

# Supplier Involvement in Product Development for Project Based Industries

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## ABSTRACT

There exists an increasing evidence of benefits with involving suppliers in a new product development activity in the mass production companies. Challenges such as, reduction of a product life cycle, technological uncertainties, and increased cost of R&D activity have made it necessary to extend a new product development activity, beyond the firm's boundary. However, in a project based industries this trend is not predominant and importance of innovation and suppliers, applies to this industry also. Hence, Objective of the thesis is to establish a framework for involving suppliers for a project based industry.

The qualitative research makes use of extensive literatures within the field, product development, innovation and project based industry and supplier involvement in product development. Several interviews were carried out for collection the empirical data at the case company, which is a project based organization. Required framework, a result of the thesis is achieved through an extensive empirical analysis.

The results show that a value of innovation is different between the project based industries and the mass production industries and it is perceived differently. However, innovation is equally important for a project based industry and it has a potential to include innovation within its processes. On this regard, several challenges and innovation promoting elements have been identified. Project management techniques and disruption in the knowledge transfer are some of the impediments for innovation within project based industries. The thesis provides the suggested framework to overcome these challenges and increase innovation in a project based industry and involves suppliers in its innovative and development activities.



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## 1. INTRODUCTION

Involvement of suppliers in new product development activity is widely researched within academia. The researchers have been probing this issue since 1980s (Johnsen, 2009). Initially works on this issue focused on an empirical study of Japanese automobile industries. They were the pioneers in involving suppliers in a new product development activity. Hence, earlier studies focused on the mechanism and the advantages, Japanese automobile industries have achieved through this practices. In the next decades, such practices spread into US and European markets. Once the concept of involving suppliers in new product development was well established and accepted within the global market, dynamics around these concepts have been studied. These dynamics are; associated problems with trust and other risks, setting up of performance measurements, timing of involvement and an extent of involvement (Wynstra, Weele, & Weggemann, 2001).

Alongside, this practice achieved numerous benefits for the practicing firms. Involving suppliers in new product development had proven benefits of; reduced development time and cost and increased product quality. Hence, this practice was considered as a means to attain competitive advantage. Apart from the proven benefits, forces of globalization, growth in technologies, and increasingly demanding customers have forced the firms to become extremely competitive (Cousins, Lawson, & Squire, 2008). These developments have further increased R&D costs, product complexity and difficulties in managing technological changes. Hence, firms started extending their new product development programs across the firms' boundaries. However, these situations are mainly limited to the mass production industries. This fact can be further confirmed, if we take a look at the empirical literatures on this field (Johnsen, 2009).

Despite the proven benefits and existing need for involving suppliers in new product development, similar theme of research is not found for a project based industry. This industry, vastly utilizes the suppliers in order to deliver the results. Hence, researches focusing supplier relationships and partnering aspects is very common for a project based industry. (Beach et al., 2005). The research has not extended further to investigate the involvement of contractors or suppliers in development or innovation of a project based industry. However, available literatures focus on innovation in project based industries. The literatures on this issue clearly suggest lack of innovation in project based industries (Keegan & Turner, 2002). These literatures do not extend their work beyond innovation in project

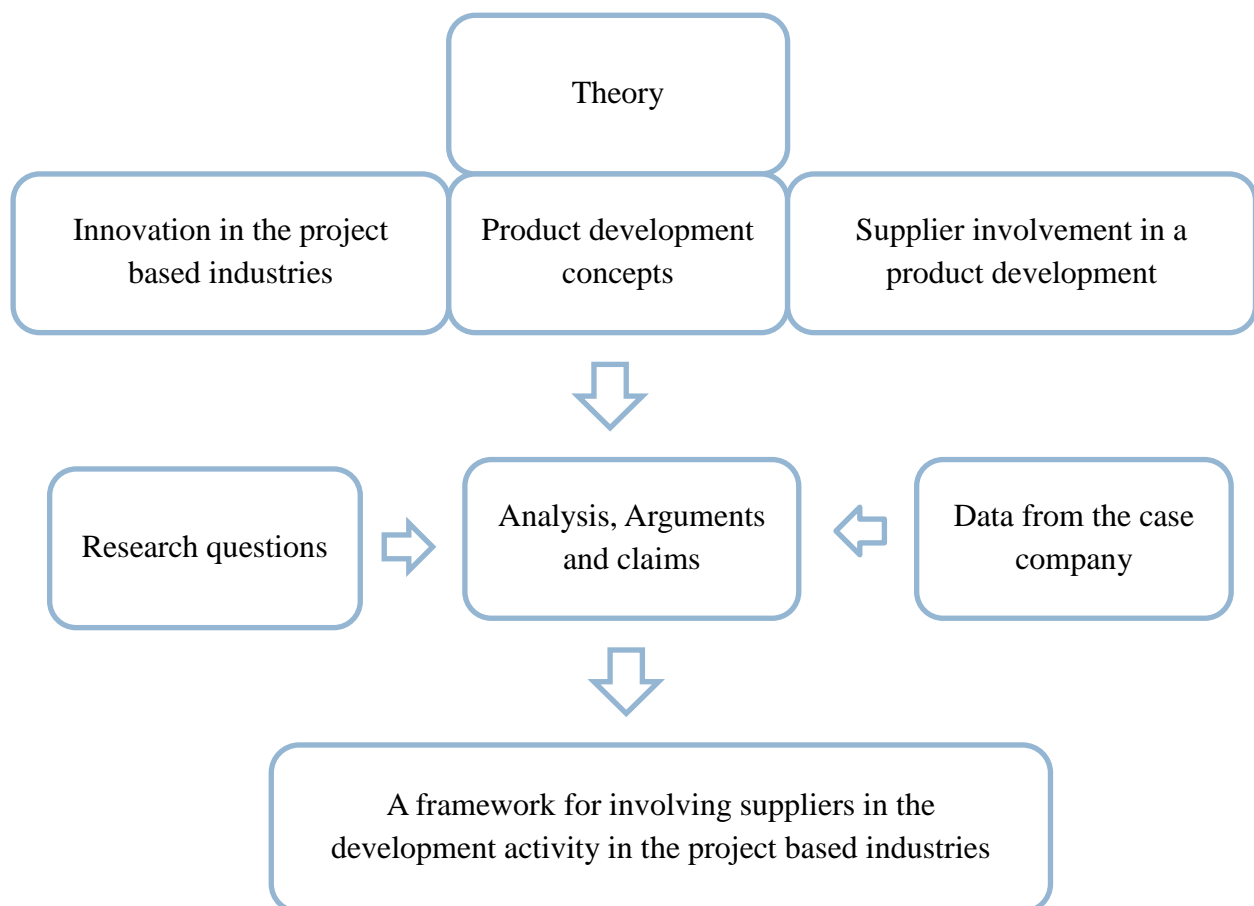
based industries and involving suppliers in such development and innovative activities. It will be interesting to know the reasons for lack of innovation in project based industries and also, to know if this industrial sector also can attain the benefits of involving suppliers, similar to the mass production industries.

Three major reasons influenced why this research has been carried out as a thesis work. First reason is that, it is challenging and at the same time, encouraging taking up the challenge of researching on a fairly new problem. Secondly, back ground study on the literatures give out contradicting information. Literatures mention that the project based firm is a suitable type of organizational structure to build complex and uncertain systems, which is very similar to a new product development activity (Hobday, 2000). At the same time, lack of innovation is also highlighted in the literatures (Keegan & Turner, 2002). This recommends further investigation on this issue. The third reason to carry out the research is about the relevance of the issue to the industrial practices. Relevance of this issue is very evident in the mass production industries. The focus on the project based industries will be a contribution to the field of project management.

The purpose of the thesis is to study the trends of innovation in the project based industries and product development trends in the mass production industries and involvement of suppliers. The final expected result is to come up with a framework for involving suppliers in product development activity for project based industries.

### 1.1 PROBLEM APPROACH

The purpose of the report is to study and develop a framework for the implementation of supplier involvement for the project based industries. The initial approach to the problem included, literature reviews and empirical analysis. The theoretical review was divided into three major fields. Those are; 1. Innovation in the project based industries; 2. Supplier involvement; 3. Product developments. Parallel to the literature review, interviews are carried out in one of the selected case companies. The selected case company is a project based organization. Central scope of the interviews was also same as above mentioned elements. By observing the trends in the literature and at the case company, research questions are formed. The research questions are a means to analyze the thesis and reach conclusions. Hence the analysis consists of three elements. Those are literature review, data from the case company and research questions. Various assumptions have been made to fill in the gaps for the lack of information. Below diagram shows the way problem in hand was approached.



**Figure 1. Problem approach of the thesis.**

## 1.2 RESEARCH QUESTIONS

The formation of the research question aimed at providing the direction for the thesis and at the same time fulfills the purpose of the thesis work. The research questions are formed based on the theoretical background and practical data obtained from the case company. The main purpose of the thesis is to develop a framework for involving the suppliers in a product development activity for the project based industry. Hence the first question which arises is, 'Are there any differences in the development activities between the project based industries and the mass production industries?' Based on the assumptions and theoretical background, there exists an evidence of differences across these two sectors. Hence second logical question arises is, 'What the reasons are, for the existing differences?' The differences are assumed as the challenges in the project based industries with respect to the development aspects. Hence, the next question is aimed at, 'finding the feasible answers to the challenges in the project based industries'. Further, by focusing towards the main purpose of the thesis, supplier involvement in the development activities in the project based industries is addressed. With regards to this, question raised is, 'Does the project based industry have the potential to involve suppliers within its development activities?' As a logical sequence, if the answer for the previous question is yes, then the next question would be, 'how is it achieved?' The answer to the final question is aimed at providing conclusion to the thesis work or substantiating the purpose of the thesis work. The questions are as mentioned below:

- (1) Is a 'product development' activity perceived differently within the project based industry compared with the mass production industries?
- (2) If so, what are the reasons for perceived differences?
- (3) How can a project based industry manage development activities in a best possible way?
- (4) Is there any potential within the project based sectors for involving suppliers within its development activities?
- (5) What are the best possible ways to involve suppliers in the development activities in a project based industry?

## 2. RESEARCH METHODOLOGY

### 2.1 RESEARCH APPROACH

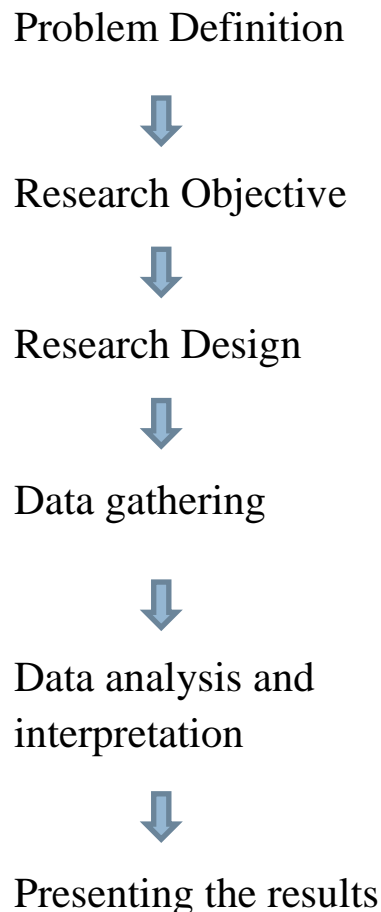
Scientific explanation approach has been considered to carry out this research. According to Frankfort-Nachmias & Nachmias (1992), scientific explanation should not only explain particular phenomena of interest, also explanation should be applicable to more general questions. One way of coming up with scientific explanations can be through scientific methodologies. The scientific methodology is a system of explicit rules and procedures on which research is based and against which claims for knowledge are evaluated (Frankfort-Nachmias & Nachmias, 1992, p.14). Scientific methodology involves logical reasoning and analysis of facts. A fact is either certainly or probably true when objective evidence exists to support it (Frankfort-Nachmias & Nachmias, 1992, p.16).

Research process is the best strategy to carry out systematic enquiry and thus arrive at scientific explanation for the problem in hand. There are several research processes suggested in the literatures. According to Frankfort-Nachmias & Nachmias (1992) there are seven main research processes with theory being the base for everything. Polonsky & Waller (2005) suggest six step research processes.

### 2.2 RESEARCH PROCESS

Research process given by Frankfort-Nachmias & Nachmias (1992) is cyclic in nature. The processes involved are; Problem, hypothesis, research design, measurement, data collection, data analysis, generalization and theoretical background which is linked to all the processes.

Polonsky & Waller (2005) provide six similar research processes. These processes are utilized in this research because these processes are more appropriate for the qualitative research. Each process is as followed below and they are elaborated. The working process of the thesis work is very similar to the research processes given by the authors. The research processes are:



**Figure 2. Research Process, (Polonsky & Waller (2005), p. 81).**

Prior to the *problem definition* phase, area of research is decided. Selection of research area involved, selection of the master thesis topic. The thesis topic is selected based on the background knowledge, self interest in the topic, and the observed trends of usefulness within the academia and industry on the particular topic. In the later stages of the thesis work, a contact person at the case company highlighted the usefulness of the issue for the project based industries. This was very encouraging for the thesis work. Thus the topic selected is 'Involving suppliers in product development for the project based industries'. The main focus is placed on the project based industries, in order to link the thesis work to the project management study field. The selection of the topic and the objectives of the thesis were carefully guided by the supervisor of the thesis. Establishing research objectives and the thesis title included, planning of broader area to be researched within the thesis. Thus, planning of the title and the thesis contents are similar to the *problem definition* phase of the research processes as mentioned here. The thesis work is further divided into several components and the final objective is to come up with a suitable frame work for supplier involvement especially within the project based industries.



The *research objectives* are specific components of the research problem that will be worked on in order to answer the overall research problems (Polonsky & Waller, 2005). The previous sections, 1.2 and 1.3 provided research questions and problem approach. Research questions were formed based on the elements in the problem approach section. The main elements in the problem approach are gathering required theoretical background, data collection through interviews, analysis and formation of framework and writing the report.

The next step is deciding a framework for doing a research. According to Polonsky & Waller (2005) there are four different *research designs*. Those are *exploratory*, *descriptive*, *casual research* and *definition research*.

- Exploratory research provides insight into, and an understanding of, the problem confronting the researcher. Exploratory research focuses on the ‘why’ questions. This type of research is being carried out when there is no prior knowledge of the subject in hand.
- Descriptive research tries to identify what is going on. It describes certain functions and characteristics of the issues in hand.
- Casual research is designed to examine the cause-and-effect relationships of certain variables that affect the problem.
- Definitional research seeks to define the domain of issues and is frequently used in developing ways to measure a given phenomenon (Polonsky & Waller, 2005).

There are other *research-methods*, which are incorporated within the above mentioned research designs. These are *qualitative* and *quantitative* research methods. In the quantitative research everything in the social system can be described according to some kind of numerical systems or on a numerical scale. Quantitative approach is concerned with averages, variation, differences and relationships, and it represents one of the major research approaches (McQueen & Knussen, 2002, p. 27). On the contrary quantitative research is distinctive from the qualitative research. Qualitative research adopts an interpretive approach to data and subjective meaning is considered.

The *research design* utilized in this particular thesis is both *exploratory* and *descriptive*. Approach towards literature review part is more of descriptive in nature. In this part, description of product development, innovation in project based industries and supplier involvement in a product development is carried out. While gathering data and documenting, the approach is to understand *what is going on*, within those fields. In the analysis part, more

of exploratory research approach is being carried out. In this section, mostly '*why question*' is being asked to carry out the analysis. In the analysis part various perceptions, assumptions, inferences and subjective reasoning have been carried out. The data collection is also subjectively carried out through semi-structured interviews which are very common within the qualitative research methods.

Theoretical data is collected by reading the relevant theories across various books, management journals, project management journals etc. Telephonic interviews were carried out to collect empirical data from the case company. According to Griffe (2005) interviews offers several limitations. Author highlights that people interviewed may not be able to say what they mean, may not have an opinion and may not be able to clearly state the opinion. In order to overcome these challenges, selected people and experts from the specified field have been interviewed. Also, necessary measures have been taken during the interview.

There are various techniques of *analysis* according to Polonsky & Waller (2005). According to the authors purpose of the analysis is to bring out the meaning of data and convert data into useful information. Seidel (1998) suggests simple techniques to carry out qualitative data analysis. This approach is mainly being used in the thesis because of its simplicity and its applicability for this thesis work. The three processes involved are; *notice*, *collect* and *think*. The process is iterative and progressive because the process keeps repeating throughout the process. First level of noticing involves writing field notes, gathering documents, etc. At the later stage, *collecting* and sorting of relevant data has been done. The relevant data are sorted into groups and recorded. The *thinking phase* involves examination of data and interpreting the collected data, looking for patterns and relationships and making the general discoveries about the phenomenon which is being researched. The analysis part of the thesis follows exactly the same processes. This framework for analysis is mentioned in the figure, 2. Data utilized in the analysis part are from the literature and the interview information, thus the framework has been formed. Research questions have been major drivers of the analysis part and have given the direction for logical thoughts.

