital to its profitability. In the case where the owner and the user is the same organisation, this focus will change, but it will still be important to utilise the building in the best way possible in order to achieve the best accommodation for the organisation for a competitive prize.

To achieve the best possible utilisation of the building, one needs to consider at least two aspects: Efficiency and capacity. Space has to be used as efficiently as possible, and the capacity of the building has to be matched to the demands of tenants, to avoid under- or over-capacity. Because of constant changes, the number of tenants and the space they acquire, both qualitative and quantitative, will vary a great deal. Owners will have a lot to gain by making these transitions as smooth as possible, and adaptability both physically, functionally, and in contracts, may be one way to achieve this. Some building owners apply long term contracts in order to make the users commit themselves for a longer period of time. The duration of contracts is, however, very dependent on market conditions and competition. Others develop the opposite strategy, and rent out small, flexible "objects", which can be rented out on a relatively shorterm basis.

An attractive, highly demanded building will secure a high utilisation during its life cycle. Such demand is a result of factors such as location, market for real estate (both demand and supply), the building's image and quality, all of which decides how the building is perceived in the market. A building which scores high on these factors will be adapted and will have the best possibilities for a low vacancy rate during its lifetime.

**Costs of changes and upgrades**

For the owners and managers of buildings, costs of changes, upgrades, and retrofits are considerable. In addition to the costs related to operation, management, and maintenance, a considerable amount is spent on keeping the building up to the standards demanded by clients.

Examples from the new Norwegian Standard for "Life cycle costs for building and engineering work" on costs for upgrades can show us the nature of these changes:

| | | |
|---|---|---|
| Continuous adaptations: | Smaller construction works which are carried out periodically, and which will result in changed floor layouts and new use of space. These are smaller jobs which can be carried out without major disturbance to the daily activities in the building | - Demolish partitions<br>- Move partitions<br>- New opening for shafts in order to facilitate new user equipment<br>- Reinforce structure because of new user equipment<br>- Move air inlets because of new space plan<br>- Etc. |
| Regulation and public standards: | Costs to cover expenses because of upgrades answering to new regulations and standards | - Fire<br>- Work environment<br>- Etc. |
| Upgrades[1]: | Costs to cover expenses in order to satisfy lack of functionality or specific demands which have become important after the building's completion in order to maintain the original level of performance | - New windows<br>- New HVAC system<br>- New cabling<br>- Etc. |
| | Upgrades which increase standard above the initial level | - Finishing of higher quality, floors anc walls |
| Outdoors: | Costs for improving quality at the building site and entrance | |

[1] Upgrades in order to keep pace with expectations. A substantial increase in performance is defined as a retrofit, see definitions and concepts in "Theoretical Framework", Chapter 6.

Table A.2. Costs related to upgrades, translated from the Norwegian Standard life cycle costs for buildings and civil engineering work. Principles and classification. (NS3454, 2000).

The same Norwegian Standard defines another classification of costs related to adaptations: realising the real estate potential. These are larger investments that will increase the value of the property. Examples from NS 3454 are retrofits and extensions.

| | |
|---|---|
| Retrofits: | Construction works in order to change the facilities' functions, use of space or standard |
| Extensions: | Horizontal and/or vertical extensions |
| Outdoors: | Works in order to raise the property value |

Table A.3. Costs related to realisation of the real estate potential, based on the Norwegian Standard life cycle costs for buildings and civil engineering work. Principles and classificatio*n* (NS3454, 2000)

Another example showing the financial consequences of changes is when a tenant chooses to move out. The financial consequences of relocations result from both the process of moving out and finding a new tenant and from upgrades and retrofits to the building. How often this happens depends on several issues; the duration of the contract, the market, etc.

> "This is a rule of thumb; changing a tenant costs us 1 year's rent. And then we do not carry out any major upgrades. It is just to get the old tenant out, and then it takes some time until the new one can move in. And you have to carry out some upgrades, like new floor finish, some painting and moving of internal walls. But basically it is the same office space, and still it costs us one year's rent. (...) If you tear down the interior walls and put in a whole new setting in an office floor, it will cost you 3-7 years' rent. New HVAC systems will be even more." Quote Steinar Manengen, KLP Eiendom, empirical material (Authors translation from Norwegian).
>
> "... you see, the percentage of annual investments is related to the rent. Capital investments, this is not maintenance, but the money you need to keep the building in 100% shape over the years. For hotels 16% of your annual rent must be put aside for future investment. For offices it is 10,5%. For shopping centres and industrial premises it is 5,5%. This is because industrial is less tailormade than offices, and there is less capital involved." Quote G. D. J. Verweij, Wereldhave, empirical material.

[1] The Building System is here divided into 4 levels, for a more in-depth discussion of building layers, see chapter 8.
[2] Upgrades in order to keep pace with expectations. A substantial increase in performance is defined as a retrofit, see definitions and concepts in "Theoretical Framework", Chapter 6.

A. 14

# Attachment 3

# List of interviews and workshops

## Interviews:

Pullen, Wim
Government Buildings Agency, Directorate of Real Estate and Accommodation Policy
Ministery of VROM, den Haag, the Netherlands
20. February 1998

Gustavsen, Kai
Gjensidige FM
Sollerud, Lysaker, Norway
28, April 1998

Spekkink, Dik
EGM Arkitekten
Dordrecht, the Netherlands
17. June 1998

Verweij, Gijs D. J.
Wereldhave N.V.
den Haag, the Netherlands
29. June 1998

Hande, Kjell
Gjensidige Eiendom
Sollerud, Lysaker, Norway
19. August 1998

Manengen, Steinar and Godell, Dagfinn
KLP Eiendom
Oslo, Norway
29. October 1998

Brydøy, Kåre and Homelien, Tom
NORDIA
Tønsberg, Norway
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Sæbø, Olav Egil
K-bank and Celexa
Lysaker, Oslo, Norway
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Solem, Tormod
Interconsult
Trondheim, Norway
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Nyland, Sigrid and Nyrud, Gudmund
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## Workshops:

"Adaptability"
Voorburg 23. April 1998
Participants: Karel Dekker, Hans de Jonge, Kees Gerritse, Rob Geraedts, Geert Dewulf

"Tilpasningsdyktighet", BEAM-meeting
Trondheim 11. March 1999
Participants: Tore Haugen, Fredrik Horjen, Gunnar Næss, Geir Hansen, Tore Wigenstad, Marte Gjesdahl, Birgit Sudbøe

"Flexibility – Workspace – Office Buildings"
Copenhagen 8. June 2001
Euro FM Research Forum, report available from Tore Haugen, NTNU