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THE FUNCTIONAL FIT BETWEEN COLLABORATIVE SOFTWARE AND WORK SYSTEMS

QUALIFICATION OF WORK SYSTEM NEEDS TO SOFTWARE FUNCTIONALITY

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Author:
Zulfiqar Ali Raffad

Supervisor:
Ph.Lic. Antti Tuomisto

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1 INTRODUCTION

1.1 Research Background & Motivation

It is a common situation, that many enterprises do not have the time, money and resources to invest in customized solutions, so they choose a pre-built software solution (Turner et al., 2008; OECD 2008). These solutions provide many advantages such as replacement of old outdated IS, integration of disparate IS, strategic advantage over competitors and overcoming difficulties with in-house development (Hedman & Andersson, 2014). These advantages along with institutional isomorphism i.e., competitors gaining advantage using pre-built software or adoption becoming the de facto standard (Davenport 2000; Parr & Shanks 2000), are forcing SMEs to adopt pre-built software to strengthen their productivity and performance, address global competition or improve their supply chain (Robert et al., 2003). This trend in adoption and reliance on pre-built software in SMEs is giving way to software companies in creating innovative solutions targeting performance and productivity of these enterprises.

Work collaboration software are one of the innovative solutions that promise creating value when working together in operational or project based work. Yet, many disadvantages are also apparent for pre-built software such as failing to meet specific business needs, offering too rich functionality or constraints on functionality. Hence, software vendors developing pre-built software solutions have to make specific assumptions regarding the software requirements and the functionality of the software (Blanchette 2005; Selby 2007;). Thus, it becomes particularly important that SMEs that cannot afford to build a customized solution should not risk investment in pre-built solutions before evaluating properly and purposefully its suitability to their business or functioning needs. An approach is needed that can help to qualify the fit of an enterprise and its underlying work system needs to pre-built software functionality. This, thesis studies the problematic task of defining the fit of pre-built software into SME business in general and the special case of work collaboration and collaboration software.

1.2 Research Motivation

My motivation to conduct the research originates from my work experience of over 12 years in IT. This particular research focuses on questions that arose during my role as a business systems analyst at a software research and development company (R&D) that provides both ready to use customizable software solutions as well as needs based software to small and medium sized enterprises (SMEs). As a part of this role I had the responsibility of articulating business and stakeholder needs, justifying the rationale for change and recommending software solutions that deliver value to vendor and its customer i.e. business enterprises. During the course of different projects at this company, I observed that both the software vendor and their customers lacked an approach that could help in matching work system needs to pre-built software's functionality.

In the company we used systems thinking along with several tools and techniques to understand the customers' enterprise (e.g. six sigma, SCRS, CATWOE, MoSCoW, PEST Analysis, SWOT Analysis and IT software design techniques). These tools were critically important especially if the solution was developed from scratch or if the company wanted to see if their software would suit any specific organization to help them become more efficient and productive. After a detailed and time consuming analysis was performed, business analysts along with software architects and case specific experts created illustrations of the current and future business-process-models using business process discovery and business process modeling tools and techniques. These illustrations helped in creating a base line for process improvement, and helped in designing improved businesses processes that could be developed as software functionality and workflow. The software that was developed keeping in mind the outcome of the analysis was believed to improve customer enterprise functioning and productivity. The downside to these tools and techniques was that they were time consuming. Hence, they could not be used for analyzing enterprises to determine the fit between pre-built software and enterprise work systems. The other downside of these tools and techniques was that they mostly concentrated on understanding the business processes giving less to no consideration of elements such as human participation, business customers, products, strategies, environment and infrastructure and how every element related to each other. These tools and techniques could not be used until complete data or expertise was available for the analysis of an

enterprise and its underlying work systems. More over these tools could not identify problem and opportunities and their triggers within the enterprise or its work systems, drilling down to these problems and opportunities in greater detail and producing a recommendation on how to make the system better. This entire process of analyzing, design and developing the software was a part of a phase based customized software development lifecycle model that followed the waterfall model yet allowed iterations and feedback into previous stages. The phase of investigation within this customized system development lifecycle (SDLC) model provided tools (i.e., interview, survey, questionnaires, task analysis, group-work, card sorting, class responsibility collaboration cards, observations, prototyping etc.) and techniques (i.e., linear sequential model, linear iterative process model, iterative process model and spiral model) for the elicitation, analysis, specification, verification and management of the needs and requirements of the work system.

A “pre-built software to work system qualification approach” was required that would be used to qualify work system needs to pre-built software’s functionality. This pre-built software to work system qualification approach would help software vendors and business enterprises thoroughly analyze an enterprise’s work systems to identify needs from problems and opportunities that exists within these enterprise work systems. It will allow analyzing other elements such as humans, strategies, infrastructure, etc., and the link between these elements. It will allow to work at any level of detail of analysis and guide the analyst on whether a specific analysis or design effort is balanced in its coverage of relevant content and what could be omitted. It will be easy to use and will not require expertise to conduct such analysis. Furthermore, the approach would also help to determine the functionality of a prebuilt software. Application of this approach would help in comparing the findings from enterprise work system analysis and functionality of prebuilt software in determining the fit between the pre-built software and the enterprise work systems and would help understand what changes would need to be incorporated within the software’s to provide the enterprise value.

I felt that the lack of such a pre-built software to work system qualification approach caused the software vendors difficulties in finding out whether their pre-built software would cater enterprise work system functioning and its needs. In understanding was that he customers had difficulties making informed decision on whether they shall invest in the purchase and implementation of software without knowing accurately if the software will comply with the work system needs. It seemed to me that the lack of understanding

on both software vendor and their customers' side resulted in making ill-informed decisions on going ahead with the implementation or refraining from it. I even felt that in case the implementation did not proceed or failed, it impacted software vendor sales and psychologically demotivated them. I witnessed cases, where the prospective customer got frustrated for not being able to find a pre-built solution that would improve the perceived problems. Hence, the customer certainly faced loss of time, effort and money. In some cases, when the software was implemented, the software was incompatible with the existing enterprise work systems and their underlying processes. This lead us and our customer to restructure work processes within the enterprise and further re-engineering the software affecting both the vendors and their customers in terms of consumption of one's resources. The drawbacks mentioned induced the process to identify and formulate pre-built software to work system qualification approach.

A more recent opportunity to work as a research assistant at Work Informatics in the Department of Management, Turku School of Economics, University of Turku, Finland in two research project helped me to develop an approach that could be used to qualify pre-built software functionality to work system needs. This research involved the study of tools of collaboration in work enterprises to execute the approach that has been developed. It allowed me to capitalize on the opportunity and theorize the answer for my research question by utilizing the collected material as an empirical base for my thesis project.

1.3 Research Aim and Question

Suitability of pre-built software to enterprise work system needs is an ongoing challenge for SMEs as well as for software vendors who want their software to be applicable to any type of enterprise. This challenge is prevalent in cases where the business analysts and developers try to analyze the enterprise work systems without utilizing frameworks. Frameworks are required to identify or work with already known problems and opportunities within customer business processes, formulate needs to deal with these problems and lastly match the needs to the adoption of some prospective software's functionality. Hence an approach is required that could bridge the gap between pre-built software and work-system in SMEs in the phases of planning and implementing a pre-built software.

This thesis answers the following research questions;

RQ 1. How to design a pre-built software to work system qualification approach which will help to derive and qualify work system needs in enterprises to software functionality and then to validate it through a real world example (RQ2)?

RQ 2. What special requirements work collaboration systems have regarding pre-built software, i.e. work collaboration needs of project and operational work?

a. How can the functionality of a work collaboration service be determined? (PHASE 1)

b. How can we evaluate the enterprise work systems to identify the collaboration needs that exist in project and operational work? (PHASE 2)

c. How can the functionality be compared to the needs to understand if the service addresses these needs? What unaddressed needs can be identified to make modifications or new features to the service so that it fits to the operational and project collaboration needs within SMEs? (PHASE 3)

1.4 Importance of the Study

In the information age collaboration is one of the key elements of today's work in small to medium enterprises (Robson & Bennett, 2000). Working together within enterprises is of even greater importance than ever as it helps in achieving shared goals, create common understanding, achieving better work quality and generating faster outputs (see e.g. Mattessich 2001; Gupta & Souder 1998; Nonaka & Takeuchi 1995; Pentina et al., 2007; Dayan & Di Benedetto 2009). Collaboration occurs naturally amongst two or more people. It can also be deliberately enforced as a way of work due to highly structured processes within enterprise work systems or due to external or internal influences on these work systems. Examples of these influences include globalized workforce, products and service alliances, decentralization of activities in enterprises, team based work in projects and co-operation in operational work (Dayan & Di Benedetto, 2009). Enterprise management are under pressure towards managing these influences, which can pose great challenges for the business enterprise. To cater the pressure, enterprise management employs

new ways of working together either through reorganization of work roles and the communication structures or re-engineering the business processes. They may also utilize software to manage work collaboration and make it better. However, software selection and adoption is a challenge without an approach that could be used for identification of work collaboration needs and their qualification to available software.

This study lessens the gap that exists for the qualification of a pre-built software to work system needs by providing a pre-built software to work system qualification approach. This approach helps to compare software functionality to work system needs. For this particular study, we determine the collaboration needs in SMEs in operational and project work in teams. The importance of pre-built software to work system qualification approach relates to the very core of business world. It could ease the customer's requirements management if the software vendors are provided a method to analyze and understand different work systems processes and their needs within enterprises. Understanding the problems in work systems and identifying the actors' needs for resolving these problems can help the software vendors to establish what areas they should address within their software to maximize value and reduce costs to deliver and implement. For the companies, especially SMEs, our approach provides a way to identify their business and work needs and present their internal functioning more clearly to software vendors for the procurement of software solutions. It can further help SMEs to determine collaboration software's or any other software's functionality being provided by different technology vendors to determine its conformity to earlier determined work system needs. This approach aims to help SMEs identify if they will benefit from a particular software and if it requires any change. Software development vendors can use the approach to evaluate customer enterprises and their work systems needs and determine if their software functionality will address these needs and if not then what changes would be needed to match the needs.

1.5 Research boundaries

The research focuses on determining an approach, which can be used to seek if a pre-built software's functionality would actually address the needs of the work systems within small to medium enterprises. The research limits itself to a Work Collaboration Service (a software that promises to enhance collaboration at work) and how it will be able to

address collaboration needs in project and operational work within different work systems. Hence, the approach will need further verification in different enterprises that are in need of similar analysis to determine qualification of work system needs to software functionality.

1.6 Structure of the thesis

This section introduces each chapter within this thesis. It shows how each chapter has been sequenced and forms a bridge to the proceeding chapter. The structure of the thesis is as follows:

Chapter 1) Introduction: This chapter introduces the background of the research. It explains why the research has been conducted by identifying the gap in the collaborative work and WCS literature and practical world it addresses. It presents the aim of the research and the questions and research boundaries.

Chapter 2) Realities of Work and SMEs: The nature of the research requires us to focus on prevalent work types existing in small to medium sized enterprises (SMEs). Hence there is a need to understand what is work and how is it carried out in SMEs. Although we have the work systems method and framework, which can help understand the work systems within any enterprise (Alter, 2010), they do not give for the purpose of this study a holistic explanation on what is work, the types of work in enterprises and also does not impart important information on SMEs. Hence this chapter covers this gap and plays a pivotal role by imparting information on all of these topics from researched literature on the definition and understanding of work in today's enterprises. It unveils the work phenomenon and helps to understand the need for mental work in today's enterprise. It then describes prevailing categorizes of work into two dominant types operations and projects within different work system. Lastly, it introduces the small and medium enterprises by including reflections from latest research.

Chapter 3) Collaboration at Work: The focus of this research is on studying the collaboration phenomenon in enterprises and identifying problems and opportunities pertaining to collaboration in operational and project work. As a result, devising needs,

which are qualified against a work collaboration service's functionality to determine whether the service will suffice against these needs. This chapter helps in investigating the collaboration phenomenon by investigating the importance of work collaboration in enterprises, what influences the quality of collaborative work and the factors, which make collaboration between individuals successful. It then explores how collaborative technologies of different kinds are used within enterprises.

Chapter 4) Work Systems: The chapter introduces the work systems method and framework by Alter (2006) which is used to study work systems in small to medium sized enterprises to identify problems and opportunities which will help devise the needs required of a software that the work collaboration service has to fulfil. The chapter starts by explaining the concept of work systems framework and its elements which help to establish how to think about, identify and analyse work systems in enterprises. It then introduces how to represent the analysis in a tabular format i.e., Work Systems Snapshot.

Chapter 5) Research Strategy: The chapter describes the process and methodology utilized for this research. It introduces the background of the project, which establishes why the qualitative research methodology is used. It then provides an overview of how the research is done and how the results are approached through various evaluation. Lastly, the chapter provides the data on the enterprises used in the analysis of this research.

Chapter 6) Findings: This chapter introduces the findings and their evaluations, and answers to the research questions. It also provides implications based on these findings and identifies what can be done to make the service better.

Chapter 7) Conclusions: Summarises research and its findings, what was the challenge that was faced, what new knowledge was discovered, where is it applicable, what limitations are there and areas for further development.

2 EXPLORING THE REALITY OF TEAMWORK AND SMES

Enterprises perform work through individuals and teams who use a combination of project and operational work types to produce products and services that are of value to their customers (Aguinis et al., 2009). This chapter provides a theoretical overview on work, its influences, the worker and the collaborative work types. It also presents SMEs as an working environment and an organization, the challenges faced by SMEs performance, and how the different work types can help in overcoming the challenges.

2.1 The Essence of Work and Knowledge Workers in Enterprises

Work is the fundamental construction behind the production and delivery of products and services by an enterprise (Budd, 2011). Work requires mental and physical effort to achieve personal and corporate goals (Blyton & Noon, 2008). Based on the work realm in enterprises it is important to investigate the work phenomenon by studying the nature of work, its influences, and the emergence of knowledge work.

2.1.1 Demystifying Work

Work is defined by Vallas (2012, p. 3) as "any expenditure of human effort aimed at producing a socially valued good or service". Thomas (1999) identifies that work comprises of three essential constituents without which work shall suffer;

i) "It helps to produce results hence is not an end in itself",
ii) "Involves a degree of necessity or obligation where tasks can be either be performed personally or can be allocated to others based on their importance and need",
iii) "Requires effort and persistence from a resource".

Today, it can be argued that even machines perform work, which is true but is not applicable to this study as our focus is to investigate work done by humans in enterprises

to achieve the outcomes that are expected from it. It is obvious that human effort is required to produce a product or a service with a degree of responsibility towards work. If any of the above three constituents is missing, work performance will suffer and would result in low quality of the result. The above definition is generic and is applicable to any form of work be it entertainment or sport. Our focus is work in enterprises. Enterprises perform work activities to produce some results in terms of products and services. On logical grounds, one can argue that there is a relationship between the work and its outputs. Both work and the end results require a balance where changing the result will impact the way the work is conducted to produce it and vice versa (Blyton & Noon, 2007). Furthermore, work is also impacted by a number of internal and external influences that affect the enterprise where the work is carried out. These influences are studied next in more detail.

2.1.2 Factors that Affect Work

A number of factors affect the enterprise as well as the how work is conducted within it. These factors can be categorized broadly under political, economic, social and technological (Aguilar, 1967). Environmental and legal are added as factors at a later stage giving the PESTEL tool. Originally PESTLE was designed as a business environmental scanning tool. The PESTEL analysis can be used to analyze the external macro environment of a business and how external factors impact the business enterprise. What makes these external factors important is that they are beyond any direct control or influence of a business enterprise, however measures can be taken to deal with their impact on the business during product or service development through strategic planning.

External political factors can be e.g. in the form of government and its stability, regulation and de-regulation laws, level of bureaucracy and corruption, social and employment legislations. Economic factors are e.g. business lifecycle, unemployment, globalization, technological change, labor costs. Technological factors such as automation of business processes, innovative technologies and their impact on business, faster internet access, reduction in costs to communicate and work remotely, research and development, etc., Social factors relate to population growth rate and age, employment patterns, job market freedom and attitudes to work, etc., (Aguilar, 1967). Apart from the external fac-

tors a number of internal factors affect the business internally these can range from enterprise culture and trends, technological resources, human resources, financial resources, product line, competitive resources, innovation etc., (Blyton & Noon, 2007). The foregoing discussion on the factors implies that a major difference exists between the internal and external factors. The internal factors can be controlled through planning and management process. The external factors are the ones on which the enterprise has either no or very limited control hence requires strategic planning and alignment of these factors to the internal factors thereby managing their impact and adjusting accordingly. Hence, it can logically be deduced that to understand the functioning of an enterprise, the enterprise should be understood both internally and externally as the work practices that are utilized towards the operation of an enterprise are dependent on the factors affecting it as a whole. It is the responsibility of executive management to plan and implement strategies, policies and practices to effectively manage the impacts of these factors. The management should also take into account the human resources and their intellectual capabilities, experience, enterprise culture and skills as these would play a great role in minimizing the impact of these factors. At the same time the enterprise's management should disregard the deskilling nature of any policies that will affect the viable work performance of human actors (Blyton & Noon, 2007). The above narrative emphasizes that work is dependent on internal and external factors affecting the organization. It requires strategic planning and change in work practices within work systems to adapt to the changes accordingly. To summarize this approach, it means that to understand and work with these factors intellectual capability is required in the enterprise workforce.

2.1.3 Advent of Knowledge Work and Knowledge Worker

Work in enterprises has seen fundamental shifts in the way it is performed as a result causing deskilling and up-skilling of the enterprise workforce. This deskilling can be attributed to Fordism and Taylorism. The central idea behind Taylorism is to achieve efficiency in work by finding out the single best way of performing it. This is done by breaking all major activities into the smallest components and analyzing each step to come up with the one best way of performing them. Management is responsible to allocate tasks to a skilled person who could perform the task (Blyton & Noon, 2007). This managerial ideology had four dominant themes

i) "Removing any employee discretion allowed managers to control the method and work pace",
ii) "Planning activities to business needs and objectives",
iii) "Not trusting people in performing jobs diligently",
iv) "Motivating employees to work for money".

(Williams 2007; Vallas 2012).

Hence, the basic premise behind Taylor's theory is that it required workers job to be automated to achieve work efficiency and control by the management. Henry Ford later adapted this approach to the factory floor settings for the mass production of automobiles parts through by using assembly lines (Ford & Crowther 1973; Williams & Haslam 1992). Both views forsake employee development over work efficiency and control (Braverman, 1974). Management took control of the process of work and performed conceptual tasks while the execution of work was handled by shop floor workers thereby limiting discretion of the worker through process automation. Fuchs (1968) opposed this way of working and suggested that enterprises should hire resources who are qualified and have the potential to use minds at work rather than hands. This is what he referred to as up-skilling where knowledge played a central role in performing work with an enterprise.

Blackler (1995) identifies five forms of knowledge through a critical review of previous works in enterprise workforce knowledge. These forms are;

i) Embrained, sits in the brain and is used for solving complex problems using creative methods,
ii) Embodied, learnt from experience and applied in similar context by drawing upon previous experience in similar context,
iii) Encultured, shared understanding of how work is accomplished,
iv) Embedded, systematic routines embedded in the brain helps getting work activities done without thinking,
v) Encoded, information conveyed using signs and symbols.