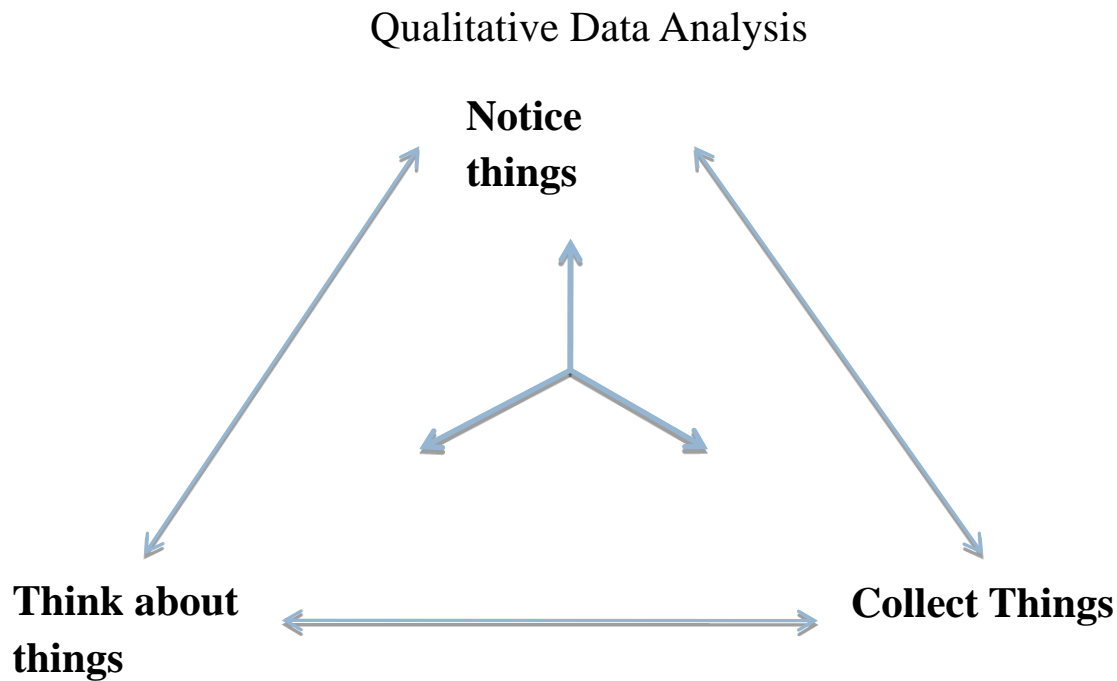


Figure 3. Processes of Qualitative Data Analysis (Seidel (1998), p.2).

The final step involves presenting the results. In this thesis work, presenting involves presenting the data in the written form or in the form of a report. Reports are particularly important as they present the results in an organized and permanent manner, which reflect quality of research and increase the likelihood of action (Polonsky & Waller, 2005).

### 2.3 WORKING PROCESS OF THE THESIS

The initial phase of the thesis has been selection of the topic. Once the topic, has been selected, the title has been defined. Along with the title, set of contents of the thesis have been formed. Contents formed describe set up a scope for the thesis. According to these contents, it has been planned to investigate regarding supplier involvement in a product development activity within the project based industry. Hence, the main scope is about project based industries. The title and the contents have been formed with the discussion and guidance from the supervisor for the thesis. It was also decided initially that empirical data should be collected for an empirical analysis. Once the contents were in place it gave a structured scope for preceding the thesis.

Initially theoretical review has been carried out. The literature review is more like a background review. General background review of the literature gives insights into the issues or industry being examined. Thus, background review of the product development, innovation in project based industries and supplier involvement in product development is carried out.

The literature provides an overall idea on the existing norms and trends within the industries and academia. Depending on the objectives set, screening of the issues, which has to be addressed within the theoretical sections is carried out. Works of several authors in each of these fields have been studied and documented simultaneously.

With the empirical data in mind, strategies for collecting empirical data have been formed. As per the guidance of the supervisor, some of the project based industries were selected. The requests have been made to these companies to utilize their data which are useful for the thesis. Statnett is being considered as a potential case company, since it is involved in commercial projects and development projects. Also, it sees its suppliers as the potential technology providers. With this information in place, it was confirmed that Statnett would be a suitable company for the case study and request has been sent to the company. Upon the acceptance of the request by the company, a plan has been established to utilize the data from the company. As per the plan, four interviews have been carried out with the company's personnel. The telephonic interviews have been carried out with the personnel from a project division, procurement department and a research and development head at Statnett. The interview data and inferences have been listed in the data collection section.

Only four telephonic interviews were challenging to collect the necessary information. The main challenges were about; time interval for the interviews, number of interviews provided and relevance of the answers provided by the interviewees. Single interview was carried out with four different personnel of different departments. Very often, interviewees provide the answers which they feel is relevant based on their experience. The answers provided may not necessarily be relevant to the thesis work. In addition, there existed time restriction to probe further, for the thesis specific answers. In order to compensate for this challenge, necessary assumptions were made, while analyzing the interview answers.

Simultaneously, research questions have been formed which aimed at guiding the analysis part. The analysis is made utilizing the literature and interview data from the case company. The final analysis was aimed at forming the framework for utilizing supplier involvement in project based industries, which is the aim of the thesis. . The discussion section towards the end of the report provides the result achieved by this thesis work.

Throughout the thesis work regular discussions have has been carried out with the supervisor, which has majorly contributed towards the successful finishing of the thesis work.

### 3. THEORY

#### 3.1 PRODUCT DEVELOPEMENT

Product development is the set of activities beginning with the perception of a market opportunity and ending in the production, sale, and delivery of a product (Ulrich & Eppinger, 2008). The essence of product development is satisfying the customers' needs. The needs here are mainly products, services, and upgraded version of a product. The companies which are into production of products make use of the concept, 'product development'. Hence, the manufacturing companies, consumer goods companies, automotive industries and other product oriented companies have been focusing and investing heavily on the product development activity.

Product development activity definitely has various dimensions. The stakeholders involved in the development activity will have contradicting demands from the development process and outcome. For instance, the development team might want to deliver 'state of the art' product; the production team might be more concerned about ease of production; the market team might be more concerned about the sales performance and timing; indirect stakeholders might demand ecologically sound product (Ulrich & Eppinger, 2008). The interdisciplinary team of development project contains 'core team' and 'extended team'. The suppliers are identified in the extended team (Ulrich & Eppinger, 2008). A product development activity is hugely dynamic and sufficient research has been done on this issue. The literature on this issue are given in the below table.

Contents	Authors
Over all trends within the field of product development and past research and findings.	(Brown & Eisenhardt, 1995)
Strategic importance of competitive advantage which is linked to new product developments.	(Wit & Meyer, 2004)
Importance of innovation and product development at the operational and strategic level.	(Korth, 2005)
Product development process and other dynamics.	(Ulrich & Eppinger, 2008)
Product development best practices.	(Griffin, 1997)

Product development processes.	(Cooper, Edgett, & Kleinschmidt, 2002) & (Cooper & Kleinschmidt, 1986)
Different types of product development projects.	(Wheelwright & Clark, 1992)

**Table 1. Various literatures referred regarding product development.**

### 3.1.1 TRENDS OF PRODUCT DEVELOPMENT RESEARCH

Brown & Eisenhardt (1995) identify trends of past research in the field of product development. Even though work is comparatively old, their study is referred to reveal success factors, various actors and dimensions of the development projects. The work of these authors is useful to identify various aspects to which product development is linked to and the context of product development researches. The common success factors identified as a result of past research on product development are; *suppliers and customer's involvement, senior management support, effective project leader, internal and external communication of the development teams, cross-functional team composition, product concept effectiveness* (Brown & Eisenhardt, 1995). The concept of the product development research finds relevance in computer firms, chemical and instrument firms, manufacturing firms, electronic firms, R&D laboratory, R& D organization, large high-tech firms and auto industries (Brown & Eisenhardt, 1995).

### 3.1.2 IMPORTANCE OF PRODUCT DEVELOPEMENT

Product development activity produces innovative solutions, products and services. Further, innovation is considered as one of the major tool for achieving sustainable competitive advantage (Korth, 2005). Competitive advantage is considered as one of the techniques to survive in the complex market and to lead in a particular segment. Cost leadership and differentiation are some of the options through which the firm attains competitive advantage (Wit & Meyer, 2004) . The low cost product and state of the art product can be an outcome of a development activity. Sustainable competitive advantage explains the strategic importance of product development. A product development activity further improves the processes, materials, business practices, safety, performances, time, and quality and reduces cost (Korth, 2005). Apart from the business benefits attained from the companies, upgrading and variation within the product ranges also carried as a product development activity.

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### 3.1.3 CHALLENGES OF PRODUCT DEVELOPEMENT

With its proven advantage, a product development activity poses its own challenges (Ulrich & Eppinger, 2008). The product can have superior technology but it will increase its cost. For a company to attract new customers, low cost is also one of the means. Hence, a company faces a challenge of making *trade-off* between cost and technology during designing a product. The decision making for this *trade-off* situation becomes even more challenging because of the market *dynamics*. In a *dynamic* environment situation, technologies change, customers preferences evolve, competitors introduce new products, and a macroeconomic situation shifts (Ulrich & Eppinger, 2008). Higher degree of *detailling* is required during the development process. Decision regarding the choice of screws or snap-fits will have an economic implication. Because of the market *dynamics* product development will be under *time pressure*. For a company to have its own development activity, it is important that the company has maturity and ability to invest in the development processes. According to the term ‘new product development’ the development of anything new requires *creativity*. Hence, it is important to have creative core and extended product development team. Most of the products aim at satisfaction of the customers. Hence, development team constantly faces the challenge of interpreting the need of customers. The development activity requires various skills along with creativity. Hence, activity faces the challenges associated with different needs of stakeholders, different sets of skills needed, time, quality and cost constraints.

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### 3.1.4 PRODUCT DEVELOPEMENT PROCESSES

Literature list various success factors for the for the product development. It is common notion in the literatures that successful product development is a result of successful processes incorporated within the industry [ (Cooper & Kleinschmidt, 1986), (Griffin, 1997)]. Hence authors carry out industry practices to investigate process involved within a new product development activity. It is considered important to trace product development practices among the companies according Griffin (1997). The reason is that in dynamic condition, there is no standard solution for all the problems. Hence it is important to know the process which produces a successful product. Although aspects of the process were slightly modified by a firm to cater to the needs of the industry, product type, and corporate culture, the basic process consists of exploration, screening, business analysis, development, testing, and commercialization (Griffin, 1997, p. 431). It also highlighted by the author that amongst several companies there is no established new product development process. Literatures

suggest several activities and processes of new product development which are practiced amongst selected industries.

Cooper & Kleinschmidt (1986) identify 13 extensive activities as a result of an investigation within 127 companies. The activities identified by the authors are; (1) Initial screening; (2) Preliminary market assessment; (3) Preliminary technical assessment; (4) Detailed market study/ market research; (5) Business/financial analysis; (6) Product development; (7) In-house product testing; (8) Customer tests of product; (9) Test market/ trial sell; (10) Trial production; (11) Pre-commercialization business analysis; (12) Production start-up; (13) Market launch. Even though author suggests that all these processes are at the later stage of idea generation, there is no step to screen and select the idea, amongst a pool of ideas. It is identified that ideas which are selected for the development process are customer driven. Work by the renowned authors, (Cooper, Edgett, & Kleinschmidt, 2002) emphasize on the generating better ideas. Decision gates are added at the front end of all the processes which are involved in the stage-gate model developed by the Robert Cooper. Different processes are as shown below.

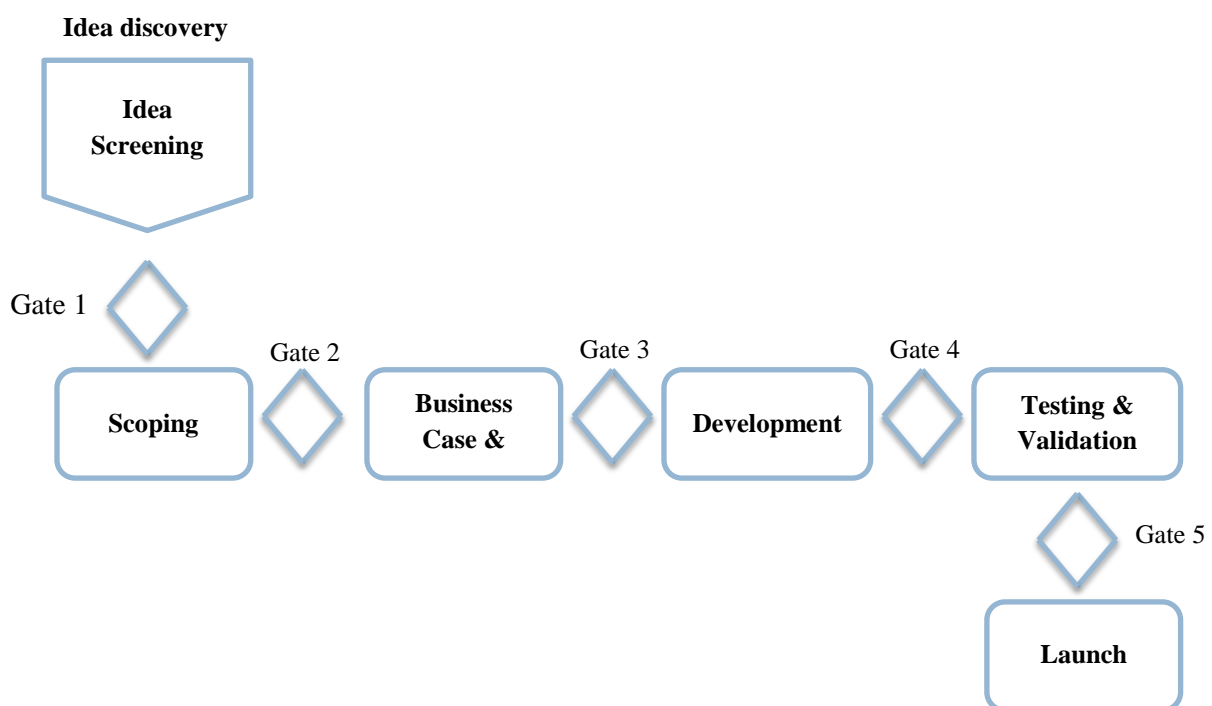


Figure 4. Stage Gate Process for New Product Development (Scott et al. (2002), p.22).



The process model suggested by Ulrich & Eppinger (2008) explains the core activities involved in a product development activity, which is more suitable for the mass production industries. These phases are explained in detail in order to utilize this model to compare product development activities and project life cycle, between the mass producing industries and project based industries. The phases involved in this model are: 0. *Planning*; 1. *Concept Development*; 2. *System-level Design*; 3. *Detail Design*; 4. *Testing and refinement*; 5. *Production ramp-up*. (Ulrich & Eppinger, 2008).

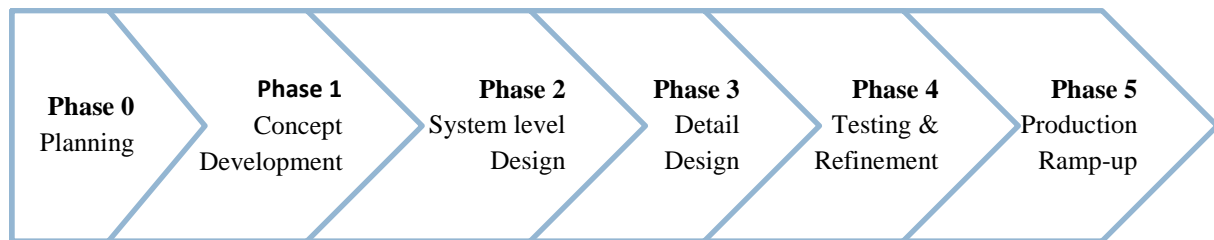


Figure 5. Product Development phases (Ulrich & Eppinger (2008), p. 9).

The planning phase precedes project approval phase. The product development activity should support the business strategy of a company. Hence, the basic questions asked in a planning process are: What development projects will be undertaken? How do the various development projects relate to one another as a portfolio? What are the budget and time frames for the project? What market segments should be considered? What new technology should be incorporated in the product? What are the manufacturing, service and financial goal of the project? (Ulrich & Eppinger, 2008).

In the *concept development* phase, various concepts are tested and evaluated. Lead users and competitive products are identified in this stage. Feasibility of the selected concept is investigated. Once the product concept is developed, production feasibility is assessed and manufacturing cost is estimated. Patent issue is also investigated at this phase (Ulrich & Eppinger, 2008).

In the *System –level design* product architecture is defined. The product architecture is a scheme by which the functional elements of the product are arranged into the physical elements and by which physical elements react (Ulrich & Eppinger, 2008). In this phase products are decomposed into components and sub-systems and alternative product architecture is also developed. At this stage, the company identifies key suppliers for different components. Also, a company needs to take decisions regarding make or buy. The *detail design* stage includes, complete specifications of the geometry, materials, tolerances of all

parts and identification of parts to be purchased from the suppliers. At this stage market plan will also be developed.

*Testing and refinement* of the product involves multiple preproduction versions. Various tests are carried out at this stage. Such as, reliability test, life test, and performance test. Supplier ramp up is facilitated at this stage. Preparation for production and development of sales plan is done after the required regulatory approvals. In the *production ramp-up phase* the product is manufactured using the intended production system. Early production output is evaluated among key customers. At this stage, there will be a gradual transition towards extensive production phase.

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### 3.1.5 PRODUCT DEVELOPMENT PROJECTS

Product development is often carried out as a project (Ulrich & Eppinger, 2008). As any other project, product development will also have time and resource constraints. Also, the product development may come under the influence of various stakeholders priorities. Wheelwright & Clark (1992) classify product development projects into five different types. The classification is helpful for companies to have better scheduling and resource allocation. Each of the five project types requires a unique combination of development resources and management styles. The two dimensions which are helpful for classifying are *degree of change in the product* and *the degree of change in the manufacturing process*. The five different development projects distinguished by the authors, Wheelwright & Clark (1992) suggest that new product development activity does not always imply as inventing completely new product. Slight variation in a product is also come under the category of a product development activity. Such various development activities as indicated by the authors are: 1) Derivative projects 2) Breakthrough projects 3) Platform projects 4) Research and Development projects 5) Alliance and Partnership projects. Breakthrough, platform and derivative projects are considered as commercial development projects.

*Derivative projects* range from cost-reduced versions of existing products to add-ons or enhancements for an existing production process. These types of project require fewer resources and can be finished within a short period of time. Example for derivative projects can be introducing new features within already existing product, improvement of reliability, minor changes in the materials used, and different types of packaging.

*Breakthrough projects* involve significant changes in existing products and processes. This will also involve revolutionary technologies and material. Such projects require more resources, time and management support. Break through development projects will have its team working in different plants and equipment, operating techniques and supplier networks. Few of the examples for breakthrough projects are compact discs and fiber-optic cable (Wheelwright & Clark, 1992).

