Quantitative Multidisciplinary Approaches in Human Capital and Asset Management

Meir Russ
University of Wisconsin-Green Bay, USA

A volume in the Advances in Human Resources Management and Organizational Development (AHRMOD) Book Series

BUSINESS SCIENCE Reference
An Imprint of IGI Global

Published in the United States of America by
Business Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue
Hershey PA, USA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: http://www.igi-global.com

Library of Congress Cataloging-in-Publication Data

Names: Russ, Meir, 1968- editor.
Title: Quantitative multidisciplinary approaches in human capital and asset management / Meir Russ, editor.
Description: Hershey, PA : Business Science Reference, [2016] | Includes bibliographical references and index.
Identifiers: LCCN 2015037478| ISBN 9781466696525 (hardcover) | ISBN 9781466696532 (ebook)
Subjects: LCSH: Human capital--Management. | Knowledge management.
Classification: LCC HD4904.7 .Q33 2016 | DDC 658.3--dc23 LC record available at http://lccn.loc.gov/2015037478

This book is published in the IGI Global book series Advances in Human Resources Management and Organizational Development (AHRMOD) (ISSN: 2327-3372; eISSN: 2327-3380)

British Cataloguing in Publication Data
A Cataloguing in Publication record for this book is available from the British Library.

Chapter 3
Towards an Understanding of Team Dynamics in Very Small Enterprises:
An Exploratory Study in Software Development Firms

Rory V. O'Connor
Dublin City University, Ireland

ABSTRACT

Given that it is relatively noncontroversial to claim that human capital, both in terms of education and experience, is associated with superior firm performance, this can be extended to say that having the requisite human capital in terms of software development staff is highly important for software development project success. However, translating into actual corporate benefits implies an understanding of the range of human capital issues in organizations. The present study examines one such range of issues with a focus on the dynamics of teams, where team dynamics is taken as a general term to denote the nature, quality and quantity of interactions among a firms human capital at the team level. Specifically we refer to collaborative dynamics among human capital team resources to indicate the extent to which valuable information is shared, levels of engagement, the existence of a collective sense of awareness and the ability to learn from one another. The results of a study of a series of very small software development firms are presented to ground this study in industrial practice.

INTRODUCTION

The proposition that firm-level resources in general are associated with sustainable competitive advantage (Wernerfelt, 1984) quickly led to the proposition that human capital is a resource that organizations can leverage to achieve competitive advantage (Barney, 1991). Further Coff (1997) observed that since human assets have, among other powers, the ability to leave the firm, human capital constitutes a special class of firm-level resource. Building upon this concept of a collective-level resource that has individual-level

DOI: 10.4018/978-1-4666-9652-5.ch003

origins Ployhart and Moliterno (2011) define the human capital resource as a "unit-level resource that is created from the emergence of individuals' knowledge, skills, abilities, and other characteristics". This definition brings to the foreground the collective nature of the human capital resource composed of individual human assets (Nyberg, Moliterno, Hale, & Lepak, 2014). It is therefore relatively non-controversial to claim that human capital, both in terms of education and experience, is associated with superior firm performance. Taking a context of software development using expert knowledge workers, we can extend this concept to say that having the requisite human capital in terms of expert software development staff is highly important for software development project success. However translating this into actual corporate benefits implies understanding a range of human capital issues in organizations.

Various observers describe the modern global economy as one in transition to a 'knowledge economy' as an extension of an 'information society'. As the modern world economy has transitioned from an industrial to knowledge-based economy, the nature of software development has also changed. Software development is a knowledge-intensive process, where knowledge is created and shared, when different aspects of a software development process (concepts, products, tools, process, people etc.) interact with each other (Qumer & Henderson-Sellers, 2008). Software development is a knowledge-driven industry, which relies on employees' expert knowledge to create a finished product, where this expert knowledge is mostly tacit (Ryan & O'Connor, 2009). Software development teams have a relatively unique structure, wherein the division of labour among members is highly interdependent. Therefore the organization, management and support of the human capital resource is a key process in developing software products and in the ultimate success of software development firms.

This chapter will focus on one such range of human capital issues, namely the dynamics of teams, where team dynamics is taken as a general term to denote the nature, quality and quantity of interactions among a firm's human capital at the team level. Specifically we refer to collaborative dynamics among human capital team resources to indicate the extent to which valuable information is shared, levels of engagement, the existence of a collective sense of awareness and the ability to learn from one another. From a human capital resource management perspective this is especially important in project teams because positive dynamics, where there is a flow of information and constructive comments, encourage learning processes to take place and enable the creation of new knowledge. This type of dynamic also enables the team to cope with uncertainty and excessive work demands, and helps it make the right choices and implement them in a more efficient way than groups with low levels of interaction (Ryan & O'Connor, 2012).

There is a substantial amount of literature examining the software process and how to improve the actual software development process steps, however, there is a lack of published studies addressing the issues of teamwork in software development teams and specifically the impact of team dynamics on the software development process. This chapter will discuss the role of team dynamics, both positive and negative and internal and external, in the context of software development teams. Further, this chapter will present the results from a series of studies from very small software companies with regard to team dynamics and its impact on the software development process.