He further establishes that knowledge work is not important per se. He states that is important is managing how an individual shifts emphasis between the different forms of knowledge during work. Critics such as Kumar (1995), Collins (1997), and Thompson, Warhurst & Callaghan (2001) claim knowledge work to be meaningless and as argue that

work in enterprises is often repetitive and offers less discretion and training to employees who are given a way to do things rather than do things by their own way. They further argue that knowledge work is nothing new as employees have always relied upon knowledge to carry out their tasks. Other commentators suggest that knowledge work can still be defines regardless of the different opinions surrounding it. (Frenkel et al., 1995) support the works of Blackler but argues that changes in work due to enterprise influences require theoretical and abstract rather than contextual knowledge. This implies is that enterprise workforce are more dependant on their brains rather than relying only on systematic routine and experience.

Peter Drucker (1959) first identified such work force within enterprises. Drucker boded that in the upcoming decades it would become impossible to maintain a middle class lifestyle by working with one's hands. His prediction holds true when we analyze current job markets where nearly all jobs require utilizing more information and working with knowledge than they did in the past. Autor & Price (2013) support Drucker's findings by displaying the change in demand for skill in Figure 01.

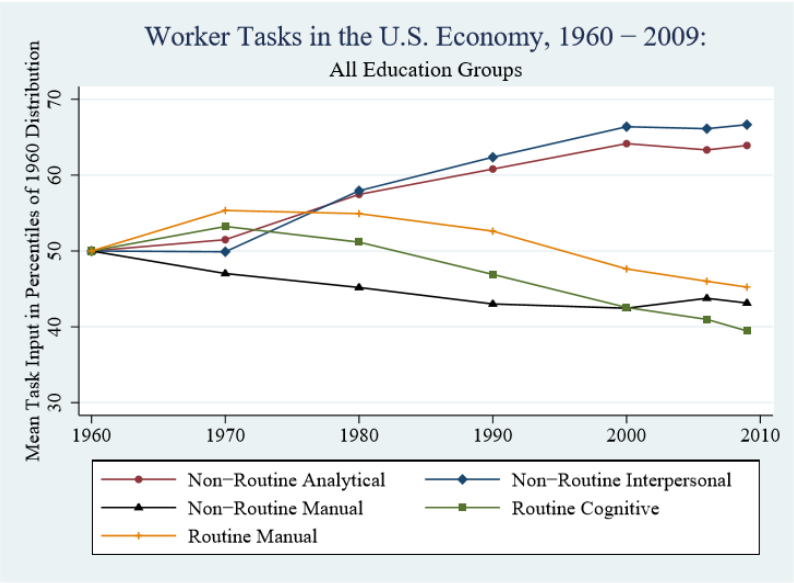

Figure 01: Change in Demand for Skill (Autor & Price, 2013, p. 5)

The graph represented in Figure 01 amply supports Drucker's claim. It indicates that during a period of 50 years between 1960-2010, utilization of knowledge has significantly seen an increase within the enterprise workforce. This increasing trend in the utilization of knowledge will continue to grow. This claim is supported by research done on how much is mental demand increasing per year in jobs. A report from the European Working Conditions Observatory (2005) highlights this trend where at least four in ten employees considered that the mental demands of their job had increased compared with the previous year. This increase in the mental demands has been attributed to the advances in the enterprise's way of working to match competition and to stay up to date with the latest trends. The report further indicates that enterprises are investing time, resources and effort to develop the skills of their workers in order to utilize their full potential.

Using the above literature and illustration on knowledge work and worker we can derive that knowledge worker and knowledge work are business "*enablers"* of today. This means that the skills employed by the knowledge workers help enterprises become more efficient in their day-to-day activities. Due to their importance to the enterprises of today, the skills of knowledge workers are addressed by continuous training and development programs offered by their enterprise or through self-learning, which benefits both the worker and the enterprise (Aguinis & Kraiger, 2009). This training and development of knowledge workers occur at different level within enterprises, be it enterprises training (Arthur et al., 2003), management training, leadership development (Collins & Holton, 2004), cross-training; coordination and adaptation training, and guided team self-correction training (Salas, Nichols & Driskell, 2007). In addition, help and support become an elementary way of working together in enterprises. Participants work towards shared goals and during this they try to help and support each other to develop similar understanding on issues and tasks at hand. These enterprises also provide other kind of sustainable working conditions. For example, health and safety, quality framework for traineeships, and decent working condition for maximum utilization of the training and skills that the knowledge worker has developed, so that time and effort are effectively used (European Commission, 2014). Enterprises motivate their workforce today through promotion of the benefits of knowledge to its workers and through the delivery of incentives in the form of compensation, benefits, recognition and appreciation. This sub-chapter aimed to introduce the concepts of knowledge work and knowledge workers. It also shed light on the increase in the demand of utilization of knowledge in enterprises today. Next

subchapter introduces two prevalent work types, operational and project work employed by enterprises to achieve better delivery of products and services and for management of work accomplished by the knowledge workers.

2.1.4 Enterprise Work Types

Work categorization in any enterprise has two prevailing types i.e., Operational and Project (PMBOK, 2013). The operational work enables enterprises to achieve on-going, repetitive activities, such as day to day accounting or manufacturing. The project work is temporary endeavors that are initiated to create a unique product, service or to achieve a specific result. Project work differs from operations in that they end when objective has been met or when the project is terminated. But both project and operational work are similar in their basics of how they are initiated, performed and completed (Schwalbe, 2013). But it could vary in what the workers achieve, in the type of tasks they perform, their life, what change they bring evolutionary or revolutionary, work continuity, etc., (Meredith & Mantel 2009). The management of both these modes of accomplishing work is essential to both knowledge workers and their managers.

2.1.4.1 Operational Work

Operations as defined by Oxford Dictionary (2015), “is the action of functioning or the fact of being active or in effect” and “an activity in which a business is involved”. These definitions point out two characteristics of operations, where operations involve act of functioning towards achieving something and secondly this act is in the form of an activity in which business is involved. These day-to-day activities of individuals and teams help enterprises produce and deliver products and services as well as remain competitive. Operations have distinguishable characteristics from project work. These are as follows;

- Operation activities are repetitive and ongoing and exist till an enterprise exists,
- Operations are goal driven and change over time. Once a goal is modified operation activities adopt to the new set of objectives and the work continues,

- Operations supplement projects to be smoothly transitioned into a business environment,
- Operations are continuous and allow gradual quality improvements for both process and end product,
- Operations differ to projects as they implement evolutionary change rather than revolutionary change which is evident in the nature of projects,
- Individuals working in operations seldom change,
- In operations individuals and team skill sets are nearly similar hence work allocation is easier,
- Operations are highly dependent on enterprises structure while project are not,
- In operations needs define priorities,
- Operation work helps identify quantity and quality of delivery,
- Operations help in providing support, standard service requests, availability management, incident and problem management, capacity management, release management, budget management and change management to the business,
- In operation work measurement metrics involve e.g. SLA, OLA, KPI, and incidents,
- Operation work require daily, weekly, monthly documentations.

(AXELOS 2011; PMBOK 2013; Schwalbe 2013; Srinivasan 2008)

The foregoing discussion implies that operations are activities that are carried out by the knowledge workers individually and in teams on a day-to-day basis for the functioning of a business. These activities are cyclic in nature and require ongoing efforts where these efforts do not cease and if they do, they affect the smooth running of the business.

Hence, operations can be seen as two separate views: one view covers the work which an individual or team does to accomplish their work activities to function and the second is the view of the business where it refers to activities involved in everyday functions of the business that are conducted for the purpose of generating profits. A more logical deduction showing the relation between the two views is that individuals and teams both perform work activities on day-to-day basis to achieve assigned tasks. These tasks are a breakdown of the business operations

where each operation is fulfilled once all the assigned tasks to the resources have been met. Hence, the purpose of individual or teams and business operations is to sustain the daily business. If the goal of the business is changed or redefined, these activities take up the new set of objectives and the work continues (Srinivasan, 2008).

2.1.4.2 Projects Work

A prevalent category for performing work within enterprises is projects. “Project Based Enterprises” a term referred by (Soderlund, Bredin & Karin 2011; PMI 2013) are enterprises that employ projects, governance and management practices. These enterprises employ project teams comprising of individuals with variant skills that use project work form to organize and coordinate activities and achieve outcomes in the form of products, services and results. One example can be that startup that is going to build a new smart watch over a period of a year. Other example can be that of a software development team at a software house that develops new applications for popular smartphone operating systems. Bernstein & Braude (2011, 8-9) argue why employing project and project management practices in enterprises can be beneficial. They emphasize that these practices can help create better enterprises by administrating structure, delegation and management of activities. These practices employ process-oriented approach to achieve the better quality and delivery of products and services not just to their external customers but also within the enterprise. Significant research has been done on project management in enterprises as seen in the works of (Baydoun 2010; Söderland et al 2012; Owens et al., 2012; Shore & Zollo 2015). Their works explain how enterprises use project management practices to achieve and deliver quality products and service within and beyond organizational boundaries.

Projects require that a work activity should be broken down into tasks. An example of such a breakdown could be a team working on testing a piece of code that modifies some existing function of a software system. This activity could be divided into a set of tasks, e.g. to verify algorithm, data flows, EDI implementations and conformity to any data standards, to verify if the ODBC connections are established to handle any exchange on information between database and the application. Here project management practices take control over structuring of this kind of activities. (Spring et al., 2009;

Armistead & Machin, 1997). Based on the research needs for this thesis, it becomes essential to develop similar understanding in SMEs, their work systems, the challenges faced by them and the usage of operational work and project management practices in them.

2.2 SME - Small Innovation Giant

National economies are boosted by enterprises of micro, small and medium structures. The SME sector as a whole has delivered 57.6% of the gross value added in Europe itself during 2012 (European Commission, 2013). It can be claimed that SMEs are the dominant force behind a healthier economy based on a number of factors such as,

- bringing forth new and innovative technologies to the national and international markets and improving the flow of innovation,
- increasing jobs,
- steadying national and international economy,
- bringing in cheaper and better products and services to existing markets, etc.

This subchapter describes SMEs; what they are, their importance, what affects them, and how the earlier categorization of work exists in these structures.

2.2.1 SMEs and their Importance

Business research has placed considerable emphasis on the categorization of companies based on their size and turnover. The importance behind this emphasis is to give a clear perspective on how the size defines the enterprise's nature, enterprise customers, market share and ownership (Storey & Greene, 2010). Various definitions exist for SMEs. J.E. Bolton (1971) in his well renowned report on the inquiry of small firms indicates that small businesses have three essential characteristics, which differentiate them from large enterprises:

i) ownership and management of the firm is done from the same individual,
ii) these firm are legally independent
iii) have a small share of the market place.

(Bolton Report, 1971)

The Bolton report suggest that these characteristics should be present in a small firm. Eliminating any characteristic will not qualify the firm to be small. OECD (2005) establishes its own definition and defines SMEs as non-subsidiary independent firm which employs fewer than a given number of people. This number varies across countries. On a similar note, the European Commission defines such enterprises based on headcount and financial indexes. It defines a SME as an entity that performs some activity that helps it earn money to keep its operations going, employs less than 250 people with an annual turnover not exceeding 50 million euros (European Commission, 2013). Other distinctions on SMEs are presented in Table 01 below. These comparisons are based on metrics other than size and turnover and help to realize the nature and characteristics of SMEs in greater detail than just a generic definition.

Table 01: Nature and Characteristics of SMEs

Author	**Characteristics**	**Explanation**
(Bolton, 1971)	Market Power	Smaller businesses have a smaller share in market and a lesser control of resource hence they are less likely to influence the market price of goods and services as compared to larger enterprises
(Shocker et al. 1994)	Brand Name & Value	Brand value does not exist in SMEs except local loyalty in a specific place or region based on business reach.
(Jennings & Beaver, 1997)	Better Offerings & Market Responsiveness	SMEs are more flexible in their offerings as they can manufacture new and innovative products and services using variant methods bringing down the cost of their offerings. These enterprises are seen to be more responsive to their customers feedback and wants than larger businesses.
(Rangone, 1999)	Strategy	SMEs adopt flexible management strategy because they cannot compete on the economies of scale with their larger counterparts. They are more likely to switch to development of new product and services and venturing into new markets.
(Honjo, 2000)	Failure	Points out that new manufacturing firms fail because of, • Smaller size and insufficient capital, • High entry rate manufacturing industry, • Timing of entry in the industry and market before or after the collapse of the bubble economy.
(Cosh, 2003)	Ownership and Management	Smaller businesses are more commonly owned and managed by individuals rather than groups.

(Cosh et al., 2005)	Investment	Small businesses investments in fixed assets are relatively lower than their larger counterparts..
(Van et al., 2007).	Innovation	SMEs are producers and users of innovation. When an SME produces something, there is a high chance of commercializing the result. At the same time SMEs are also consumers of other valuable innovations of other SMEs as they try to achieve better efficiency in their enterprise.

Apart from the above characteristics and nature on SMEs, their importance to the economy has been well researched and emphasized in literature. Table 02 points out and describes this importance.

Table 02: Importance of SMEs

Author	**Importance**	**Description**
(Choi, 2003)	Increase in exports	Help in the increase in national exports to international markets. They enable international importers to acquire low cost and better quality products.
	Foreign investments	Help in the increase of foreign direct investment. An example of this is during 1990 to 1994 SMEs in Korea made foreign direct investment and the value of those investments increase by over 500%.
(Storey & Greene, 2010)	Informal communication	SMEs employ informal communication with lesser bureaucracy in their structures and practices. As a result improving the work environment for its employees.
	Fund utilization & Transparency	Funds are applied more efficiently to where they are actually needed the most. Transparency is a key to keep everyone at the same page as to the direction the company is taking and the strategies being employed.
	Risk taking propensity	SMEs are better suited in taking risk than their larger counterparts as there is lesser to lose. Taking risks in areas such as

		• bringing out different innovations, • trying different methods of production • exploring different markets.
	Innovators	SMEs are more concerned on bringing new products and service to the market while larger enterprises are concerned on making their products better and achieving mass production. Hence giving them the edge over their larger competition and hence causing creative destruction.
	Better adopters of technology	SMEs are better adopters of technological innovations such as new tools and technologies than larger enterprises who rely on bigger and expensive systems.
	Larger pool size	Larger share in the pool of enterprises in Europe amounting to 99.8 percent. SMEs create jobs and influence strongly the economy in Europe.
(ETSI, 2016)	Increase in employment	In the EU alone they provide around 75 million jobs. Two out of three private sector jobs are provided by SMEs.
	Representation	SMEs represent 99 percent of all enterprises in the EU alone.
	Total added value	Contribute more than half of the total added value by businesses in the EU alone.

The above characteristics and importance of SMEs help to understand that they play a pivotal role in boosting the national and international economy. These enterprises produce and consume innovations better than larger enterprises and facilitate in producing better products and services at affordable costs. They know how to adjust to market trends and needs of their consumers than their larger counterparts. On these grounds, we can argue that SMEs are agile and require sophisticated management of work activities and structuring of work processes to remain effective and competitive. Schwalbe (2013) suggests that to achieve efficiency at work, work activities should be grouped up into operational and project activities. This work grouping should then be managed through operational

and project management directives, practices, techniques and tools and knowledge. This project and operational work in turn require sensitive methods to determine requirements for e.g. software to support SME's case-specific collaborative action.

2.2.2 Challenges faced by SMEs

According to PESTEL tool, factors can affect business enterprises internally and externally. External factors affect enterprises work practices as well as internal factors such as structure, motivation, role of company leadership, enterprise culture etc., The external factors that can be analyzed to identify influences that affects work environment are as follows (Table 03):

Table 03: Challenges faced by SMEs

Author	**Challenge**
(Lu & Paul 2001)	Internationalization • Foreign investments • Collaboration initiatives with other firms
(Quayle, 2002)	Un-strategic implementation of customer facing e-commerce systems
(Bowen et al., 2009)	• Competition with other SMEs and large firms • Political uncertainty and economic instability • Low customer reach • Limited credit access • Access to cheaper raw material and resources to larger firms
(Kelly et al, 2010)	• Investment in communication and information technology in work place to enable better working conditions for employees • Emergence of new and innovative social and communication technologies • Emergence of an international, mobile and temporary workforce

The above set of challenges identifies some major concerns that affect SMEs. To deal with these challenges, work activities need to be well managed, quality control should be implemented at practice for each output as well as quantifiable work practices need to be employed. Enterprises should foster an environment through the provision softwares that enhance the efficiency and effectiveness of work an example of these can be work collaborating systems which could help individuals and teams to manage and perform work

with ease. Work collaboration systems answer challenges of increased competition, increased pace of business and alliances especially customer based alliances where customers work together with the enterprise to develop products and services. Coleman & Levine (2008) supported this fact by forecasting the dependence on information technology systems in the near future as a way to work for enterprises.

2.2.3 Operational Work and Projects in SMEs

Based on the importance of SMEs and the challenges they face, it becomes necessary for the management of the enterprise as well as local and international authorities governing policies and legality surrounding SMEs to create a feasible environment for them. An environment where SMEs can nurture, innovate and develop better products and services, collaborate through alliances and create job opportunities that foster national and international economies. Operational and project work can augment SMEs to achieve such contributions (Greene et al., 2010; Schwalbe 2013).

Businesses enterprises need eliminate rigidity in their structures by adopting flexible and functional structures (Boddy et al., 2005; Ross et al., 2006). Project and operational work practices help in reducing this rigidity by providing the right knowledge, techniques and tools. Project work, is similar to operational work with the exception of having time, quality and scope constraints. Management of these two work categories should be given high importance within every enterprise to realize and achieve their ambitions (Meredith & Mantel, 2009). Companies are repositioning their core business activities to accommodate the challenges of external competition, change in business practices, change in alliances and pace of business. Management is forced to take up initiatives such as adopting agility in operations to become flexible and react proactively to these challenges. Major new trends in recognizing working habits of the knowledge worker can be seen in enterprises. The shift is towards creating a knowledge intensive enterprise (Vreede et al., 2009). This shift towards knowledge intensive enterprises require that goals align with the activities that are taking place within enterprises, while keeping the activities on budget, within time and scope while keeping the quality in balance with these constraints (Schwalbe, 2013). Operational and project work are becoming the norm to run an enterprise efficiently. This is especially evident in SMEs with lesser bureaucratic and thus

more flexible structures. Success of these operational and project work initiatives impact the ways businesses survive in the long term (Raymond & Bergeron, 2008).

The above findings provide confirmatory evidence that change is evident in the way the SMEs function to deliver valuable products and services. The new requisites of successful business are becoming customer centric, adopting agile ways and indebted of technological advancement in their day-to-day work. To support the requisites, enterprises are employing new ways of working together. Furthermore, these new ways of working combined with innovative technologies are enabling enterprises to achieve better compete, manage knowledge, manage collaborative work and improve their application landscape that supports their business.

It becomes increasingly important to study how collaboration between individuals plays a pivotal role in achieving shared goals in SMEs. The upcoming chapter introduces the phenomenon of collaboration, its influences and typologies and what enables successful collaboration. It also looks at project and operational work within work systems, and how collaboration plays a pivotal role in accomplishing enterprise goals.

3 COLLABORATION AT WORK

Collaboration is defined as working together towards a shared goal (Moyano 2006). Collaboration is of vital importance for business enterprises to achieve results faster with greater quality when working together (Mattessich et al., 2001). Working together implies working together in teams as no single individual has sufficient expertise, influence, or resources to solve the problem alone (De Vreede et al., 2009). The following chapter presents the phenomenon of work collaboration in SMEs. This chapter covers an introduction to collaboration at work, its crucial importance for enterprises, what factors relate to successful collaboration, the increasing influences of collaboration in organizational life and how the growing influence of collaboration technologies affect work practices in day to day operations or in specially designed projects to achieve high quality results.

