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Failing to plan – planning to fail: How early phase planning can improve buildings' lifetime value creation

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Purpose: How do early phase planning of Real Estate (RE) and Facilities Management (FM) create value for owners and users of commercial and public sector buildings?

Design/methodology/approach: The data were collected in Norway in 2015 through a national online survey (N = 837). The sample gives a good picture of Norwegian owners' and even users on tactical level (customer) perspectives on RE and FM. The data have been analysed through descriptive statistics and exploratory factor analysis. The hypotheses have been tested through analyses of correlations and OLS linear regressions.

Findings: Exploratory factor analysis made it possible to establish seven composite variables (constructs). Based on these seven constructs, six hypotheses were derived and tested. Obstacles and Financials have no significant effect on buildings' perceived usability. The most important factors during early phase planning that influence buildings' perceived usability and lifetime value creation are measures promoting Environment and LCC, FM, Adaptability and Image.

Research limitations/implications: Further empirical and preferably, comparative studies are needed to establish whether the findings can be generalized. The study has shown that a building's usability and lifetime value creation is largely determined by decisions made during early phase planning. Whether organizations are able to implement successful FM during a building's use phase is partly also determined during early phase planning. Thus, moderate investments in early phase planning can be very profitable.

Originality/value: This study indicates what to emphasize during early phase planning.

Keywords: Early phase planning, Facilities management, Norway, Real estate, Survey, Value creation.

Paper type: Research paper

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1 Introduction

During many years' work with strategic analyses, development planning and feasibility studies for real estate portfolios and existing buildings, both in public and private sectors, Bjørberg et al. (2012) have documented the scope of unfortunate technical solutions, detailed design and use of materials are remarkably large, even within new buildings. These detrimental solutions leads to unnecessarily high operating and maintenance costs, increased replacement rate and negative impact on core business, in terms of disruption and in the worst cases even HSE (Health, Safety, Environment) related issues. Larssen and Bjørberg (2013) also found that a large proportion of the buildings, 31 per cent, is evidenced as ill suited, inefficient from operational level, with poor usability, and is too expensive for adjustments. These factors substantially reduce the functional life of buildings. The most striking finding is that many examples are relatively new buildings. Hence, these findings indicate that modest investments in early phase planning of Real Estate (RE) and Facilities Management (FM), hereunder life cycle considerations can provide very high return on the investments both to owners and to users of buildings.

However, despite the fact that early phase planning and life cycle considerations can be very profitable and beneficial for users, owners, environment and society (Larssen and Bjørberg, 2007), there is limited empirical research about how owners and users of buildings actually carry out early phase planning to facilitate value creation for owners and users of buildings. According to a Norwegian definition (NOU: 22:2004) "good property management is to give the users satisfactory and efficient buildings at the lowest possible costs/use of resources". In addition to this a government white paper Meld. St. 28 (2011-2012) points out the sustainability element in properties and states that "sustainable properties create the best usability for the core business over time and meet the demands of the owners, property managers and society".

This paper presents some findings from the first part of the research project Oscar, which is partly funded by the Norwegian Research Council. Oscar's starting point is an assumption about clear connections between early phase planning and design and value creation for owners and users during the buildings' operational phase. To get good, adaptable and usable buildings over time, there is a need for competent players with good decision and communication tools for projects and processes. The Life Cycle Aspect is essential as an input in early phase planning. The aim of Oscar is to develop knowledge, methods and tools that enable optimization of the building design given the owners and users' needs. In this way, buildings can contribute to good value creation during its lifetime – both for owners and users.

The left hand side of Figure 1 shows the research model, Oscar's Value Contribution Map, which is designed on the basis of EN15221 (CEN, 2006), the European FM standard. The model contains two headings, namely "space and infrastructure" and "people and organization". The value creation is understood as a result of the interaction between space and infrastructure and people and organization and value contributions from among others planners, architects, consultants, contractors, deliveries, Facility Managers and service providers.

< Insert Figure 1: Oscar's Value contribution map and value contribution model approximately here >

The right-hand side in Figure 1 shows Oscar's value contribution model, which in the early phase (WP 1) includes characteristics that can be divided into four dimensions, namely the economic, social, environmental and physical dimension. If the last one is bad, it affects the other dimensions. These dimensions were established through a literature review, case studies and workshops. WP 2 includes the strategy means, which consist of contract, economic incentives, and knowledge, which interact with the early phase characteristics. EPP indicates Early Plan Phase, D indicates Detail Design Phase, C indicates Construction phase and O indicates Operational use of the system. WP 3 includes development of tools and methods to improve the interaction between the early phase and the construction phase.

This paper present results from Oscar's WP 1. The research question is how do early phase planning of Real Estate (RE) and Facilities Management (FM) create value for owners and users of commercial and public sector buildings?

The paper's further structure is first a literature review concerning value creation and early phase planning, thereafter sections about methods, results, discussion, and finally the conclusions.

2 Value creation and early phase planning

Value creation is not yet a clearly defined concept, but it includes value contribution orientation in every project or process. From a psychological perspective, the basic value system is defined by Rokeach (1960) as relatively robust organization and structures of beliefs that pertain to the more desirable individual and social forms of behaviour and finite states of existence in the continuum of relative significance. From socio-psychological view Temeljotov (2005) states that "every environment surrounding 'humanity' has certain features, characteristics that need special attention, simply because they are very important for humans, their life, survival, living, leisure and work". The interaction models between individual and environment are gathering on analyses of social variables (individual and group, personality, culture, part, organization, social-economic environmental processing, sphere and frequencies characteristics) considering the influence of physical facts and variable's analyses of nature and shaped environment (characteristics of architecture and landscape, characteristics of the processes).

In the RE and FM fields value creation goes in line with added value ability of real estate decisions, processes and inputs to create shareholder's wealth (Jensen et al., 2012a, 2012b; Finch, 2011; Lindholm, 2008). Especially when it leads to add-on benefits or customer, value in addition to core benefits (Menon et al., 2005). Coenen et al. (2012) propose FM as a "Value network" - network of relationships, which creates perceived value amongst key stakeholders (clients, customers and end users). Similarly, Hjelmbrekke and Klakegg (2013) state that value creation is the result of human activity and this is the only source of new value, where they define different values, like: value creation, use value, exchange value, captured value and value proposition. Coenen et al. (2012) prepare a list of different multiple dimensions of FM value: exchange value, use value, environmental value, relationship value and financial value, and emphasized that key stakeholders are seen as an integrated economic system to co-create value in FM.

From the user perspective, the value elements are connected with better living condition, like sustainability, adaptability, reliability, flexibility, perceived value for benefits (Sarasoja and Aaltonen, 2012; Valen et al., 2014; Haynes, 2008; Menon et al., 2005; Thompson, 1990; Zeithaml, 1988). The building's effect on the user brings us to the concept of usability, which according to ISO 9241-11 (1998) is defined as "the extent as to which a system can be used by specific users to achieve specific goals with effectiveness, efficiency and satisfaction in a specified context of use". According to Alexander (2008), usability "includes all aspects of the users' experience when interacting with the product, service, environment or facilities". Usability particularly focus on "task efficiency and effectiveness", according to Nenonen et al. (2008), and Alexander et al. (2013) describe "User experience" as "the core of usability". Hence, buildings that provide good user experiences usually also provide a high degree of usability.

For the business, the focus is in the harmonization of the resources and provisions (Coenen et al., 2012, Jensen et al., 2012a, 2012b; Boge, 2012; Huovila and Hyarinen, 2012). In the findings, they state a number of different definitions and focus points on added value of FM, dependent on the academic field and the area of application. Different research perspectives provide, in combination, a holistic view by integration of an external market based view (aimed output) and the internal resource based view (input from FM and RE). The emphasis for added value of FM include the focus on strategic aspect of FM towards the business impacts and effects (Jensen et al., 2015). The concept of added value or value creation changes the perspectives from the traditional cost reduction orientation of FM (Jensen et al., 2015; Coenen et al., 2012; Sarasoja and Aaltonen, 2012; Boge, 2012). A change from FM as a mean for cost reductions to FM as mean for value creation may necessitate increased outsourcing of FM, because outsourcing of FM may facility innovation and increased value creation. However, organizations that outsource FM may also face serious obstacles to value creation, such as adverse selection and moral hazard problems (Boge 2012).