*Platform projects* lie in the middle category. These types of development projects involve significant changes in the products and processes compared to derivative projects, but not necessarily introduce entirely new materials, products and technologies. Platform projects can bring changes in several dimensions at the same time. Namely, cost, quality and performances. The platform products or technologies can create smooth transition from existing products to high end products. This can also bring substantial competitive advantage and market expansion.

*Research and development project* is the creation of know-how and know-why of new materials, products and technologies which eventually generate commercial development (Wheelwright & Clark, 1992). The research project is a precursor to derivative and platform projects. Research projects might have to compete with commercial projects for resources. Expectation from research projects and development projects are different. Also, research projects involve creative and high-risk processes.

*Alliance and partnership projects* are formed when external company takes up the responsibility of development. The partnering company can have the responsibility over R&D projects, breakthrough, platform and derivative project. In this type of case, acquiring company should devote in-house resources to monitor the project, capture the new knowledge being created, and prepare for the manufacturing and sales of the new product (Wheelwright & Clark, 1992).

Each type of project plays a different role; each requires different levels of mix of resources; and each generates very different results (Wheelwright & Clark, 1992). The variations in the development projects and corresponding changes within product and processes are as shown in the figure, 5.

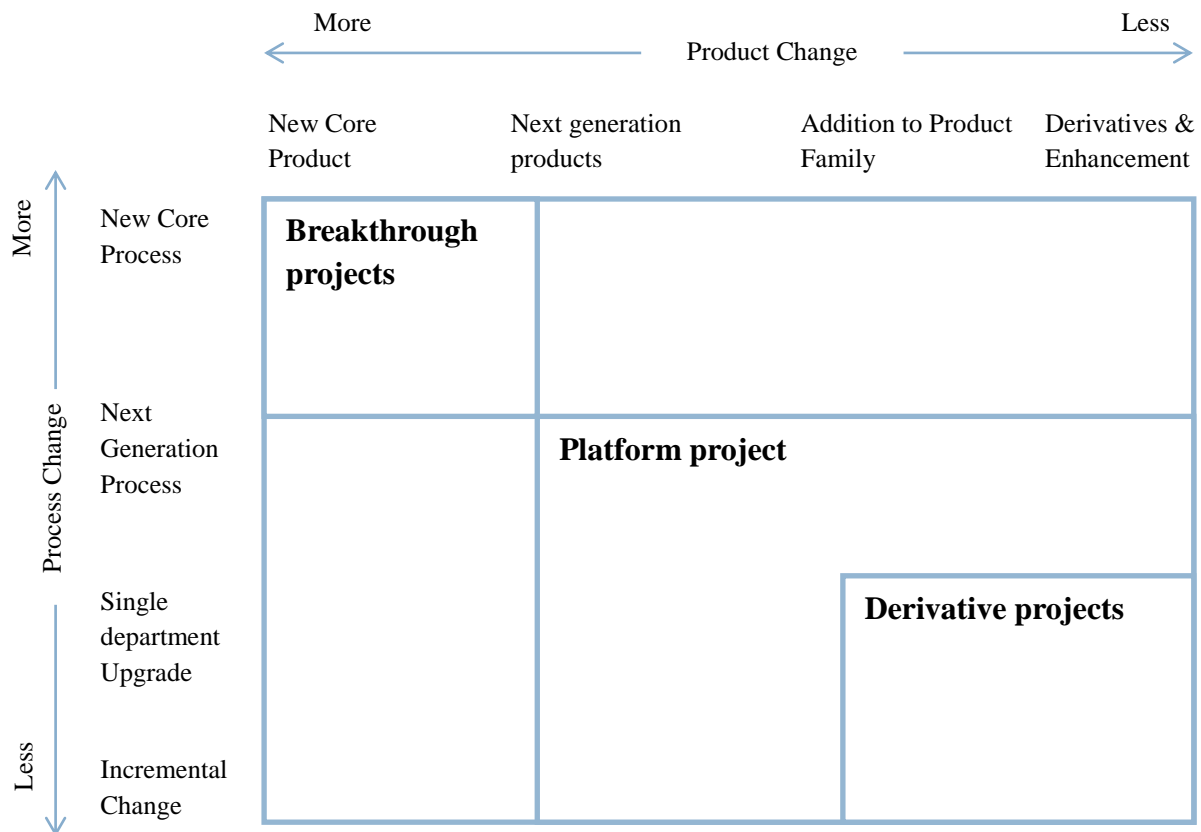


Figure 6. Variations in the product development projects. (Wheelwright & Clark (1992), p. 9)

Research & development and partnership projects are different from the commercial project. However, these two types of the projects are included with commercial projects for the following reasons: R & D is a precursor to the product and process development; partnership project can include any of the other four project categories.

### 3.2 DEVELOPMENT/INNOVATION IN A PROJECT BASED INDUSTRY

According to the authors Keegan & Turner (2002) project based firms are always innovative if we consider the uniqueness of the projects. The authors suggest that unique project will be initiated for solving unknown problem at some instances. Thus, such projects might demand innovative processes. Innovation in the project-based firms involves developing new or improved services for current or prospective customers, or developing new technologies that can be used to solve client's problems better than existing technologies (Blindenbach-Driesses & Ende, 2006). If we consider organizational structure of the project based industries, some of the functional organizations have become completely obsolete (Hobday, 2000). The authors highlight that amount of research in the field, 'development in project-based industries' is limited. The term, 'innovation' would be more applicable for the product

based industries. Also, existing literature on this issue address this way. This issue is being discussed in the literatures since past ten years. In most of the studies, project-based industries are being compared with functionally organized industry in terms of innovation. All the authors referred in this section highlight that innovation or development activity in project-based industries is less( (Taylor & Levitt, 2004); (Keegan & Turner, 2002); (Gann & Salter, 2000); (Barrett & Sexton, 2006); (Blindenbach-Driesses & Ende, 2006); (Hobday, 2000)).

Contents	Authors
Comparison of the success factors for development projects in PBO and in functionally organized firms.	(Blindenbach-Driesses & Ende, 2006)
Model for linking project and business processes for innovation in PBO	(Gann & Salter, 2000)
Comparison of PBO and matrix organization for its effectiveness to produce CoPS(Complex Product Systems)	(Hobday, 2000)
Approach of project management towards innovation in projects	(Keegan & Turner, 2002)
Identification of research gaps in the area innovation in project based industries.	(Barrett & Sexton, 2006)
Two types of innovation in project based firms	(Taylor & Levitt, 2004)

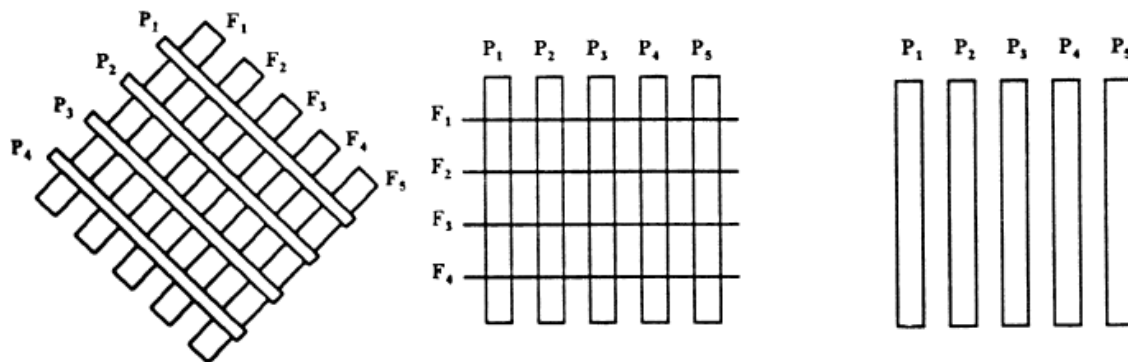
**Table 2. List of literatures referred on innovation in project based industries.**

### 3.2.1 FEATURES OF PROJET BASED INDUSTRY

Project based industry is selected over the functional and matrix organizations to tackle product complexity, fast changing markets, cross-functional business expertise, customer focused innovation and market & technological uncertainty (Hobday, 2000). This aspect is very evident in the industries such as aerospace, construction, ship building, pharmaceuticals, healthcare and defense. In the functional organization, new product development activity is carried out in terms of projects. Organizational structure of the project based industry is very attractive and efficient feature compared with functional organization.

Hobday (2000) describes the nature of the project based industries, to identify suitability of this industry over functional organization to produce CoPS (Complex Products Systems). The author recognizes six ideal type of organizational form: (1) Functional organization, (2) Functional matrix, (3) Balanced matrix, (4) Project matrix, (5) Project-led organization and (6) Project-based organization.

In the functional organization there is a strict boundary between various functional organizations (e.g., marketing, finance, human resource, engineering, R&D, and manufacturing). Functionally oriented matrix organizations will have weak project coordination. In a balanced matrix organization, the projects and project management will have stronger authority and presence. In the project matrix, project managers will have equal status as functional managers. In the project-led organization, projects outweigh the functional influence on decision-making and representation to senior management. In the case of project based organization, there is no formal functional coordination across project lines and the entire organization is dedicated to one or more projects. Also, the business processes are coordinated within the projects. The pure form of project based organization is seen in an independent film industry. In independent film making, the producing company is essentially disbanded once the film is released (DeFillippi & Arthur, 1998). In the case of construction, shipbuilding, software writing, the principal company still exists even after the completion of the project. The below diagram shows the description of project matrix, project-led matrix and project based matrix. P<sub>1</sub>, P<sub>2</sub>... indicate different projects. Similarly, F<sub>1</sub>, F<sub>2</sub>... indicate several functional departments.



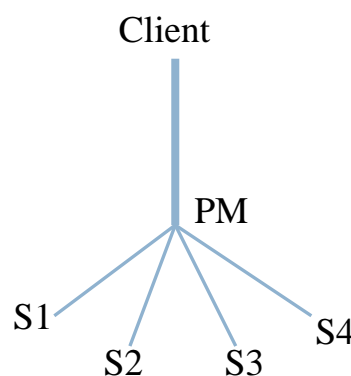
**Figure 7. Project matrix, Project-led organization, Project Based Organization (Hobday (2000), p. 877)**

According to Hobday (2000), in a project based industry, a project is a mechanism to integrate and coordinate business functions, such as production, R & D, marketing, personnel and finance in the project based organization. A project being a temporary organization, has defined resources, goals and time limit. Sometimes a single project can involve a consortium of companies to execute it. Joint knowledge, capabilities and resources are put together for a single project. Within this industry, a project manager has same authority as any functional manager. Since each project is unique and temporary, project based organization is highly flexible to reconfigure. Project based organizations organize their structures, strategies, and capabilities around the needs of the projects, which often cut across conventional industrial

and firm boundaries (Hobday, 2000). However these arrangements are too ideal across many industrial sectors. These arrangements are seen in the filming industries. In the filming industries, very often making of one movie is a one project. Various functional organizations and all the resources required are put together for a particular film, and everything is disassembled once the film making is finished.

The project based industries rely upon combining technical expertise from other organizations in order to deliver their own technical capabilities, usually in one-off processes (Gann & Salter, 2000). The challenge of the project based industry is not only executing its own capability but to link its own technical capabilities with the other enterprises. This implies that delivery of the products and services require collaboration between various firms. In such a scenario competitiveness of single a firm is not enough but entire network of the firm should be competitive. When a project is perceived as a network of activity, it poses a very unique challenge. The challenge is that the project uncertainties and complexities should be managed across the network.

Unlike functional managers, project managers have a different scope of work. This can be perceived as complex and very important, considering the features of this industry and demands of the projects. Project managers in project based industries will have complete authority over resources. The project manager (PM) can directly interact with the customers, suppliers and top management without the intervention of functional departments and processes. The PM is the main line of communication. He can exercise control to coordinate and integrate specialists and functions in new creative ways, focusing on the needs of the project (Hobday, 2000). Project manager acts as a central entity, which coordinates and integrates suppliers and customers in a concurrent fashion. The diagram pictures the project manager's communication with suppliers and clients.



**Figure 8. Project manager Vs. Suppliers & Clients. (Hobday (200), p. 889)**

However project based organizations are not good choices where there is a need for mass production. These industries organize their product development activities in terms of projects. One of the critics of the project based industries is that it can breed sense of insecurity among new recruiters due to dispersion of human resources and leadership (Hobday, 2000). Management and control of several projects is very challenging in case of resource scarcity and complex projects.

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### 3.2.2 INNOVATION IN PROJECT BASED INDUSTRY

The project based industry has the potential to foster innovation and promote effective project leadership across business functions (Hobday, 2000). Organizational structure, flexibility, expertise and the way projects revolve around the project manager will have great potential for innovation. Innovation in these firms involves developing new or improved services for current or perspective customers, or developing new technologies that can be used to solve client's problems better than existing technologies (Barrett & Sexton, 2006). In general innovation is closely associated with generation of the new ideas and its implementation into new products, processes or services. In a project based firm innovation is the act of using new ideas, technologies, product and/or processes aimed at solving problems, viewing things differently, improving efficiency & effectiveness and enhancing standard of living. Hence, values and perception of innovation in a mass production industry is different from a project based industry. Considering the example of a construction industry, new communication channels and partnering arrangements with contractors can be proven as an innovation of greater value.

Some of the drivers for the innovations are same as in mass production industries. Namely, demands from a market side and need for internal efficiency. Globalization of markets, production and economic growth across different regions, demand for execution of complex and engineering projects has pressurized construction industry to innovate. Apart from industry's external and internal demands projects are always subjected to pressure of tight cost and time. Innovation of any type will ease this pressure. According to Gann & Salter (2000) reputation and branding are also drivers of innovation in a project based industry. Failure of one project might cause lack of projects for the industry and financial value of one project is higher compared to one specific product of a mass production industry. Failure of one product will not affect the future of the mass producing industry. However, a project based industry is dependent on the success of every single project because of future



consequences and financial values of the projects. Thus, a project is forced to have innovative solutions because of the high importance placed on most of the projects in the projects based industries.

Taylor & Levitt (2004) distinguish innovation in the product based industry into two categories: (1) Incremental innovation; (2) Systematic innovation. Incremental innovations are those that reinforce the existing product or processes and provide a measurable impact on productivity (Taylor & Levitt, 2004). Incremental innovation is confined to one element in the entire project setting. For example in the case of construction industry, usage of prefabricated wall panels is an example of incremental innovation. Systematic innovation refers to the reinforcement of an existing product but necessitates a change in the process that requires multiple firms to change their practices (Taylor & Levitt, 2004). Systematic innovation brings overall productivity across a network in the long term. One of the examples of a systematic innovation is supply chain integration.

Within a project based industry, projects are classified as *business projects* and *development projects*. Business projects are those projects that are executed by order of a specific external client (Blindenbach-Driesses & Ende, 2006). Business projects are initiated by the client with defined specification, needs and deliverables. Business projects adhere to contractual agreements and have very specific time frame. Business projects are the one that provide financial benefits to a firm. However, innovation or developments in the project based industry are client specific. On the other hand project based industries also carry out development projects. Development projects are projects aimed at innovation, and take place separately from business projects (Blindenbach-Driesses & Ende, 2006). Development projects are aimed at developing new processes and services; those can be aimed at a set of customers or commercialized at later stages. Unlike business projects, development projects are more under the specific firm.

Innovation in a project based industry is not confined to the R&D department and to the set of specific resources. It is mainly through business projects and development projects. In this sense, a project based industry faces the challenge of absorbing development activity into the core organization and transferring it to various other projects.

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### 3.2.3 HINDRANCE FOR INNOVATION IN PROJECT BASED INDUSTRY

The projects are portrayed in the literatures as a flat, fast, flexible approach to managing changes (and innovation) in the organizations (Keegan & Turner, 2002). According to literature, the organizational features of project based industry support innovation. However, there are several problems associated with project management techniques and project based firms that hinder innovation and development activities in the industry as mentioned by the authors.

Management of innovation is complicated because of the discontinuous nature of the project based operation (Gann & Salter, 2000). In such a scenario learning loop will be disrupted. The literature addresses the question of transferring innovation related knowledge to a core organization and other projects. The innovation and development in a project based firm can be perceived as risky activity, because the industry does not have an advantage of testing prototypes. Testing in the project based setting can be an expensive practice for a firm. A project consists of vast network working in a concurrent fashion. In such a scenario, innovation is not confined to R & D department alone. The project based firms need to manage technology and uncertainty across the organizational boundaries, within the networks of interdependent suppliers, customers and regulatory bodies. This implies that innovation and development activities are carried out in such scenario.

It is identified in the literatures that lack of slack resources in the project based industries hamper innovation and the slack resources are considered as potentially important for innovation (Keegan & Turner, 2002). The slack resources allow experimentation and absorb uncertainty. Resources are assigned to projects based on availability, not on expertise (Gann & Salter, 2000). Also, during the downturn of business cycles resources from the projects are withdrawn. This can have harmful effect on the projects creating uncertainties.

Project management practice does not cover innovation aspects according to the authors Keegan & Rodney (2002). The authors suggest that project management control and evaluation methods stifle innovation and the project management literature itself largely ignores innovation. According to the traditional literatures on innovation, in order to be innovative firms should de-emphasize planning and control (Keegan & Turner, 2002). On the contrary, within the project based firms, strict planning and control is engrained in the project management disciplines. Project control techniques, like earn value management techniques, mainly promote efficiency and effectiveness. These techniques again restrict slack resources.

The whole concept brings the project within the planned schedule, cost and work contents. Even, the valuation methods stifle innovation. Evaluation according to strictly pre-defined criteria, at early stages of the projects, leads to elimination of a project that do not quickly produce positive results at some cases (Keegan & Turner, 2002). The projects which do not meet pre-defined goals at intermediate stages are cancelled. Abandoning of the projects might cause problems related to the knowledge disruptions.