3.1 Work Collaboration

Collaboration is naturally embedded phenomenon which occurs in our daily lives and within any form of work that requires more than one participants. At the root of performing work in enterprises and accomplishing shared goals there is an adjoining force and that is collaboration. AIIM (2015) specifies that at conceptual level collaborating participants should have the following characteristics to achieve the best outcome of a collaboration endeavor,

- Awareness: where the participants of collaboration should understand themselves being a part of a functional entity which has similar goal,
- Motivation: participants of a collaborative endeavor should make attempts on seeking unanimity on issues,
- Self-synchronization: participants should be able to make decisions by themselves where they can rather than relying on others all the time,
- Participation: each individual who participates in a collaborative endeavor should try making the collaboration work through enough individual participation,
- Mediation: Differences should be negotiated amongst participants,

- Reciprocity: Information and resources should be actively shared by participants,
- Reflection: Alternatives should always be looked into when reflecting on work tasks while collaborating,
- Engagement: Engagement should be proactive rather reactive.

This means that for successful collaboration to take place participants should understand their responsibilities. Though participants need to be well acquainted of their actions in a collaborating endeavor, great responsibility lies on the management who are governing this endeavor. Mismanagement can cause a collaborating endeavor to suffer even if the participants are aware of their responsibilities. Therefore, management needs to strategize on how to organize, resource and manage a collaborative endeavor. Collaboration if done strategically through proper facilitation of tools, technologies and practices can help in the reduction project overheads in planning, research and training, design and development activities in enterprises (Mattessich et al., 2001; Sakal 2005; De Vreede et al., 2009). Things that impede collaboration amongst collaborating participants can be excluded using interactive efforts of the collaborating partner who can point out such hindrances and can help devise a solution with other participants (Mattessich et al., 1992). Effective collaboration can help to deliver better functioning and performance of an enterprise not only within but also beyond the enterprise's boundary when collaborating in product/ service alliances. For the collaboration to be effective enterprise structure and policies have to be designed and employed in a way that they support the enterprise objectives and goals. Enterprise influences such as the requirement for increase in knowledge work, the need for decentralization of activities, the quadruple constraint (time, cost, scope and quality) impacting delivery of products and services, the reliance on technologies for automation and effectiveness and different individual skills, etc., require that exchange of information and communication should be continuous between collaborating participants. This continuous collaboration helps to gain results that supplement the entire outcome of the enterprise (Bennett et al., 2010).

Collaboration can also be defined as an effort that has been entered into at the discretion of two or more entities to achieve shared goals. This defintion emphasizes on;

i) establishing mutual relationships to achieve shared goals,
ii) collectively building up organization of work and shared responsibility,

iii) reciprocal authority and accountability,

iv) and lastly sharing resources and rewards amongst the participants.

(Mattessich et al., 1992).

Zigurs & Munkvold (2006) state that collaboration affects work at not only strategy level but also at task level. They state (as cited in Galletta, 2006, p.143-145) collaboration as "*the process of two or more people working together on a common task*". Kumar et al. (2004), defines it to be composed of a set of mechanisms that are interlinked and co-ordinate with one another, while Coleman & Levine (2008) give a techno-centric viewpoint on collaboration by researching on how technology supports it. This viewpoint include collaboration to be;

- Synchronous: Where interactions between participants are computer mediated and occur in a span of five seconds. A popular example for this is that of messaging services.
- Asynchronous: Where interaction occurs indefinitely between participants. An example of this being web boards, blogs, emails, etc.,
- Semi-Synchronous: Where interaction occurs within a certain time frame but with more than five second intervals. An example of this can be online presentations through video conferences.

The above definitions on collaboration share similarities that collaboration implies working together for an outcome which has some intrinsic value to the participants. Yet these definitions identify different aspects of collaboration such as being synchronous and asynchronous, comprising of interlinked mechanism, having reciprocal authority and accountability and requiring special characteristic from participants in order for collaboration to be effective. Yet the word collaboration is argued to be used alternatively to "Co-operation" (e.g. Lyytinen & Ngwenyama 1992; Schmidt & Bannon 1992; Bannon 1993). Bannon & Schimdt (1992) explain collaboration as a mutual adjustment through spirit when working with one another while co-operation implies a neutral meaning. They further emphasize that collaboration through the effort of its participants should help overcome any obstructions that can impede work. For example, in classical work practices obstructions visible in the form of managerial control can impede employee motivation.

Hence, such control should be openly pointed out by the participants and an effective control process should be adopted.

3.1.1 Success Factors & Benefits of Collaboration

Obviously there exists good and bad, effective and ineffective collaboration. It is important to understand what factors influences collaboration in SMEs. Mattessich & Monsey (2001) identify factors that influence the success of collaboration in operational and project based work. These factors are broadly categorized into Process/ Structure, Communication, Resources, Purpose, Membership Characteristics and Environment (Table 04). The factors include,

Table 04: Factors of Collaboration (Mattessich & Monsey, 2001)

Category	**Factors**
Process/ Structure	Sharing of risks and stakes amongst participants, Multiple levels of decision making, Flexibility, Development of participant roles and policies, Adaptability.
Communication	Open and frequent, Established informal and formal communication links.
Resources	Sufficient funds, Skilled convener.
Purpose	Concrete attainable goals and objectives, Shared vision, Unequated purpose.
Membership Characteristics	Mutual risk understanding and trust, Suitable cross-section of members, Participant collaboration as in their self-interest, Ability to compromise.
Environment	An account of collaboration and co-operation within the community, Collaborative group seen as a leader in the community, Political/social climate favorable.

Hoegl and Gemuenden (2001) refer to these factors as quality aspects for both operational level and project-based work activities in SMEs. They point out to similar factors such as communication and co-ordination but also identify other critical factors such as

contribution, support and effort which can be grouped under membership characteristics in the work of Mattessich & Monsey (2001) (Table 05). Hoegl and Gemuenden (2001) give a precise understanding of these quality aspect/ factors which are;

- Communication: Communication is the progression of information between two or more participating entities. Often regarded as a critical factor when working with others it requires transparency and frequency of information exchange to carry out work or achieve results together,
- Co-ordination: The collaborating participants should work together effectively towards achieving a mutual goal,
- Contribution: Each participant should utilize their skillset to achieve work goals. Contributions should be made where and when needed and skills should not be held back,
- Support: In case a participant lacks a skill to accomplish a task on hand, other participants should provide assistance to carry out these tasks,
- Effort: Individual and group efforts should always be result driven so that mutual goals can be achieved.

From understanding the above quality aspects/ factors one can conclude that by achieving the right balance between these factors one can significantly impact the process of work and its outcomes. Understanding and contributing by individuals towards each factor can improve the communication amongst individual and teams, can help to understand that to make collaboration work best of skills would need to be brought to the table while supporting those who might not have a particular skill thereby creating a feasible environment for work that will help in achieving better outcomes together. The benefits achieved by executing successfully the above factors are listed in Table 05.

Table 05: Collaboration Benefits

Authors	**Benefit**	**Description**
(Nonaka & Takeuchi, 1995)	Better knowledge management	New knowledge is created while existing knowledge is utilized more effectively to work tasks.
(Gupta & Souder 1998)	Reduced cycle time	Products and services are developed and delivered in a quick manner thereby shortening the time to market these products and services.

(Mattessich & Monsey, 2001).	Better product & Service portfolios	Better products and service portfolios can be achieved when collaborating in day-to-day and project based work not only with internal teams but also with external teams in the form of alliances. These products and services can be marketed in the name of alliances and hence attract more attention.
Pentina & Strutton 2007)	Level of expertise	New learning influences development of new expertise. Hence, increase the overall skill set.
(Dayan & Di Benedetto, 2009)	Improved quality of the product and service	Quality of the resulting product and service is improved by employing feedback mechanisms from each other and the customers during product/ service's development.

These benefits can be reached faster and more effectively by individuals and teams during operational and project work when some specific software tools and techniques are employed that support working together (Munkvold et al., 2006). Thus, the next question is: How collaboration technologies augment and enhance the collaboration success factors and help achieve benefits faster and more efficiently.

3.2 Work Collaboration Software

Work collaboration brings forth new challenges especially when working in demographically displaced teams, project based alliances, customer collaboration in product development etc., By analyzing the functionality in many software applications one can see that software vendors are focusing on developing functionality in software applications that help in the performance, co-ordination and collaboration of work activities amongst participants of a collaborative endeavor. The benefits provided by these softwares are that they support and compliment new ways of working together through free communication, flawless information exchange, better knowledge management and sharing, management of work tasks and co-ordination of activities through the use of a single software system. (Munkvold et al., 2006).

Similar proliferation of functionality and benefits applies to work collaboration software that are designed to address special collaborative needs of the enterprise. Significant debate exists on collaborative work and collaboration software within research and academic circles. Zigurs & Munkvold (as cited in Galletta, 2006, p.143-145) suggest that

various disciplines such as management and enterprise behavior, group dynamics, decision making, human-computer interaction (HCI) and software engineering have added their own definitions of collaboration software. Zigurs & Munkvold (as cited in Galletta, 2006, p.148) define collaborative work that is supported by collaboration softwares as,

> *"a set of behavior requirements for accomplishing both explicit and emergent goals via a process that uses available resources and techniques".*

This definition identifies how participants of a collaborative endeavor accomplish collaborative work goals, the process by which they carry out collaborative work, and the means in the form of skilled resources and tools they use to accomplish work together in enterprises. They further indicate that collaborative work varies in its context as well as in its characteristics (i.e., task difficulty, solution multiplicity, intrinsic interest, cooperative requirement (Shaw, 1976); unitary vs. divisible requirements (Steiner, 1972) etc.,), depending on the participants who perform this work. Therefore, it becomes important how participants interpret their work relationships with one another when planning or performing collaborative work. It also becomes extremely important for the focus of this thesis, how to study the fit between collaborative work and software that helps accomplishing it. As Zigurs & Munkvold (as cited in Galletta, 2006, p.145) say it,

> *"The interesting thing is to ask how different views of technology, task, and context have contributed to where we are today in our understanding of the intersection of humans with computers in collaborative activity. What have we learned in this area and what remains to be studied?"*

This thesis studies the fit between collaborative work needs and pre-built collaboration software functionality. Zigurs & Munkvold (as cited in Galletta, 2006, p.145) define collaboration software as

> *"one or more computer-based tools that support the communication, coordination, and/or information processing needs of two or more people working together on a common task".*

This definition helps us understand that collaboration software supports communication, co-ordination and information processing aspect of work collaboration. Grudin

(1994) in his study of the historicity of Computer-Supported Cooperative Work of over a period of 10 years indicates restrict and broad perspectives on collaborative software. The restrictive perspective includes software that are specially designed and developed to support collaborative work in enterprises. The broader perspective includes software with feature that helps with basic collaborative activities such as emails, network messaging services and file servers for sharing of documents over some network. It is apparent from the amount of research available today that the broad perspective makes more sense in the current knowledge worker's environment. With the amount of research available on the broad perspective not to forget the proliferation of even a wider amount of softwares in enterprise containing features that enable collaborative work, it becomes important to see on what basis are these softwares categorized.

3.2.1 Categorization of Work Collaboration Software

Over time, significant research has been done on how to categorize software that enable collaborative work in enterprises. Researchers have emphasized on three different different perspective based on which collaborative software categorization can be made. These perspective along with the kind of collaboration software in each perspective is represented in Table 06.

Table 06: Categorization of work collaboration softwares

Author	**Perspective**	**Categorization of Collaboration Softwares**
(DeSanctis & Gallupe, 1987)	Information exchange support	1–2–3 Level Framework: Level 1 systems remove barriers to communication, by including functionality such as anonymous and simultaneous communication, and feedback capture and display. Level 2 systems address decision-making needs by providing modeling and idea-structuring tools. Level 3 systems provide expert advice and computer-based guidance and design of the group process.

(Nunamaker et al., 1991; Zigurs & Buckland 1998; McGrath & Hollingshead, 1994)	Communication and group performance support	Collaboration software included under this perspective provide differentiation between communication, internal information support, external information support and group performance support.
(Johansen 1988; Munkvold 2003)	Time/ Place support	Provide a matrix that represents four modes of group interactions based on time and space. This matrix provides a concrete view of capabilities of certain collaboration softwares on which categorization can be made

	Same Time	Different Time
Same Place	Group support system Electronic meeting system	E-mail Document management system Calendar and scheduling system Workflow management system Electronic bulletin board Collaboration product suite
Different Place	Audio conferencing Video conferencing Data conferencing Instant messaging/Chat room Integrated team support technology E-learning system	E-mail Distributed group support system Document management system Calendar and scheduling system Workflow management system Electronic bulletin board Collaboration product suite Web-based team/project room Integrated team support technology E-learning system

From the above categorizations one can conclude that collaboration softwares are broadly serving some perspective i.e., Information Exchange Support, Communication and Group Performance Support and Time/ Place Support. These perspectives are being addressed by including either relevant features into the broader perspective collaborative software (as indicated in section 3.2) or by creating some specifically designed collaboration software as per the restrictive perspective (as indicated in section 3.2). Based upon the perspectives these softwares address, it becomes foremost important to see how these collaboration enhancing softwares are being utilized in Project and Operational Work.

3.2.1.1 Using Collaboration Software in Project and Operational Work

Collaboration software highly impact the success rate of both face-to-face and virtual projects (Broils, 2014). Bardhan et al., (2007) classifies project by amount of turbulence in the project, the enterprise environment and lastly by the degree to which the project is

structured. This classification suggest that highly structured projects employ basic collaboration softwares as opposed to less structured project. Less structured projects rely on advanced collaboration softwares as they involve a greater degree of risk and uncertainity.

PMI (as cited in in Bonnie, 2015) provides the statistics on the growing trend of employing project and project management practices within enterprises across the world. According to this report, 15.7 million roles will be created globally as the project management industry grows to $6.61 trillion between 2010-2020. This claim is supported by Overby et al., (2006) who emphasized that enterprises are employing project management softwares to facilitate the increasing role of project in enterprises. Brynjolfsson et al., (2007) adds that in combination with the project management softwares, the use of asynchronous tools, such as e-mails, can be seen to enable a more efficient management of communication of information when employed during project work in enterprises. A study by Fortune et al., (2011) reveals that in addition to project management, collaboration softwares increase possibilities of improving knowledge and skills as well as relationships amongst the project teams. These evidences indicate the growing adoption of projects in enterprises as well as how the combination of collaboration and project management softwares critically impact the success of these projects.

Collaboration software not only impacts project work but also influence day-to-day operational work within enterprises. An example of this is usage of social platforms for the interfacing with the enterprise's customers. One cannot deny the fact of the growing influence of social platforms in the design and development of products and services through customer feedback. These influences have paved the way to the "Enterprise 2.0" concept today. Where enterprise 2.0 a term introduced by Andrew Mcafee, indicates the presence of social media platforms within and amongst companies as well as their customers. Andrew Mcafee (2006) was of the idea that in the near future there will be a proliferation of internet based solutions within enterprises that will advent new ways of collaborating at work in enterprises. He defined Enterprise 2.0 as *"a collaborative platform that reflects the way the work really gets done"* (Mcafee 2006, p. 21) where social media platforms are integrated in both intra-enterprise and inter-enterprise settings. These trends are being analyzed by software providers who are working on providing innovative work collaboration software that can make the most of this opportunity. These softwares provide functionality in the form of,

- Creation of employee profile,
- Indexing and search services on enterprise information including employee profiles,
- Department based and enterprise level information and discussion boards,
- Wiki and blogs for information on specific topics,
- Content creation, sharing and management platforms.

These above collaborations softwares serve as an example of what form of collaborative softwares are being used in enterprise. It can be seen that these softwares offer a combined workspace to address the work related needs of work participants internal and external to the enteprise. For internal stake holder such as managers these solutions provide the opportunity to control remote operations and resources effectively and allowing enough space to work and improve their abilities, while leaving routine work to technological solutions (Filev, 2008). External stakeholders such as external teams can use these solutions to manage and complete their work activities with the enterprise teams efficiently hence decreasing the space for error. Also customers can use web based collaboration software to interface with the enterprise for product and service feedback, development and even usage. These above mentioned collaborative software functionality is in accordance with McAfee's (2006) prerequisites of a collaborative platform which are as follows,

- Searching Information: A pre-requisite that can help to find information that has been created, managed and stored by a collaborative platform.
- Appropriate Navigation: Ensures that users of an intranet based collaborative platform are provided enough links through which they can easily navigate their way without getting lost. The linking structure and dynamics are what term the quality of such a platform.
- Authoring Echoes: Individuals and teams should be able to voice their opinions and concerns through the collaborative platform hence helping the dissemination of explicit knowledge over such platforms.
- Associating Content Using Tags: Should be provided that can help users of the collaborative platform to create categorization of their material i.e., documents and information for search and sharing with others.

- Artificial Intelligence: The collaborative platform should be intelligent and should suggest relevant material for its users based on previous actions that they might have performed.
- Alerts: The collaboration platform should alert its users through notifications on changes to documents, events, or information that is either created or marked important by the user.

With the above pre-requisites on what a collaboration software should address, it is also important to know what benefits do collaboration softwares provide. Table 07 provides few benefits identified in research of using collaboration softwares in project and operational work.

Table 07. Benefits of using collaboration software in project and operational work

Authors	**Benefits**
(McAfee 2006)	Easier access to critical resources and information, time saving, facilitated workflows
	Better decision making on issues
(Oshri et al., 2007)	Making work efficient by managing processes, products, and services
	Knowledge creation and sharing
(Kanawattanachai & Yoo, 2007)	Rapid processing, transformation and application of acquired knowledge
	Improved management of decentralized resources
	Simplicity of learning and working with the technology for the users
(Pisano & Verganti, 2008)	Bigger and better access to problem solvers
(Schooley et al., 2010)	Improved communication at all levels in the enterprise
(Pellerin et al., 2013)	Better management of work constraints (scope, time and cost, quality)

All the above on the usage of collaboration softwares in project and operational work can help us sum up that collaboration software improves and supports work efficiency

and relations in both operational and project work within and across enterprises boundaries. Collaboration software are not the only determining factor in the success of project and operational work. At the root other factors such as individual skills, management support, smart goals, mutual trust, motivation etc., are of equal importance if not greater importance. Briggs & Nunamaker (2013) emphasize that employee focus at work also helps in achieving work related goals. The collaboration software supports participant during collaborative work through a single platform that facilitates, manages and accomplish work goals. These softwares help to reduce the workload of work participants by managing work activities, improving productivity, consolidating knowledge which facilitates in better decisions making and managing work distribution among collaborating participants while allowing the participants to work on what is necessary rather than focusing on how to manage and administer collaboration (Munkvold, 2003).

This chapter establishes that collaboration is a main cursor of accomplishing work in today's enterprises during project and operational work. Collaboration softwares play a pivotal role in supporting and managing collaboration activities during project and operational work. The remaining question is how to fit the SME's collaborative work system demands with pre-built collaborative software. The next chapter addresses this by introducing the Work Systems Framework along with the Work Systems Method.