Huovila and Hyrainen (2012) listed possible drivers which motivate better solutions, such as: trends (including sustainable renovating /refurbishment), demands from society, market internationalization, international ownership, awareness of the client (social responsibility), international ranking, new products/ services, ethical goals, demanding client, new actors on the market, strong brand, significant quality problems. Strong brand also include an identification of a corporate image. Bromley (2000) defines that corporate identity is a mode of corporate presentation; corporate image is a mode of its presentation in the public, and; corporate reputation is how the external interested groups perceive it.

The style that marks various processes in the organization is part of the organizational culture, and can be divided to explicit (urbanistic-architectural, bio-ergonomic, informational, technological and "micro-electronic" aspect, ecological viewpoint, material symbolic) and implicit culture (manifested mainly in various characteristics of social climate, values, beliefs, the image of organization etc.) (Rus, 1997). An image of the environment is created because the process between the observer and the environment is subjective: this produces images of various experiences, emotional perceptions of various observers that can be completely different. Intellectual, emotional or pragmatic complex of perception can be dominant, depending on various circumstances and capabilities of the subject (Trstenjak, 1987).

From many conferences in the area of life cycle (LC) planning and economics during the years 1995-2015 (CIB W70, EFMC, IALCC, ICCREM, CEN, ISO) it is seen that the knowledge is emerging within academia, but this knowledge is still largely absent in the construction industry. The classification of LCC was supported in Nordic countries (Bjørberg et al., 2005), on European level and within ISO (5868, part 5 "Whole Life Costing"). All mentioned levels include an LCC approach for new and existing buildings.

In Norway, there has been an increasing interest and focus on LCC in recent years, especially after revision of the public procurement law (Listerud et al., 2012), established requirements for calculations of the net present value (NPV) of the consequences of the investments over a defined period. NPV calculations facilitate comparisons of investment alternatives, and may thus also facilitate better decisions.

According to Leiringer and Bröchner (2010), the construction industry is changing its focus from cost efficiency to added value, and this shift broadens the construction industry's scope from product delivery to design, production, operation and maintenance, and even facilities management. One implication of this shift for the construction industry is increased importance of early phase planning, to improve the construction industry's ability to satisfy the clients' needs. Gottlieb and Haugbølle (2013) suggested that fundamental dynamics of collaboration in the construction industry could be understood as three activity systems of production, values and interest. The activity system of values institutionalizes creation and maintenance of culture, community and professional identity. Culture, community and professional identity are all important determinants for early phase planning. El. Reifi and Emmitt (2013) found that design time is one of the factors that seriously hinder development of design value. Other obstacles are lack of early contractor involvement, poor communication and management, the design team's attitudes, and their ability to understand the clients' goals. The design is highly consequential for the buildings' ability to meet the clients and the users' needs during the use phase.

The Nordic project Sustainable refurbishment (2013-2015) shows that building adaptability in terms of possible reconstruction/refurbishment for changed use is one of the most important measures for achieving the effective framework for the business in a long term. In the hospital sector, it was often seen that neglecting the adaptability perspective can lead to higher costs for core business in the long term (Valen et al., 2014). Lack of adaptability can affect the possibility for different modifications and can therefore influence the organization's efficiency.

The VALPRO project (Arge and Hjelmbrekke, 2012) found a lack of understanding of the project owner's/users' strategic objectives and lack of methodology for translating them into functional buildings. The new findings from that research shows the movement of the main project target from a finished building towards the effect of owning and using the building over its lifetime. In the construction industry, both in Norway and internationally, this is a new approach that requires in-depth knowledge of the owner, core business, user and LC planning to prepare new models and processes. Green and Jack (2004) discuss values and value mapping, to support three main FM branches place, people, and processes, and to optimize business support. They stress value mapping solutions as one of the value drivers.

The concept and function of "Value Management" (Shen, 2013) emphasize it is important to coordinate various actors' values before early planning the project. The project has to look at the needs, so the content should be in function with "Property Management" including "Value Management" from the early analysing phase through all phases of building lifecycle. The function should ensure that defined owner's/user's added value requirements in the early phase are ensured and safeguarded through the design/build/delivery phase and monitored in the "use phase". International trends also show that increasing the clarification between the distinctions "Architectural and Engineering Early Phase Plan"

and “Architectural and Engineering Detailing Design” can strengthen the integrated approach in the early stages to deepen the project's value over time. However, according to Klakegg et al. (2013, pp. vi-viii), in building projects, governance and project management issues may represent significant obstacles for value creation.

3 Methods

The data in this paper have been collected through a national online survey in Norway from May 2015 until mid-October 2015. The main channels for distributing the invitation to participate in the survey were business sector organizations such as Norwegian Building and Real Estate Association, the Architects’ association, and the Consulting Engineer’s association. Even employees in the organizations participating in Oscar’s consortium, and several others received invitations. The vast majority of respondents are employed by other organisations than those participating in Oscar’s research consortium.

This survey did not address end users of RE and FM, but addressed specifically respondents working with RE and FM on strategic or tactical level in their organisations. The respondents (N = 837) who answered the web survey are not a result of random sampling. It is thus not possible to generalize the results. However, the sample gives a good picture of Norwegian owners’ and even users on strategic and tactical level (customer) perspectives on RE and FM in private enterprises, hybrid organisations and public administrations.

The online questionnaire was developed based on findings in Oscar’s literature survey during the fall 2014, several workshops and meetings with the research consortium’s partners during the second half of 2014 and early 2015, and even some students’ bachelor and master thesis written during the spring 2015.

The questionnaire begins with questions about the respondent’s demographic data and background (Q1 employer, Q2 gender, Q3 age, Q4 education, Q5 main role in RE projects, Q6 main tasks in RE projects, Q7 what kind of RE projects the respondent has been involved in). In Q8 the respondent is asked about her or his perspective (owner or user) when answering the remaining questions concerning Q9 the economic dimension (11 items + open question), Q10 the social dimension (11 items + open question), Q11 the environmental dimension (9 items + open question) and Q12 the physical dimension (11 items + open question). The questionnaire also includes questions Q13 about owners vs. users perspective on RE, Q14 reporting, and Q15 obstacles against value creation (18 items + open question). Q13 and Q14 are not on the agenda in this paper. This paper emphasizes the four value dimensions Q9, Q10, Q11 and Q12, and Q15 obstacles against value creation.

All questions about the respondents’ background, except the age question, are nominal level variables, and thus inherently qualitative. The questions in the four value dimensions (Q9, Q10, Q11 and Q12) have a four item Likert scale on ordinal level, ranging from “No emphasis” = 1, “Some emphasis” = 2, “High emphasis” = 3, to “Very high emphasis” = 4, and 9 = “Don’t know/Not relevant”, and thus inherently quantitative. Even the questions about obstacles against value creation (Q15) have a similar four-item Likert scale supplemented with “Don’t know/Not relevant”. The “Don’t know/Not relevant” answers in the four value dimensions Q9, Q10, Q11 and Q12, and in the obstacles against value creation Q15 were coded as missing (9), but were kept apart from those who had not answered the question (system missing, coded as 99).

The paper’s data concerning the four value dimensions Q9, Q10, Q11, Q12 and the obstacles against value creation in Q15 are thus ordered categorical; i.e. ordinal level data where the ordering is clear, but where the absolute distance between the levels is unknown (Agresti 2010, p. 2). According to Agresti (2010, p. 4) there are two approaches to analyses of ordinal data, which are inherently quantitative. The first is to ignore ”the categorical nature of the response variable”, and to use ”standard parametric methods for continuous response variables”, and to assign ”numerical scores to the ordered categories” and to use ordinary least square (OLS) regression, such as linear regression. The other approach is to use non-parametric methods that ”use only the ordering information about the categories”, based on ”rank and models for cumulative response probabilities”. One reason that many researchers ignore the categorical or discrete nature of ordinal variables, according to Tabachnick and Fidell (2014, p. 38-39) is that the ”underlying scale is thought to be continuous”. That is the case in this paper.

The survey data have been analysed with IBM SPSS version 23. The most important analytical methods have been descriptive statistics (frequency, mean, etc.), exploratory factor analysis (EFA), and OLS linear regression.

Factor analysis (FA) is based on analysis of the shared variance between the variables. In FA, the latent variables are assumed to produce the respondents' score on the variables. The main question in EFA is thus according to Tabachnick and Fidell (2014, p. 662), "what are the underlying processes that could have produced correlations among these variables"?