The project management discipline must include innovation aspects within its techniques. Little progress has been made in relaxing of the project evaluation criteria for innovative projects (Keegan & Turner, 2002). The author, Weaver (2007) describes evolution of project management practices and its origin. As described by the author, project management discipline evolved and takes elements from the scientific management principles. This mainly focuses on division of work contents, improving productivity and repetition of a task to improve efficiency of a task. It is evident within the concepts such as Work Breakdown Structure (WBS), scheduling etc. Other disciplines, such as, developed human resource school of thought, administrations, system theories, contingency view and operations research influence evolution of project management techniques (Weaver, 2007). Project management discipline is yet to include the practices and techniques of innovation management.

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#### 3.2.4 SUCCESS FACTORS FOR INNOVATION IN PROJECT BASED INDUSTRY

The project based industries need innovation for the same reasons as other mass production firms. There are several success factors addressed in the literatures. Gann & Salter (2000) suggest that linking business and project processes result in innovation. Blindenbach-Driesses & Ende (2006) list some of the success factors that promote innovation in the project based industries.

**Contingency planning-** In the project based industries planning is methodological in order to deliver the output of a project on time, within budget, within quality requirements and in accordance with the contractual agreements. Hence, the project leaders perceive delays and uncertainties as failures, because the project-based firms are experienced in handling the complexities in the projects but not the uncertainties (Blindenbach-Driesses & Ende, 2006). Hence the authors suggest that contingency planning approach is an important success factor for development projects for project-based firms.

**Management support-** In the project based firms more often there is no dedicated R&D departments. Hence very often, the development projects have to compete for the resources along with other business projects. Blindenbach-Driesses & Ende (2006) suggest that the dedicated development committee from the top management side is one of the important success factors of the development projects in the project-based industry. Also, in some cases top management gets involved in the business projects only in the case of conflicts, if not business projects run more autonomously (Blindenbach-Driesses & Ende, 2006). Authors suggest that top management should show more involvements.

**Team structure-** Cross-functional team is a success factor for a development activity. This is an existing phenomenon in the context of a project industry. However, expertise of the project team is an important success factor in the project based industries. Often, project teams are formed depending on availability not on expertise. Hence, expertise of the development teams should be considered.

**Customer and supplier involvement-** It is a common practice to see that the customers are closely involved in the business projects. This brings customer specific innovation. Suppliers should be involved as early as possible in the development projects to improve quality and to prevent delays. Additionally, collaboration with the suppliers is a common practice within the project settings.

**Pre-development and testing activities-** Blindenbach-Driesses & Ende (2006) hypothesize that creating a business case or executing a pre-development phase is an important success factor for development projects in the project based industries in order to compensate testing.

### 3.3 SUPPLIER INVOLVEMENT IN PRODUCT DEVELOPEMENT

This section elaborates all the literary works referred to on the topic, ‘involvement of suppliers in product development’. This issue is widely researched within the academia and practiced mainly in the mass production industries. Hence, the literature referred here mainly involve case studies and interviews from the mass production industries. Some authors (Wynstra, Weele, & Weggemann, 2001) however extend their investigation to the field of medical equipments, food packaging and power plant construction industries.

The scope of the literary work on this section includes; identifying the benefits and challenges of involvement, success factors & managerial implication of an involvement, justification for need to involving the suppliers, management of involvement and relational aspects and

critical aspects, a company should consider before involving suppliers. The below table lists the work and respective authors which are referred for this issue.

Contents	Authors
Summary of the major works or research on involving suppliers in new product development and innovation.	(Johnsen, 2009)
Charecterestics of supplier involvement in know-how and capacity research and developement projects.	(Wagner & Hoegl, 2006)
Customer-Supplier relationship charectecharacteristics for managing involvement of suppliers.	(Walter, 2003)
Critical issues, which should be considered before involving suppliers in the new product development projects.	(Wynstra, Weele, & Weggemann, 2001)
Managerial practices to involve suppliers early in the developement activity.	(Ptersen, Handfield, & Ragatz, 2005)
Managerial practices, success factors and environmental factors which support involving suppliers in product development.	(Ragatz, Handfield, & Scannell, 1997)
Benefits of involving supplier in new product development .	(Ragatz, Handfield, & Petersen, 2002)
Attaining competitive advantage along with suppliers.	(Jap, 2001)

**Table 3. Literature referred on involving suppliers within a new product development processes.**

Few aspects which distiguish the area of involvement from the traditional purchasing activity are: tiering of suppliers, degree of responsibility for designing, timing of involvement, inter-company communication, intellectual property agreements, supplier membership on the project team and alignment of organizational objectives to facilitate involvement. The invlvoment of the suppliers in a new product development activity fundamentally concerns;

the integration of the capabilities that the suppliers can contribute to new product development projects, the tasks they are able to carry out on behalf of the customer and the responsibilities they assume for the development of a part, process or service (Johnsen, 2009).

As summarised by Jonhenson (2009) the first empirical research to focus on the role of the suppliers in new product development can be traced to a few internationally influential studies in the 1980s. The earlier work focused on Japanese automobile sectors and its proven benefits of involving suppliers in new product development activity. By relying heavily on their suppliers, Japanese manufacturers were able to bring new automobiles to market at a faster pace, with more innovative features and with less efforts in terms of development hours and number of engineers involved (Wynstra, Weele, & Weggemann, 2001). In the next decades, studies focused mainly on the US practices of involving suppliers in comparison with Japanese car manufacturers. Performance measures still remained quality, cost and speed. Few of the late 90's work focus on the problems associated with involving the suppliers and barriers for shared training, trust, risk & rewards sharing, agreed performance measurements and top management commitments (Ragatz, Handfield, & Scannell, 1997). In the next decade, various models for involvement of suppliers have been discussed. Along with speed, quality and cost, utilization of a supplier technology have been discussed. Long term perspective of supplier involvement, future collaboration, access to technology, roadmap alignment project transfer solutions are currently being discussed in the literatures.

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### 3.3.1 WHY INVOLVE SUPPLIERS?

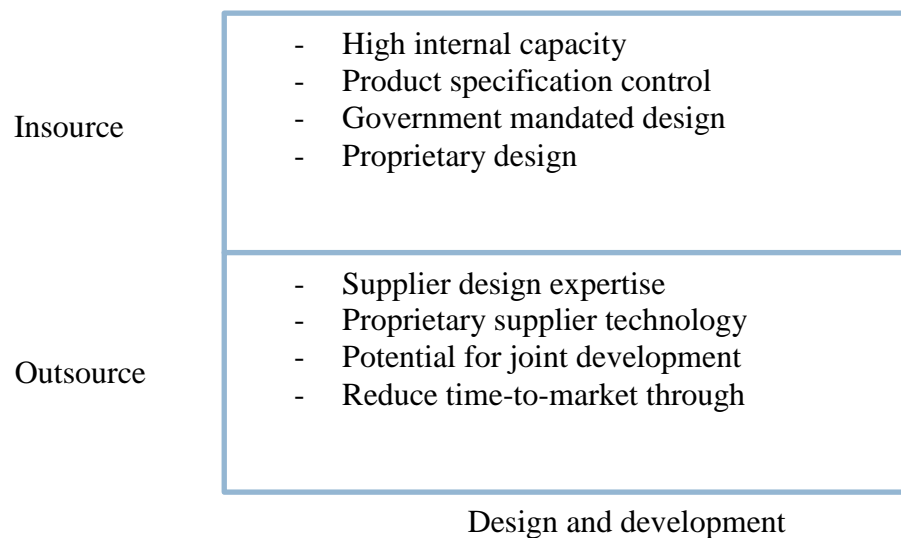
Since literature dates back to 80's it is obvious that there are proven results of supplier involvement in new product development and it answers the question, of why involve suppliers in new product development. There are three major benefits within the literature pertaining to this issue; (1) empirical finding which lists tangible results; (2) arguments on ultimate need to involve suppliers; (3) resource based view within the field of strategic management.

Tangible results of involvement of a supplier in product development, listed in the literatures are: speeding up of the product development process, improvement in the quality of product development, reduction of development cost, reduction in the R&D investment, shared risk and rewards (Ragatz, Handfield, & Petersen, 2002).

Need for involving suppliers in a product development activity becomes essential because of the global market competition, lack of capabilities and need for suppliers complimentary capabilities, increasing collaborative nature of buyer-supplier relationships.

Strategic management highlights on competitive advantage and one way to attain this is through the resources and capabilities. However, resources are dynamic at nature and firms need to find different means to attain and sustain resources and capabilities. This gives us the concept of sustainable competitive advantage and competitive advantage across the firm's boundary. Jap (2001) argues that it is possible to attain competitive advantage through buyer-supplier relationship. The author suggests that there are various conditions under which a firm attains competitive advantage. Those conditions are; (1) resource heterogeneity, (2) ex ante limits to the competition, (3) ex post limits to competition (4) imperfect mobility. Resource heterogeneity means that the resources have various efficiencies and productivities. Any firm which creates required value at the market place attains competitive advantage. When a buyer and supplier combine the unique competencies and resources together, then they will be able to create superior value at the market place. Ex post limits to competition is about creating barrier to competition for other companies. When a buying firm gets involved with a supplier, it is difficult for the competitors to observe and duplicate the efforts and activities that go into the involvement. Hence, a competing firm may not be able to produce the same value. Imperfect mobility refers to the resources that are not traded easily; they are more valuable within the firm than in the other firms. Hence buyer supplier involvement is considered as a resource or a competency, which is heterogeneous and cannot be repeated easily and creates entry barriers.

Handfield et al. (1999) provide the reasoning for involving suppliers in development or have a joint development activity. It is identified by the authors that keeping development in house is also necessary for few cases.



**Figure 9. Insourcing and Outsourcing decision of development. (Handfield et al. (1999), p. 67)**

### 3.3.2 TIMING OF INVOLVEMENT

There is no absolute situation and timing during which suppliers have to be involved. The literatures try to identify the stages of the product development, during which the suppliers can be involved. One such discussion is about early involvement of suppliers (Wagner & Hoegl, 2006); (Ptersen, Handfield, & Ragatz, 2005). Determining how early is arguable. However, often the term, 'early' is perceived as involving suppliers at a design stage.

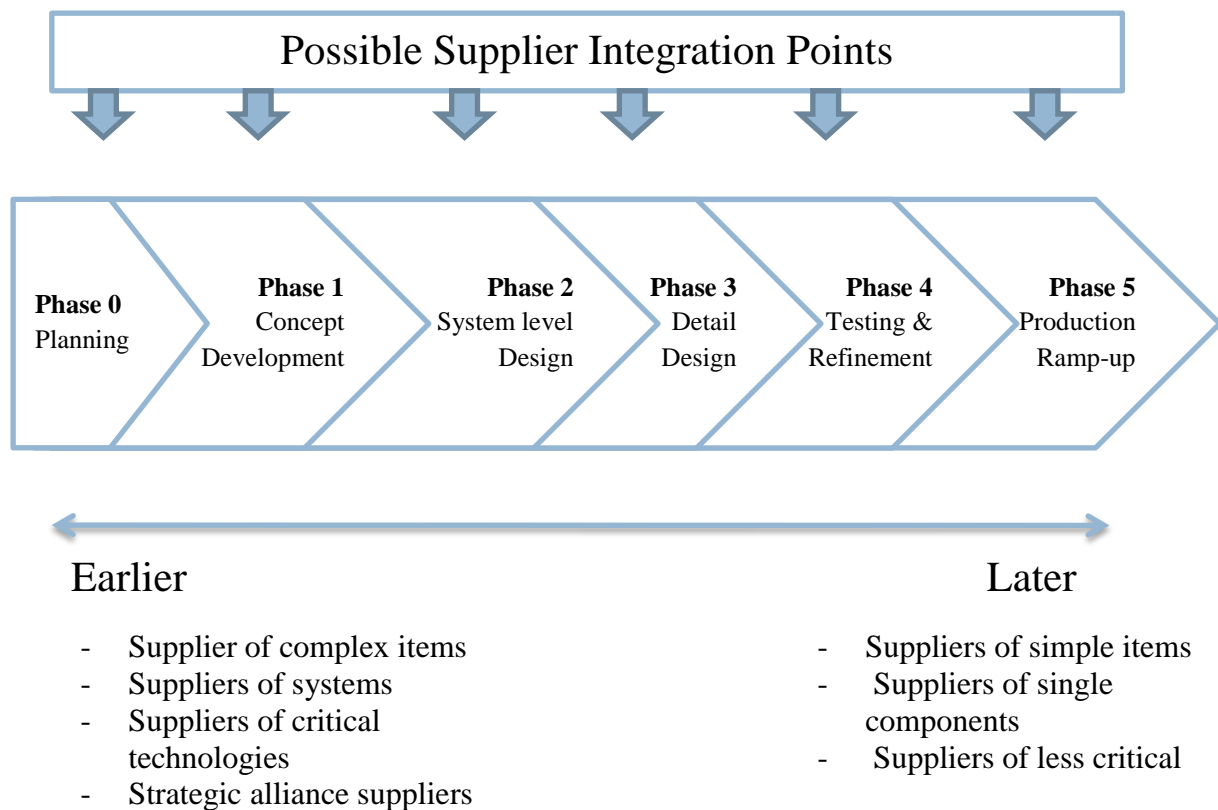
There are various reasons, which suggest involving supplier at earlier or design stage of the development processes. Product's cost will be determined at concept generation and design engineering stage (Ragatz, Handfield, & Petersen, 2002). Hence, the authors highlight that supplier's contribution would facilitate further cost reduction. Another reason that is identified from same authors is the technological uncertainty. This can be a reason for involving the suppliers at early stages. If a supplier possesses high level of expertise in particular technology that is essential in particular product development activity, then a supplier should be integrated at very early stages of the product development processes. As an example, Airbus involves suppliers in early stages of product development. As a result, suppliers are expected to accept responsibilities for development, design, integration, manufacturing, qualification, delivery, target performances and quality for their systems and sub-systems (Wagner & Hoegl, 2006). The early involvement of suppliers allows buyer firm to know each other and exploit one another's expertise. According to Wagner & Hoegl (2006) buyer supplier relationship do not merely exist, but emerge. For the close involvement to work, trust and commitments should be mutual. Early involvement will facilitate development



of trust and commitments. At the same time early supplier involvement poses the threat of being ‘locked into’ a particular supplier (Ptersen, Handfield, & Ragatz, 2005).

Hence early supplier involvement is very conditional. Wagner & Hoegl (2006) considers timing of involvement as a delicate issue. This delicate decision has to be taken by management and project leaders. Also the authors highlight the fact that there is not enough empirical research on this topic. The authors distinguish development projects as ‘capacity projects’ and ‘know-how projects’. Goal of a *capacity projects* is to cover shortages in own R&D capacity and become more flexible in R&D. The goal of a *know-how project* is acquiring and utilizing supplier’s knowledge. Timing of involvement depends on the type of development project. In the case of capacity projects, a firm prefers to involve suppliers at the later stages of product development. Another argument is that earlier integration is beneficial in cases of higher technological uncertainty (Handfield, Ragatz, & Petersen, 1999). Also, authors Petersen et al. (2005) test hypotheses and reach conclusion that the relationship between project team effectiveness and design quality is stronger in the case of earlier supplier involvement. From the above two arguments of the authors regarding the timing of the involvement, it can be concluded that it is possible to involve suppliers at any stage of the development. This aspect is shown in the below diagram. The diagram is further coupled with the concepts presented by Handfield et al. (2009), which emphasize on ‘earlier’ and ‘later’ involvement considering different conditions.

According to the upper part of the diagram, it is possible to involve the suppliers at any stages of the product development. The bottom part of the diagram indicates that the suppliers can be involved in the early stages of a product development activity according to certain conditions mentioned in the diagram. According to these conditions, suppliers are the providers of a complex products and technologies.



**Figure 10. Timing of Supplier involvement.** [(Handfield et al. (1999), p. 62); Petersen et al. (2005)]

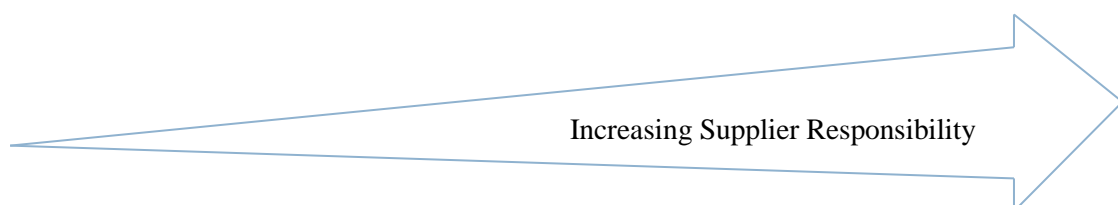
### 3.3.3 EXTENT OF INVOLVEMENT

Extent of involvement deals with the level of responsibilities that is given to a specific supplier and how the supplier is integrated within an organization and a development team. Extent of responsibilities varies according to long term and short term involvement decisions. Also, decision pertaining to this aspect can be project and firm specific one.

According to Wagner & Hoegl (2006), extent of involvement is related to level of integration. Supplier integration can be dealt at the *organizational level* as well as at the *project level*. Organizational level of involvement is such that there will be assigned contact person from both buyer and supplier companies. Two contact personnel come together in an ad hoc meeting or through e-mails and telephone call. In this kind of scenario, a supplier will have an assigned task to be delivered and buyer will have more flexible development activity. On the other hand, integration can also happen at the project levels (Wagner & Hoegl, 2006). The authors consider project size and configuration of project teams as being important aspects of integrating suppliers within the project team. The number of interfaces and the size of a project team are critical to the functioning of new product development (Wagner & Hoegl, 2006).

Level of responsibilities varies depending on the development projects. As mentioned above, suppliers involved in a ‘know-how’ and ‘capacity’ project will have different responsibilities. In a know-how project, a supplier takes a responsibility for critical modules or systems. In a capacity project, a supplier takes responsibility for the less critical components or sub-systems (Wagner & Hoegl, 2006). Levels of responsibilities vary according to the particular development projects. In order to conceptualize different responsibilities assigned to the suppliers, they are divided into three categories. They are (1) Black box suppliers; (2) Gray box suppliers; and (3) White box suppliers. Petersen et al. (2005) summarizes responsibilities assigned to each of these suppliers.