4 THE WORK SYSTEM METHOD AND FRAMEWORK

A novel pre-built software qualification method to collaborative work systems is needed. This method should help in qualifying software functionality to specific work system needs. A part of this approach requires identification of collaboration needs in project and operational work in SMEs work systems. These needs help to identify the requirements for the collaborative software. For this purpose, we apply the work system method (WSM) and work system framework (WSF). This chapter describes the method and framework. WSM is used here to evaluate enterprises and their work systems, identify problems and opportunities in project and operational work within the relevant work systems, and define software-based requirements.

Many frameworks exist that measure different aspects of enterprises. These include for example Beale and Cole's Framework (for performance and profitability of information system), COSO Framework (for risk management), Work Systems Framework etc., (see e.g. Olugbode et al., 2008; COSO 2004; Alter 2010a). Work System Method and Work Systems Framework is a good representative as a tool, because they are standardized and they have a solid theoretical knowledge base. But most important of all, WSM and WSF are well suited to the purpose of this study of work systems in enterprises, i.e., study of the work practices and other elements, identification of collaboration needs within work systems. Further, WSM and WSF are quick and easy to use and have been widely used and accepted within different fields of research and development.

4.1 Work Systems Principles

A work system is a system that uses humans and/or machines to perform work using information, technologies and other resources to produce products and services (Alter, 2013). Some examples of work systems can include how a bank approves some personal loan, how some enterprise tries to find a sales prospect, how consumers buy good at an online web shop, how a software team develops some mobile application etc., These cases have similarities. We can see that people are performing work in each case whose outcome is of value to some other person or group of people. The other thing that is noticeable is that there is a use of information and technology. In each case there is an environment that can impact the work system by requesting adjustment in the way of doing

things. The work systems concept is not just confined to enterprises that build tangible products but is also applicable to service providing companies who develop services and market these services. Work systems can be either socio-technical or fully automated and can also be a mix of both in form of a hybrid system. Socio-technical systems involve human intervention where work participants perform the activities using manual labor or the use of technologies. On the contrary, a fully automated practice employs machines and technologies to do most of the work with very limited human intervention. Application of the work systems concept to socio-technical or totally automated work system can bridge gaps in the understanding of these disciplines for both social scientists and technical specialists (Alter, 2013).

The work systems method offers two distinct views of a work system i.e., static and a dynamic view, in operation within an enterprise. The static view analyzes and describes the present or proposed system of working, which is used in this thesis to describe the enterprises and how collaboration occurs in them at operational project level. It also helps in finding the changes that need to be applied as well as the outcome of their application The dynamic view analyzes system's evolution and change through planned or unplanned adaptation. The dynamic view uses work systems life cycle model and is not within the scope of this study, because it concentrates on the evolution and change of work systems which is not the focus of this thesis. Figure 02 displays the structure of the work systems method.

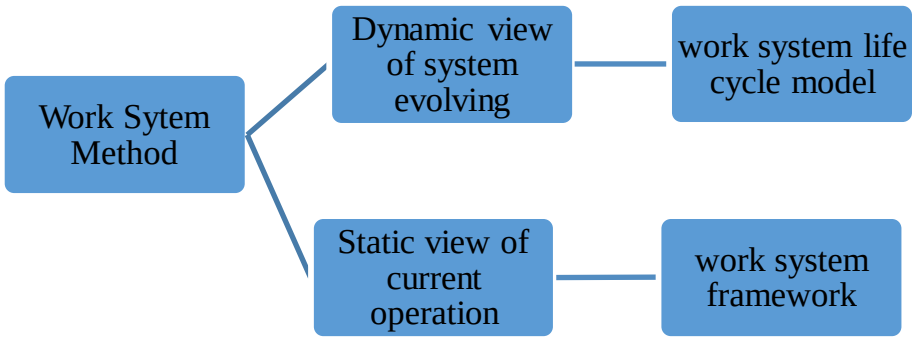

Figure 02: The structure of Work System Method (Alter, 2013)

The following chapters provide a more detailed insight into the Work System Method and the Work Systems Framework.

4.2 The Work System Method

The Work System Method (WSM) analyzes and describes the current or proposed work system. It provides a prescriptive methodology (i.e., that gives directives and rules) for analyzing and designing different work systems within an enterprise at any depth level. It helps in identifying the problems, seeking opportunities, determining needs and devising and testing solutions. This method can be used by any analyst to analyze and design any work systems within an enterprise or the entire enterprise, a function/ department or a view of work in some system (Petkov & Petkova 2008).

Work systems method outline includes following steps

- Identification and Data Gathering:
    - Problem and opportunity that impact the work system,
    - Relevant constraints and other considerations,
- Analysis and Summarization (AS-IS):
    - Analyze the situation using measures of performance, key incidents, root cause analysis, implications of structural characteristics, work system principles, and other factors,
    - Summarize the work system using the work systems framework (WSF) and its elements using the work system snapshot,
- Results and Recommendation (TO-BE)
    - Identify possibilities for improvements within the work system,
    - Decide on recommendation,
    - Justify the recommendation by explaining how work system performance will improve, in terms of relevant metrics, principles and other factors.

(Alter, 2013)

4.3 Work System Framework

As suggested before the work systems method provides two views of a work system i.e., a static and dynamic perspective. The static perspective which include the work system framework is the one we use as it suits the nature of study because a part of our study focuses on gathering collaborative needs of an enterprise during project and operational work. The dynamic view will not be of much use as we are using enterprise work system

data of a single point in time rather than studying on going changes that effect a work system in it. The work system framework identifies the elements that need to be focused on when analyzing a work system. A diagrammatic representation of the framework in Figure 03 can be used as a focal point to describe and summarize any work system in an enterprise (Alter, 2013).

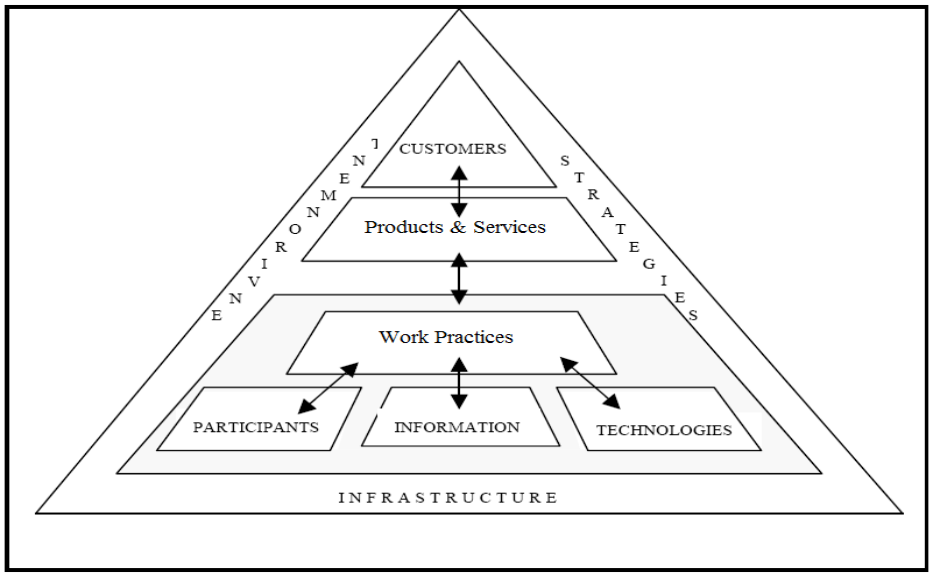

Figure 03: Work System Framework (Alter, 2013)

Figure03 give the basic understanding of the work systems framework, work system elements and their dependencies. Alter (2013, p. 79) describes the usage of the framework as well as how the elements should be conceived:

> *"The work system framework is a useful basis for describing and analyzing an IT-reliant work system in an organization because its nine elements are part of a basic understanding of a work system. The framework outlines a work system's form, function, and environment. It emphasizes business rather than IT concerns. It covers situations that might or might not have a tightly defined business process and might or might not be IT-intensive. Of the nine elements in the work system framework: Processes and activities, participants, information, and technologies are viewed as completely in the work system. Customers and products/services may be partially inside and partially outside because customers often participate in the processes*

and activities within the work system and because products/services take shape in the work system, and environment, infrastructure, and strategies are viewed as largely outside the work system even though they have direct effects in the work system". (Alter, 2013, p. 79)

From the above explanation on work systems element one can conclude that four main elements are required for a work system to function which are processes and activities, participants, information, and technologies. The rest elements can be considered internal or external based on their level of participation and impact on the main work system elements. The arrows between elements in Figure 03 represent that these elements should be in balance with one another. Alter (2013, p. 79) describes an example of this balance,

"The knowledge, skills, interests, and motivation of the participants should fit with the processes and activities in the work system. Conversely, the processes and activities should be appropriate for attributes of the participants. Changes in the processes and activities may require related changes in the participants ranging from additional training or new incentives all the way through changing participant roles, replacing some participants with others, or automating parts of the work, which thereby renders some roles unnecessary. Similar alignment issues apply for all pairs of elements that are linked by arrows".

(Alter, 2013, p. 79)

From the above explanation, it can be inferred that an alignment between elements needs to exist if the elements don't align to each other's change then the work system shall suffer in achieving efficiency. Next we describe each element separately and suggest what aspects to concentrate on for when analyzing especially work system's collaborative needs. These definitions form the basis of our analysis and evaluation of the SMEs and the work collaboration service.

4.3.1 Customers

Customers are the people who receive the output produced by a work system. Enterprises and their work systems exist to serve their customers need and meet their demands. Hence it is essential to identify the customers, their wants, their trends in consumption of products and services. Both internal and external customers need to be identified where the difference between them is that the external customer are simply enterprises customer while the internal customers are hired by the enterprise to work for them and are paid for their work. Not to forget that external customer can become a part of the work system as well by participating in some aspect of product or service development.

The key concept of customer element regarding work collaboration is that these enterprise customers can act as participants in some joint production of a product or a service by enterprises. It becomes important to understand the needs of these participant to work effectively with the enterprise especially when working remotely. An example can be of hiring of testers globally by a software enterprise to test their beta release of an application they are developing. Or can that be of a complaint filed by a customer on a enterprises website for some defect in their received product which they had ordered online from the enterprises web store.

4.3.2 Products and Services

Work systems produce outcomes in terms of products and/or services. These products and service can be consumed by either the work system itself or for the customers of the work system. Hence they can be of any physical form such as agreements, legal documents, etc., or can be something intangible such as verbal commitments, insurance, tax services, computer softwares etc., Multiple work systems can co-exist in an enterprise at any instance. Rather than concentrating on all it is beneficial to concentrate on those which are produced by the work system which is under scrutiny. The scope of analysis should limit which products and service to target in the work system under scrutiny (Alter, 2006).

To understand the collaborative needs of the work system participants, is important to focus on the products and services that are achieved by them working together their knowledge can help in understanding which products/ services require more collaboration

than others, what characteristics do these products have, what is the best work type (operational or project) to develop these products based on their characteristics, which products require customer participation etc.,

4.3.3 Work Practices (Business Process & Activities)

Work practice is a broader name given to the processes and activities that occur inside a work system. Work practices can be both structured i.e., business process and unstructured. An example of an unstructured work practice can be that of a flight control room at an airport, where air traffic controllers navigate traffic in and out of the airport and surrounding areas. All this requires real time communication and cannot be treated as a sequential business processes (Alter, 2006). While the example of a structured work practice/ business process could be that of hiring an employee which involves finding potential candidates using different channels, verifying experience and selecting the candidates for interview, interviewing candidates and then hiring the best candidate. These activities are structured as the activities cannot precede one another. When analyzing a work system both structured and un-structured work practices should be considered. The thesis requires us to concentrate on collaborative needs in project and operational work types that are employed in work systems hence any collaborative effort during these work types should be taken into account and investigated as to what initiated the communication or work between individuals so that process based needs can be identified.

4.3.4 Participants

Participants are people who have been authorized to work in some arrangement provided by the enterprise. Work participants can be internally employed within the enterprise or can be hired from outside the enterprise based on a contractual agreement to work on some product or service development. These externally hired individuals can include enterprise customers as well. Alter (2006) indicates that customers act as work participant when they are either employed, use the enterprises e-commerce system or provide feedback into the system which can initiate some work activities. Considering customers as

work participant can help enterprises reduce costs and develop better products and services. Alter (2006) suggests that when performing work systems analysis, participants who have greater roles and presence in the work system should be given precedence over technology users. Furthermore, when analyzing a work system, focusing on a technology user may omit essential aspects of other users who have a more encompassing role. Hence, a participant who uses technology more in his job role should not be considered as a separate entity rather as a work participant. This will help in focusing on work practices and technology usage separately as individual entities. When analyzing collaboration needs of participants during operational or project based work, all participant who are a part of the collaborative endeavor should be taken into consideration rather than only focusing on the source of the information. What needs do these participants have based on their roles when collaborating together during project and operational work. What participant characteristics impact the collaboration in a good way or bad way during any collaborative endeavor etc.,

4.3.5 Information

Information is a critical element of work systems framework. Work systems elements, processes and activities use, create, capture, transmit, store, retrieve, manipulate, update, display, and/or delete information (Alter, 2013). During work system analysis informational entities for example; orders, sales, invoices, warranties, statements, medical histories, are identified that produce and consume information. For example, the past social family history of a patient in his continuity of care (an electronic document) which display relevant information of a patient to a referred physician during the course of treatment of some illness. Any sort of information computerized or non-computerized is of essence here such as verbal communication, commitments, physical documents, notes of a meeting etc., that can be used by the participants of a work system to carry out their activities. For this thesis the information element plays a vital role as we look into studying the collaborating needs of the work participants when performing work together during operational and project based work activities in work systems. Information pertaining to work practices as to which work practices require frequent collaboration and what needs might exist that might not be figured from the analysis of other elements.

4.3.6 Technology and Infrastructure

Work systems framework takes into account technology which includes both IT and non IT based technologies. A work system can also rely on external technical infrastructure providers so that they can focus on their primary goals. The external technical infrastructure is invisible to the participants of the work system for example the computer networks, data and content management systems etc., while the tools and techniques used within work system in form of interfaces, application, internet and intranet services, etc. can be seen by the participants (Alter, 2006). When analyzing a collaborative work system both Internal and External IT landscape need to be identified and considered especially those which supplement the work practices and the process of working together as to what functionality they provide to carry out collaborative work activities, what are the work activities, and how does the technology impact the overall quality of collaborative work and its outputs.

4.3.7 Environment

Usually many environmental issues and constraints surround work systems. When analyzing any work system, it becomes essential to investigate the surrounding environment as it can affect the functioning of a work system. For example, enterprise's culture may have less to no effect on how software is developed within a software house. But it can affect the adoption of a new software systems within the enterprise. Alter (2013, p. 81) describes:

"Environment includes the relevant enterprises, cultural, competitive, technical, regulatory, and demographic environment within which the work system operates, and that affects the work system's effectiveness and efficiency. Enterprises aspects of the environment include stakeholders, policies and procedures, and enterprises history and politics, all of which are relevant to the operational efficiency and effectiveness of many work systems. Factors in a work system's environment may have direct or indirect impacts on its performance results, aspiration levels, goals, and requirements for change. Analy-

sis, design, evaluation, and/or research efforts that ignore important factors in the environment may overlook issues that degrade work system performance or even cause system failure"
(Alter, 2013, p. 81).

The collaborative work system analysis of the environment, can helps us determine what environmental factors affects the enterprise work system. Such as cultural environment which can help us identify if the enterprise employs a culture of working together. Technical environment identify what technologies exist around the enterprise and its work systems and how do they influence collaboration. For example, how social media affects the way company addresses and manages feedback on their products and service. Regulatory environment can determine what legal obligations exist when participants are hired from outside the environment to work on some development of a service. There can be other possibilities underlying each factor when a comprehensive study of the enterprise work system is made to identify collaborative needs during project and operational work.

4.3.8 Strategies

Johnson & Scholes (2002) defines strategy as "the direction and scope of an organization over the long-term: which achieves advantage for the organization through its configuration of resources within a challenging environment, to meet the needs of markets and to fulfil stakeholder expectations". Strategies identify why a firm operates the way it does to achieve its goals. Alter (2013) emphasizes that there are three level of strategies i.e., enterprise, department and work system strategy, that are relevant to a work system. Each level should be aligned with and support the other levels. Hence when analyzing a work system, it is considered beneficial to understand how the work system strategy relates to the firm's strategy or the departments strategy. In collaborative work system analysis, especially work system strategy must be taken into account because the analysis being conducted is not just of the firm or its departments rather its collaborative work systems that help the firm and these departments to function.

4.4 Work System Snapshot

The current work system can be summarized by using a simple and widely applicable tool called a work system snapshot (Alter, 2006b). Work system snapshot as it names implies is a snap shot description of the current work system. The summary focuses on only six central elements of the work system framework i.e., customers, products and services, work practices, participants, information, technologies and infrastructure. Although infrastructure is considered mostly to be an outside element, we consider it inside for this study because we think that a work system can have not only internal technologies but also external technical infrastructure in the form of cloud services such as SAAS or PAAS being provided by an external provider. The outside elements environment and strategies are not considered in the snapshot, because they are included in the snapshot context, especially in the information and technologies sections. Table 08 is an example of a work system adopted from (Alter, 2013). It describes the E-Commerce Orders & Fulfillment process of an enterprise and how it can be represented using a work systems snapshot

Table 08: Work system snapshot E-Com. Orders & Fulfillment (Alter, 2006 p.51)

COMPANY IS CONCERNED THAT ITS E-COMMERCE SALES ARE LAGGING BEHIND		
Customers	**Products & Services**	
• Customer who orders • Customer who uses what is ordered • Finance Department	• Made-to-order products received by customer	
Work practices		
• Customer uses website to order a made-to-order product, • Computer verifies availability of product components, • Computer verifies credit card, accepts order and transmit order to manufacturing department, • Manufacturing department manufactures the order and tests it, • Shipping department packages the product for shipment, • Third part courier service ships the product.		
Participants	**Information**	**Technologies**
• Customer who submits the order, • Manufacturing Department, • Shipping Department, • Third Party Courier.	• Order details, • Customer credit card and CVV • Inventory on hand, • Manufacturing status of the order,	• Customer PC & Internet • E-Commerce website, • Corporate database and network

	• Shipping status of order.	

In the analysis of collaborative work systems, a similar snapshot is used to determine the collaborative needs of the work participants during project and operational work. As can be seen in the example (Table 09), there are several critical points. E.g. Customers' needs to be mentioned under both Customer and Participant elements based on whether the customer is performing tasks himself rather than requesting an employee at the company to place the order for him. Work Practice includes the major activities and processes that are required to fulfill the goal of placing an order. The work practices represent happy flow of event which means it does not include flows related to rejection of the order. These flows are mentioned in case the problem being investigated requires such. Information includes everything required to fulfill the order. While technologies element includes customer and company technologies.

5 CASE SETTINGS & RESEARCH STRATEGY

This chapter presents the research strategy, method and process employed for this study.

5.1 Case Company

The case company is a startup company called “ProductCo”. ProductCo has developed a Work Collaboration Services (WCS). This service helps in accomplishing work together in both project and operational work. The term service is used instead of software because the product is built using the Software as a Service (SaaS) cloud architecture and runs completely on the internet with no installations required. ProductCo started operating in 2013 in Helsinki, Finland. It has employed a growth and expansion model for marketing and sales. This model initially targets small and medium enterprises (SMEs). After the service is tested in pilot SMEs, and major development and deployment issues are resolved, the company will move towards marketing the service to SMEs and then later focus on targeting larger enterprises for its adoption.