The present research is based on EFA with Maximum Likelihood (ML) factor extraction. ML factor extraction maximise the canonical correlation between the variables and factors (Tabachnick and Fidell 2014, p. 689). In canonical correlation, the aim is to identify and maximise the common (shared variance) between several metric independent variables (IVs) and several metric dependent variables (DVs) (Hair et al., 1998, p. 444; Tabachnick and Fidell, 2014, p. 617-618). Rotation often makes it easier to interpret EFA solutions. The present research is based on VARIMAX rotation because orthogonal rotation usually provides clear separation of the factors; i.e. high or low factor loadings (Hair et al., 1998, p. 109-110). All other things equal, clear separation between high and low factor loadings simplifies interpretation of the rotated factor matrix.

Factor loadings as small as +/- .30 can be significant if the sample size exceeds 350 (Hair et al., 1998, p. 112 Table 3.2). This is the case in the present research, where it is possible to utilize factor loadings down towards .30, or if there is a clear separation between the factors with approximately 0.30 if the items have factor loadings on more than one factor.

The results from EFA are often used to establish new composite variables (constructs); i.e. summated scales by adding variables loading on the same factors and calculating the mean score. All other things equal, summated scales reduce measurement error and simplify identification of common factors (Hair et al., 1998, p. 116-1117). Based on the factor analysis, seven constructs were established. These constructs are continuous and vary between minimum 1 and maximum 4, and are thereby possible to use as data for OLS linear regressions. The constructs' reliability (internal consistency) has been tested through calculation of Cronbach's Alpha, which ranges from 0 to 1.0, and .60 is usually considered the lower limit of acceptability in exploratory analyses. However, the rule of thumb is usually to require a Cronbach's Alpha of at least .70 (Hair et al., 1998, p. 88, 118).

The constructs have been analysed through bivariate and multiple OLS linear regressions. It is worth to notice that in multiple OLS linear regression, the unstandardized b-values not only tell us the regression line's slope, but also to which degree each IV affects the DV's outcome (i.e. the "effect"), when the other IVs in the model are held constant (Jaccard and Turrisi, 2003, p.8). Thus, the b-values in multiple OLS linear regressions represent the effect of each IV on the DV controlled for the model's other IVs. It is similarly worth to notice that the IVs' standardised Beta values (Beta or β) in OLS linear regressions tell us the number of standard deviations the DV will change if the IV in question is changed one standard deviation (Jaccard and Turrisi, 2003, p. 8-9; Field 2013, p. 340). The Beta is measured in standard deviations, and is thus a standardised effect measure, which can be compared across studies.

4 Results

This section provides an overview of the respondents and their answers to questions about which factors in early phase planning of buildings they perceive create or do not create value for owners and users of buildings. EFA of the respondents' answers made it possible to reduce the data to seven composite variables or constructs. These seven constructs have been used to develop six hypotheses to elucidate the research question about how early phase planning of Real Estate (RE) and Facilities Management (FM) create value for owners and users of commercial and public sector buildings. The six hypotheses have been tested through analyses of correlations and OLS linear regressions.

4.1 The respondents

The 837 respondents consist of 460 (55.0 per cent) from private enterprises, 111 (13.3 per cent) from hybrid organisations and 266 (31.8 per cent) from public administrations (government, counties and municipalities). The gender distribution is almost 20-80, namely 173 or 20.7 per cent women and 663 or 79.3 per cent men. The 459 respondents from private enterprises who have answered the question about employer and gender consist of 82 women (17.9 per cent) and 377 men (82.1 per cent). The 111 respondents from hybrid organizations consists of 24 women (21.6 per cent) and 87 men (78.4 per cent).

The 266 respondents in public administrations consists of 67 women (25.2 per cent) and 199 men /74.8 per cent). Thus, the majority of respondents are men employed by private enterprises or public administrations. There are relatively more female respondents among those employed by hybrid organisations and public administrations than among those employed by private enterprises.

What about the respondents' age? In Norway, RE and FM is often considered the grey haired persons' businesses. The respondents' age ranges from 22 to 83 years. The respondents' mean age is 49.7 years, and the median age is 50 years (N = 832). Thus, half of the respondents are 50 years or older. In other words, the respondents confirm the commonly held assumption in Norway as RE and FM as the grey haired persons' business.

What about the respondents' education? 600 respondents (71.9 percent, 96 women and 504 men) have a degree in engineering. 85 respondents (10.2 percent, 26 women and 59 men) have a degree in business administration. 54 respondents (6.5 percent, 21 women and 33 men) are architects. 47 respondents (5.6 percent, 12 women and 35 men) have other educations, and many of these are various kinds of artisans. 30 respondents (3.6 percent, 12 women and 18 men) have education in finance, investment and law. Finally, 19 respondents (2.3 percent, 5 women and 14 men) have education in social sciences or humanities.

The respondents' two most common roles are property and landowner (N= 198, 23.7 percent) and consultant engineer (N= 170, 20.4 percent). The third most common role is property manager (N =149, 16.1 percent). The least common roles are property agent (N = 1, and 0.1 percent) and supervisory authority (N = 11, 1.3 percent). Only 27 respondents (3.2 percent) represent tenants or users. 19 respondents (2.3 percent) represent FM service providers. 425 (51.0 percent) respondents have been involved in early phase development of RE. 264 (31.7 percent) of these are employed by private enterprises. 48 (5.8 percent) are employed by hybrid organizations, and 113 (13.5 percent) are employed by public administrations. 472 (56.6 percent) respondents have been involved in the construction phase. 284 (34.1 percent) of these are employed in private enterprises, 50 (6.0 percent) in hybrid organizations, and 138 (16.5 percent) in the public sector. 284 respondents (34.1 percent) have been involved in the operational and FM-phase. 115 of these (13.8 percent) are employed by private enterprises, 59 (7.1 percent) by hybrid organizations, and 110 (13.2 percent) by public administrations.

What kind of RE projects have the respondents been involved in? 437 (52.5 percent) have been involved in commercial premises and offices. 305 (36.7 percent) have been involved in housing projects. 249 (29.9 percent) have been involved in schools. 217 (26.1 percent) have been involved in facilities for assisted living. 167 (20.1 percent) have been involved in facilities for higher education. 149 (17.9 percent) have been involved in cultural facilities. 129 (15.5 percent) have been involved in hospitals. 115 (13.8 percent) have been involved in sports facilities. 103 (12.4 percent) have been involved in other projects, such as for instance military installations. Finally, 25 (3.0 percent) have been involved in prisons. Thus, the present research's respondents have been involved in most kinds of RE projects. These respondents are not representative for the Norwegian population as such, but fairly well represent those working with RE and FM on strategic and tactical level.

4.2 The answers

Table 1 to 5 shows the respondents' answers to the questions in the Economic dimension (Q9, 11 items), the Social dimension (Q10, 11 items), the Environmental dimension (Q11, 9 items), the Physical dimension (Q12, 11 items), and Obstacles against value creation (Q15, 18 items). The questions in each dimension about the respondents' perceptions are in the same order as in the questionnaire. The answer alternatives for the questions in these dimensions was a four item Likert scale, ranging from "No emphasis" (coded as 1) to "Very high emphasis" (coded as 4), and "Don't know/Not relevant" (coded as 9).

< Insert Table 1: The Economic dimension approximately here >

Examination of the Economic dimension's reliability gave Cronbach's Alpha .795 (11 items, N = 479), which indicates a reliable questionnaire. The number of valid answers varies from 658 for Energy costs (rank 3), to 548 for Yield (rank 8). The answers' mean value vary between 3.39 for Investment costs (rank 1) and 2.30 for Market value in case of sale (rank 11). The number of Don't know/Not relevant

are particularly high for the questions about Yield (127), Total costs per workspace in the operational phase (90), Economic risk (84), Market value in case of sale (84), Cost efficient services (82), Cost efficient cleaning (52) and the Building's economic life-span (45). The high number of Don't know/Not relevant answers for these questions may indicate that future financial and operational issues are less important for the respondents than the immediate out-of-pocket expenses.

< Insert Table 2: The Social dimension approximately here >

Examination of the Social dimension's reliability gave Cronbach's Alpha .849 (11 items, N = 514), which also indicates a reliable questionnaire. The number of valid answers vary from 617 for Security and safety (rank 2) to 564 for Facilities for physical activities (rank 11). The answers' mean value vary between 3.00 for User involvement (rank 1) and 2.25 for Facilities for physical activities (rank 11). The number of Don't know/Not relevant answers is far less in the Social than in the Economic dimension, but is particularly high for the questions about Facilities for physical activities (70), Owner governance (44), and Areas facilitating formal and informal meetings (44).