None	White Box	Gray Box	Black Box
No supplier involvement. Supplier “makes to print”.	Informal supplier integration. Buyer “consults” with supplier on buyer’s design.	Formalized supplier integration. Joint development activity between buyer and supplier.	Design is primarily supplier driven, based on buyer’s performance specifications.



**Figure 11. Tiring of suppliers and respective responsibilities. (Petersen et al. (2005), p. 378)**

### 3.3.4 MANAGEMENT OF INVOLVEMENT

Although the potential benefits from involving suppliers in product development are substantial, the concept is quite new and it is an uncomfortable practice for some companies (Ragatz, Handfield, & Scannell, 1997). The challenge arises from various issues which are related to both buyers and supplier’s general approach or attitude towards joint product development. The barriers related to managing supplier’s involvement in product development: (Ragatz, Handfield, & Scannell, 1997).

- (1) There might be a concern at different levels of organization for sharing the proprietary information with suppliers. The major concern is about this information being

revealed to the competitors intentionally or unintentionally. This concern might be even more problematic when a supplier company itself is a competitor.

- (2) Buying companies designers or engineers may not accept the ideas from the suppliers. Ragatz et al. (1997) name this issue as “not invented here”. This issue is directly associated with cultural aspect of the buying firm. Also, buying company designers or engineers might resist giving up any control over design decisions.
- (3) There is a possibility that above mentioned problem arises from the supplier end also. This is a bigger challenge for the suppliers when they are dealing with a more-powerful buyer. A supplier might worry about inequitable treatment (Ragatz, Handfield, & Scannell, 1997).

Effective management of involvement will overcome possible barriers. The managerial practices identified by the authors, (Ragatz, Handfield, & Scannell, 1997) are; (1) Buyer’s top management commitment; (2) shared education and training; (3) joint agreement on performance measures; (4) confidence in supplier’s capacity; (5) formalized risk/reward sharing; (6) formal trust development practices; (7) supplier’s top management commitment; (8) Intellectual assets sharing; (9) Human assets sharing; (10) Physical assets sharing.

Importance of a *top management commitment* is identified in number of literatures. With the top management commitment, buyer firm can have systematic formalized relationship building processes. Authors further classify *shared education and training* as periodic and ad hoc. Training addresses various performance improvement areas including management/leadership, quality control processes, problem solving techniques, team building, activity-based costing, government or agency regulations and continuous process improvement. *Joint performance measurement* keeps the project on track and helps resolving conflicts. Early agreements on performance measures that took a total cost of ownership perspective were often cited as a key to successes. *Confidence in supplier’s capability* is important to accept designing and engineering solution from a supplier. It will also increase the chances of giving more responsibilities to the suppliers. Through *formalized risk/reward sharing*, deviation in the agreed plan can be accommodated. According to the authors formal trust development practices are; customer requirements and technology information sharing, direct communication, membership on the product/project development team, joint education practices and *formally develop trust* among two parties. Also, according to the survey from Wagner & Hoegl (2006), buying firms prioritize ‘trust and reliability’ on top, among the required characteristics of suppliers to be involved in NPD. *Supplier’s top management*

*commitment* is helpful to involve supplying team in the training activities arranged by the buying side. With its own top management commitment it is possible for a supplier to map their technology with buying firm's technology.

Relationship can be further strengthened by sharing *intellectual assets*, *human assets* and *physical assets* with the suppliers. Direct cross-functional intercompany communication, customer requirements sharing and technology sharing processes are considered as *intellectual assets* which are shared in between firms. Technology involvement means that identifying technology road maps and capabilities in order to generate new product ideas (Ragatz, Handfield, & Scannell, 1997). Customer requirement information sharing enables suppliers to develop innovative solutions that may not have been identified by the buying firm. *Human Assets* sharing means that both buyer and supplier will co-locate required personnel as the per new product development needs. Supplier participation in the project team or supplier membership within the buying firms project development are the issues often cited in the literatures. *A physical asset sharing is rare* in new product development efforts in the companies they have surveyed. In practice it is often found that buying or supplying companies have common and linked information systems, technology sharing, shared plant and equipment.

Supplier evaluation and risk assessment is an important aspect of management of relationship and integration. Evaluating the suppliers for potential integration into new product development should involve criteria beyond those used to evaluate ordinary material/service suppliers (Handfield, Ragatz, & Petersen, 1999). The elements that are to be considered during assessing the suppliers are; (1) is the supplier capable of meeting cost, quality, product performance/ function, schedule of the development? (2) Innovation and technical ability of a supplier: Does the supplier have the required engineering expertise and physical facilities to develop an adequate design, manufacture it and solve problems when they occur? (3) Do the supplier's key personnel have the required training to start-up required processes and debug them? Risk assessment must answer following questions: (1) Likelihood that supplier's ability to bring the product to market? (2) How does this risk compare to other potential suppliers? (3) At what point decision made with one supplier can be reversed and what are the measures/criteria that should be considered? (4) What is the contingency plan that takes effect in the event of suppliers failing to perform?

Above are the issues buying firm must consider while managing the relationships with supplier as specified by the literatures.

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### 3.3.5 PUBLIC PROCUREMENT (EU)

Important aspect about the public procurement comes into picture when a government is a customer. Government or government owned companies need to adhere to some laws and regulations while buying goods from the suppliers. In Europe, European Union (EU) directives prescribe how governmental institution within Europe should buy. The main principle behind procurement directives are (Van Weele, 2010); (1) non-discrimination; (2) equality; (3) transparency; (4) proportionality. The public or governmental organization is subjected to these directives because it is accountable towards public. The public procurement begins with public tendering and ends with a contract. The steps involved in the tendering includes supply market research, developing a sourcing strategy based on the product or services required, preparing tendering documents, which includes technical requirements, supplier selection and award criteria, contractual conditions and evaluating supplier data and supplier bids.

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#### 3.3.5.1 IMPLICATION FOR PUBLIC PROCUREMENT

Public procurement has resistance among procurement community in Europe. The resistance is caused by relentless complaints concerning the complexity of directives themselves, their lack of flexibility, and the terms that need to be adhered to for publication and answering questions, the fact that the directives do not stimulate supply chain collaboration and innovation sufficiently and the complex project administration that is required for the application of these directives (Van Weele, 2010).

Public procurement is procedure driven than being performance driven (Van Weele, 2010). The author also mentions that the public procurement in the governmental organization is not as competitive as private sector and decision making is slow and political in nature rather than fact based and rational. Van Weele (2010) suggests that within the area of public procurement there is a lot of work that has to be done.

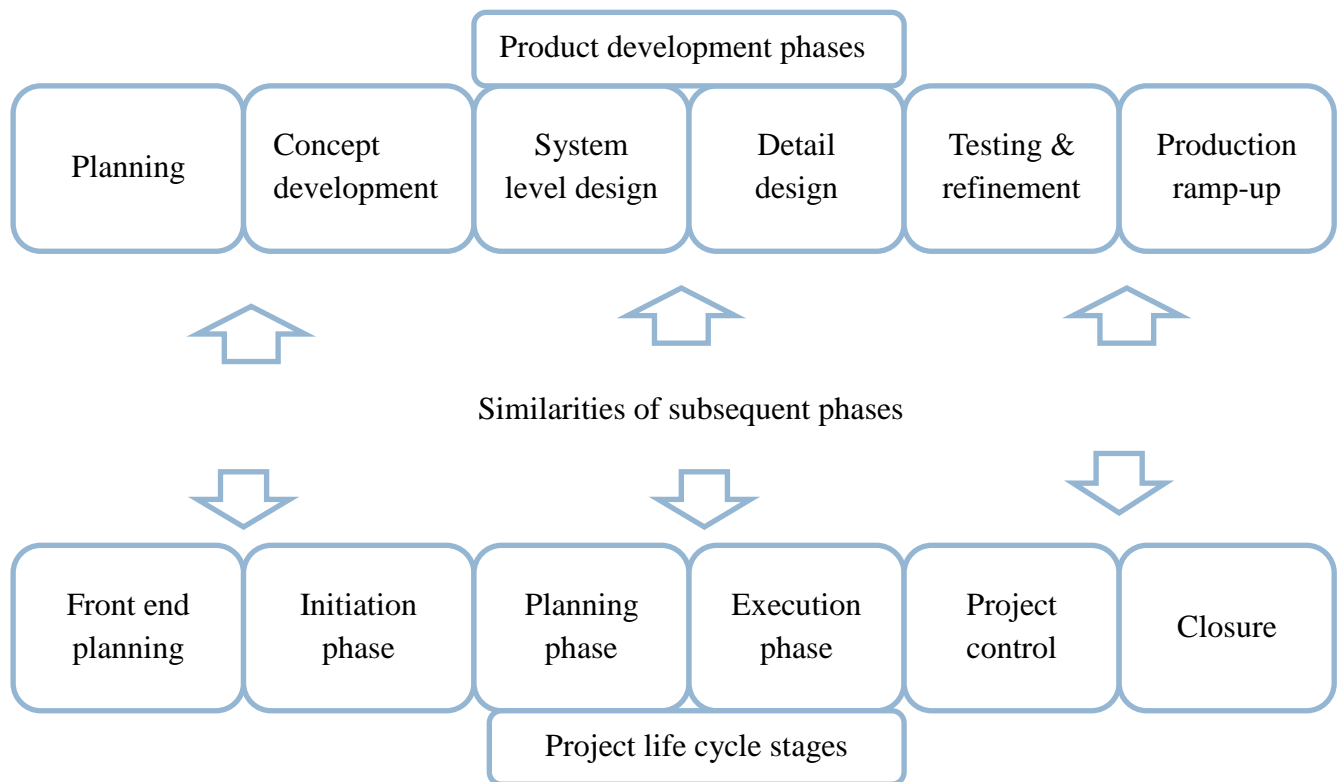
### 3.4 THEORETICAL DISCUSSION

#### 3.4.1 SIMILARITIES BETWEEN PRODUCT DEVELOPMENT AND UNIQUENESS OF A PROJECT

The phases of a product development process mentioned by Ulrich & Eppinger (2008), is very similar to the phases of the project life cycle. A project life cycle, according to the PMBOK (Project Management Body of Knowledge) are; *project initiation*, *project planning*, *project execution*, *project controlling* and *project closing*. There exists a *front-end planning* phase, prior to actual project life cycle. In a front end planning phase, business objectives, project justification and cost estimations are carried out (Samset, 2003). In this phase a project concept will be conceived. Similarly, in a *planning phase* of a product development process, over all goals of a product development activity, its financial aspects and how it fits within the portfolios of the projects is considered. As a second phase, in a *concept development phase* of a product development process and in a *project initiation phase* of a project life cycle, feasibility study of the selected concept is carried out. As a third phase, a *planning phase* of a project involves planning of different components, such as project plan, resource plan, financial plan, and quality plan etc. Similarly, in a *system level design* of a product development process, product is decomposed into several subsystems and designed. We can say that the functional sub components of a product are planned. Thus, a *planning phase* of a product is similar to the *system level design phase* of a product development. By assumption, in most of the cases, supplier selection is also carried out in these phases. In a *detailed design* of a product development process, complete planning of the specifications, geometry, materials, tolerances of all the parts are identified and it is also assumed that prototype is built. Similarly, at the *execution phase* of a project, all the operational work is carried out in detail. Hence, similarities are identified between *execution phase* of a project life cycle and *detailed designing* phase of a product development processes. At the *testing phase* of a product development processes, several tests are carried out and various corrections will be carried out. Unfortunately, most of the projects cannot accommodate testing of an entire project and make adjustments. It might be possible to test any one particular unit or sub-elements of a project. However, *project control techniques* are used to make any adjustments in a project. Even though *testing* and *controlling* activities are different, it is possible to perceive them as the similar activities, because both of these activities allow necessary adjustments. Production ramp up is the final stage of a product development process, similar to a closure of a project. From these phases onwards, operational phase starts both in a project and in the case of product development. Considering the close similarities between project life

cycle and a product development phases, it can be perceived as every unique project is a new product development in a project based industry.

The below diagram shows the comparison between the product development processes as mentioned by Ulrich & Eppinger (2008) and project life cycle as mentioned by PMBOK.



**Figure 12. Comparison of similarities between product development and project life cycle phases.**

The works of Wheelright & Clark (1992) provide an idea that product development does not necessarily mean innovating completely different products and processes. Few changes with the products and processes can be classified as a product development activity. This can also be seen especially in the case of information technology industry, which can be classified as a project based industry. These aspects can be compared with the uniqueness of the projects within the project based industries. In the project based industry, projects are unique for the reasons; there involves some changes in the processes, products, resources, and also change in the geographical locations. These changes in the products within the mass production companies are carried out as a new product development project. Thus, it can be said that every unique project is a new product development for the project based industries.



This theoretical discussion hints that a meaning or a perception of product development in the project based industries is different from the mass production industries. However, every unique project, in a project based industry is very similar to a new product development, within a mass production industry.

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#### 3.4.2 THEORETICAL DISCUSSION ON THE SUPPLIER INVOLVEMENT IN A NEW PRODUCT DEVELOPMENT ACTIVITY

Main focus of a research on this issue is related to the mass production industries. From the above literatures, it is very clear that the suppliers are very important resources for the mass production companies. The similar issue, which is been researched in the project based industries are; partnering with the suppliers and a long term relationship with the suppliers (Beach et al., 2005). This trend shows that, importance of suppliers in predominant both in the mass production companies as well as in the project based industries. This indicates that the suppliers are perceived as very important in both mass production and project based industries. The way these industries function, depends on the way they utilize the suppliers. Investigation regarding involvement of suppliers in product development in the project based industries should focus on the importance of the product development in the industry. Hence, in the later section, analysis will be mainly focused on the different perception about product development in the mass production companies and in the project based companies.

The researches on the supplier involvement issue can be applicable for both the mass production companies as well as to the project based industries. The work of Wagner & Hoegl (2006) will be applicable for the project based industries because, they separate development projects as *capacity projects* and *know-how projects*. In the case of project based industries, most projects are *capacity projects* and development is done through separate development projects.

It is also known from the literatures that, there is no standard rule on the timing of the involvement of suppliers. The success of the involvement can be achieved through a success of integration. In some cases in the project based industries, suppliers are involved in the execution phase of the project. Integration mechanism and supplier relationship management techniques provided by Ragatz et al., (1997) can be well applied to the project based industry, when the suppliers are involved in the later stages. The work of Wagner & Hoegl (2006), also applies to the project based industries, because authors separate involvement, at an organizational level and a project level. In most of the cases in the project based industries

projects are run separately from a core organization. In such cases, integration or involvement techniques should be different from the organizational level integration techniques. All of these literatures are further utilized in the empirical analysis.

## 4. DATA COLLECTION

### 4.1 PRESENTATION OF DATA (STATNETT)

Statnett is an electric energy transportation company owned by the State of Petroleum and Energy in Norway. The supervisory authority is the Norwegian Water resources and Energy Directorate (NVE). Statnett is responsible for transportation of electric energy not for production and selling and has a monopoly over this sector. The company owns the majority of central grids and operates them. Thus, the company needs to balance consumption and production of electricity.

Statnett's organization is divided into various sections with different role and responsibilities. The various sections are; (1) Strategy and Public Affairs; (2) Projects divisions; (3) Grid operations divisions; (4) Commercial development; (5) ICT Division; (6) Finance; (7) Corporate staff. In addition there are various divisions under these main divisional departments.

Strategy and public affairs, is responsible for the planning and development in the main grid relating to transmission of electric power, strategy process, public affairs and international consultancy and advisory services. Project division, is responsible for planning and implementation of development projects. This division has the expertise on engineering and power transmission on overhead lines, cables and stations and within project management and project control. The division provides engineering services for research and development within the division's area of responsibility. The grid operations division is responsible for the operation, maintenance of main grids. This division also ensures that the grid is available for power transmission at all times. The commercial development division act as a marketing division for Statnett. The division is also responsible for developing market solutions for trade of various power market products in Norway as well as in the other Nordic countries and Europe. ICT division maintains Statnett's ICT systems which includes monitoring and controlling of the electricity grid. The finance division consists of six departments: controlling, finance, accounting, procurement, business control and financial analysis. Statnett's corporate staff comprises of administration, HR and top management.

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#### 4.1.1 PROJECT ENVIRONMENT AND STATNETT

Statnett carries its operation in terms of projects. Each division is separated into further departments and there are various projects under these departments. The common trend is that

project selection and project management is carried out according to contemporary practices in project management. A research and development project is carried out separately from the ongoing commercial projects.

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#### 4.1.1.1 HANDLING OF REGULAR PROJECTS

In the very initial stages, commercial projects are defined based on power production and consumption. In the first stage of project definition, analysis of the national grid and time scheduling is done. In the later stage, detailed designing of the project is done. Also, risk evaluation, more realistic time and budget planning is done.

Project is also selected considering the strategic orientation of the Statnett. Different alternatives are considered before making the final selection. Various risk factors associated with the project and licensing is also being considered before the final selection. The decision is made by a board of directors and assigned to the designated department and to the project owner. The project manager is selected by the project owner. Project manager holds the responsibility to select human resources. These resources are basically different technical personnel. Project manager also makes the procurement strategy along with procurement department which should be signed by the higher authority.

Projects are not strictly planned with resources. Interviewee expressed that it is hard to know at the initial stage how much resource a large project needs. Hence Statnett makes sure that any variation in the needs for resources is accommodated. Before the starting of the project, more resources and time is being allocated

Statnett utilizes decision gate system as a project evaluation technique. First decision gate is at project defining stage. Second decision gate is after defined project scope, budget allocation and time scheduling. Decision gate three is project scope approval stage. In the next stage, project execution starts. At the execution stage, external sourcing starts. The projects, which do not meet planned specifications, are not abruptly stopped. Statnett is aware of the fact that the projects do not run as planned. Hence, various solutions are tried when projects deviate from the planned specification. It is very unlikely that a project will be terminated at Statnett.

In general ongoing projects, suppliers are involved in the execution phase. There are some occasions in which suppliers are involved earlier. Such conditions are; in the large engineering projects, to discuss about equipment with which Statnett has not been worked

before. In one of the project department, it is mentioned that Statnett and the contractor's team do not generally work as a team. There exists, separate team from the contractors and from the Statnett with different roles and responsibilities.