5.2 Project Background

This thesis is based on data gathered for a research project, which evaluates a WCS developed by ProductCo. The owner of ProductCo came up with the idea of creating a service that enhances collaboration in day-to-day operational and project work. He applied his years of knowledge on work strategy, project and program management and mathematical measurements to develop the WCS. ProductCo wanted to find out if the service would actually support work collaboration during project and operational work in different work systems in SMEs. A research project was established between ProductCo and Work Informatics, University of Turku. The research was on the validation of the WCS and providing complementary criteria for a viable service that matches actual business needs of enhancing collaborative work.

At the start of the project, the service owner and two developers from the ProductCo visited the university to meet up with the researchers. The service owner and his team gave an introduction into their service, how it worked and what functionality and model

it is constructed on. Later there was product presentations, testing of the service and familiarizing with the customer service manuals. Based on this a deeper understanding of the service was developed. These efforts helped in directing the aim of this particular study.

This research aims to evaluate the fit of a ready-made WCS functionality to work collaboration needs that exist in operational and project work in small to medium enterprise work systems. This firstly requires evaluating the functionality of the WCS. It then requires evaluating the functioning of the SMEs and its underlying work systems, and exploring the work collaboration needs from problems and opportunities within operational and project work within these work systems. Both the evaluations of the WCS and the SME work systems are compared to determine the fit of the WCS to the work collaboration needs. The following chapter introduces the choice of methodology and the reason for its selection.

5.3 Research Methodology

Qualitative research approach was selected for this study. Reason behind this selection is that the aim of the research was to study a real life phenomenon i.e., collaboration at work. Qualitative research is required for a comprehensive understanding of the social life phenomena in its natural settings. It is used to study enterprises, groups and individuals (Fischer, 2010). It recommends to understand the participants' viewpoint through interpretivism, it is process oriented and it provides a holistic view of the phenomena under study (Ghauri & Gronhaug, 2002). It works with smaller datasets of text in any form i.e., narratives, documents, interviews on which analysis is based, insights are revealed and conclusions are made which could not be revealed through a Quantitative analysis. Quantitative research works with large data sets where numbers are the object of analysis. These numbers are interpreted to determine relationships between them and then examining these relationships to conclude results. Based on these difference between qualitative and quantitative research, that qualitative research is more detailed and subjective to the person interpreting the findings while quantitative is considered to be objective with lower in detail (Silverman 2006, Eriksson & Kovalainen 2008).

The characteristics of qualitative research match the nature of the collaborative work system study. In this study is a need to understand the work systems in different SMEs

and identify the collaborative needs that exist in the form of problems and opportunities identified from work system actors during project and operational work within these work systems. This study also requires to determine the functionality of the service (WCS) and validate it in SMEs. Hence, the case study method is used as the nature of the current study requires an in depth study of the service as well as a detailed study of the work systems and its work participants. Furthermore, a case allows studying an event, individual or an enterprise. This makes the case study approach very useful as it allows studying flexible more than one case and event and/or participants (Yin, 2009).

5.4 Research Process

The research follows a non-sequential process. Some stages within the process are completed before next one starts, for example designing the theoretical framework and identifying the research methodology. But some stages are run in parallel such as doing literature review and setting up contacts for data gathering.

These stages include

- planning and designing the project,
- review of literature,
- creating a theoretical framework,
- collecting, analyzing and interpreting the research material,
- framing arguments and writing the dissertation.

These stages help in planning and investigating the thesis. Last stage which involves writing the thesis involves segmenting and organizing chapters in such a way that they can easily be read and help to answer the research questions.

The first research question (RQ1) involves designing a pre-built software to work system qualification approach. The pre-built software to work system qualification approach is generated by using a phase-based approach with three phases of investigation and evaluation. Each phase consists of parts that describes what has to be accomplished and how. The first phase determines the functionality of a software or in easier word the capability of the software. For this investigation a simple strategy is adopted where the software is tested with or without the help of software documentation and/or having conversations with some subject matter expert or the software product owner or any representative from

the software providing company. This phase does not require any theoretical analysis rather requires a more practical effort to determine the functionality and determine the functional model which binds the functionality together. Such investigation is supported by FIPS (1993) and Burk (2010). The second phase involves analyzing work systems in enterprises. This requires a framework that could be used as a part of the approach to determine needs from problems and opportunities within those work systems as well as what aspects and tools supplied by the framework can be used for such an analysis to take place within any enterprise. After researching different frameworks Work Systems Framework and Work Systems Method are employed. Chapter 4 provides an introduction of this framework and tools and method that can be employed to carry out an enterprise work systems analysis. The third phase requires comparison between the first and second phase to identify what needs are not fulfilled and which needs are. The entire approach is identified in detail in section 5.4.1 - 5.4.3 of this thesis. This developed approach is then validated with a real world example (RQ2).

The second research question (RQ2) is answered with the help of the created approach where the fit between a WCS and collaboration needs that exist during project and operational work in work system, is determined. Chapters 2-3 serve the needs to understand SMEs and the phenomenon of work collaboration during operational and project work. The developed approach along with what needs to be achieve in each stage is as follows.

5.4.1 PHASE 1: Investigation of Software Functionality

To determine the functionality of the software, first, the software's functional model is determined through interviews and presentations conducted with the service provider or through product testing or review of any available material such as i.e., customer manuals and documentation. The software functional model is a high-level representation used by software vendors to model their software's. According to National Institute of Standards and Technology (1993) in their FIPS report a function model or functional model in systems engineering and software engineering is, "a structured representation of the functions (activities, actions, processes, operations) within the modeled system or subject area". The software functional model gives us an idea of the workflow and logic behind a software and is depicted using diagrammatic representation of the activities, actions, processes, operations software construction. Functionality is provided to the user which

encapsulates the activities, processes and operations inside a software. The software functional model derived for the software is later used for verification against the work system model that has been derived from the evaluation of small to medium enterprise work systems in PHASE 2 of the analysis. Similar the functionality is determined once the functional model is identified.

I. Investigate the functionality of the software,
    a. Derive out the software functional model through product testing, software manuals, or communication with software owners and then represented using a diagram.
    b. Determine the software's functionality from the software functional model,
II. Document the functionality of the software from the above analysis.

5.4.2 PHASE 2: Investigation of Small to Medium Enterprise Work Systems Needs using Work Systems Framework and Work Systems Method

Next the needs within small to medium enterprise work systems are identified. The analysis of an enterprise and its work systems include the identification and analysis of problems and opportunities within them. Step I of this phase determines the focus and scope of the investigation; that is what work systems of the enterprise will be included in the investigation. The work system is investigated using the work systems method and framework. A work system model is produced as a result of the analysis. This model helps in understanding how work is done and how it progresses in each work system. The work systems method and framework by Alter (2006) helps to determine needs from problems and opportunities within the work systems. These identified needs from problems and opportunities are compared to the functionality of the software in PHASE 3.

I. Determine the focus and scope of the investigation.
II. Analyze enterprise.
    a. Collect data on enterprises through interviews and personal observation. Data pertaining to each enterprise and their work systems i.e., Description, Business Industry, Size & Type, Interviewees, Main Business Activities (Work Systems), Work modes, Work Activities & Technologies Used.

b. Describe the enterprise as a whole i.e., stating also the bigger picture.

III. Analyze enterprise work systems using work systems framework and method,

a. Model the work system using the work systems framework (WSF) and its elements and document using the work system snapshot,

b. Derive the work system model for qualification against the software functional model to see if the software will support the work practices employed within enterprise,

c. Identify the problems and opportunities that exist in each work system (including relevant constraints and other considerations),

i. Analyze the situations using measures of performance, key incidents, root cause analysis, implications of structural characteristics, work system principles, and other factors.

IV. Identify and document the needs from problems and opportunities within these work systems.

5.4.3 PHASE 3: Qualifying Work System Needs to Software Functionality

This phase evaluates the conformance or the functional fit of the service's, i.e. the software's functionality to work system needs. The comparison of software functionality to work systems needs determines what additional functionality need to be considered, tailored or otherwise taken into account when making the purchase decision of a new software.

I. Compare the findings from PHASE 1 & 2 to identify if the service meets the needs of the enterprise work systems.

a. Compare the functional model of the software to enterprise work system model.

b. Compare the functionality to the needs derived from the enterprise.

c. Identify possibilities for improvements within the work system.

d. Decide on recommendation.

e. Justify the recommendation by explaining how work system performance will improve, in terms of relevant metrics, principles and other factors.

The above approach answer RQ1 of the thesis which requires the formulation of it. This approach is later tested to determine the fit between the functionality of a work collaboration software to collaborative needs in project and operational work in small to medium enterprise work systems in chapter 6.

5.5 Data Collection

To carry out the investigation of whether a WCSs functionality fits the collaborative needs in project and operational work in small to medium enterprise work systems, semi-structured interviews, open-ended questions and personal observations are conducted in four SMEs. Persons from top and middle management are interviewed to ensure credibility and validity of the research. The semi-structured approach enabled the interviewees to follow a natural flow of conversation. But at the same time, the researcher had the power to control the conversation so that questions were answered. These interviews also helped to explore previously unidentified issues that the course of the conversations brought up and which were relevant for the topic of the study.

To get a better scope of the issues from various participants, snowball sampling was used. There the interviewee refers to other colleagues to be interviewed (Wilkinson and Young 2002). This guided 14 semi-structured interviews in four enterprises. The interviewees were notified about the topics of the interview several days prior to the interview date. Interviews were recorded but no transcript was made. The notes and key themes were notes were used in analysis and recordings were used to check and correct the notes when necessary.

6 CASE STUDY AND FINDINGS

This chapter answers to the second research question: "What special requirements work collaboration systems have regarding pre-built software, i.e. work collaboration needs of project and operational work?" Here we test how the pre-built software to work system qualification approach developed in the previous chapter to see if it helps in determining and qualifying a work collaboration service's (WCS) functionality to the collaborating needs pertaining to operational and project work within work systems in SMEs.

The new approach is phase based because the research requires phases for the identification of pre-built software functionality and enterprise work system needs. Moreover, it also requires the fit between the functionality and needs to be determined. This means that it achieves specific results in each development phase. So to avoid confusion and maintain control of the analysis, a phase-based approach is selected for answering the research question. The phases and the setting of software and work systems are described shortly below.

- PHASE 1: In its first phase of analysis, the functionality of a pre-built work collaboration software (WCS) is determined.
- PHASE 2: The second phase uses the "The Work Systems Method" and its underlying framework, "The Work Systems Framework" (Alter, 2013). This phase determines the collaboration needs derived from problems and opportunities that exist in enterprise work systems that employ projects and operational work types.
- PHASE 3: The fit between the work collaboration service and the SMEs will be determined by comparing the functionality of the work collaboration software to the collaboration needs of the enterprise work systems. After matching the functionality to work collaboration needs within the enterprise work systems, uncovered collaborative needs for both project and operational work are identified for improving the particular WCS.

The detailed application of each phase with the case follows next.

6.1 PHASE 1: Work Collaboration Service Functionality Investigation

The investigation and analysis of the Work Collaboration Service (WCS) functionality is divided into two distinct sub parts. Part I investigates the functional model behind the WCS, and Part II identifies the functionality from the work collaboration service functional model.

I. INVESTIGATION OF SOFTWARE FUNCTIONALITY USING MODELS

By analyzing the data collected from many sources (meetings with the software vendor, interviews, training material, customer reference manual and one's own software usage), the work collaboration service functional model is derived for the WCS.

a. WORK COLLABORATION SERVICE FUNCTIONAL MODEL

Interviews with the service owner and service developers helped in developing an insight of how the WCS worked. From this understanding a functional model of the service was developed. This model resembled their understanding of how they perceived enterprises functioned when collaborating during project and operational work. Figure 04 displays the work collaboration service functional model followed by its explanation.

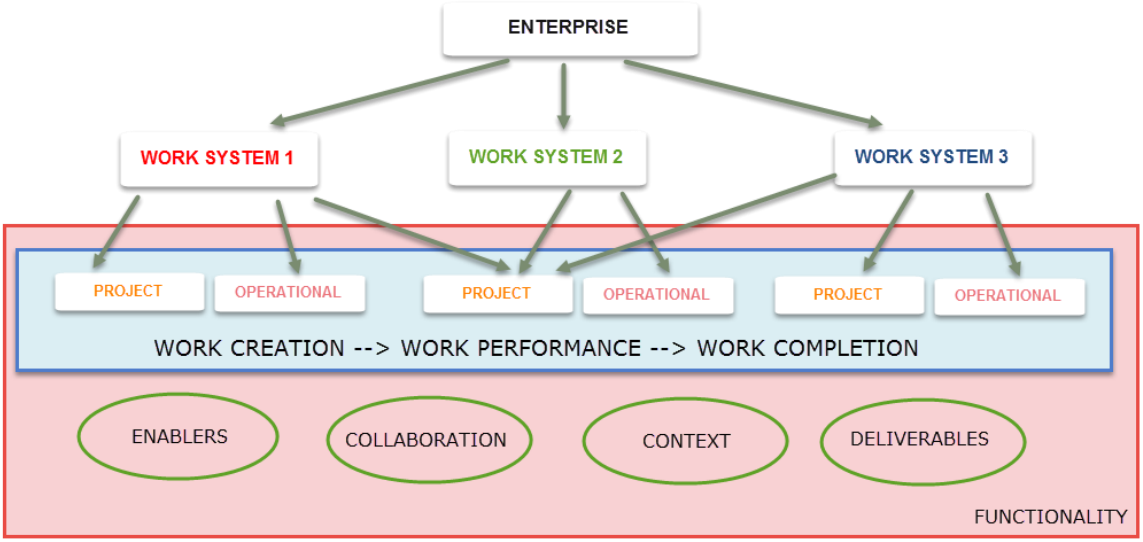

Figure 04: The Work Collaboration Service Functional Model

According to their perception, this functional model was applicable to any collaboration endeavor regardless of the work type i.e., i.e., project or of operational work, that had been employed to achieve the work goals. The reason behind the functional models generic applicability is that it was built on the assumption that work regardless of its nature being operational or project has three major stages of work progression: from creation to performance and lastly completion. These major stages have sub-stages such as definition, assignment and progress. Hence, all collaborative work regardless of it being performed in a project or being performed in day to day operations require the same stages from work creation, performance to completion.

This view is in accordance with the findings in literature that work regardless of its work types is same in its basics of how it is created, performed and completed. But it could vary in what the workers achieve, in the type of tasks they perform, their life, what change they bring evolutionary or revolutionary, team continuity, etc., (Meredith & Mantel 2009; Schwalbe 2013). Furthermore, these stages of work progress are supported by four dimensions i.e., Enablers, Collaboration, Context and Deliverables which are also the same regardless of the nature of work i.e., operational or project. Hence, the functionality provided within the service is based on work progress stages, and the four dimensions. These form the functional model of the WCS. A brief description on the four dimensions follows.

- Context: Refers to the information related to project or operational work and other dimension that help accomplish some task with a work system. Some of the question that context dimension addresses are
    - What tasks are being performed?
    - How do these tasks relate?
    - Who will be performing these tasks?
    - What is the process to perform tasks?
    - When will these need to be delivered?
    - For whom are these being performed?
    - What is the budget behind the activity and how much time will need to be allocated to it?
    - What technologies will be used?
    - What are the requirements for the activity?

  - What quality will be required?

- Collaboration: Refers to the communication and co-ordination information in project and operational work. The collaboration dimension works hand in hand with other dimensions. Thus, it also manages the control of information dissemination between the other dimensions.
  - Communication refers to sharing of information on any aspect of work during any stage to make the work progression easier.
  - Co-ordination refers to the ability of participants of a collaborative effort to work together effectively in reaching some goal. This requires structure and synchronization of tasks and activities.

- Enablers: Are the drivers that help in delivering the results within a specified quality, on time, within the budget and scope. These drivers are mostly skills of the participants individually and in teams as well as the resource the company has to deliver the outcome.

- Deliverables: This is the actual outcome, which can be in terms of completed tasks, completed activities, completed service requests, completed products etc. It also relates to the quality, time, cost and scope of the deliverable if they actually coincide to the expected results. Deliverables entail reports that can help management get a quick view of the entire activity.

II. DERIVING SERVICE FUNCTIONALITY

Now we have the work collaboration service's functional model. It helps in managing and accomplishing collaborative activities together in both Project and Operational work types employed within the work systems.

The functional model assumes that project and operational work can be created in the form of agreements between individuals. This agreement acts as a binding contract between the participants who undertake some tasks listed under the agreement. Tasks can be created under an agreement. Constraints such as time, quality, priority, cost and scope can be specified both for agreements and for its tasks. The agreement and its tasks can be assigned to individuals by looking up resources from a pool of participants within an

enterprise (which have earlier been added to the system). Once assigned the participants is notified on work assigned to them via messages in a team or individually. Further, additional tasks can be created by the participants in case of need. Participants in each agreement can communicate and comment on any object in the system.

If the assigned work is not performed in time, notifications are generated to all relevant people that exist under the agreement and the task is marked notably as delayed. In order to relieve the tasks from being delayed totally, resources can be allocated or time can be changed based on privileges within the service. Work progress can be adjusted through indicators provided against each activity. These indicators include time and quality and are not automated in any way. Once work is completed, notifications are generated about its completion.

The functionality is derived as above, and it is grouped under the three major stages of work progress of the functional model i.e., Work Creation, Work Performance and Work Completion. This grouping is in Table 09 below.

Table 09: Derived Software Functionality Grouped Under Three Stage of Work

Software Functionality
Work Creation
Definition
• Create and define Projects/Operational Agreements (Agreements are promises of some work delivery which are signed once work is accepted by the participants)
• Define goals and constraints (cost, time and quality)
• Creation of a discussion space (at agreement level)
• Create tasks (separately for each agreement)
• Link Tasks for Task dependency in agreements (primary & secondary)
• Create and assign roles and privileges (to work participants)
Assignment
• Assign tasks to teams and individuals (to project/ operational work)
• Provide notifications based on task assignment
• Select individuals from resource pool for task allocation
Work Performance
• Notify users within service on work assignment
• Create tasks if not created
Progress
• Notifications based on deadline and burning
• Adjust work progress for each task (through indicators)

Work Completion

- Notification on work completion
- Feedback through discussion

As mentioned earlier, the functional model comprises of the phases of work progression, which is supported by four dimensions. Hence, it becomes compulsory to see what functionality can be represented through each of these dimensions and what additional functionality can be determined that could not be determined using the work progression stages alone. The underlying Table 10 helps in identifying these.