< Insert Table 3: The Environmental dimension approximately here >

Examination of the Environmental dimension's reliability gave Cronbach's Alpha .893 (9 items, N = 539), which also indicates a reliable questionnaire. The number of valid answers varies from 602 for Use of materials and components with long life to 572 for Environmental certification. The answers' mean value vary between 3.19 for Energy efficiency (rank 1) and 2.06 for Use of recycled/recyclable materials (rank 9). The number of Don't know/Not relevant answers are fewer than in the Economic and Social dimensions, but are particularly high for the questions about Environmental certification (44), Greenhouse gas emissions during the building's life-span (41), and Use of recycled/recyclable materials (39).

< Insert Table 4: The Physical dimension approximately here >

Examination of the Physical dimension's reliability gave Cronbach's Alpha .856 (11 items, N = 491), which also indicates a reliable questionnaire. The number of valid answers vary from 587 for Accessibility and universal design (rank 1) to 543 for The existing building's technical condition in case of transformation and upgrading (rank 3). The answers' mean value vary between 3.13 for Accessibility and universal design (rank 1) and 2.52 for Life cycle planning (rank 9). The number of Don't know/Not relevant are fewer than in the Economic, Social and Environmental dimensions, but are particularly high for the questions about The existing building's technical condition in case of transformation and upgrading (57), Generality (35), Life cycle planning (31) and Elasticity (30). There is a particularly high number of Don't know/Not relevant answers for some of the aspects that determine buildings' long-term or lifetime value. Given the last decades' research about factors that facilitate value creation from buildings, these findings are somewhat disappointing. The research results concerning factors facilitating value creation from buildings have obviously not yet trickled down to many owners and users of buildings.

Finally, Table 5 shows the respondents' answer to the questions concerning perceived Obstacles against value creation (Q15, 18 items). The questions are in the same order as in the questionnaire.

< Insert Table 5: Obstacles against value creation approximately here >

Examination of the Obstacles against value creation's reliability gave Cronbach's Alpha .915 (18 items, N = 439), which also indicates a reliable questionnaire. The number of valid answers varied from 560 for Lack of multidisciplinary understanding in the project organisation (rank 3) to 543 for The technical professions have a too dominant role (rank 18). The answers' mean value vary between 2.76 for Lack of appropriate and unambiguous commissioning of the project (mandate) and Lack of emphasis on and competencies concerning the operational phase (both with rank 1), and 1.98 for The technical professions have a too dominant role (rank 18). The number of Don't know/Not relevant answers is

approximately as in the four value dimensions, but are particularly high for the questions about Absence of incentives for users (77), Lack of strategic foundation (51), Insufficient use of digital tools for decision support (48), and The architectural (36) and Technical professions have too dominant roles (36).

4.3 Exploratory factor analysis

The data from the Economic dimension (Q9), Social dimension (Q10), Environmental dimension (Q11) Physical dimension (Q12), and Obstacles against value creation (Q15) were subject to EFA with ML extraction and Varimax rotation. Table 6 shows the rotated factor matrix for those questions (items) with factor loadings above .3.

< Insert Table 6: Rotated factor solution (ML extraction, Varimax rotation, factor loadings > .3) approximately here >

One important measure in EFA is Bartlett's test of spericity, which tests whether there is sufficient correlation among the variables in the data matrix (Hair et al., 1998, p. 99). The sample is acceptable for FA if the p-value for Bartlett's test is less than 0.05. Another important measure is Kaiser-Meyer-Olkin's (KMO) measure of sampling adequacy, which varies between 0 and 1. A KMO of 0.8 or more is "meritorious". Above 0.7 is "middling", above 0.6 is "mediocre", and below .50 is "unacceptable" (Hair et al., 1998, p. 98-99). The dataset was suitable for EFA, because Bartlett's test of spericity (approximately Chi-Square = 9744,914, df = 1770 and $p < .001$) was less than .05, and KMO's measure of sampling adequacy was .897. The EFA made it possible to derive seven factors (F1-F7), which explain approximately 46 per cent of dataset's variance. Items with factor loadings above 0.3 and/or with approximately 0.3 separation between the factor loadings if there are factor loadings on more than one factor have been included in each factor.

The first factor F1 denoted Obstacles (17 items) includes several obstacles to value creation. All these items are from the questionnaire's dimension Obstacles to value creation. Most of these items are about poor planning and project management. F1 Obstacles explains approximately 12.2 per cent of the variance.

The second factor F2 denoted Environment and LCC (11 items) includes mainly questions about environment, energy efficiency, materials, waste management, environmental certification and life cycle costs. Eight of these items are from the questionnaire's Environmental dimension, two are from the Economic dimension and one is from the Physical dimension. F2 Environment and LCC explains approximately 6.6 per cent of the variance. The items Life cycle planning (Physical dimension) and Energy costs (Economic dimension) have been included for theoretical reasons, even if the rotated solution gave modest separation between these factors. Environmental issues are important for the environment as well for the organisation's bottom line and a building's life cycle costs.

The third factor F3 denoted Usability (six items) includes questions about area use, accessibility and universal design, the building's condition in case of transformations or upgrades, materials, user involvement and effect on the core business. Four of these items are from the questionnaire's Physical dimension, one is from the Social dimension and one is from the Economic dimension. F3 explains approximately 3.3 per cent of the variance. The items The Existing building's condition in case of transformation and upgrade (Physical dimension) and Suitable materials for intended use and life-span (Physical dimension) have been included for theoretical reasons, even if the rotated solution gave moderate factor separation for these items.

The fourth factor F4 denoted Image (five items) includes questions about architectonic qualities, interior, pride and organisational culture, parking facilities for bicycles and facilities for physical exercises. Four of these items are from the Social dimension, and one is from the Physical dimension. The item Parking facilities for bicycles (Physical dimension) has been included for theoretical reasons, even if the rotated solution gave modest factor separation for this item. Image is of high importance for many organisations, and buildings are often used as highly visible landmarks and advertising posts for organisations that emphasises image building.

The fifth factor F5 denoted Financials (four items) include questions about Yield, Economic risk, Market value in case of sale and Investment costs. All items in F5 Financials are from the Economic dimension.

The sixth factor F6 denoted Adaptability (three items) include questions about the building's Flexibility, Elasticity and Generality. All items in F3 Adaptability are from the Physical dimension. Adaptability is of high importance for a building's future value, as well for a building's life cycle costs and environmental impact.

The last factor F7 has been denoted FM (four items) and these questions are about Cost-efficient services, Cleaning costs, Safety and security and Total cost per workspace in the building's operational phase. Three items are from the Economic dimension, and one is from the Social dimension. The item Security and safety (Social dimension) has been included for theoretical reasons, even if the rotated solution gave moderate factor separation for this item. FM is of high importance for both the users' experience with a building, for the users' and building owners' operational costs, as well for the building owners' return on their investment.

Based on the EFA, seven constructs F1 Obstacles, F2 Environment and LCC, F3 Usability, F4 Image, F5 Financials, F6 Adaptability and F7 FM were established.

< Insert Table 7: Constructs, factor loadings and reliability approximately here >

Table 7 shows the seven constructs have factor loadings between .796 and .357. The inter-item correlations vary between .723 and .098. All constructs have a Cronbach Alpha above .70 and thus acceptable reliability. Hence, the seven constructs seem reasonable, given their N, number of items, factor loadings, inter-item correlations and Cronbach Alphas.

< Insert Table 8: The constructs' means, medians, SD and distributions approximately here >

Table 8 show the seven constructs with their means, medians, SDs and distributions. The means vary between 2.55 (F1 Obstacles) and 3.04 (F3 Usability). The standard deviations vary between .550 (F1 Obstacles) and .782 (F5 Financials). F1 Obstacles, F2 Environment and LCC, F3 Usability and F4 Image have SDs less than .60. F5 Financials, F6 Adaptability and F7 FM have standard deviations between .642 and .782. Thus, the respondents agree somewhat more about the four first constructs than the last three.