Projects at Statnett face various challenges. Some of them are associated with time restriction, coordination between different parts of the projects. A challenge also lies in handling of a complex project, which is split into various parts and executed. For example, building of a new transformer station and drawing new cables between them. In such cases, Statnett has to coordinate its personnel resources across the projects, which is split into different parts. For example, operation of cable work and transformer stations separately.

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#### 4.1.1.2 PROJECT MANAGERS

Project managers at Statnett are involved in the tendering process. Project manager's approval of contractors who submit tenders is considered. Project manager's authority over keeping the personnel are not being considered as challenging because resources are meant to move across various projects. When a project manager appoints resource personnel from the different departments, contract will be made between the project manager and resource owner within Statnett. Even project manager is assigned with many projects. However, large complex project is assigned with designated resource and single project manager. Knowledge transfer between projects is being carried out in an informal manner. Project managers are supposed to attend various conferences and seminars. At such occasion, there exists opportunity to share knowledge. The different skills expected from the project manager are basic technical knowledge, ability to handle people, good communication and previous experiences.

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#### 4.1.1.3 RESEARCH AND DEVELOPMENT PROJECTS

As mentioned earlier, involvement and incorporation of research and development activity within the commercial projects is limited. Statnett carries research and development projects separately from the commercial or general projects. Both the development projects and commercial projects are given equal importance. The results or solutions of the development projects are utilized in several business projects. Both business and development projects go through same resource constraints. Emphasis on the development projects will be more towards technical aspects. It is been mentioned that financial value of the development projects is less compared to commercial projects. Also, research and development had lower profile compared with other large projects at Statnett. Statnett also seeks external source to

incorporate developments within the field which is new to Statnett. For example, development within wind energy is fairly new within Statnett and Norway. In order to cope up with this situation, Statnett is carrying out required development projects and also seeks solutions from other countries. In this regard, Statnett seeks countries like Netherlands, Denmark and Germany in order to gain knowledge and expertise in wind energy sector. One of the interviewees mentioned an incidence, involving research and development project within the existing ongoing project. The expected outcome from the development projects is finding the improved methods. It was indicated that suppliers are involved in such development projects. Also, Statnett comes together with other Norwegian and European companies under several development programs from the beginning of the development project itself.

Research and development project is very important according to the interviewees. It has also been mentioned that half of the knowledge used in the regular projects are derived from the R&D projects. In the maintenance work, even more R&D results have been made use of.

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#### 4.1.2 RESEARCH AND DEVELOPMENT AT STATNETT

This section explains the structure of R&D activity at Statnett. The main focus of the section is identifying how the R&D activity is handled in the company. The below mentioned information are the summary of the interview with head of the R&D theme at Statnett.

The interviewee at Statnett asserts that R&D activity is extremely important for the organization. She also suggests that the same opinion within the company may not be prevailing. Statnett's operation is carried out in terms of projects. Hence development at Statnett means identifying new ways of doing work or in other words, development of innovative processes. The application of developed process is utilized in several projects. The R&D activity is perceived important for the reasons; (1) achieving future goals; (2) to increase competence level of personnel; (3) in order to achieve competitive advantage; (4) as a motivational factor; (5) it can be used as a marketing tool.

Even though development activity is important for the company, there is no dedicated R&D department. The reason for not having dedicated R&D department is not mentioned by the interviewee, as the interviewee is fairly new to the organization. Development activity is handled by one of the R&D director and an assistant. Other personnel engage themselves in the R&D activity on top of their day to day activity in different departments. Thus, R&D has a very low status in Statnett. The interviewee suggested that R&D activity should be given

more importance and commitment from the top management. One of the reasons for less R&D activity at Statnett can be attributed to lack of top management support. However at middle and lower level of the organization, development activity perceived as very important activity for the organization. The other challenges are R&D activity can be seen as monotonous activity and it is hard to show the results in numbers. Hence, personnel who are involved in the R&D activity can be unmotivated. The reason for R&D to have lower profile is that R&D unit has been very bad at marketing itself. The unit could have done better if it published its results about what results they have achieved and how much money they have saved by it. However, there is a considerable effort to improve R & D status at Statnett.

Statnett utilizes external R&D organizations, i.e., universities and research centers such as Sintef. Statnett owns one of the external R&D organizations. Statnett approaches these external organizations with the problem and the external organizations give Statnett quotations and specifications. In some cases, external contractors are selected according public procurement.

There are two R&D themes and 4 R&D projects in each theme. Altogether it comprises of 39 development projects. Some projects long time frame and in which both Statnett and external organization work together in a project team. There are also very small projects which last for one week. All these R&D projects are completely separated from the commercial projects. The development projects at Statnett differ from commercial projects in terms of scope but share same resources. The interviewee expresses that the R&D projects should be handled separately from the commercial projects. However at Statnett some R&D projects are also managed like commercial projects. This means that the managers are supposed to report work packages they have accomplished and amount of money they have utilized. The solutions obtained from these projects are used in several business projects and aligned with long term strategic goal of Statnett.

Innovation and development happening in the business projects are project specific developments. There is no formal structure to transfer knowledge of development activity of commercial projects to Statnett as an organization and distribute it to other projects and functional fields. Since the personnel who are involved in the R&D projects are also involved in other projects, there is knowledge transfer across different project and the organization. However it is very personnel specific and informal means of knowledge transfer.

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#### 4.1.3 PROCUREMENT AT STATNETT

Statnett is a Norwegian state enterprise. Hence, the company should obey Norwegian public procurement regulations. The report does not investigate in depth the Norwegian public procurement regulations, since it is not within the scope of the thesis. The requirements for selection of the suppliers according to regulations and its effect on supplier relationships is been discussed in the report. Hence, the interview with the legal advisor at procurement department was carried out to collect required information. Below section gives the information on suppliers and procurement at Statnett.

Statnett has its suppliers within Norway and outside Norway. Statnett aims to select all the suppliers based on Sellihca and its own requirements. Sellihca is an EU-approved qualification scheme and supplier register for the entire Nordic energy industry (Statnett Web site, 2009). Statnett gets in touch with only those suppliers who register themselves in Sellihca. As a first step a supplier should register himself and get qualified. Such suppliers will have a transaction which exceeds NOK 1 million per year. To prequalify, supplier company should meet minimum set of standards; (1) it should be a legally established entity; (2) the supplier company should be free of charges related to taxes and debt settlement; (3) the company should have published previous years financial statements or annual report; (4) the supplier company must have plans to introduce a quality management system and health safety and environment management system. The prequalification stage extends to the second stage, in which certain critical products should be qualified by the Statnett's technical experts and procurement department. Such critical products are, control systems, power transformers, overhead conductors, glass insulators, composite insulators, and fitting for overhead lines.

In the next stages suppliers are tested for financial and technical viability, also considering their long term commitment with Statnett. To evaluate supplier's financial factors, Statnett refers to auditor's certification and proven track record. Supplier must demonstrate how an order will be dealt with, throughout the different phases of a project, which production units will be involved and individuals' involved and respective responsibility toward an individual. In relation to certain contracts, Norwegian-language documentation may be required. In the same manner, suppliers should demonstrate that they possess technical know-how corresponding to the products they supply. The suppliers must also show that they have the capability and qualification necessary to complete projects, including project planning and



design, production, testing and start-up (add reference). These selection criteria apply to the suppliers who will be involved in the both development and commercial projects of Statnett.

Project division prefers long term relationship with suppliers and work with the same suppliers with whom they have previously worked. However, main goal is to get the best qualified supplier. Once the contract is awarded, it is project leader's responsibility to build the relationship with suppliers who are involved in the projects. There usually is a project leader from the supplier end which help Statnett project leader establish good relationship with the suppliers.

The current situation at the supply side is such that there are fewer suppliers who meet Statnett's requirements and deliver. One of the reasons is that the Statnett is operating in a very specialized sector. The supply pool for this sector is quite small. Hence, Statnett is dependent on a small group of suppliers. In the same way, Statnett is also very important for these suppliers. Hence, the company feels that there exists mutual dependency. It is been specified in the interview that the suppliers are very important for Statnett to deliver its projects.

Statnett faces some problems associated with public procurement. The problem is basically with the process time which goes into selecting the right supplier before the starting date of a project. This has been considered as a very big challenge. However, public procurement is not problematic to establish good a relationship with the suppliers because of the long duration of projects. The company feels that the reason for conflict would be suppliers not being able to live up to the contracts and delivery expected.

## 5. ANALYSIS

Evolution is seen in both biological and social systems. We witness many invention and changes in our social, industrial and everyday life. The first motor vehicles invented have not remained same. They have evolved and developed into powerful, faster and superior automobile. The process involved has changed over the period of time. Even though Henry Ford's conveyor belt assembly line of producing vehicles gave success to the Ford motors, contemporary automotive industries have developed much efficient product systems as well as production systems, for example the 'Toyota production system'. One of the reasons for inventing the first airplane was one's desire to fly. Now, the same invention has evolved into massive aviation industry. Also, application of airplane is not limited to one's desire to fly, but it is about efficient means of transportation and further applications. In the same way, current airplanes are not made out of wood as earlier days. Even if we consider nature, animals evolve themselves to cope up with external environment. Hence, product, process and its application changes constantly. By all means new product development is very important across all sectors. The perception of this importance varies across different sectors. Complying with the scope of the master thesis, the difference of perception is investigated between project based industries and general mass production industries. Among these two sectors, there are several industries. For example, project based industries comprises of construction, information technology defense etc. In the same way mass production firms involves automotive, food industries etc. One on one comparison is not made between any of these industries; rather much broader comparison between mass production and project based industries is made. Hence the terms often mentioned here are project based industries and mass production industries. This leads us to the analysis of first research question of the thesis.

The analysis will be based on the research questions of the thesis. As mentioned initially, the research questions are formed to arrive at the result of the thesis. Hence, the last section involves the discussion based on one of the research questions. The final discussion provides the required framework.

### 5.1 IS A 'PRODUCT DEVELOPMENT' ACTIVITY PERCEIVED DIFFERENTLY WITHIN THE PROJECT BASED INDUSTRY COMPARED WITH MASS PRODUCTION INDUSTRY?

According to theory there are differences in the project based industries and mass production industries, if we consider the organizational structure, techniques used and the way operations

are held. We assume that there are other differences too. Hence, investigating if there are any differences in a product development activity across these two types of industries is relevant to this thesis. These differences and similarities are analyzed utilizing the data from the case company and the theoretical background.

#### 5.1.1 EXPECTATIONS FROM RESEARCH AND DEVELOPMENT ACTIVITIES

We compare research and development project with the product development activity in order to make an analysis and to link with the theoretical background. In the case of Statnett, R&D is perceived as extremely important from the head of project division and head of R&D activity. The importance however given was for different reasons. From the head of R&D it has been mentioned that R&D is important because Statnett can attain competitive advantage, it can market its capability, it can motivate its employers and as a tool to achieve future goals. These advantages expected can be said of more strategic advantages. On the other hand advantages expected from head of the project divisions were more of the operational benefits towards the business projects. It is been stated by the interviewee from the project division that R&D projects have more technical elements involved in them. This means that the results expected are more of the technical solutions. Most of the solutions related to maintenance of grids are generated from the development projects. Additionally, the project division expects new processes and new way of performing the task. Thus, in the case of Statnett R&D activity is perceived important strategically and operationally across various divisions.

If we look back into the theory (section, 3.1.1), it can be known that new product development not only keeps the industry excelling but also provides competitive advantage. Competitive advantage is a widely discussed issue in the field of strategic management. Ultimate existence of any firm is entirely dependent on the competitive positioning of a company. Following the strategic management theorists like Michael Porter, competitive advantage is achieved through either cost leadership or differentiation. It means that, the firm which offers a product of same value with reduced price is set to attain competitive advantage. Similarly, a firm which provides very superior value to the product also grabs competitive position at the market place. There is no counter argument to the fact that a product development activity contributes in reducing production cost for the company, improves quality, safety, performance, processes and other business practices. It plays an important role in increasing the value of the product. Competitive position is important for both mass production and project based industries. Hence, considering the aspect that a

product development activity contributes towards achieving competitive advantage, it should be equally important for both project based industries and mass production industries. This view point can be further justified, considering Statnett, which is assumed as a project based company.

#### 5.1.2 STAKE HOLDERS AROUND PROJECTS

In the case of Statnett, every project comes across stakeholder pressure. Government is one of the important stakeholders, since the company is a public organization. Thus it is natural that public interests should be considered while initiating and executing most of the projects.

Apart from the stakeholder's pressure, there are several factor's Statnett should be cautious before constructing new power line projects. Some of those interesting factors are effect on biodiversity and aesthetics related to nature. This mainly affects decision, while selecting an option between headlines and underground cables. Thus, projects at Statnett need to fulfill or tackle various stakeholders' interest.

According to the theory (section, 3.1.2), product development activity also attracts interests of several stakeholders. This aspect is also very similar to the project based industry setting and it is a very clear scenario in the case of Statnett. Stakeholder management itself is one important part of academia within the study field of project management. Some of the stakeholders, who are mentioned in the project management literature are, the operators, users and a financing party (Samset, 2003). Each of these stakeholders will have varied interest within the projects. Ulrich & Eppinger (2008) list several stakeholders who are concerned about the product development activity within a mass production company. It indicates that a product development activity within the mass production firms also undergo distinctive pressure from stakeholders. Type of stakeholders around the business projects might be different from the stakeholders around the product development activities. However, both the activities undergo similar pressure. This situation highlights that the product development activity within the mass production firms is very similar to the project industry environment.

Further similarities between a product development activity and a project are related to success factors for a product development and a project. Namely, top management involvement seemed extremely important for the success of product development and success of any project. Importance of a project leader or a project manager is also considered to be of greater importance. Other common success factors are customer and supplier involvement and effective planning. Since some of the critical success factors of a new product development

activity is also the same as the critical success factors of most of the projects. Thus by comparing this way it can be said that every project activity is similar to a new product development activity. By extending the same line of thoughts it can also be noted that a new product development activity is carried out like a project within several industrial sectors (section, 3.1.5).

PMI (Project Management Institute) states that a project is a temporary endeavor undertaken to create a unique product or service. Since a unique project is very similar to a new product development activity, it is assumed that the differences in the perception of development lie within the context of the industries. This implies that the perception of a product development within a mass production firm is different from an industry which delivers all its operations in terms of projects (a project based industry). If we consider the context of an industry, some of the elements that can be analyzed are macroeconomics around the industries, evolution of industries, practices found within the industry, resources within the industries.

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## 5.2 IF SO, WHAT ARE THE REASONS FOR PERCEIVED DIFFERENCES?

The above section elucidates the similarities between a product development activity and a project in project based industries. However, data from the case company and some of the literatures suggest that the innovation aspects in the project based industries are not as predominant as within the mass production companies. This preceding section attempts to identify the reasons for existing differences in the way new product development is perceived in the project based industries and other industries.

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### 5.2.1 DRIVERS OF THE DEVELOPMENT PROJECTS

The way projects are initiated can also give valuable information about the research and development aspects within the project based industries. In case of Statnett, government and energy production and demands play major roles. Commercial projects are designed according to the operational scope the company currently has. Statnett is also appointed as Norway's Transmission system operator with the responsibility of coordinating the operation of the country's electric power system and maintaining the balance between supply and demand at all times. It is Norway's main grid owner and operator in addition to being the regulator for the main grid (Norway's electricity grid is split into main grid, regional grid and distribution grid). Thus, the commercial projects are construction of new power lines (overhead lines and underground cables), building of new power stations and dismantling of

old power stations, and maintenance of power grids. So, it can be assumed that innovation required is only for solving any particular problem within the above mentioned projects. For those solutions Statnett depends on external research organizations and small development projects within the departments. Statnett invests on research and development to bring innovation in methods, solutions and products. Hence there are several research projects with a view to meeting the future demands and changes in trends of electricity generation (Projected investment by the government on wind power) and transmission. This can be one of the reasons for the lower research and development profile within Statnett. Even for huge development projects, Statnett seeks solutions from other countries that have already developed related technologies and other research organizations. Apart from these factors, Statnett has monopoly within the industry. Hence there are not strong drivers of innovation from the market side. It is already meeting the demands of the market within which it is operating and there is not much need of offering completely new solutions. Only developments required are related to new methods and possible change in the energy sector.

If we consider the literatures, similar views are highlighted. It is mentioned in the literatures that innovation within the project based industries are less compared with the mass production companies. One of the fundamental reasons can be a source of drive for the innovation and this view point is quite clear in the case of Statnett. Even within the mass production companies, customer driven product development is higher compared to in-house technology driven product development (Cooper & Kleinschmidt, 1986). Simple reason could be that it is more likely that the product sells within the market when it is market driven so is the perception within the industries. The scenario within the mass production company is that, customers are expected to pay for the value they are getting from the products, after the product is released to the market. In the project based industries, it is common that a customer sponsors or initiates a project. Hence project has to be made as per the customer's requirements. In this way such projects are already within the brackets or under restriction. The major constraint in this scenario can be very strict client requirements.

On the contrary, when a company is trying to identify best possible solutions, then there are more chances to innovate such solutions. Also, the mass production industries will constantly explore more and more arenas to offer new products and services to the customers because competition is high for these types of industries. Hence mass production companies will have both market driven and in-house technology driven innovations. In the project based industries, projects are initiated mostly by the client and clear demands. In many occasions

within the project based industries, the client himself is a customer and a project is designed strictly as per the customer's requirements. Thus source of developments or drivers of developments play major role and act differently across various industry sectors.