Table 10: Derived Software Functionality Grouped by Collaboration Dimensions

Dimensions	**Functionalities**
Context	• Create and define Projects/Operational Agreements • Define goals and constraints (cost, time and quality) • Create Tasks • Link Tasks for Task dependency in agreements (primary & secondary) • Create and assign roles and privileges (to work participants) • Assign tasks to teams and individuals (to project/operational work) • Allocate resources and time to tasks • Adjust work progress through indicators
Enablers	• Select individuals from resource pool for task allocation • Ease of communication through discussion space • Feedback mechanism • Notification for task completion and burning • Notifications based on task assignment • Intimate users within service on work assignment
Collaboration	• Intimate users within service on work assignment • Task assignment to team and individuals • Creation of discussion space (at agreement level) • Communication of information on tasks • Adjusting work progress • Generation of notifications on delayed tasks to participants • Generation of notification on completed tasks to participants
Deliverables	• Completed products and services

It can be seen that some functionalities are shared amongst the dimension. The reason behind this is that the functionality can be a requirement for both multiple dimensions to

accomplish work goals. Hence, the final set of functionality identified from the PHASE 2 of the pre-built software to work system qualification approach by the culmination of Table 09 and 10, is as follows in Table 11:

Table 11: The Final Derived Software Functionality Categorized by Three Stage of Work (i.e., Functional Model)

	Work Creation		**Work Performance**		**Work Completion**
	Definition	***Assignment***	***Performance***	***Progress***	***Completion***
Create and define Projects/ Operational Agreements	✓				
Define goals and constraints (cost, time and quality)	✓				
Creation of a discussion space (at agreement level)	✓				
Task creation	✓				
Link Tasks for Task dependency	✓				
Create and assign roles and privileges (to work participants)	✓				
Select individuals from resource pool for task allocation		✓			
Assign tasks to teams and individuals (to project/ operational work)		✓			
Notifications based on task assignment		✓			
Communication through discussion space for every agreement			✓		
Feedback mechanism			✓		
Create tasks if not created			✓		

Notifications based on task deadline and burning				✓	
Adjust work progress (through indicators),				✓	
Generation of notifications on delayed and completed tasks to participants				✓	
Notification on work completion					✓
Feedback mechanism					✓

The set of functionality is grouped by the three stages of progression for easier qualification against the needs derived from the evaluation of the work systems in enterprises in the PHASE 2.

6.2 PHASE 2: Investigation of Work Collaboration Needs in Enterprise Work Systems

In this section, we test the second phase of the pre-built software to work system qualification approach to determine work collaboration needs required to overcome the work collaboration problem and opportunities that might exist in project and operational work in work systems within SMEs. The different stages of investigation are presented below.

I. Focus and scope of the investigation

The focus of this stage of investigation is to determine collaboration problem and opportunities that exist in project and operational work in work systems of SMEs. It is from these problems and opportunities that software based needs are derived. The interviewed companies are from different fields of industry, and their work systems employ project and operational work to carry out work tasks within them. Chapter 2.1.4 pointed out that the basics of work are same across all work types. The analysis from all enterprise work systems (II) are combined together in a single snapshot (III) to determine functional model for both project and operational work types, and to identify problems and opportunities (IV) and the development steps (V).

II. Analysis of Enterprises

Data from four different SMEs (i.e., Description, Business Industry, Size & Type, Interviewees, Main Business Activities (Work Systems), Work Type, Work Collaboration Activities & Technologies Used.) is collected through semi-structured interviews, open-ended questions and personal observations. Employees from top and middle management are interviewed. These characteristics are presented in the underlying Tables 12 to 15. The names assigned to the company are pseudo names. These names are based on the work nature in general in order to distinguish one from the other.

Table 12: Enterprise 1: Business Research & Software Development

Research and Development Unit	
Description	Technology research unit which acts as a link between academic research and the business industry. The enterprise promotes the commercialization of inventions into successful ventures or business opportunities for existing companies. Company is a strong believer in collaborative development and open innovation. It also analyzes ideas that have potential if they can be further developed as well as assists in looking experts and partners.
Business Industry	Academia, Business Research and Software Development
Size & Type	Less than 50 people. Small Enterprise
Interviewees	1 project manager, 2 senior employees, 2 junior employees.
Work Systems	• Business research and development • Market research • Software design and development • Creation and commercialization of inventions • Analyzing ideas from industry and businesses • Human resources assistance • Client service management
Work Types	Projects and Operational Work
Work Collaboration Activities	• Scheduling project meetings between clients and teams • Building consensus on requirements for upcoming projects through team discussions • Creating work and project schedules • Setting up industry contacts • Information sharing within team • Review meetings • Assigning work tasks • Assigning roles • Creating and allocating tasks and activities • Document and resource sharing • Constant email and phone communication with project stakeholders • Offering support for already developed projects etc.,
Collaboration Technologies Used	• Document Management Systems • Email clients • Phones • Project Management Software • Calendars • Bug Tracking Software

Table 13: Enterprise 2: Technology Consulting Company

Technology Consulting Company	
Description	A company that visions itself to be a global market-leader in providing next generation e-business products and services. Provides state-of-the-art online-business products (e.g. e-commerce solutions, content management systems, digital marketing tools, technology consulting services).
Business Industry	Technology development and consulting
Size & Type	50-100 people. Medium Enterprise
Interviewees	1 project manager, 2 line employees
Work Systems	• Software portfolio management • Performing business analytics • Software roll outs • Research and development • Integration support • Software development and customizations • Marketing and sales • Consulting services • Client service management • Customer relationship management • Change request support
Work Types	Project work
Work Collaboration Activities	• Scheduling project meetings between clients and teams • Collaborating work in and across teams with different domain expertise • Maintaining wiki/ blogs on corporate website • Approaching companies for e-business solution marketing and sale • Developing consensus on requirements for upcoming projects through team discussions • Creating work and project schedules • Information sharing • Review meetings • Forming project teams • Sharing project tasks • Assigning roles • Creating and allocating tasks and activities • Document and resource sharing • Constant email and phone communication with project stakeholders • Task and workload management • Offering support for already developed softwares etc.,
Collaboration Technologies Used	• Document Management Systems • Email clients • Phones • Project Management Software • Calendars • Online Meeting Services • Bug Tracking Software • Online Support Service

Table 14: Enterprise 3: Software Development Company

Software development company	
Description	A software company that creates and maintains a development framework used by web developers around the globe. They offer various professional tools developed using the same framework, development support services, and training as well as consultancy services.
Business Industry	Software Development
Size & Type	100-250 people. Medium sized enterprise
Interviewees	1 project manager, 2 line employees
Work Systems	• Maintaining a software development framework • Develops professional tools using the same framework • Provides support services to clients • Training • Consultancy services
Work Types	Project Work
Work Collaboration Activities	• Software development • Scrum practices • Product backlogs • Poker allocations, • Scheduling project meetings between clients and teams • Collaborating work in and across teams with different domain expertise • Maintaining wiki/ blogs on corporate website • Approaching companies for e-business solution marketing and sale • Developing consensus on requirements for upcoming projects through team discussions • Creating work and project schedules • Information sharing • Review meetings • Forming project teams • Sharing project tasks • Assigning roles • Creating and allocating tasks and activities • Document and resource sharing • Constant email and phone communication with project stakeholders • Task and workload management • Offering support for already developed projects etc., • Training and customer development
Collaboration Technologies Used	• Agile project management services • Office packages • Document management systems • Email clients • Phones • Calendars • Online Meeting Services • Bug Tracking Software • Online Support Service

Table 15: Enterprise 4: Nordic Insurance Company

Nordic Insurance Company	
Description	A leading insurance company offering different insurances ranging from Vehicles, Animals, Home and Enterprises, Journey, Young and Elderly, and Forest Ownership. It maintains a huge network in all the Nordic Countries and has a very strong IT landscape which enable it to perform at the level it does.
Business Industry	Insurance
Size & Type	250+ people. Large Enterprise
Interviewees	1 project manager, 2 line employees
Work Systems	• Creating and designing insurance packages for private and corporate customers • Maintaining customer relationship • Keeping work on track by relating them to corporate goals • Managing IT software and hardware landscape
Work Types	Operational Work
Work Collaboration Activities	• Claims handling and process • Communicating with partner and external affiliates • Creating and design insurance package throughout Nordics • Project Management • Scheduling project meetings between clients and teams • Collaborating work in and across teams with different domain expertise • Maintaining corporate website • Marketing insurance packages • Team discussions • Internal and external trainings • Creating work and project schedules • Information sharing • Review meetings • Forming project teams • Sharing project tasks • Assigning roles • Creating and allocating tasks and activities • Document and resource sharing • Constant email and phone communication with project stakeholders • Task and workload management • Offering support for already developed projects etc.,
Collaboration Technologies Used	• Enterprise Resource Planning software • Project management services • Office packages • Wikis/ Blogs • Document management systems • Email clients • Phones • Calendars • Online Meeting Services • Bug Tracking Software • Online Support Service.

III. Analysis of Enterprise Work Systems:

Four main work systems from different SMEs from section II are selected and analyzed using the work systems framework and method. These work systems employ either or both the work types i.e., project and operational work. This analysis is conducted to understand how work is performed and how work collaboration actually occurs when performing project and operational work within these work systems. This helps to create the functional model of each work system. This model is then later combined into a generic work system functional model if the work practices are similar in their nature across the work types i.e., project and operational in all the four work systems.

This helps us to understand each work systems functioning and to identify problems and opportunities through the study of each element and their relationship and dependencies within these work systems. The results of the evaluation are provided using a Work Systems Snapshot in Tables 16 to 19. The snapshots are developed through in-depth analysis of the data from the interviews and observation and from the understanding as a result of analysis of the collected data. The snapshot is extended from its actual state as in (Alter, 2006) to accommodate evaluations for the enterprise work systems.

Table 16: Enterprise 1 - Market Analysis (Project Work & Operational Type)

CUSTOMERS	**PRODUCTS & SERVICES**
Manager	Market Analysis Reports
WORK PRACTICES (MAJOR ACTIVITIES)	
Work Creation • Manager identifies need for market analysis for creating or improving existing business plan • Manager creates an email regarding the work. He defines the what is required to be done, the time restrictions and the scope of the system • Manager assigns work to suitable marketing analyst based on experience, domain and skills **Work Performance** • Marketing analyst views email and views his calendar, informs the manager accordingly if the work can proceed within the given time frame or negotiates time requirements as when does it need to be delivered • Negotiation is done via phone calls, face to face interactions, emails and work information has to be traced back to emails or just be remembered	

- Marketing Analysts schedules a date when to start the work using a personal calendar not shared with enterprise
- The day to work appears and notifications are generated from personal calendar if digital
- Marketing analyst collects information on potential and target markets, as well as other information on government or commercial statistics. He can also extrapolate information from different sources to get more information such as CRM systems, online sources, digital libraries, data warehouses etc.,
- Divides target market into useful segments to understand and address specific needs
- Measures and quantifies the market to be able to understand the target market
- Identify market trends that will influence market segments

Work Completion

- Create a market analysis report and presents it to Manager

PARTICIPANTS	INFORMATION	TECHNOLOGIES
• Manager • Market Analyst	• Work Creation • Information required on potential or target market • Work Performance • Government or commercial statistics • Segmentation of market • Market Trends • Work Completion • Market Analysis Information	• Emails • Digital Libraries • Online Sources • Data Warehouses • CRM systems

Table 17: Enterprise 2 - Customer Change Request in ERP Service (Project Work Type)

CUSTOMERS	**PRODUCTS & SERVICES**
• Internal: Analysis, Development and Testing Departments • External:Customer	• Requirements Specifications • Design Specification • Wireframes • Test Scenarios • Algorithm • Manuals
WORK PRACTICES (MAJOR ACTIVITIES)	
Work Creation • Customer (internal/ external) requests a change in a software module in an custom built ERP • Work is registered by a customer care representative and a ticket is generated with a CAS number • Work is then assigned by customer care representative to Business Systems Analysis **Work Performance** • In business analysis department, customer requirements are studied and change is evaluated. If it is worth to change algorithm or there is a way around, or if the change is small it directly assigned to programming department • If change is accepted, it is added to backlog manually (repository), where it remains if priority is low. It will come when its turn comes by viewing it manually • Backlog stores information on requests based on date and priority • Business Analyst team lead look up for project which concern them in the repository frequently to retrieve work and start it • Team lead decide if a team will work on this change request or an individual with appropriate skills, • Locates suitable candidates and assigns work • For accepted changes, requirement specifications are developed and business rules documented which explore impacts to existing module and specify how the change is carried out. Or if an alternate way exists, case is closed and issue is marked resolved after feedback to customer • In addition to acceptance on change, Design specifications and wireframes are developed by systems analyst and designer to map requirement specifications • All above documentation is assigned to programming department and testing department • Programmers develop algorithms, map requirement specifications & design specifications, and testers develop testing scenarios • Developed code is assigned to testing departments • Test scenarios are executed and product tested using different methods • Hosting is done on a local host and tested again **Work Completion** • Documentation and manuals are prepared • Implementation rolls out on live for clients if any or for own enterprises	

PARTICIPANTS	INFORMATION	TECHNOLOGIES
• Business Analysts • Systems Analysts • Testers • Programmers • Individual Users • Team Members	• Request for change • Information on changes • CAS information is used by Analysis department to identify what to work on • Business and Design logic created and used by programmers • Algorithmic logic to implement change • User functionality information in manuals	• Wireframing tools • Photoshop • Emails • CAS • Document Management Systems

Table 18: Enterprise 3 - Training Requests (Project Work Type)

CUSTOMERS	PRODUCTS & SERVICES
External:Customer	Training clients on framework

WORK PRACTICES (MAJOR ACTIVITIES)

Work Creation

- Client initiates a contact requesting training services
- Customer service representative (CSR) receives the request and generates a training number using specialized software
- CSR reviews and documents the exact nature of request
- CSR looks into company training department schedules through a service
- CSR assigns request to specific training department project managers
- Work management system generates an email to assignees

Work Performance

- Training department views training and creates a list of trainees with appropriate skills who will conduct the training
- Training department gives the go ahead to CSR which negotiates date and time of training as well as provides information on charges
- If negotiation is successful, CSR approves training provides negotiated details back to training department, generates an invoice and dispatches to client
- After receiving payment, CSR re-assign the job to training department

Work Completion

- Training initializes

PARTICIPANTS	INFORMATION	TECHNOLOGIES
• Customer Services Representative • Clients • Training Department	• CAS information is used by Analysis department to identify what to work on • Business and Design logic created and used by programmers	• Wire-framing tools • Photoshop • Emails • CAS

	• Algorithmic logic to implement change • User functionality information in manuals	• Document Management Systems

Table 19: Car Insurance Claim Process (Operational Work Type). (Company 4)

CUSTOMERS	**PRODUCTS & SERVICES**
Internal: Authorized repair shop, billing department External: Claimant (Insurance holder)	Claim settlement documents Service of fixing the car
WORK PRACTICES (MAJOR ACTIVITIES)	
Work Creation • Claimant notifies and exchanges insurance details with people if there is a damage between two vehicles to avoid surprises • Claimant notifies insurance company through a phone call or insurance company website and provides insurance details • Claimant is provided two ways for car inspection either through drive in or through the insurance company repair network • The claimant accepts one process, e.g. drive in claims through the phone on the, website **Work Performance** • Claimant takes the car to drive in where an associate is assigned to carry out the assessment • Claim associate appraises the vehicle damage in 45 mins • The associate gives a rough estimate to cover the claims and provides a list of shops which the claimant can use as a shop of choice through a brochure • Associate gets documents signed by claimant upon the agreement, claimant is billed the deductible through billing department once the associate returns to office **Work Completion** • Claimant takes car to desired location and gets it fixed	

PARTICIPANTS	INFORMATION	TECHNOLOGIES
• Claimants • Associates • E-Commerce • Website	• Insurance details • Collision details • Third party insurance information • Agreement information • Information on shops	• E-Commerce Website • Insurance ERP system •

From the above findings, we can deduce that the work practice in each work system is highly dependent on the surrounding elements i.e., Information, Participants, Technology, Customers and Products and Services. They also show that at the core work practice regardless of its type i.e., project or operational, has a common denominator,

which is apparent in all snapshots. This common denominator is the stages between work creation to work completion. More on these follow in the next section,

a. A Single Enterprise Generic Snapshot

The data from the four enterprise work system snapshots are compared to create a generic enterprise work system snapshot especially for the functional model. Here we can ascertain that project and operational work are same in their basics of work creation, performance and completion. Thus, the main interest is in the functional aspects, the stages of collaborative work. Once we know this, it becomes easier to not create different segregations for operational and project work, and determine different needs for both work types. To achieve this, we use the logical categorization of the three stages from the above work system snapshots into one snapshot for ease of assimilating, illustrating and discussing the results.

Table 20: Comparison of all four enterprise snapshots

CUSTOMERS	**PRODUCTS & SERVICES**
• Includes both internal and external customer • Customers can be participants	• Products and services • Products and services can be delivered to internal and external customers and can have both monetary and innate value
WORK PRACTICE (FUNCTIONAL MODEL OF PROJECT AND OPERATIONAL WORK)	
Work Creation • Work identification: a trigger initiates work to be performed which is identified from either customers and or participants, this trigger can be internal or external to a work system and can exist within these environments • Work definition: once a work is identified it is evaluated if it has to be performed, if yes a definition of work is created this definition exists either in the mind or it is explicitly mentioned in some medium accessible to participants of the work endeavor, this definition comprises of the requirements of work along with the scope, time, cost and volume aspects of work • Work Assignment: defined work requires people skills hence requires assignment of work to the employees who have the right skills **Work Performance**	

• Work Acceptance: Assigned work is accepted or rejected based on wrong delegation of work, or work load. Accepted work is either performed as soon as its received or is performed later by registering it in some work log • Work Performance and Progress: Accepted work is performed using the method employed to perform it. For examples developing a software module would require analysis, design, development, testing and implementation hence the software development lifecycle would be the method employed to carry out the performance function. Hence, it can be said that most activities that help in actually performing the work are located under this function. The performed work is tracked to view progress and derive reports **Work Completion** • Work Completion: Once the work is completed, its information is updated and notification are generated to the participants and to the customers • Work Inspection: Inspection is carried out either at the performance level or at the completion level to determine work quality		
PARTICIPANTS	**INFORMATION**	**TECHNOLOGIES**
• Internal and external departments • Can include customers	• Information used and produced by work practice activities and are work specific	• Communication • ERPs • Work Management • CAS tools • Office • Document Management Systems

As mentioned earlier though each work practice appearing in the four work systems employ either project or operational work to accomplish tasks, these work systems share the same main stages of work progress along with common sub stages. Without these sub-stages, the main stage would not be complete. For example, work creation requires work to be identified, defined and assigned. And if some stage is not completed, it hinders proper progression of work, and this results in work failure or low work quality. The same applies to the rest of the stages, but it should be noted that stages can run in parallel or can be returned at for example if the requirement of work is not completely understood, the work is still carried out while the requirements are finalized and accepted.

Combining the enterprise work system snapshots into a single snapshot helps us understand that both project and operational work are same in their fundamentals of work progression. The fundamental refer to how the work is created, performed, and completed when working together. These stages of work progression are not techno-centric. When understanding a work system techno-centric approach should be avoided and instead a

more balance approach should be adopted on how work actually takes place in the business and then how technology supports it (Alter, 2006).

Technologies could be made a part of the analysis but is not a must or should be avoided. These stages of work progression provide a generic functional model of the enterprise work systems. This functional model is triggered and supported by other elements i.e., the customer, the products and services being produced, the participant of the collaboration, the technologies being used and the information being produced and consumed. This model is used for comparison against the work collaboration service functional model in PHASE 3 of the analysis.

IV. Identify problems and/or opportunities:

Analysis of the findings from interviews and the snapshots of each work system help us identify work collaboration problems and opportunities that exist in each work system during project and operational work. The evaluations of the enterprise snapshots validate that all work and work collaboration activities regardless of projects and operational work are similar in their fundamentals. Hence, it can be assumed that the work collaboration problem and opportunities that are present for one work type will also be applicable to the other. This is found when relating the work collaboration problem and opportunities between all four snapshots, where similar work collaboration problems and opportunities were found to be present in both work types. The finding from the analysis for the identification of problem and opportunities within enterprise work systems is in Table 21.