There are several ways to calculate skewness and kurtosis. SPSS' method for calculation of skewness and kurtosis assumes that perfect normal distributions have zero skewness and zero kurtosis, and skewness and kurtosis within +/- 1,0 is usually considered as acceptable distributions (Field 2013, p. 182). Positive skewness indicates several low scores, and negative skewness indicates several high scores. F1 Obstacles, F2 Environment and LCC, F3 Usability and F4 Image have slightly negative skewness. F5 Financials, F6 Adaptability and F7 FM have slightly positive skewness. Positive kurtosis indicates peaked distributions with heavy tails, and negative kurtosis indicates flat distributions with light tails. F3 Usability and F4 Image have slightly positive kurtosis. F1 Obstacles, F2 Environment and LCC, F5 Financials, F6 Adaptability and F7 FM have slightly negative kurtosis. Thus, Table 8 shows the seven constructs have approximate normal distributions, which make them acceptable for OLS models.

4.4 Hypotheses

Based on the results of the EFA there have been established six hypotheses to investigate the research question, namely how early phase planning of RE and FM can create value for owners and users of commercial and public sector buildings:

H1: There is a negative relation between F1 Obstacles and F3 Usability.
H2: There is a positive relation between F2 Environment and LCC and F3 Usability.
H3: There is a positive relation between F4 Image and F3 Usability.
H4: There is a positive relation between F5 Financials and F3 Usability.
H5: There is a positive relation between F6 Adaptability and F3 Usability.
H6: There is a positive relation between F7 FM and F3 Usability.

The hypotheses have first been tested through examination of the constructs' correlation matrix. The hypotheses have thereafter been tested through use of bivariate and multivariate OLS linear regression

models with construct F3 Usability as DV and proxy for a building's value for owners and users. The six other constructs F1 Obstacles, F2 Environment and LCC, F4 Image, F5 Financials, F6 Adaptability and F7 FM were IVs in the regression models.

4.5 Testing of the hypotheses

Table 9 shows the results of the first test of hypotheses H1-H6, based on examination of the constructs' correlation matrix.

< Insert Table 9: The constructs' correlation matrix approximately here >

Cohen (1988) distinguished between small, medium and large effect sizes, and established .10, .30 and .50 as limits for small, medium and large effect sizes for Pearson's Rho (r). The correlation matrix show that F1 obstacles is almost uncorrelated with F2 Environment and LCC, F3 Usability, F4 Image and F7 FM ($r < .10$, $p > .05$) and slightly correlated with F5 Financials ($r = .196$, $p < .001$) and F6 Adaptability ($r = .120$, $p < .05$). These findings clearly weaken hypothesis H1 about a negative relation between F1 Obstacles and F3 Usability.

F2 Environment and LCC is similarly highly correlated (large effect size) ($r > .50$, $p < .01$) with F3 Usability, F4 Image, F7 FM and partly also with F6 Adaptability ($r = .472$, $p < .01$). F2 Environment and LCC is almost medium correlated (almost medium effect size) with F5 Financials ($r > .2$, $p < .001$). These findings clearly strengthen hypothesis H2 about a positive relation between F2 Environment and LCC and F3 Usability.

F3 Usability is strongly correlated ($r > .50$, $p < .001$) with F4 Image, F6 Adaptability and F7 FM. These findings clearly strengthen hypotheses H3 about a positive relation between F4 Image and F3 Usability; H5 about a positive relation between F6 Adaptability and F3 Usability; and H6 about a positive relation between F7 FM and F3 Usability.

F3 Usability is almost uncorrelated with F5 Financials ($r < .05$, $p > .05$). This finding clearly weakens hypothesis H4 about a positive relation between F5 Financials and F3 Usability.

Finally, Table 9 shows that F4 Image is strongly correlated ($r > .50$, $p < .001$) with F7 FM and medium to strongly correlated with F6 Adaptability ($r = .433$, $p < .001$). F4 Image is also almost medium correlated ($r > .20$, $p < .001$) with F5 Financials. F6 Adaptability is almost strongly correlated with F7 FM ($r = .449$, $p < .001$).

The second test of hypothesis H1-H6 is a series of bivariate OLS regressions with F3 Usability as DV and the other six constructs as IVs.

< Insert Table 10: Bivariate regressions with F3 Usability as DV approximately here >

Table 10 shows that it is possible to rule out F1 Obstacles and F5 Financials as explanations of F3 Usability. Firstly, F1 Obstacles and F5 Financials are not statistically significant ($p > .05$). Secondly, Beta is smaller than .10. Finally, R^2 or explained variance in the bivariate regressions with F1 Obstacles and F5 Financials as IVs is zero; i.e. F1 Obstacles and F5 Financials cannot explain any of F3 Usability's variance. Thus, these linear bivariate regressions exclude F1 Obstacles and F5 Financials as explanations of F3 Usability, and seriously weaken H1 about a negative relation between F1 Obstacles and F3 Usability, and H4 about a positive relation between F5 Financials and F3 Usability.

Table 10 similarly shows that F2 Environment and LCC, F4 Image, F6 Adaptability and F7 FM can explain significant parts of F3 usability's variance. Firstly, these four IVs are statistically significant ($p < .05$). Secondly, their Betas are above .50. Finally, R^2 vary between .387 (F2 Environment and LCC) and .262 (F6 Adaptability). Thus, F2 Environment and LCC can seemingly explain 38.7 per cent of F3 Usability's variance. F7 FM can similarly explain 31.3 per cent, F4 Image 27.6 per cent, and F6 Adaptability 26.2 per cent of F3 Usability's variance. Thus, even these findings strengthen H2 about a positive relation between F2 Environment and LCC and F3 Usability; H3 about a positive relation between F4 Image and F3 Usability; H5 about a positive relation between F6 Adaptability and F3 Usability; and H6 about a positive relation between F7 FM and F3 Usability.

However, these results are too good to be 'true'. The correlation matrix in Table 9 shows medium to high correlation between F2 Environment and LCC, F4 Image, F6 Adaptability and F7 FM and with F3 Usability. Thus, to find the 'true' effect of F2 Environment and LCC, F4 Image, F6 Adaptability and F7

FM on the DV F3 Usability, we have to control for the effect of the other IVs on each IV through use of multiple regression. Multiple regression makes it possible to keep the other IVs constant (control variables). By doing this we can find the "true" effect of each IV on the DV F3 Usability controlled for the effect of the other three IVs.

The final test of hypotheses H2, H3, H5 and H6 is therefore a multiple regression with F2 Environment and LCC, F4 Image, F6 Adaptability and F7 FM as IVs and F3 Usability as DV. Table 11 show the results. The model with F2 Environment and LCC, F4 Image, F6 Adaptability and F7 FM as IVs can explain 48.8 per cent of the variance in F3 Usability as DV, which is very good.

< Insert Table 11: Multiple regression with F3 Usability as DV approximately here >

The first thing to notice in Table 11 is that all the four IVs F2 Environment and LCC, F4 Image, F6 Adaptability and F7 FM are statistically significant ($t > 2.56$ and $p < .01$). These findings clearly strengthen hypotheses H2, H3, H5 and H6 that F2 Environment and LCC, F4 Image, F6 Adaptability and F7 FM can explain variation in F3 Usability.

The other thing to notice is that when controlling for the other three IVs, F2 Environment and LCC's unstandardized B is reduced from .556 in the bivariate regression (Table 10) to .285 in the multiple regression; i.e. approximately half the effect. But there is still a positive and statistically significant effect. F2 Environment and LCC's Beta is similarly reduced from .622 to .316, even here half the effect, but it is still there. These findings clearly strengthen H2 about a positive relation between F2 Environment and LCC and F3 Usability.

The same is the case for F4 Image, where there unstandardized B is reduced from .487 in the bivariate regression to .285 in the multivariate regression controlled for the other three IVs. There is even here still a positive and statistically significant effect. F4 Image's Beta is similarly reduced from .525 in the bivariate regression to .130 in the multiple regression. Thus, controlling for the other IVs reduce F4 Image's Beta with DV F3 Usability to a fourth compared to the bivariate regression, but the positive effect is still there. These findings clearly strengthen H3 about positive relation between F4 Image and F3 Usability.

F6 Adaptability's unstandardized B is similarly reduced from .363 in the bivariate regression to .145 in the multiple regression; i.e. approximately the half. Even here, a positive and statistically significant effect is still present. F6 Adaptability's Beta is also reduced from .512 in the bivariate regression to .200 in the multiple regression, i.e. only forty percent of the bivariate regression's Beta, but the positive effect is still present. Even these findings strengthen H5 about a positive relation between F6 Adaptability and F3 Usability.