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#### 5.2.2 PROJECT MANAGEMENT TECHNIQUES AND PROJECT NETWORK

Statnett being mainly a project oriented company, project management techniques. Some of the project management techniques mentioned by the interviewee are decision gate techniques for evaluation and Work Breakdown Structure (WBS). Thus, it is common that project based industries utilizes various techniques of modern project management to deliver the output. These practices also have major impact on the processes of projects and its deliverables. The projects, in most cases are designed to deliver the task within time, scope and budget. Project control techniques would try to bring the projects within these three elements. Assuming that project is put within the brackets (within time, within cost). Practices like WBS mainly focus on the deliverables of the activities. There has not been much attention paid in order to extract value and innovation from of each of the activities within the WBS. Techniques like WBS are very common to use at Statnett. The project management techniques hampering the innovation aspect is discussed in the literature. It has been urged that the project management techniques should involve more innovation aspects within them.

One more challenge the project faces is the huge network, within which project is embedded. Hence, systematic innovation (see 3.3.2) within the project based industries can be very expensive and complicated. In the case of Statnett, extensive changes in the overhead line project can cause changes within entire grid in the country. This can even cause disruption in entire power supply. Also the project based industries do not have the privileges of testing as mass production industries have. In such industries, prototype of the developed product is tested even in the market and then mass production begins. In the case of project based industry testing of a project concept is still not heard of. If we consider the example of Statnett, the company may not test overhead project lines and dismantle it in case of changes. It is important for the company to get the first trial right. Hence, within the project based industries, planning and controlling is tightly done because rework of the process can be very expensive and complex.

Another noticeable challenge for the Statnett is absence of *Project Office* setting. Without the project office setting information transfer from one project to another project is difficult. It is the case with the Statnett. However, the company relies on the informal means of transferring



knowledge from one project to another project through conferences for the project managers. In the case of mass production companies, all the research and development related knowledge will be stored within a research and development department. So without structured R&D department or a project office, knowledge deposition and transfer is a challenge for the project based industries.

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### 5.3 HOW CAN A PROJECT BASED INDUSTRY MANAGE DEVELOPMENT ACTIVITIES IN A BEST POSSIBLE WAY?

Some elements of the project based industries have high potential for innovation. Considering the work of Hobday (2000), projects based industries are known to be best suited for managing CoPS (Complex Products and Systems). It can be assumed that CoPS are similar to the complex innovative projects. Thus, it leads us to investigate the elements which can promote innovation or development within the project based industries. This section identifies some of those elements.

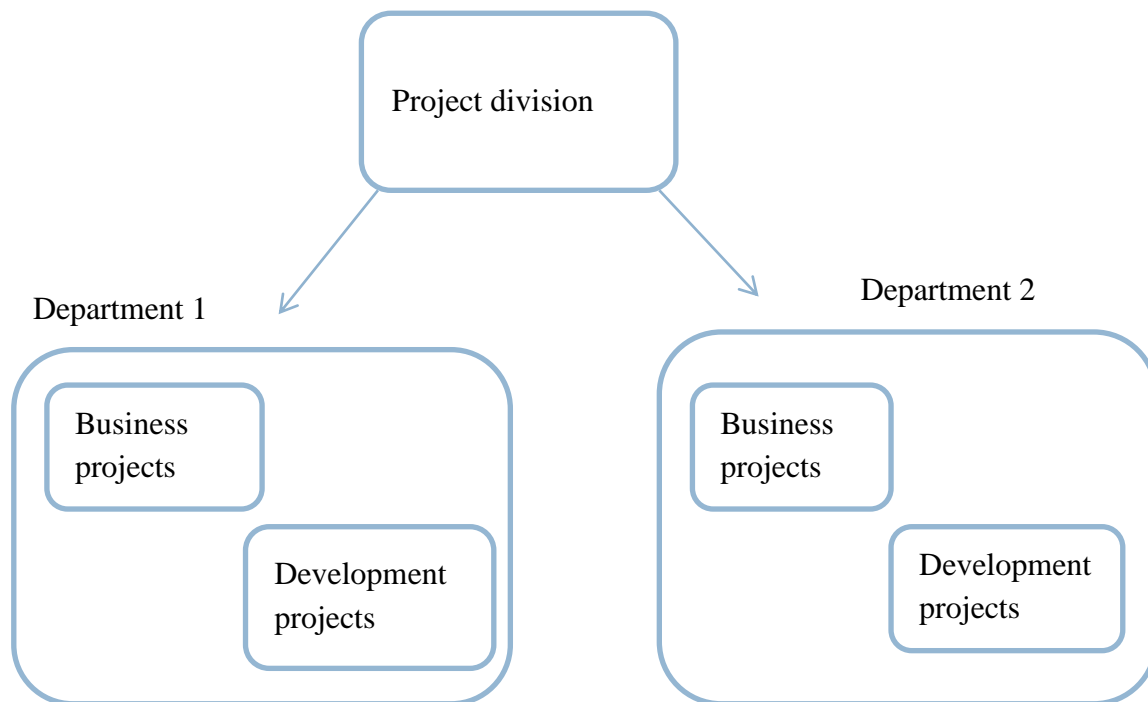
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#### 5.3.1 ARRANGEMENT OF THE PROJECTS

We can take Statnett as a case to analyze the best possible way to improve development aspects within its projects and the project industries. It is important to understand the way projects are arranged and managed in the company. The company handles most of its operations as projects. Its organizational structure involves several functional departments (See the section 4.1). The indication that there exists a project division, explains that the company runs several projects. The project division is further divided into several departments to carry out different types of projects according to different technical knowledge needed. Each department has both business projects and development projects. There are other functional departments, such as finance and procurement departments which are in coordination with the projects and projects' requirements. Thus the organizational structure is considered similar to the 'project matrix', one of the project organization structure mentioned by Hobday (2000). As mentioned in the literature, the project managers have equal status as functional managers. This was clearly shown in the case of Statnett that the project managers have similar level of authorities as functional managers. Indication that human resources are not moved around from the projects to projects is a good practice within the company. Also, project manager's involvement in the tendering process and selection of suppliers indicates project manager's strong positions. The practice of having contract with different functional departments, while utilizing human resources in their department is a good practice because it



reduces the uncertainty associated with human resources. The below diagram provides the pictorial explanation of business and development projects at Statnett.



**Figure 13. Project setting at Statnett.**

Through this arrangement it is possible for Statnett to deliver a project as well as to understand know-how and know-why required for the project. This situation also clearly indicates the challenge of development knowledge transfer across two departments. This type of problem has been identified in the literature and was discussed in the previous section. However one informal means of spreading information across various projects and departments are through conferences. However, it is not obligatory within Statnett that the project managers are supposed to share information in one of these conferences. It is just considered as one of the options. The framework mentioned in the figure, 14 provides few of the possible solutions for this issue.

Literatures address the problems that project management practices do not address innovation aspects. Keegan & Turner (2002) specifically emphasize on project management control and evaluation techniques which hinder innovation. This problem has also been discussed in the previous section. Especially in the scenario that a project which is terminated for the reason that it is deviating from the planned course of action can be a drawback for the project if we consider innovation aspect of the project. This scenario may not be applicable for all the projects, but to the some projects which involves know-how aspects within them. In the case

of Statnett, this was not seemed to be a problem. Interviewees responded that projects are not terminated, in case there is any deviation in a plan. Rather several options are utilized to solve any such problems. A decision gate technique is used for project evaluation in the company. Every decision gate provides an opportunity to absorb innovation aspect from each activity.

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### 5.3.2 RESOURCE CONSTRAINTS

Resource constraints related to projects was not highlighted by the interviewees. Human resources are meant to move from project to project. It is also mentioned that single project manager sometime will have more than one projects. In the case of Statnett, resource constraints are not mentioned in the project setting. In the company, projects are allocated with required level of resources and also any resource requirements during the project execution phase are fulfilled. This aspect suggests that all the project based organizations may not experience resource shortages. Top management involvement can also prove to be an important aspect for subsequent resource allocation. According to Keegan & Turner (2002) slack resources improve innovation because they accommodate experimentation. However it is an interesting phenomenon to know the reason behind the resource constraints in the project based industry. Engwall & Jerbrant (2002) provide one of the reasons for resource constraints within the project based industries. In the project based organization there are several projects run simultaneously. It is possible that all the projects draw resources from a common resource pool (Engwall & Jerbrant, 2003). Thus, it shows that project based industries can accommodate their projects with proper resources. However, the industry can accommodate slack resources and experimentation is arguable.

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### 5.3.3 RESEARCH AND DEVELOPMENT DEPARTMENT OR PROJECT OFFICE

If we take the example of the Statnett, there is no designated research and development department as a part of the functional departments. However company obtains required know-how solutions through the external research organizations. Other developments within the processes are carried out within the particular department. Even though this situation seemed to be working for Statnett, one challenge can be assumed. The challenge is that, since there is no designated R&D department, it can be problematic to coordinate with the external research organization, and absorb knowledge and make it available for all the relevant projects. It is a common phenomenon within the mass production industry that the Research & development department plays a major role in the product development activity. Within the established

mass production industries such as car makers, R&D department is one of the important functional units. Even platforms projects and derivative projects (section 3.1.4) often confine to R&D departments. Structure of the project based organization, might vary in comparison with the mass production company.

For a company like Statnett, either designate research and development department or a 'Project Office' set up can be very feasible. Advantages of having R&D department are; (1) more and more in-house research and development, (2) the department can coordinate within the development projects and know-how or know-why knowledge from the business projects too; (3) the department will be more suitable for Statnett because it is within an energy sector. The energy sectors have high potential and need for the developments and also at times it is inevitable for such firms to innovate and develop new solutions. At certain geographical locations, energy sector is forced to develop and distribute alternative energy sources. Hence internal research and development department in the dynamic environment can be of higher advantage. Also, the need for research and development department is asserted by one of the interviewees. The need for the top management support is asserted which theory also recommends; (4) it is highlighted that research and development activity can be monotonous and hard to show the results in terms of numbers. With the designated department, it is a motivational aspect for the human resources and also significant achievement in the development can be achieved.

Project office can act as a depository of the knowledge from projects within the Statnett. In case, the company perceives that buying research and developed projects from external organizations is feasible for Statnett, project office might suffice to act as a depository for the development knowledge both from the know-how and know-why of projects. Project office can also communicate to the external research organizations. However, challenge of this condition is to assigning the right skilled human resource for this department.

Overall, project based industry has the potentials for innovation within its projects and process. (1) The challenge for such industries as discussed before are, absorbing development knowledge from the business projects and distribution to other projects and to the relevant part of the organization; (2) Appropriate project control and evaluation techniques with the consideration towards the innovation aspects can promote innovation; (3) Appropriate resource allocation and randomly not moving the resources across the projects is helpful towards innovation; (4) the company can either establish research and development

department or a project office as a knowledge depository. All the elements are put together are shown in the model in the Figure 14, which serves as framework for handling know-how and know-why within the project based industry.

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#### 5.4 IS THERE ANY POTENTIAL WITHIN THE PROJECT BASED SECTOR FOR INVOLVING SUPPLIERS WITHIN ITS DEVELOPMENT ACTIVITIES?

The question if the project based industries have potential to integrate the suppliers in the product development can be answered with an understanding of the industry's interface with the suppliers. The industry is hugely concerned about selecting the right kind of suppliers and having right relationship with them in order to deliver the results (Martinsuo & Ahola, 2010). This research question mainly looks for answers about involving suppliers within the development projects and other development activities within the project based industries. Hence, it is essential that the industry sees suppliers as the contributors for the innovation within the industry. In such cases, supplier is considered as more than a mere process and product provider. This attitude is seen in the Statnett because suppliers also seen as a provider of technology. In this scenario, it has been assumed that a technology is one of the major contributors of innovation. This approach strengthens the view that the project based industries have potential for involving suppliers within the development activities. Having said this, it is important to analyze what are the aspects which strengthen this view.

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##### 5.4.1 INTEGRATION OF SUPPLIERS

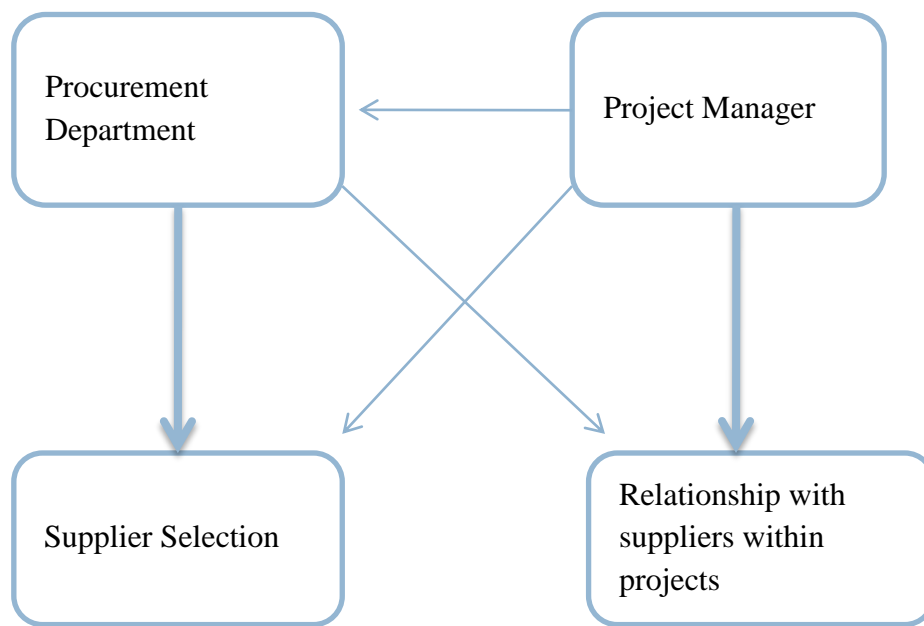
Statnett being a public procurement company, need to go through extensive selection procedures abiding various rules at national and international level. There is a high chance that the stringent rules and regulations delays the selection time. This problem has also been hinted by one of the interviewees at Statnett. Eventually, suppliers are involved in the execution phase. If Statnett is working with such a supplier for the first time, the company will have to invest time for adjusting with a supplier. In such an occasion, the company can make an effort to integrate supplier team at the execution phase. Currently at Statnett, there is a project manager assigned and he coordinates with the project manager of the contractors. The company can make an effort for integrating and communicating with the key-personnel from both suppliers and Statnett's project team. In such a scenario, there will be more knowledge transfer from both the teams and this aspect can promote innovative solutions in the product team. Effective integration mechanism between suppliers and Statnett can overcome some of the pitfalls of late involvement of suppliers within the projects. Buyer-

supplier interface and integration can be an element which affects their involvement. In the case of mass production companies, mostly products are bought from the suppliers. In most cases within the project based industries, suppliers provide both products and processes. In order to deliver complex projects it is important that suppliers are integrated in the project deployment (Martinsuo & Ahola, 2010). There are various integration mechanism theories, which suggest on integrating suppliers. According to Martinsuo & Ahola (2010) integration mechanism contributes to improved supplier relationship. In the later section integration mechanism will be discussed which helps companies to make use of supplier's competencies even in the case of late involvement of suppliers. There are various relationship building activities found in the literature. Some of those activities, as mentioned in the section 3.3.4 are shared education and training, joint agreement on performance measures, formalized risk and reward sharing and asset allocation.

Literatures highlight that the temporary nature of the projects are problematic to build good relationship between the core organization and suppliers. It is also mentioned that the relational benefits within the single projects are attained from better integration mechanism (Errasti et al, 2005). Thus better partnering mechanism promotes innovation within such industries. Statnett seem to be considering supplier involvement as a very important aspect. If a company manages to provide similar importance towards relationship building activities or integrating activities, we can assume that benefits of supplier involvement as mentioned in the section 3.3.1 can be achieved. Integration mechanism can be considered as one of the strategies to involve suppliers within the projects in project based industry.

#### 5.4.2 ROLE OF A PROJECT MANAGER TOWARDS SUPPLIER INVOLVEMENT

If we consider the Statnett's example, project manager is given extensive power to make use of the contractor's abilities. In the below diagram, thick line indicates major influence or responsibility. The thin lines indicate minimal responsibility. According to this diagram, a project manager has major influence over supplier relationship management during the project execution. A procurement department comes into picture only in the case of conflict and when a legal action is required. Even though this condition for a project manager is not similar to the ideal condition mentioned in the figure 5, it shows that project manager has considerable situation to exploit buyer supplier relationships within the projects. Thus project managers' authority is one of the important factors for involving suppliers in the projects.



**Figure 14. Procurement Department and Project manager's responsibility over supplier selection and relationship management.**

According to theory, project managers can play a greater importance towards involving suppliers efficiently. Referring to the figure 5, a project manager acts as a central entity coordinating the suppliers and the client. The condition explained in the figure 5 is an idealistic situation within the project based organization. Statnett, which is compared with the project matrix organization before, also provides its project managers considerable authority. There has been similar authority between project managers and functional managers. Also, project manager is also involved in the tendering process or supplier selection process along with the procurement department. Once, the suppliers are selected and project is started, it is a project manager's entire responsibility to manage relationship with the suppliers. Thus project manager is considered as the important entity to involve suppliers and hence gain benefits.

## 6. DISCUSSION

### 6.1 THE BEST POSSIBLE WAY TO INCREASE INNOVATION AND DEVELOPMENT ACTIVITY WITHIN THE PROJECT BASED INDUSTRIES AND INVOLVING SUPPLIERS IN SUCH ACTIVITIES

The best possible way to involve suppliers within the project based industries is a secondary issue. The primary concern here is initially having the clear framework for improved development or innovation within the project based industries and then clearly making use of suppliers within such developments. This framework is mainly developed on the analysis made by the theories and data from Statnett. Data from Statnett is mainly being used for getting a clearer picture of problems associated with research and development in project based industries. Theory is mainly made use for suggesting possible solutions for the problems highlighted. These two aspects put together form the required framework.

Some of the problems highlighted regarding innovation within the project based industries are listed in the below table. Also, associated problems regarding involving the suppliers within the development are also mentioned in the list.

<b>Problems concerning development and involving suppliers in the development process.</b>
Problems associated with customer, clients, governmental body and market. These are considered as drivers of innovation in the above discussions.
Project management practices and techniques practiced within the industries.
Knowledge transfer from projects to projects, and projects to a core organization
Difficulties associated with testing of a project.
Resource requirements.
Problems associated with Integrating suppliers within the projects.