Table 21: Identified problems and opportunities from Enterprise Work System Evaluation

PROBLEM & OPPORTUNITY	**DESCRIPTION**
Work idea capturing a problem	We lose very important ideas and miss out opportunities when working on tasks.
Emails as the medium of communication. No form of synchronous communication.	Emails used as a form of way of communication and work information lookup. Emails should be used to transfer administrative information not work information in both project and operation work types. Synchronous communication missing for transfer of information in a fast and easy manner.
Information lookup on changing work requirements is hard because of thousands of emails.	Looking up information on changing work requirements is very hard there should be a place where these requirements should be documented.

Referencing of work documents	Project and operational work related documents are hard to find within some repository. There should be a way to figure out which document belongs to what aspect of work.
Loss of negotiation and its meaning	Negotiations are done via email or at times face to face and the meaning is lost as participants interpret things differently, there is no place to refer to hence creating differences.
Personal work schedulers in play	Employees maintain their own work schedules, which are not shared at enterprise level. This makes is hard to approach them if they are busy.
Work logging non existent	There is no way to see what has been accomplished to date. There is no way to remember who did what and who could be held responsible or appreciated for work that has been done.
Information sharing and linking to work not possible	Sharing of information with the entire team on a some specific work type or task not possible.
Work not properly defined when being created	When CS creates a work assignment and lists the requirements for it, he/ she forget to add constraints and it is not easy to figure out the priority by the team lead himself.
SLA and OLA cannot be defined against some work	There is no way to have electronic service level agreements between customers and the enterprise as well as having operational level agreements between different internal support groups.
Notifications for tasks approaching deadline or which are overdue	There is no way to see work and work tasks that are overdue.
Work assignment is hard when department has many employees with different skill set	Hard to find the right person for the task to be performed
Work specific communication getting lost	Hard to communicate in real time about some specific work or its work tasks. The messages get lost in real time communication apps.
New ways of working together not supported	New ways of working together using agile practices or with teams in different locations does not exist.
Work allocation through emails a pain	Hard to track assignment and reassignment of a work through emails.
Working with geographically displaced teams in different time zone difficult	Hard to work with geographically displaced teams because of time and location barriers. Internet of things is a dream.
Resource availability is not known	It is hard to find out if the resource is available to be used somewhere else. Work monitoring not possible.
Hard to remember time, scope, priority, quality and cost constraints	Not possible to remember time, priority, scope and quality constraints as no place for logging these.
Work logs and task marking	Work progression and completion cannot be ascertained as there is no way to log which tasks have been accomplished.
Work load management missing	Some employees are over burdened with work as team leads and managers do not know how much work they have.

V. Devising Needs from Problem and Opportunities:

Once an understanding of the functioning and the problems is established, this understanding can then be measured using measures of performance, key incidents, root cause analysis, implications of structural characteristics, work system principles, and other factors. This further analysis into problems can be used to see if the problem is exactly what it is and then to see what ripple the problem can create and what other problems would need to be catered for. This helps in prioritizing the problems to decide the most important problems to be resolved.

Based on the identified problems, new needs can be identified which can help to develop the software to provide functionality to overcome these problems. Similarly, if during analysis of the enterprise and its work systems, new opportunities of improvement of work collaboration are identified, then these opportunities are kept in consideration when developing the needs from the software to address the opportunities as well as the problems identified earlier. The devised needs of the four cases from work collaboration problem and opportunities are in Table 22.

Table 22: Needs formulated from work collaboration problems and opportunities during project and operational work

Problem & Opportunity	**Need**
We lose very important ideas and miss out on opportunities when working on tasks.	Ideas on work should be captured so it can be later returned to. (Capture ideas)
Emails is the only medium of communication. No form of synchronous communication when working together on tasks that require mutual effort.	Communication should be both synchronous and asynchronous and emails as the medium of information lookup should be avoided when there is a need for faster transmission of information between participants such as Instant Messaging. (Incorporation of Instant Messaging and Emails)
Information lookup on changing work requirements is hard because of thousands of emails.	Work requirements should be documented somewhere for easier reference. (Requirement documentation and maintenance)
Referencing of documents to some work is impossible.	Documents sitting in shared repositories should have some means of reference to which work it belongs to so that the document can be searched for easily. (Document Referencing)
Loss of Negotiation and Its Meaning	Negotiated work should have a place for contracts where parties involved should be able to see the work contract and be able to sign off electronically the negotiated work

	requirements and needs. (Create and Maintain an Agreement/ Contract)
Personal work schedulers in play	Shared schedulers should be incorporated (Shared Schedulers)
Work logging does not exist	There should be a place where work and the work tasks created should be logged by who performed it and when was it completed. (Tracking assigned and completed work)
Information sharing and linking to work not possible	Central place for discussing and sharing information. (Discussion Space)
Work not properly defined when being created	When a work assignment is created it should allow constraints such as time, budget and priority to be set. (Constraint setup when registering work)
SLA and OLA cannot be defined against some work	The Service Level Agreement should be applied to the overall ticket resolution process. It is also based on the service contract with the customer. (SLA and OLA inclusion)
Notifications for tasks approaching deadline or which are overdue	There should be a way to generate notification about work progress. (Work Progress Notifications)
Work assignment is hard when department has many employees with different skill set	A repository where skills set can be created for every employee. (Managing and Tracking skills for work assignment)
New ways of working together not supported	Agile approaches are new way of working in development, these should be catered via software when teams are in different locations or when the product owner is. (Agile project work support)
Working with geographically displaced teams in different time zone difficult	Systems should be synced and accessible via devices over the cloud. (Mobility and Device Support)
Resource availability is not known	Resources who have finished their work, do not have enough work or are free should be viewable in the system. (Automated Schedulers displaying Free Resources)
Work progress not possible	Reports of work progress should be available for both work types. (Progress Reporting)
Performance and work participation not measurable	Reports on performance and participation(Performance & Participation Reporting)
Work load management missing	Workload load management should be automated where the systems shows if the resource would be able to perform the work if assigned. (Work Load Management)

The above needs can be categorized under the stages of progression i.e., the functional model to understand which need belongs to which stage. This mapping plays a pivotal role in understanding the relationship of the enterprise needs to the stage of work so that the functionality being developed to address these needs can be incorporated for the right

stage within the software service. This understanding also helps in later analysis within PHASE 3. This mapping is verifiable from Table 23.

Table 23: Needs categorized by stages of work progression

	Work Creation			Work Performance		Work Completion	
	Identification	***Definition***	***Assignment***	***Acceptance***	***Performance and Progress***	***Completion***	***Inspection***
Single Point of Reference	✓	✓	✓	✓	✓	✓	✓
Work Idea Capturing	✓				✓		
Instant Messaging and Emails	✓	✓	✓	✓	✓	✓	
Requirement documentation and maintenance		✓		✓	✓		✓
Document Referencing					✓	✓	
Create and Maintain an Agreement/ Contract		✓					✓
Shared Schedulers	✓	✓	✓	✓	✓	✓	
Tracking assigned and completed work			✓	✓	✓	✓	✓
Discussion Space				✓	✓	✓	✓
Constraint setup when registering work		✓	✓				
SLA and OLA inclusion		✓					✓
Work Progress Notifications					✓		✓
Managing and Tracking skills for work assignment			✓				✓
Agile project work support					✓	✓	
Mobility and Device Support			✓	✓	✓		
Automated Schedulers displaying free Resources			✓	✓	✓		
Progress Reporting					✓	✓	✓

Performance Reporting					✓	✓	✓
Work Load Management			✓	✓			

The above set of derived needs relate to the work collaboration problems and opportunities. These needs do not belong to a particular stage of work progression rather are shared with other stages as well. This is a very important point to be noted when developing functionality for these needs so that the functionality can be implemented at the right stage of work progression to deliver greater value. Next, these needs are qualified against WCS functionality to ascertain whether the WCSs functionality can help these enterprises overcome their problems and address any collaboration opportunities when collaborating at work.

6.3 PHASE 3: Qualifying Work Collaboration Need to WCS Functionality

In this section we compare the enterprise work systems model to the work collaboration service functional model. This is required for an exhaustive comparison of the enterprise work systems and the WCS which is required for this research. Though such an analysis might be omitted if there is a need for a quick investigation of the fit between work systems in enterprises to some software's functionality. Furthermore, the other comparison of collaboration needs to WCS functionality is also determined within this section.

6.3.1 Comparing The Enterprise Work Systems and The Work Collaboration Service Model

Before we indulge into final phase of analysis, it is important to see if the stage of work within the models for the WCS derived in PHASE 1 and that of the enterprise work systems from PHASE 2 co-relate. The work collaboration dimensions from the work collaboration service functional model and the work system elements i.e., customers, participants, information, technology etc. from the enterprise work systems model, are not compared as they only support the work progression within each model. Although both the dimensions and the elements are used for the derivation of the work collaboration functionality in PHASE 1 and enterprise work system needs PHASE 2 as their inclusion is necessary for determining the functionality and the needs. The comparison of the stages of work progression for both the WCS and the enterprise work system is an important step as it helps to create an understanding as to how the workflow of events perceived within the software differ to actual work progression in the enterprise. This co-relation is illustrated through the Figure 05.

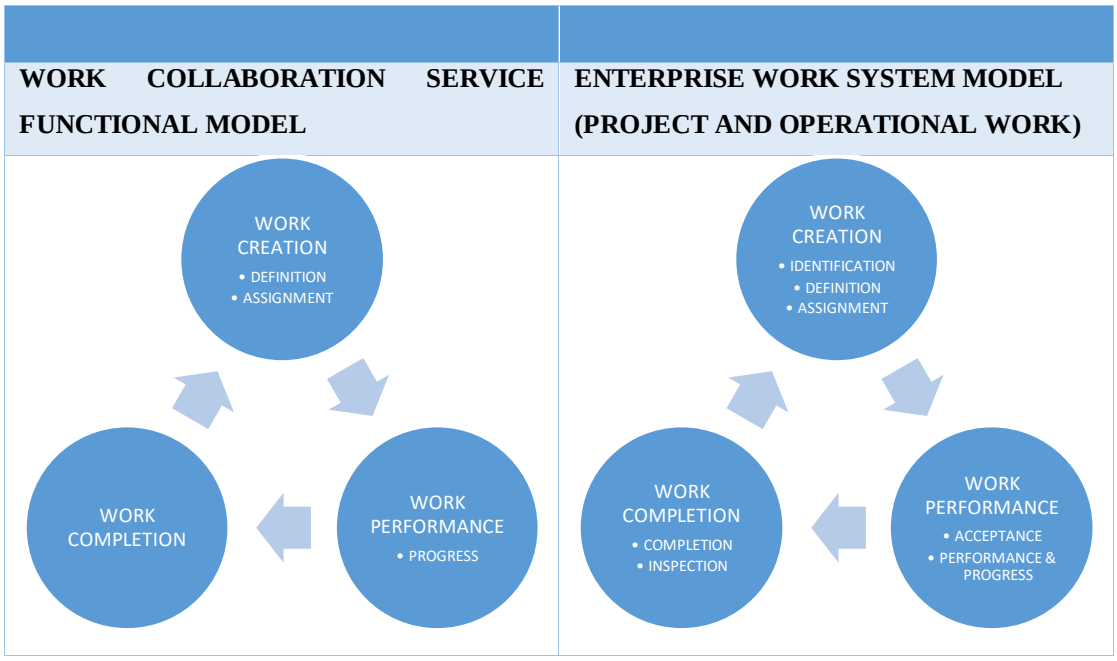

Figure 05: Comparison of the Work Collaboration Service and Enterprise Work Systems Model

It is identified that both the models i.e., WCS and enterprise work system (project and operational), shared similar stages of work progression apart from the stages of identification, acceptance and inspection. Progress and completion stages were only partially addressed. One explanation for these differences is that identification, acceptance and inspection were not addressed at all, and progress and completion were only partially addressed because these stages were either considered not important or the vendor had fallen short of his view of the needs that existed within the enterprise for them. A better way to understand this coherence can be done through the illustration of Figure 06.

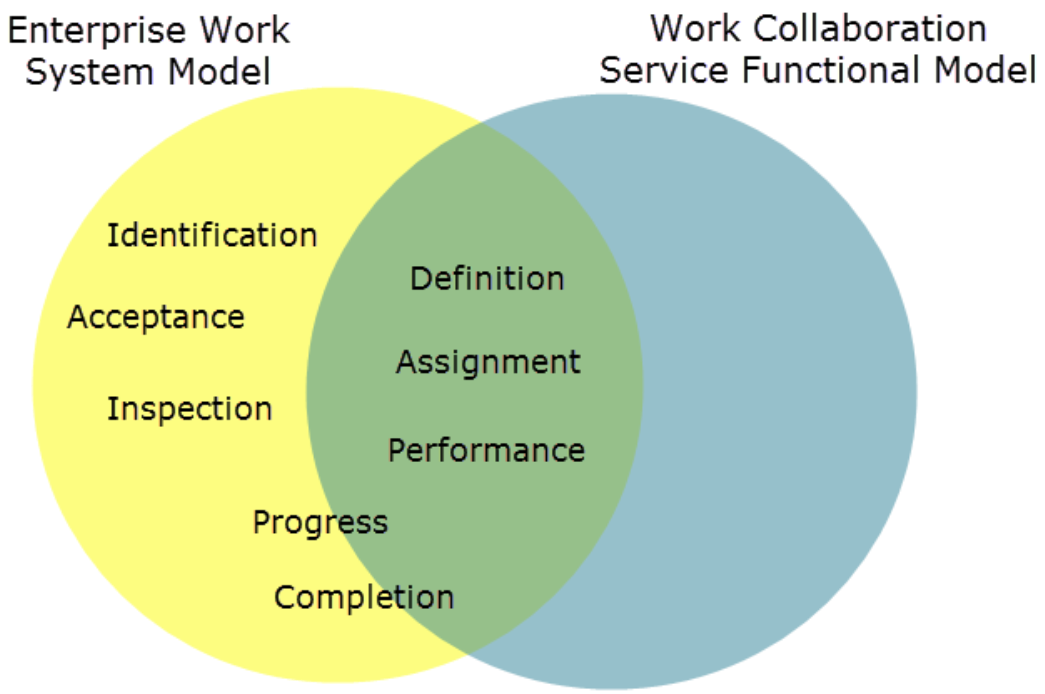

Figure 06: Coherence between the functional models

6.3.2 Qualifying Enterprise Work System Needs to Work Collaboration Service Functionality

In this section the software functionality from PHASE 1 are qualified against the work collaboration needs during project and operational work identified from PHASE 2. This qualification helps in determining the fit between WCS's functionality to work system needs. It helps in understanding whether the software meets the needs pertaining to work collaboration problem or opportunities during project and operational work in SMEs work systems. Figure 07 maps the WCS's functionality to work collaboration needs from both operational and project work in enterprise work systems.

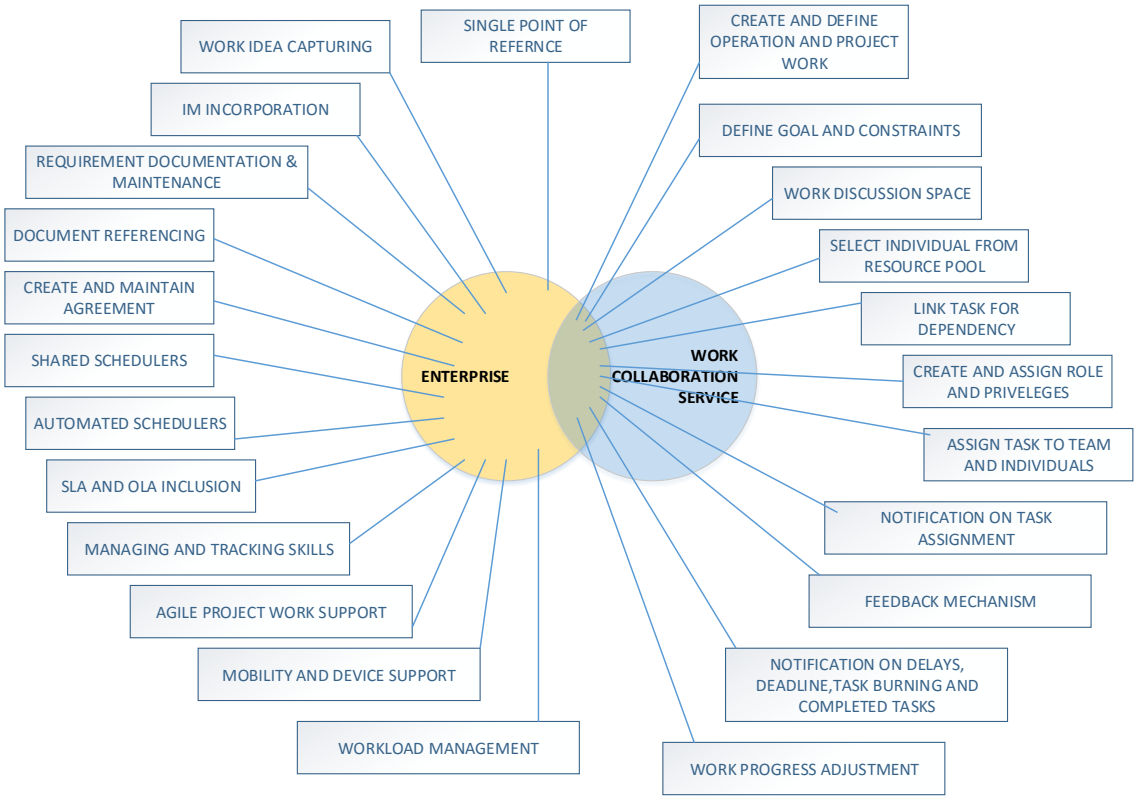

Figure 07: Qualification of WCS functionality to collaboration needs in work systems

From the above comparison it is found that functionality related to the sub stages of work completion, work performance and work completion is either missing or should be improved to accommodate their associated needs of these stages. This can from Table 24 which categorizes the needs by the stage where they are needed to make collaboration more effective during project and operational work.

Table 24: Unaddressed needs categorized by stages of work progression

	Work Creation			Work Performance		Work Completion	
	Identification	*Definition*	*Assignment*	*Acceptance*	*Performance and Progress*	*Completion*	*Inspection*
Single point of reference	✓	✓	✓	✓	✓	✓	✓
Work idea capturing	✓				✓		
Instant messaging and emails	✓	✓	✓	✓	✓	✓	
Requirement documentation and maintenance		✓		✓	✓		✓
Tracking assigned and completed work			✓	✓	✓	✓	✓
SLA and OLA inclusion		✓					✓
Managing and tracking skills for work assignment			✓				✓
Automated sched-ulers displaying free resources			✓	✓	✓		
Progress reporting					✓	✓	✓
Performance reporting					✓	✓	✓
Work load management			✓	✓			
Work acceptance and rejection				✓	✓		

6.4 Unaddressed Needs for WCS Development

Finally, following practical recommendations can be made on the functionality that can be implemented at different stages of work progress within the WCS to accommodate the needs that are not provided within the WCS.