The unstandardized B for F7 FM is reduced from .460 in the bivariate regression to .185 when controlled for the other three IVs in the multiple regression; i.e. almost sixty per cent less than in the bivariate regression. Nevertheless, there is even here still a positive and statistically significant effect left. Even F7 FM's Beta is reduced from .560 in the bivariate regression to .221 in the multiple regression, to approximately forty per cent of the bivariate regression's Beta. However, the effect is still present. These findings clearly strengthen H6 about a positive relation between F7 FM and F3 Usability.

Thus, multiple regression, which controls for the effect of the other three IVs reveals significantly reduced unstandardized B and standardized Betas in all the four IVs compared to the bivariate regressions, but hypotheses H2, H3, H5 and H6 still hold. Based on the results of the multiple regression there is largest effect (unstandardized B) on the DV F3 Usability from F2 Environment and LCC (.285), second largest effect from F7 FM (.185), third largest effect from F6 adaptability (.145) and smallest effect from F4 Image (.121).

The third thing to notice is the part correlation, which is the correlation between the IV in question and the DV controlled for the effect of the other IVs in the model's effect on the DV. Each IV's part correlation thus tells us the unique relationship between each IV and the DV (Field 2013, p. 341). The part correlation or the net effect of each IV on the DV is usually significantly smaller than the zero order correlation (Pearson's Rho) which is almost similar to Beta in bivariate regressions. In Table 11 we can see the part correlation between F2 Environment and LCC and F3 Usability is .233, a medium strong effect size according to Cohen (1988). Even this finding strengthens H2 about a positive relation between F2 Environment and LCC and F3 Usability. The part correlations between F6 Adaptability and

F3 Usability and between F7 FM and F3 Usability are .168. This is almost a medium strong effect size, according to Cohen (1988). These findings strengthens H5 about a positive relation between F6 Adaptability and F3 Usability, and H6 about a positive relation between F7 FM and F3 Usability. The part correlation between F4 Image and F3 Usability is only .098, which is a small effect size according to Cohen (1988). Nevertheless, even this finding strengthens H3 about a positive relation between F4 Image and F3 Usability. Thus, the part correlations are only between a third (F2 Environment and LCC, F6 Adaptability and F7 FM) and a fifth (F4 Image) of the zero order correlations shown in Table 10, but the part correlations clearly strengthen hypotheses H2, H3, H5 and H6.

Finally, multicollinearity; i.e. perfect linear relationships between the variables can be a problem in multiple regressions. The variance inflation factor (VIF) is a common measure of indications of multicollinearity. The rule of thumb, according to Field (2013, p. 325-326) is that a VIF larger than 10 is "cause for concern", and an average VIF "substantially greater than 1" can indicate biased regressions, and tolerance less than .2 indicates "potential" problems. Thus, given Field's rules of thumb, Table 11 shows few indications of multicollinearity. In other words, there are good reasons to trust the findings from the multiple regression model concerning hypotheses H2, H3, H5 and H6, about positive relations between F2 Environment and LCC, F4 Image, F6 Adaptability, F7 FM, and F3 Usability.

5 Discussion

The six hypotheses were tested through examination of the correlation matrix and through bivariate and multiple linear OLS regression analyses, in order to elucidate the research question: How do early phase planning of Real Estate (RE) and Facilities Management (FM) create value for owners and users of commercial and public sector buildings? F3 Usability was the DV and F1 Obstacles, F2 Environment, F4 Image, F5 Financials, F6 Adaptability and F7 FM were the IVs in the regression models.

Examination of the correlation matrix and bivariate OLS regression weakened H1 about a negative relation between F1 Obstacles and F3 Usability, because there were no statistically significant relations between F1 Obstacles and F3 Usability. Thus, obstacles against value creation seem to be far less important during early phase planning for the owners and users' perception about a building's usability than formerly assumed. This finding is somewhat surprising given Klakegg et al.'s (2013, pp. vi-viii), observations that governance and project management issues may represent significant obstacles for value creation in building projects. However, the present research's findings do not rule out that project management oriented building owners during early phase planning are highly aware of possible obstacles' relevance for their building projects' success.

Examination of the correlation matrix and bivariate regression similarly weakened H4 about a positive relation between F5 Financials and F3 Usability, because there were no statistically significant relations between F5 Financials and F3 Usability. Thus, financial issues seem to be far less important during early phase planning for the owners and users' perception about a building's usability than formerly assumed. This finding is somewhat surprising given the Investment costs' high score in the survey (cf. Table 1) and the Norwegian definition (NOU: 22:2004) that "good property management is to give the users satisfactory and efficient buildings at the lowest possible costs/use of resources". However, this finding does not rule out that investment oriented building owners during early phase planning are highly aware of the financial issues' relevance for their building projects' success.

Examination of the correlation matrix, as well as bivariate and multiple OLS regressions gave strong support to H2 about a positive relation between F2 Environment and LCC, and F3 Usability. This finding very much supports former research concerning environment and LCC (Bjørberg et al., 2005; Larsen and Bjørberg, 2007; Meld. St. 28 (2011-2012); Listerud et al., 2012). The present research indicates that both owners and users are well aware of the environmental factors and the LCC's importance for the building's usability and lifetime value creation. Hebert and Chaney (2102) gave one interesting perspective of raising the awareness of sustainability through citizen participation. With active involvement of end users in the design process, sharing decision-making power and accountability, they reached the "partnership", that led to increased recognition and understanding of the importance of sustainability. Thus, user involvement in early phase planning may increase the users' awareness of environmental issues and LCC.

Examination of the correlation matrix, as well as bivariate and multiple OLS regressions gave strong support to H3 about a positive relation between F4 Image and F3 Usability. This finding supports former

research about the organisational image's importance (Trstenjak, 1987; Rus, 1997; Bromley, 2000). Image is clearly of importance for a building's perceived usability.

Examination of the correlation matrix, as well as bivariate and multiple OLS regressions gave similarly strong support to H5 about a positive relation between F6 Adaptability and F3 Usability. Thus, the present research's findings corroborate former research about the adaptability's importance for a building's perceived usability and lifetime value creation (Department of National Health and Welfare, 1979; Hakkinen and Nuutinen, 2007; Nenonen et al., 2008; Sarasoja and Aaltonen, 2012; Alexander et al., 2013; Valen et al., 2014). All other things equal, an adaptable building will normally provide better usability in the long run than a non-adaptable building.

Finally, examination of the correlation matrix, as well as bivariate and multiple OLS regressions gave strong support to H6 about a positive relation between F7 FM and F3 Usability. Thus, this finding supports former research about FM and value creation (Sarasoja and Aaltonen, 2012; Coenen et al., 2012; Jensen et al., 2012a, 2012b; Boge, 2012; Jensen et al., 2015). The present research's findings indicate that FM has to be included already during early phase planning in order to facilitate the buildings' future usability and lifetime value creation. Adequate early phase planning is also of importance for well-founded design, such as noticed by among others El. Reifi and Emmitt (2013). Inclusion of FM and other operational matters in early phase planning of buildings may substantially improve the buildings' usability, and thereby facilitate increased lifetime value creation for owners and users. Early phase planning may also, such as Leiringer and Bröchner (2010) have observed be the construction industry's opportunity to broaden its scope from product delivery to design, production and even FM. FM is of high importance for the users' perception of a building's usability.

The main take home message to owners and users who get involved in early phase planning of buildings and who would like to improve buildings' usability and lifetime value creation should prioritise the following issues: Firstly, measures that promote environment and LCC. Secondly, FM, thirdly, the buildings' adaptability, and finally measures that improve the organisation's image. However, building owners and users have to be aware that if the fundamentals are not in place, image-building will very much be like building sand castles.

Further empirical research is needed, to establish whether it is possible to generalize this study's findings. One of the problems with the current research is the slight deviations from normal distribution in some of the constructs. These deviations are most likely a consequence of the four-item Likert scale in questions about factors that create or reduce value for owners and users of buildings. Likert scales provide data on ordinal level; i.e. it is possible to rank the data, but the distance between each level in the scale is subjective and not known. One remedy for this problem is further analysis of the dataset with non-parametric methods, such as recommended by among others Agresti (2010). Further analysis with non-parametric methods can corroborate or modify the findings in this paper, and may reveal threshold values for some of the effects detected.