**Table 4. Problems concerning development and involvement of suppliers within the project based industries.**

The model suggested by Gann & Salter (2000) involves various elements which can be considered as the solutions for the above problems as well as other issues discussed in the previous sections. The model mainly focuses on integrating resources associated with the firm

level and the projects level. The model is modified to involve elements which promote innovation and involvement of suppliers within project based industries and which are mentioned in the above analysis.

<b>Promoters for innovation and involvement of suppliers within the project based industries.</b>
Project Manager.
Project office or Research and Development department.
Top Managements.
Supporting departments.
Supplier integration mechanism within the projects both within the business and development projects.

**Table 5. Promoters for innovation and involving suppliers within the project based industries.**

The diagram shows the elements and their connectivity links within the project based industries. The links can be in the form of human resources or established communication channels. This arrangement is a possible frame work which promotes innovation or development within the project based industries as well as helps involving suppliers both in development projects and commercial projects. In the diagram, two main blocks are *project matrix organization* and *project setting*. The two elements are separated most of the time because projects are carried out separately both in theory and practices. Also, there are various elements at the project levels and firm's levels which affect innovation separately. However, elements mentioned in this framework has the potential to contribute innovation or developments within the project based industries.

In the project based industries, as discussed before the client or the project owner is an important element. In the mass production industries the customers are drivers of the innovation, in the project based industries clients or project owners initiate projects in most cases. At times, the project owner itself is a customer. Thus, the main drivers of innovation within the project based industries are clients or a project owner. These elements should be well connected with both a core organization and corresponding projects. This is shown in the below diagram. A project owner or a client is well connected to both with a core organization



and a project setting. This way, a project team and a firm will be able to understand the customer's or client's needs clearly and offer innovative solutions. In case, a client is very strict with the specifications, existing close connection helps influence the client. As a result, a project team can acquire more flexibility to try out innovative processes even in the case of client specific business projects. Hence, as shown in the diagram 14, by involving

It has been highlighted that some of the project management techniques create hindrance for innovation. A close connection between a *project manager* and *R&D department / project offices* can review project control and project evaluation techniques and accommodate innovative steps or processes. These three elements can work together towards accommodating innovation in project management techniques. One of the possibilities as mentioned in the case of Statnett is that, at the decision gates the company can analyze and absorb every innovative factor and any value adding activities. While evaluating the deliverables, the company can also analyze the activities and look into the innovative processes involved in the activity and store it within *project office* or *R&D department*. Also, a project office or R&D department can act proactively about adding innovation management within the project management techniques.

Challenges of knowledge transfer between projects to projects and from the projects to a core organization is hugely discussed in the literatures and it has been shown in the case company also. As solution, a project office and R&D department can act as a depository of knowledge. The frame work also highlights the top management involvement both within the project setting as well as with the external clients make it possible to provide adequate resources to the projects. With the proper resources, there is more likely that project personnel will be able to have better problem solving capability and thus improved development within the projects. As mentioned before project industry is deprived of testing privileges. However, improved simulation and planning tools can substitute testing option. As in the case of Statnett, external research and development organizations provide development solutions. Direct link between such external research organization and projects will improve the coordination.

Importance of adequate resources has been highlighted for the success of projects as well as to try different solutions in the case of Statnett. Theory also suggests importance of slack resources for innovation. Hence, the top management involvement is very important in order to obtain adequate resources for the projects. The framework below provides a link between the top management and the project settings.

Further, suppliers are again linked to both a core organization and the projects. This helps utilize suppliers know-how and know-why solutions both to the projects and a core organization. Elements at the core organization can contribute towards integrating the suppliers within the projects. This integration can be done both in the case of business projects as well as development projects. Additionally, there should be an effort from a core organization to utilize supplier's know-how and know-why solutions. These integrations techniques further establish strong relationship between a buying firm and a supplier. These integration techniques are described in the figure, 15.

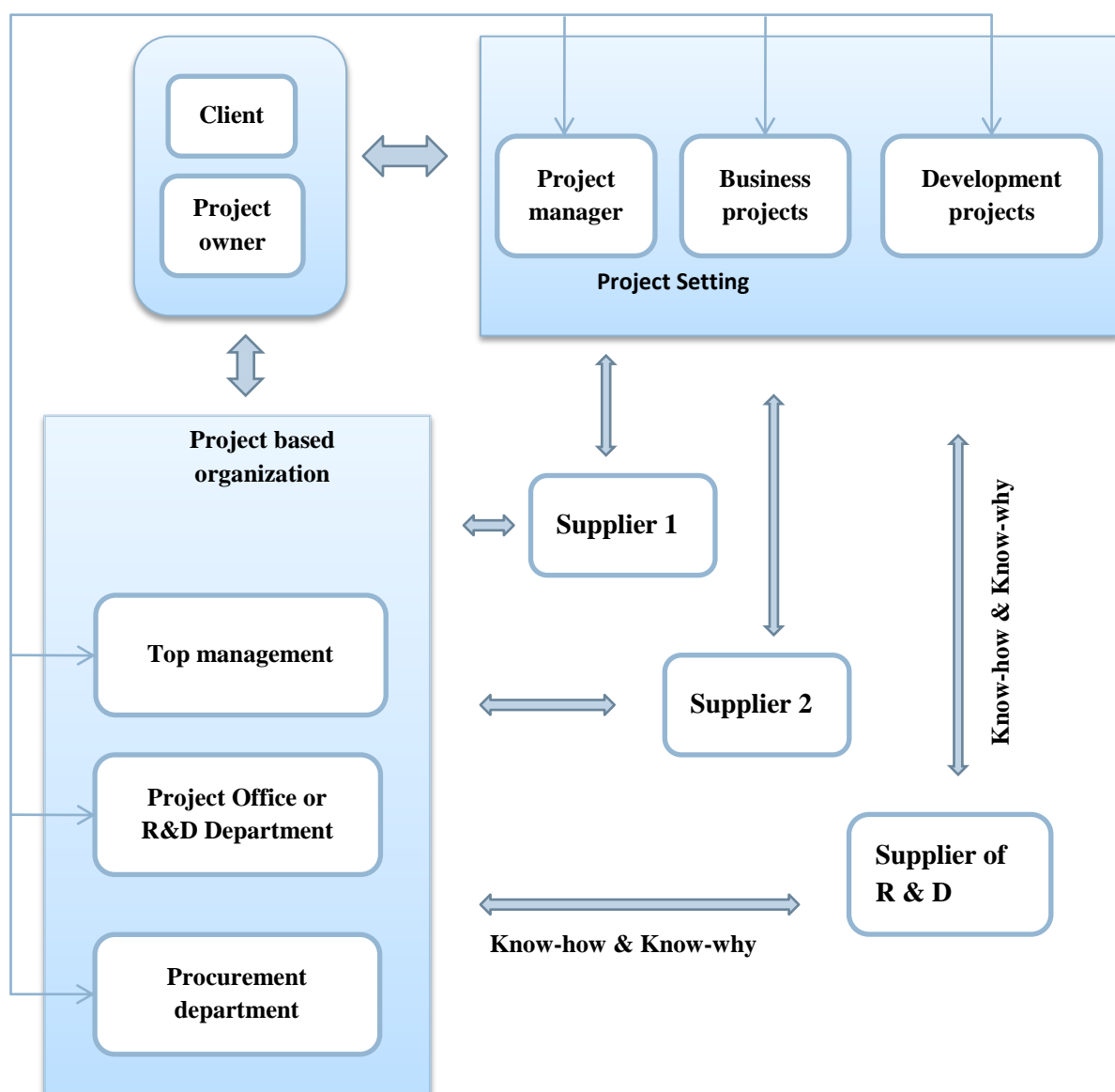


Figure 15. Framework for improved innovation and supplier involvement within project based industries.

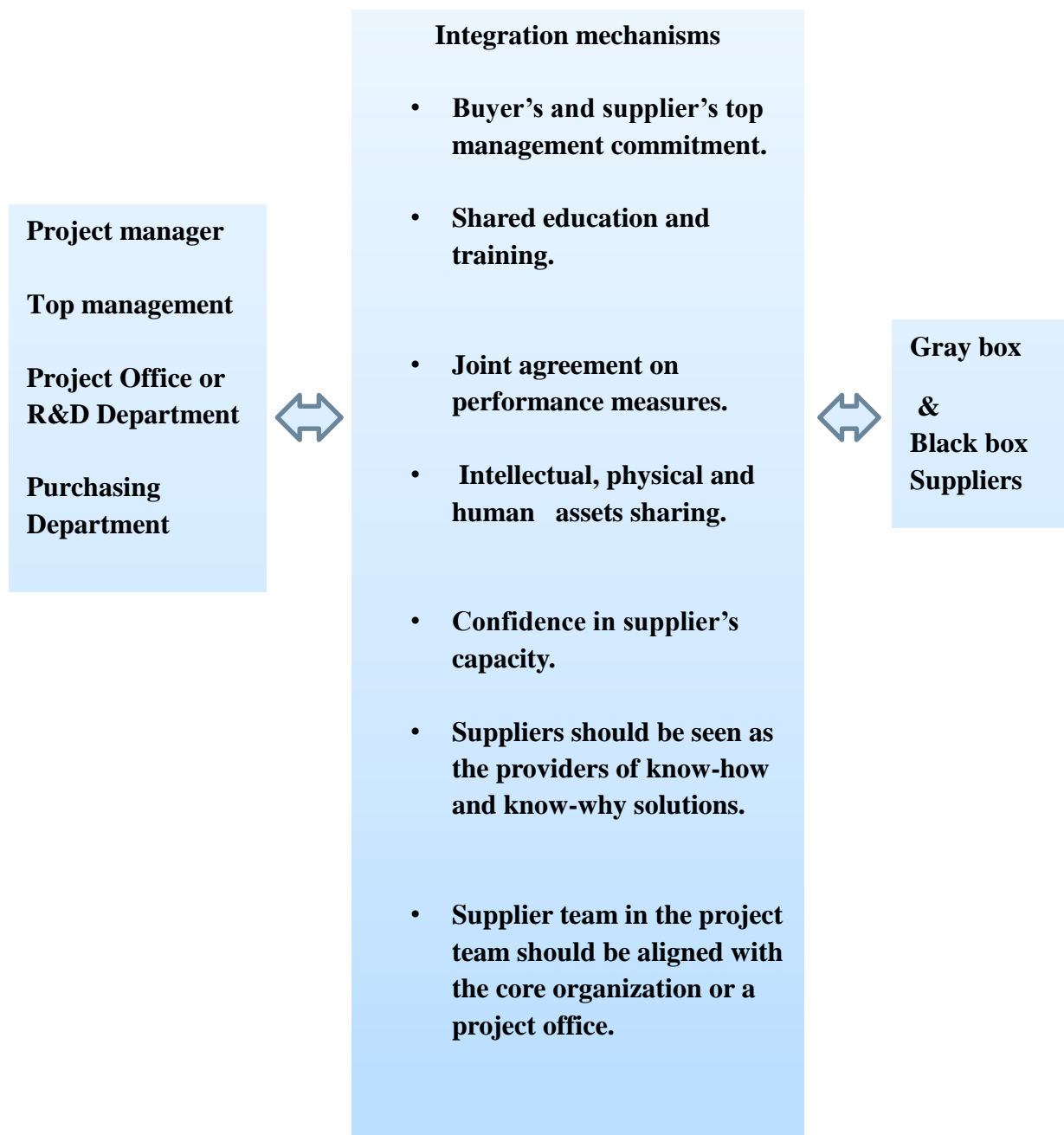
Once the project based industries finds the means to improve and absorb innovation and developments from/through its projects, then it can work towards involving suppliers in such development activities. Another important aspect here is absorbing innovative knowledge and know-how/know-why knowledge from the suppliers. Even though project based industry utilizes suppliers and contractors effectively, it is not so often that the buyer and supplier work together as a team. This aspect is also mentioned in the case of Statnett that the buyer and suppliers do not necessarily work as a team. In a situation like this, company needs to absorb know-how from the supplier team. Some of the elements which make this process happen are:

- Suppliers must be seen as the providers of know-how and know-why knowledge.
- Integration mechanism both at a project level and the organizational levels.
- In the case that a suppliers and a buyer company is not working as a team within the project, there should be a means to absorb know-how and know-why from the supplier team which are related to a particular project.

These elements are achievable in the case of project personnel, a core firm and the supplier company's joint effort. The figure, 15 provides the framework for the joint effort and provides integration mechanisms, through which it is easier to absorb innovative solutions from the supplier team.

In the diagram, the integration mechanisms mentioned are given by the authors Ragatz, Handfield, & Scannell (1997). These integration mechanisms are helpful for the project based industries. Often in the case of project based industries, buyer and supplier work together for one project for the first time and may not work together again. Hence, it is very important for the buying firm to involve the suppliers as efficiently as possible in a single project itself. One more challenge is related to the public procurement rules and regulations. In the case of Statnett, it was mentioned that procedures and obligations of the public procurements delays the supplier selection process. This can even delay the project and also delay the involvement of suppliers. In order to overcome this challenge, a buying firm can make use of the integration mechanisms to cope up with late involvements. If a supplier's team and a buyer's team are working together as a team, then it is possible to absorb innovative knowledge from the supplier's team and also it is easier to achieve integration. In the case that a buyer team and a supplier team work separately, a buying firm should try to integrate the supplier team

within the project as well as with a core organization, in order to know their know-how and know-why knowledge.



**Figure 16. Frame work for involving suppliers within the projects and development activities.**

Important actors who can be involved in the integration mechanism are suppliers, project managers, top management, project office or R & D department and a procurement department. In the case of Statnett, project managers are involved with a purchasing department for selecting the right suppliers and making procurement strategies. Similarly, a procurement department together with the project managers can contribute towards

integration. A project office can play a role in absorbing know-how and know-why knowledge from the supplier team and dissipating within a core organization. Top management can contribute towards establishing this kind of arrangements. The framework mentions as *black box* and *gray box* suppliers, because these suppliers provide technology and complex solutions as mentioned in the literature. Also, these are the types of suppliers, from whom a buying firm has great potential to learn know-how and know-why knowledge.

The product development activity in the project based industries is not confined to some sets of products and to a department, but it is embedded in every unique projects. Involvement of suppliers in a unique project means involving them in a product development activity. Effective integration mechanism can promote such involvement within a unique project. These integration mechanisms help towards forming a good relationship between a buying firm and supplier firm even if the suppliers are involved in the later stages. Hence, framework is also applicable to the public organizations, where involvement of suppliers gets delayed because of the complex selection procedures. Even if we consider the normal trends of project based industries, where suppliers are involved in the execution phases, effective integration mechanisms make it easier for the firms exchange their innovative solutions.

## 7. CONCLUSION AND SUGGESTIONS FOR FUTURE RESEARCH

The purpose of the thesis was to establish a frame work for involving suppliers for a project based industry. In order to arrive at the framework, research questions were established and they have been answered by analyzing the theory and empirical data. The process of answering each of the research questions established the following results:

Innovation or development within a project based industry is, as important as innovation in the mass production industries. The uniqueness of a project and a project life cycle is very similar to a new product development program in the mass production industries. However, value and perception of innovation is different across these two industries. Contextual elements around the project based industries also contribute towards the existing difference. The factors which contribute towards the differences are: (1) project management practices; (2) strict specifications and project owners; (3) lack of structures for managing innovation or product development, (4) disruption of innovative knowledge from a project to project and from a project to a core organization; (5) difficulties in testing of a process or a project; (6) insufficient awareness and literatures present on this issue. Alongside the challenges of managing and increasing innovation, a project based industry also has the potential to be innovative and handle complex system projects. Such potentials are due to the organizational structure of the industry, the structure of a project team and a project manager arrangement. Also, these factors promote involvement of the suppliers in innovation or development in a project based industry.

Based on the results achieved, the frameworks have been suggested. The final result consists of two frameworks. These two frameworks are helpful in understanding the dynamics of innovation and project based industries. The framework established are; (1) framework for improving innovation in the project based industries and involving suppliers; (2) framework for involving suppliers within projects and developments. The results achieved are feasible; because these results were obtained by comparing the theoretical background with the empirical data. The results also provide an indication that the project based industries have potential for innovation and management. These findings are in agreement with some of the literatures, such as Gann & Salter (2000) and Hobday (2000). Both the authors highlight the suitability of a project based industry for a construction of complex products and systems.

The research takes an approach of both exploratory and descriptive type of analysis, utilizing the data from one case company. There were some challenges in carrying out an extensive

analysis with the limited availability of empirical data. Since, the reasons for problems identified in the project based industries are not known. For example, in the case company, it was identified that the R & D profile is very low within the company and there is no R & D department. Only the fact was known through the limited number of interviews, but not the exact reason. This particular reason would be very important for the results achieved. However, the rationale behind the research questions and the logical sequence were helpful to obtain the results with limited empirical data.

This research identifies some of the elements which promote innovation and development in the project based industries. Also, the way these elements involve suppliers within the project based industries and in their development activities are also identified in this thesis. However, there should be more research on this issue. Scopes for the further research are;

- (1) Techniques and methodologies for combining innovation management with the techniques of the project managements.
- (2) Alternative solution to compensate the lack of testing within a project based industry.

The thesis work identifies that the project management techniques mainly focus on efficiencies within the processes. All the techniques aim at executing the project, within time, scope, and fixed amount of finances. Hence, a project is already placed within a bracket. On the other hand, development and innovation involves many skill sets, creativity and experimentation. The conflicting approaches between project management and innovation principles make it difficult for a project based industry to accommodate innovation within its processes. Well established methodologies should be established combining project management techniques and innovation management principles. Research on this issue will be very beneficiary for the project based industries.

It is not possible to test any particular process or an entire project. Testing can be expensive and complicated compared to a testing process in the mass production companies. Hence, a project phase has to be carefully planned and experimentation is avoided. Lack of experimentation hinders innovation. Thus, there exists a research scope for finding alternative solutions or methods to increase experimentations within a project phases.

## 8. BIBLIOGRAPHY

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