Single point of Reference

It was seen that a single reference point was highly required where all the work needs could be met rather than maintaining different systems to administer collaborative work. It was seen that different systems were in place to do small the tiniest of things which could be provided within one software through functionality. A few examples from the interviews were that, there were separate calendars that were being maintained and not shared, CAS repositories were being used for document management and it was hard to reference to different documents as every document was being generated using a unique ID hence maintaining a track was often difficult, requirements pertaining to project and operational work were in either emails or existed in the mind of the manager or participant or was kept in some local drive, projects were being managed through project management software while operational level work had no place for being documented. This created many problems when it came to collaborating with others and time was wasted in returning emails frequently. A single work collaboration view was highly recommended which is not a function but rather an opportunity. The WCS fulfills this need but it can be improved by addressing the needs that not have been met.

Capturing Work Idea during Work Progress

The identification and progress stage of work requires new work ideas to be captured at any point in time during project or operational work. Functionality such as linking ideas to some tasks or at project or operational level should be included within the WCS so that valuable ideas don not get lost during work progression and these ideas could be later returned to.

Work Acceptance and Rejection

Enterprises believe in flexibility of the work and any totalitarian management of work is not appreciated. Hence when tasks are assigned the assignee should have the ability to

respectfully reject the work in case there is some other work that is pending, or some previous work tasks are taking more time to complete or for any valid reason which cannot be viewed in the WCS. Work should be able to get accepted or rejected which is currently missing as functionality within the service and is much appreciated amongst the participants of the endeavor.

Maintaining and Tracking Requirements

Requirement of work should be documented and maintained at agreement level and task level when work is being registered with the flexibility to include these at any time before work initiation. These requirements should be able to get signed off so that work can proceed and can be referred to in case of review and update if a need arises. The inclusion of functionality should be at the three stages of definition, acceptance, performance and progress of work. Hence, flexibility should be incorporated at these levels to maintain or update requirements.

Defining Service and Operational Level Agreements

The interviews revealed that participants of a collaborative endeavor highly regard service level agreements as well as operations level agreement. These agreements change with the type of work i.e., project and operational being accomplished because of time, cost, quality and scope of the work. It is deemed necessary by the participants that at definition level the agreement should allow inclusion of SLA and OLA so that parties involved in a collaboration endeavor can abide to the details within these agreements and can refer to these over the progress of work.

Tracking Assigned and Completed Work

It is important to track assigned and completed work during the stages of work assignment - work completion. This could be included at both agreement and task level where it can easily be identified as to who is working on what, and if some work has been completed. Managers mostly identify the problem of not knowing who is doing what when there are a number of projects or when there is a lot of operational work. Although functionality on overdue tasks is there within the WCS, it can be enhanced to address these needs as well.

Managing and Tracking Participant Skill

Managers and team leads often find it hard to lookup resources when work needs to be assigned to some resource who is qualified to do it. However, if the resource is busy then the work gets delayed although there are other resources who might have same expertise. However, this information of available resources is not known to the manager or team lead. It would be great that during selection of candidates from the pool of candidates, employees/ participants can be searched for a particular expertise. This expertise can be included when creating profiles of the participants within the WCS.

Work Load Management

Workload on the participants should be automatically calculated based on the tasks assigned and the time required to complete these tasks. According to interviewees, tasks can fall into delay as the knowledge on the amount of workload on participants is hard to speculate. Proper workload management helps managers and team leads to ascertain whether some task being assigned will actually be completed on time without delay. This functionality is currently missing within the WCS and should be accommodated on assignment and acceptance stages of work progression.

Shared & Automated Schedulers

It is hard to know if someone is available, busy or even on holiday when working together in different locations specially during any stage of work progress. In addition, everyone maintains their personal scheduler which is not shared with anyone within the enterprise. This need can be addressed through functionality such as creating a personal work calendar and sharing it with other participants to convey the information on self-availability. Moreover, availability of resource for work assignment should be based on how much workload does the person have.

Incorporation of Instant Messaging

It is observed that in environments where time and money based critical work is being performed require that short administrative messages could be conveyed rather than resorting to emails and wasting time on such. Instant messaging could help at different

stages of work progression hence an IM functionality could be added at universal level with the service and could be used at any point in time rather being dependent on stage of work progress.

Progress and Performance Reporting

Work progress and performance reporting needs should be met as this is one of the most important functionalities that need to be implemented for stages work assignment and beyond within the work collaboration software. It is highly required that work that is being performed can be logged so that progress and performance evaluations can be made from it. These performance evaluations could also be made for participants for some specific project or operational work to see productivity levels.

In the final chapter, we will discuss the findings as well as recommendation as to what functionality to be included within the WCS to make it better for enterprise work systems in SMEs.

7 DISCUSSION & CONCLUSIONS

This research creates and tests a pre-built software to work system qualification approach that qualifies software functionality to work system needs in SMEs. The phases of the approach are Investigation of Software Functionality, Investigation of Enterprise Work System Needs, and Qualification of Work System Needs to Software Functionality. These phases are based on Functional Model Analysis, Work System Framework and Work Systems Method. Validation of the approach is carried out using a work collaboration service (WCS) and work systems of different small to medium sized (SMEs) as the elements of study. The Work Collaboration Service (WCS) functionality is determined and qualified against the work collaboration needs within SMEs that employ project and operational work. To determine the WCS functionality and its underlying functional model, interviews with the service owner, analysis of the software user documentation and software testing are employed. To determine the collaboration needs "The Work Systems Method" and its underlying framework, "The Work Systems Framework" from Alter (2006) are used. The qualification of the WCS functionality to work collaboration needs identifies un-catered needs for the improvement and adoption of the WCS in enterprises.

This research contributes to the practical world by providing SMEs and Software Houses an approach, which determines the fit of pre-built software. This helps both SMEs, who are the phase of finding, adopting or implementing a pre-built software to their needs, and the software houses, who are developing pre-built software. For the SMEs the approach provides a way to analyze their current work practices to determine their needs from a software and to identify if some certain software will be able to address these needs. Thus this helps to minimize the risk of adopting or implementing an incapable solution. For the software houses that develop these software, the approach provides a way to ascertain whether their software can actually address software based needs of enterprise. Thereby helping in improving the software compatibility to these business needs. In all, the approach increases the success ratio of implementing a viable software solution that addresses the needs within small and medium enterprise work systems.

This research uses well renowned scientific frameworks, to develop an approach that qualifies the fit between work systems and pre-built software by applying learning from these frameworks. The study then applies the approach to identify fit between a WCS and collaboration needs during project and operational work in small and medium enterprises

and their work systems. The identified results can also be used to validate claims held in scientific studies, which study needs of collaboration in similar settings. This will help in understanding each identified unaddressed need in greater detail. This approach being phase based uses the work systems framework and method developed by Alter (2006). The work systems framework and method in other studies has been used to analyze enterprises as systems from a business viewpoint so that problem and opportunities can be identified, limitations of IT implementations can be determined, appropriate solutions can be developed that can improve the system. This thesis uses the work systems framework and method as a part of the approach for the analysis of enterprise work systems so that problems and opportunities can be determined and appropriate needs can be developed which will be catered for by a pre-built software. For this specific study, we apply the work systems framework and method to identify work collaboration needs that exist during project and operational work. Furthermore, the scientific world can benefit from the findings of this analysis by validating the identified needs as being factors for successful collaboration in the academic research. The functional model analysis has mainly practical significance in this research. The approach as a whole provides a way to determine fit between enterprise work system needs and software functionality. This approach can be adopted in similar initiatives where such a fit need to be determined.

Next, we discuss, recommend and conclude the scientific and practical thoughts based on PHASE 3, which summarizes the findings from both PHASE 1 and 2.

7.1 Qualifying Work Systems Needs to Software Functionality – Searching for Major Improvement in Software and Work System Development

The third phase i.e., PHASE 3, involved qualifying the models of enterprise work systems and WCS and the needs of the enterprise to the functionality of the collaboration service. Next, we discuss the possible meanings of this phase in the light of practical implications.

7.1.1 Practical Implications of Findings from Model Comparison

PHASE 3 compared the work systems model and work collaboration service functional model i.e., the stages of work progression in work system model and in collaboration

service model. The comparison of the stages of work progression helped in creating an understanding as to how the workflow of events perceived within the software differ or are similar to actual work progression in the enterprise. The work collaboration dimensions (i.e., Enablers, Collaboration, Context, Delivery) and the work system elements (Customers, Participants, Information, Technology etc.) from Alter (2006), are not compared as they only supplement or support the work progression within each functional model. It was identified that progression of work during project and operational work in both the Work Collaboration Service Functional Model and Enterprise Work Systems Model have three similar over-arching stages of Work Creation, Work Performance and Work Completion. These overarching stages consisted of sub-stages, which shared similar stages of work progression apart from the stages of identification, acceptance and inspection. Progress and completion stages were only partially addressed. It is important to understand that absence of one stage will affect the quality of output of each stage.

For example, as seen in Figure 08, the Work Creation stage under the enterprise work system functional model has three sub-stages. Work within these stages requires proper identification where an internal or external trigger initiates some form of work, which has to be performed. Once work is identified it requires capturing and definition in terms of what has to be done, how will it be accomplished, what are its requirements, what cost, time, scope and quality constraints exist, who will perform it etc., This defined work is then assigned to people who are most suitable for it.

Similarly, other stages such as Work Performance requires acceptance of work and then execution of work, which once completed will result in work completion. The WCS functional model differs in the way it structures itself around these stages identified from the enterprise work systems functional model. The service's functional model addresses few stages such as definition, assignment and performance. At the same time it adds some workflows pertaining to progress and completion but leaves out identification, acceptance and inspection. This shows that the model behind the WCS is not up to the par to the enterprise work systems functional model. Hence, we recommend that the workflow within the WCS needs to be updated and added(?) with major aspects identified from the assessment of functionality pertaining to these missing stages. This evaluation would greatly improve the coherence of the software to the actual functioning of the work practices within different work systems regardless of the work type that is employed to carry out the work.

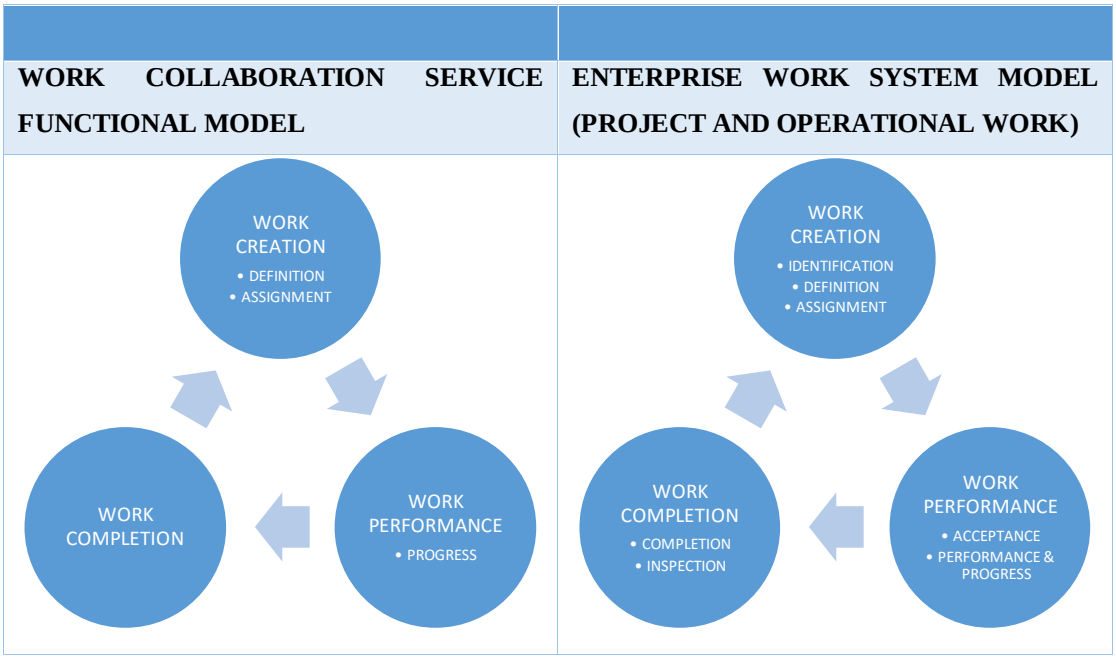

Figure 08: Comparison of the WCS and Enterprise Work Systems Model

7.1.2 Practical Implications On the Qualification of Enterprise Needs to Software Functionality

PHASE 3 further involved qualifying the collaboration needs of the enterprise work systems during project and operational work to the WCS functionality. This step would help in ascertaining if the WCS would fit the work collaboration needs in enterprise work systems during projects or operational work. The identified needs were qualified through pictorial and matrix representations for easier analysis of which needs were addressed by the WCS. It was found that the following needs remained unaddressed by the WCS. These needs are represented in Table 25 by sub-stages where they need to be addressed within the service.

Table 25: Unaddressed needs categorized by stages of work progression

	Work Creation			Work Performance		Work Completion	
	Identification	Definition	Assignment	Acceptance	Performance and Progress	Completion	Inspection
Single point of reference	✓	✓	✓	✓	✓	✓	✓
Work idea capturing	✓				✓		
Instant messaging and emails	✓	✓	✓	✓	✓	✓	
Requirement documentation and maintenance		✓		✓	✓		✓
Tracking assigned and completed work			✓	✓	✓	✓	✓
SLA and OLA inclusion		✓					✓
Managing and tracking skills for work assignment			✓				✓
Automated schedulers displaying free resources			✓	✓	✓		
Progress reporting					✓	✓	✓
Performance reporting					✓	✓	✓
Work load management			✓	✓			
Work acceptance and rejection				✓	✓		

We can deduce at a broader level that WCS in its current form can help an enterprise achieve most of its work collaboration related needs during operational and project work as it covers most of the main needs for the progression of work through the functionality that exists in it. However, it fails to qualify the needs that arerelated to the sub-phases of Work Creation, Work Performance and Work Completion. The inclusion of these needs into the WCS (i.e. software) could increase the chances of the conformance of their service to the collaboration needs for both operational and project work types with enterprise work systems. These needs can be incorporated through proper software functionality at

the right stage of work progress so that they can provide the added value where and when it is needed.

Thus, the approach seems to provide a practical, yet resource consuming, method to make visible the underlying key objects in both systems (work system and work collaboration service). This presented information can be used for the next step in development process: the purchase decision and/or tailoring decisions with relevant content to be delivered to software vendor.

7.2 Conclusion

The presented study validates the importance of the pre-built software to work system qualification approach. The analysis can be exhaustive but it can enable enterprises and software vendors to determine what needs do the enterprise have of a particular software and whether these needs can be met with the functionality in the current version of the software. Such analysis can help enterprises to reduce significantly long-term work system and information system development risks, and avoid investments into inefficient and incapable software solutions. The approach can help these enterprises understand what are their needs so that better judgments can be made regarding the purchase, implementation or changes within a particular software. In addition, it provides to the software vendor a smart fix to their software and its content and functionality so that the WCS would be better appreciated in the business enterprises where it is used. This pre-built software to work system qualification approach can be fruitful when targeting enterprises for implementing software where such analysis can be used to show how well the service caters the needs of the enterprise.

7.3 Limitations and Future Research

There are a few practical limitations regarding this research. First, the research is not tested for larger enterprises. Although this might actually not affect the outcomes a lot but still this study focused on SMEs. Secondly, the approach is developed to determine the fit of pre-built software only and not customized solutions to work system needs.

Lastly and most importantly, this research suggests an approach that can study work systems at a given point in time and does not take into consideration changing work systems and their needs. Alter (2006) has provided the work systems life cycle model to study work systems that evolve and change. This work systems life cycle model can be used to study the needs associated with changes and evolution of the work systems in enterprises. The software companies can use of the understanding provided from such an work system analysis to build software that are flexible and can accommodate changes in the work systems. On the other hand, SMEs can use such an analysis to better understand the evolution and change in their work systems, and to understand what problems can arise from such changes if their software landscape can or cannot accommodate these changes. This topic seems to have fruitful further research problems that ISD researchers could could study and help to improve the fit of pre-built software to changing work system needs.

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APPENDIX

Interviewee		Company Name	
Job Role		Experience in Role (Yrs)	

ORGANIZATIONAL QUESTION

1. Tell us a bit about your organization and its business model?
2. What is the organization structured? What is the chain of command?
3. Who are the customers of your organization and are they included in product/ service development somehow? How do you align these participants with business goals?
4. What work types do you employ? Is it operational day-to-day work or project work or both?
5. How are the employee characteristics matched to fit roles in the organization?
6. Is the organization IT dependant?
7. How well does the infrastructure support the business?
8. How well do different departments function alone and in combination with other departments?
9. Does your organization use cost-effective software technology?
10. Does this software technology reduce effort?
11. What are the measures of performance of the enterprise and at departmental/ work systems level?

PERSONAL WORK QUESTIONS

12. How do you define your work?
13. Do is your job role?
14. Do you have multiple job roles?
15. How do you manage work tasks between these roles?
16. Do you use softwares? What kind?

PROJECT & OPERATIONAL WORK QUESTIONS

17. Do you work on projects/ operational work?
18. Do you have more than one role during this work?
    a. What is your roles?
    b. Do you have multiple roles?

c. What needs can you identify when working in multiple roles alone and with others?

19. Managing projects/ operational work?
    a. Do you manage your project/ operational work yourself?
    b. What factors enable project and operational work?
    c. Do you use softwares to manage it?
    d. Do the softwares support this type of work properly? What factors do you think are not supported?
    e. Who creates the projects and manages projects within these softwares?
    f. Would you like to manage your operational work the way you do your project work?
    g. Can you create work tasks for yourself? How do you link these tasks to tasks created by others?
    h. Do work information update regularly such as requirements? Is there a way you manage that and what needs can you identify?
    i. How do you adjust goals to tasks and deliverables?
    j. Which software permissions do you over combined work?
    k. Can you assign work to others within the softwares?
    l. How do you know who to select for which task?
    m. How do you know if someone has assigned you something?
    n. How do you manage work feedback? Can it be made better somehow?
    o. What software based needs can you identify for managing projects/ operational work?
    p. How do you manage your project/ operational work related documentations? Are you happy the way you manage them? What improvements can be made?
    q. How do you protect personal and work information?
20. Work status (Project and Operational)?
    a. How is it determined?
    b. Do you discuss about issues during project/ operational work? How does the software support it?
    c. What is it the project/ operational work status based on i.e., the metrics.
    d. How do you know If you have not missed a task deadline?

e. What issues can you identify which hinder the delivery of project/ operational work with desired quality, within costs, at scope, and in time.
f. What features would you like in work management softwares?

21. Project/ Operational Work Collaboration
    a. How do you collaborate during project/ operational work?
    b. Do you use software's if yes what kind? What benefits and drawbacks do they provide?
    c. How do you manage explicit information created by a team or department during project/ operational work? What are your needs? Are these full addressed?
    d. What synchronous and asynchronous communication mechanism do you employ during project and operational work?
    e. How do you manage your roles when collaborating?
    f. Is there a defined process, protocol or a tool which you use?
    g. What are the things you have to be careful about in such collaborations?
    h. When negotiating on projects what problems do you face?
    i. Is there a reward system like who performs better? If not would you like one? If you have what do you think can be improved?
    j. Is it easy to work with others who have different skill sets or level of expertise?
    k. How inter and intra work alliances managed? Are SLA and OLA documented?
    l. How do you manage different work practices i.e., agile way of working etc.?
    m. What issues do you face with geographically displaced teams?
    n. Is it easy to look up resources who are free and available to work? What issues can you identify with work load management?
    o. What about work logging. What exists or can be improved?
    p. During discussion how can important information be captured? Do you record sessions if not then what do you use?
    q. Is work at home supported? Is work mobility supported?