This dataset has so far not yet been thoroughly examined for moderation (interaction) and mediation effects. Analyses of moderation and mediation are logical further steps. One of the preliminary working hypotheses are interaction effects depending on the respondents' gender, education, employer and role in RE projects. It can also be very useful to determine whether some of the factors identified in the present research moderate the main effect between the IVs and DV F3 Usability.

The data analyses and hypotheses testing in the present research have been based on EFA with orthogonal rotation and OLS linear regressions. A third approach for further analysis can be FA with oblique rotation and confirmatory factor analysis (CFA) through use of structural equation models (SEM). SEM can also identify more complex and not so obvious relations in this study's dataset.

6. Conclusions

There are several conclusions to be drawn from this study.

The first is that a building's usability and lifetime value creation largely is determined by decisions made or not made during early phase planning. A common saying is that failing to plan, is planning to fail. In other words, building owners and building users who are reluctant to moderate investments in early phase planning may actually have to invest substantial amounts later to remedy issues overlooked during early phase planning. In some instances, the only costs for solving issues during early phase planning are time and attention. This study has shown that measures concerning environment, LCC, FM, safeguarding the building's adaptability and even some of the measures

promoting the organisation's image are very important questions during early phase planning, if the aim is a building with good usability that facilitate lifetime value creation. Some of these decisions are actually irreversible when the construction phase have been completed and the building has been taken over by the users. In worst case, inadequate early phase planning may have long-term consequences, for instance that owners and users of buildings have to live for decades with blunders and inferior solutions that actually undermine the building's usability and lifetime value creation.

The second conclusion is that whether organisations are able to implement successful FM during a building's use phase are partly also determined during early phase planning, before construction and commissioning of the building. Thus, building owners and users who desire successful FM during the use phase should consider including FM on the agenda already during early phase planning. FM is very important for the building users' perception of a building's usability.

Finally, but yet importantly, moderate investments in early phase planning may be very profitable for both building owners and users. Adequate early phase planning may significantly improve buildings' lifetime value creation. In case of later sale, building owners may all other things equal get a better price for a building that is thoroughly thought through. The users on the other hand may all other things equal get a building that is far better concerning key issues such as environmental matters, LCC, FM and operational costs, adaptability and image.

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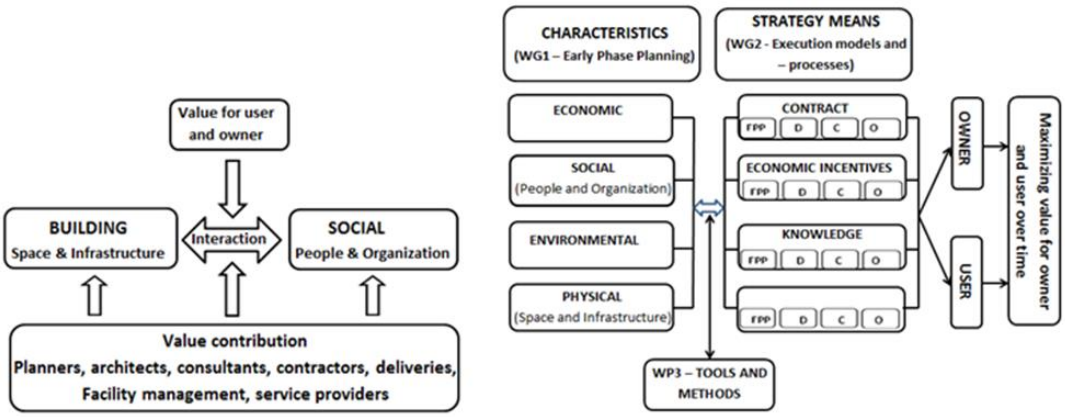

Figure 1: Oscar's Value contribution map and value contribution model

Table 1: The Economic dimension

Question	Valid N	Mean	SD	Don't know/Not relevant (N)	System missing (N)	Rank (Mean)
The building's economic life span (NPV of cash flow)	632	2.90	.828	45	160	4
Effect on core business	652	3.28	.725	24	161	2
Energy costs	658	3.07	.774	18	161	3
Investment costs	653	3.39	.698	23	161	1
Cost efficient services (front desk, catering, security, etc.)	593	2.39	.823	82	162	10
Cost efficient cleaning	623	2.55	.826	52	162	7
Life cycle costs	637	2.77	.886	37	163	5
Market value in case of sale	590	2.30	1.111	84	163	11
Total cost per workspace in the operational phase	584	2.42	.978	90	163	8
Yield	548	2.42	1.083	127	162	8
Economic risk	591	2.61	1.012	84	162	6

Table 2: The Social dimension

Question	Valid N	Mean	SD	Don't know/Not relevant (N)	System missing (N)	Rank (Mean)
Workplaces facilitating flexible ways of working	597	2.96	.800	38	202	3
Areas facilitating formal and informal meetings	591	2.78	.780	44	202	7
Promoting pride (organisation's cultural values)	599	2.68	.841	36	202	9
User involvement	613	3.00	.791	22	202	1
Owner governance	591	2.84	.756	44	202	4
Architectonic qualities	617	2.84	.735	18	202	4
Individual mgt. of sunscreens, light, temperature, etc.	608	2.67	.814	27	202	10
Interior qualities facilitating well-being and tidiness	612	2.81	.747	23	202	6
Orientable (intuitive signs, etc.)	604	2.74	.819	30	203	8
Security and safety (protection against unwanted incidents)	619	2.98	.802	15	203	2
Facilities for physical activities (gym, wardrobes, etc.)	564	2.25	.847	70	203	11

Table 3: The Environmental dimension

Question	Valid N	Mean	SD	Don't know/Not relevant (N)	System missing (N)	Rank (Mean)
Use of renewable energy sources, reduced influence on the external environment	597	2.90	.808	20	220	4
Use of materials and components with long life	602	2.96	.795	14	221	3
Use of environmentally friendly/labelled products	595	2.70	.801	21	221	5
Use of recycled/recyclable materials	577	2.06	.796	39	221	9
Energy efficiency	600	3.19	.739	16	221	1
Indoor climate and comfort	598	3.17	.720	18	221	2
Greenhouse gas emissions during the building's life-span (LCA)	575	2.37	.895	41	221	7
Environmental certification (BREEAM, etc.)	572	2.17	.919	44	221	8
Facilities for efficient waste mgt.	591	2.63	.785	25	221	6

Table 4: The Physical dimension

Question	Valid N	Mean	SD	Don't know/Not relevant (N)	System missing (N)	Rank (Mean)
Area use (logistics, movements of persons and goods, etc.)	582	3.06	.738	19	236	2
Elasticity (possibility to change the building's volume, use, etc.)	571	2.63	.836	30	236	7
Flexibility (the possibility to change the building's floor plan, etc.)	581	2.81	.835	20	236	5
Generality (the possibility to change the building's function, other uses, etc.)	566	2.34	.937	35	236	11
Innovative solutions	578	2.44	.795	23	236	10
Life cycle planning (integrated architecture and technology, long-term solutions, etc.)	570	2.52	.847	31	236	9
Parking facilities for cars	579	2.54	.773	22	236	8
Parking facilities for bicycles	580	2.75	.807	21	236	6
Suitable materials for intended use and life-span	585	2.86	.794	15	237	4
The existing building's technical condition in case of transformation and upgrading	543	2.87	.777	57	237	3
Accessibility and universal design	587	3.13	.718	13	237	1

Table 5: Obstacles against value creation

Question	Valid N	Mean	SD	Don't know/Not relevant (N)	System missing (N)	Rank (Mean)
Too much emphasis on technical and economic aspects	546	2.14	.721	33	258	16
Absence of incentives for users	502	2.41	.757	77	258	13
Lack of appropriate and unambiguous commissioning of the project (mandate)	548	2.76	.805	31	258	1
Insufficient use of digital tools for decision support	531	2.11	.789	48	258	17
Insufficient understanding of the users' real needs	559	2.62	.855	20	258	8
Insufficient organizing of the project - necessary roles and competencies not represented	556	2.67	.856	23	258	4
Lack of ambitions concerning innovations	547	2.41	.848	32	258	13
Lack of vigour and ability to make decisions	555	2.64	.926	24	258	6
Lack of multidisciplinary understanding in the project organization	560	2.73	.860	19	258	3
Lack of emphasis and competencies concerning life-cycle planning and economy	547	2.60	.832	32	258	10
Lack of emphasis on and competencies concerning the operational phase	559	2.76	.826	20	258	1
The end-users lack understanding of the scope of the delivery	558	2.61	.786	21	258	9
Lack of transfer of information from the early phase actors to those involved in the subsequent phases	552	2.64	.833	27	258	6
Lack of involvement of the end-users	557	2.47	.847	22	258	11
Lack of knowledge concerning how to describe functional and technical requirements	558	2.66	.846	21	258	5
Lack of strategic foundation	528	2.47	.913	51	258	11
The architectural profession has a too dominant role	543	2.35	.927	36	258	15
The technical professions have a too dominant role	543	1.98	.775	36	258	18

Table 6: Rotated factor solution (ML extraction, Varimax rotation, factor loadings > .3)

	Factor												
Question	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Lack of emphasis on and competencies concerning the operational phase	**.762**												-.315
Lack of multidisciplinary understanding in the project organization	**.752**												
Insufficient organizing of the project - necessary roles and competencies not represented	**.751**												
Lack of vigour and ability to make decisions	**.702**												.356
Lack of knowledge concerning how to describe functional and technical requirements	**.700**												
Insufficient understanding of the users' real needs	**.697**												
Lack of involvement of the end-users	**.691**												
Lack of transfer of information from the early phase actors to those involved in the subsequent phases	**.691**												
Lack of strategic foundation	**.685**												
Lack of emphasis and competencies concerning life-cycle planning and economy	**.678**												
The end-users lack understanding of the scope of the delivery	**.675**												
Lack of appropriate and unambiguous commissioning of the project (mandate)	**.669**												
Lack of ambitions concerning innovations	**.548**												
Insufficient use of digital tools for decision support	**.538**												
The technical professions have a too dominant role	**.428**												
The architectural profession has a too dominant role	**.420**												
Absence of incentives for users	**.360**												
Greenhouse gas emissions during the building's life-span (LCA)		**.796**											
Use of environmentally friendly /labelled products		**.784**											
Use of recycled/recyclable materials		**.678**											
Use of renewable energy sources, reduced influence on the external environment		**.675**											
Use of materials and components with long life		**.646**											
Energy efficiency		**.646**										.322	

Facilities for efficient waste mgt.		**.589**	.352										
Environmental certification (BREEAM, etc.)		**.563**											
Energy costs		**.541**						.315				.396	
Life cycle costs		**.510**						.463					
Life cycle planning (integrated architecture and technology, long-term solutions, etc.)		**.466**						.315	.403				
Indoor climate and comfort		.435	.367							.402			
Innovative solutions		.416				.303			.402				
Orientable (intuitive signs, etc.)		.391	.343	.321									
Area use (logistics, movements of persons and goods, etc.)			**.632**										
Accessibility and universal design			**.601**										
The existing building's technical condition in case of transformation and upgrading		.396	**.484**										
Suitable materials for intended use and life-span		.435	**.458**										
User involvement			**.447**										
Effect on core business			**.440**										
Owner governance			.320		.308								
Architectonic qualities				**.675**									
Interior qualities facilitating well-being and tidiness				**.649**									
Promoting pride (organisation's cultural values)				**.569**									
Parking facilities for bicycles		.340		**.401**									
Facilities for physical activities (gym, wardrobe, etc.)				**.375**									
Individual mgt. of sunscreens, light, temperature, etc.		.320		.332									
Yield					**.846**								
Economic risk					**.769**								
Market value in case of sale					**.745**								
Investment costs					**.392**								
Flexibility (the possibility to change the building's floor plan, etc.)						**.750**							
Elasticity (possibility to change the building's volume, use, etc.)						**.718**							
Generality (the possibility to change the building's function, other uses, etc.)						**.668**							
Workplaces facilitating flexible ways of working			.337	.346		.382					.357		
Cost efficient services (front desk, catering, security, etc.)							**.664**						
Cost efficient cleaning							**.624**						
Security and safety (protection against unwanted incidents)		.315	.331				**.396**						
Total cost per workspace in the operational phase							**.357**						
The building's economic life span (NPV of cash flow)		.311			.345			.512					

Parking facilities for cars										.337			
Areas facilitating formal and informal meetings				.453							.489		

Extraction Method: Maximum Likelihood. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 20 iterations.

Table 7: Constructs, factor loadings and reliability

Factor	**N**	**No. of items**	**Factor loadings**	**Inter-item correlation**	**Cronbach's Alpha**
F1 Obstacles	440	17	.762 - .360	.583 - .098	.914
F2 Environment and LCC	509	11	.796 - .466	.676 - .297	.907
F3 Usability	514	6	.632 - .440	.463 - .292	.794
F4 Image	514	5	.675 - .375	.488 - .240	.760
F5 Financials	519	4	.846 - .392	.723 - .189	.794
F6 Adaptability	557	3	.750 - .668	.701 - .570	.828
F7 FM	517	4	.664 - .357	.586 - .269	.733

Table 8: The constructs' means, medians, SD and distributions

		F1 Obstacles	**F2 Environment and LCC**	**F3 Usability**	**F4 Image**	**F5 Financials**	**F6 Adaptability**	**F7 FM**
N	Valid	441	509	514	514	519	557	517
	Missing	396	328	323	323	318	280	320
Mean		2.55	2.68	3.04	2.67	2.68	2.60	2.59
Median		2.59	2.73	3.00	2.60	2.75	2.67	2.50
Std. Deviation		.550	.591	.529	.570	.782	.752	.642
Skewness		-.126	-.100	-.511	-.141	.076	.058	.128
Std. Error of Skewness		.116	.108	.108	.108	.107	.104	.107
Kurtosis		-.281	-.387	.225	.030	-.982	-.581	-.509
Std. Error of Kurtosis		.232	.216	.215	.215	.214	.207	.214

Table 9: The constructs' correlation matrix

Constructs		F1	F2	F3	F4	F5	F6	F7
F1 Obstacles	Pearson Correlation	1						
	Sig. (2-tailed)							
	N	441						
F2 Environment and LCC	Pearson Correlation	-.008	1					
	Sig. (2-tailed)	.879						
	N	408	509					
F3 Usability	Pearson Correlation	.014	.622**	1				
	Sig. (2-tailed)	.774	<.001					
	N	402	462	514				
F4 Image	Pearson Correlation	.093	.577**	.525**	1			
	Sig. (2-tailed)	.061	<.001	<.001				
	N	404	459	461	514			
F5 Financials	Pearson Correlation	.196**	.219**	.034	.212**	1		
	Sig. (2-tailed)	<.001	<.001	.488	<.001			
	N	373	440	424	432	519		
F6 Adaptability	Pearson Correlation	.120*	.472**	.512**	.433**	.281**	1	
	Sig. (2-tailed)	.013	<.001	<.001	<.001	<.001		
	N	428	495	502	496	455	557	
F7 FM	Pearson Correlation	.063	.571**	.560**	.544**	.172**	.449**	1
	Sig. (2-tailed)	.207	<.001	<.001	<.001	<.001	<.001	
	N	397	455	453	464	459	476	517

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 10: Bivariate regressions with F3 Usability as DV

IV	Constant	Unstd. B [95% CI]	B's Std. Error	Beta	t	Sign.	R^2
F1 Obstacles	3.013	.014 [-.080 - .108]	.048	.014	.287	.774	<.001
F2 Environment and LCC	1.547	.556 [.492 - .620]	.033	.622	17.044	<.001	.387
F4 Image	1.743	.487 [.415 - .559]	.037	.525	13.224	<.001	.276
F5 Financials	2.982	.023 [-.043 - .089]	.033	.034	.694	.488	.001
F6 Adaptability	2.087	.363 [.310 - .417]	.027	.512	13.312	<.001	.262
F7 FM	1.841	.460 [.397 - .523]	.032	.560	14.340	<.001	.313

Table 11: Multiple regression with F3 Usability as DV

IV	Unstd. B [95% CI]	SE B	Beta	t	Sign.	Zero-order corr.	Partial corr.	Part corr.	VIF
Constant	1.079 [.874 - .1.284]	.104							
F2 Environment and LCC	.285 [.199 - .372]	.044	.316	6.501	<.001	.614	.310	.233	1.833
F4 Image	.121 [.034 - .208]	.044	.130	2.726	.007	.527	.136	.098	1.759
F6 Adaptability	.145 [.084 - .206]	.031	.200	4.679	<.001	.507	.229	.168	1.418
F7 FM	.185 [.107 - .263]	.040	.221	4.668	<.001	.563	.228	.168	1.740