BACKGROUND

A team can be considered to be a collection of individuals who are inter-dependent upon each other in terms of their tasks, who share responsibility for common outcomes, who see themselves and who are

seen by others as an intact social entity embedded in one or more larger social systems (for example, a business unit or company), and who manage their relationships across organizational boundaries (Cohen & Bailey, 1997). In the modern business environment, the basis of every software development organization is a team, be it a management team, a development team, a support team or other form of team. Cohen & Bailey (1997) identified four types of teams which can be observed in organizations:

- **Work Teams:** The type of team most people think about when discussing teams. They are continuing work units responsible for producing goods or providing services. Membership is usually full-time, and well defined.
- **Parallel Teams:** People from different work units or jobs perform functions that the regular organisation is not equipped to perform well. Parallel teams (such as trouble-shooting teams, task forces and quality improvement teams) literally exist in parallel with the formal organizational structure.
- **Project Teams:** Produce one-off products such as a product or service and thus, are time limited. Project team tasks are non-repetitive in nature and when a project is completed, the members either return to their functional units or move on to the next project.
- **Management Teams:** Responsible for the overall performance of their business units, and composed of managers responsible for each sub-unit. Management teams coordinate and provide direction to the sub-units under their jurisdiction, and are responsible for the overall performance of their sub-unit.

In the current economic environment, software organizations are under more pressure than ever before to become more productive and cost effective. The use of teams has been shown to increase speed, productivity, problem-solving ability and organizational learning (Barnum, 2000). Levi (2001) stated that a team is more than just a collection of people, with the foundations of the team and team dynamics laid down during team building. To remain competitive, organizations must focus on forming and maintaining high-performing, successful teams. A study by Beaver and Schiavone (2006) found that teams undergo the following stages of evolution:

1. **Forming:** Where members get to know each other
2. **Storming:** Conflict and disagreement about rules and procedures
3. **Norming:** Establishment of rules and social relationships
4. **Performing:** Work, completion of task
5. **Mourning or Adjourning:** Wrapping up the task and the team breaking up

According to Rushmer (1997) a team should not be viewed as the end product of a team-building activity. Instead she found that a team should be viewed as a dynamic entity, always changing in response to its circumstances and environment. She found that the team-building activity should be viewed merely as kicking off a process that should be continued when the team returns to its real-life work environment, otherwise the team would regress to its original state.

Software Development Process and Teams

There are multiple approaches to organizing the software development process and multiple factors influencing the software development process (Clarke & O'Connor, 2012), which should be harmonized with the software development setting (Jeners, Clarke, O'Connor, Buglione, & Lepmets, 2013a). At the core of all software development activity are the human beings that implement the software development process in order to produce the actual software systems. In this context human beings gain expertise through perception, intuition and experience, rather than by following a predefined process (Dreyfus, Dreyfus, & Athanasiou, 1986). In support of this it has been argued that software engineering is knowledge study and hence knowledge management is of high importance in software engineering (Edwards, 2003), which clearly has implications for the management of knowledge in software development.

A software process essentially describes the way an organization develops its software products and supporting services, such as documentation. Processes define what steps the development organizations should take at each stage of production and provide assistance in making estimates, developing plans, and measuring quality. All companies follow a software process and a number of standard process models (Mora, Gelman, O'Connor, Alvarez, & Macías-Luévano, 2008) have been designed to help companies manage their software development activity (Jeners, O'Connor, Clarke, Lichter, Lepmets, & Buglione, 2013b). There is a widely held belief that a better software process results in a better software product, with authors such as Humphrey (1989) claiming that to improve your product, you must improve your process quality, although there is evidence that many organizations do not subscribe to the philosophy of process improvement and process maturity models, despite the widely agreed benefits (O'Connor & Coleman, 2009).

Software development depends on many factors such as people, organization and procedure. People involvement in improvement activities is important because employees must adopt process innovation in their day-to-day activities. A lack of involvement will disturb the improvement process because if an employee did not commit themselves to all the proposed change activities, the aim of process improvement will fail (O'Connor, Basri, & Coleman, 2010). Moreover, the strengths and weaknesses of the current process are in staff hands and knowledge (O'Connor et al, 2010). Hence people can be seen as the main factor in software process improvement that needs to be encouraged and supported in an organization (Basri & O'Connor, 2010). Moreover, Beaver and Schiavone (2006), in their analysis of the effect of the software development teams on the software product quality claimed that even though people are the main drivers for software quality, the processes have been given more attention. Therefore the involvement and full commitment from teams in process improvement is critical.

The software development activity is essentially a human knowledge intensive activity, involving software developers executing a software development process, utilizing expert knowledge, within a team. The dynamic performance of a software project involves many processes and always depends on the team, especially the quality of communication within the team. Moreover, communication may take many forms, both verbal and non-verbal (Hall, Beecham, Verner, & Wilson, 2008). Previous research shows that the level of communication in software process depends on the size of the software project (Phongpaibul & Boehm, 2005) where the authors claim that for a small project the interaction between team members is adequate but for a larger project a mixed interaction between team member and specification are required. Communication is also impacted by the team's physical proximity, in that an increased distance between the members of the team can affect the team dynamics, resulting in interrupted team communication, coordination, mutual support, effort and cohesion (Hoegl & Proserpio,

2004). Hence the link between team members also becomes more difficult with the increase in the number of team member and this will impact the team dynamics (Furumo & Pearson, 2006). In small software organizations the influence of key individuals is signficant (Knauber, Muthig, Schmid, & Widen, 2000). However staff participation also is essential in improvement activities as they have detailed knowledge and experiences of the current process (Stelzer, Mellis, & Herzum, 2006).

The Dynamics of Teams

Social facilitation is the term used by Triplett (1998) to describe the fact that when people are working in the presence of others, this leads to an increase in productivity. Participation in a team should be of benefit to team members on both a personal and professional level. Katzenbach & Smith (1993) found that being a member of a team should help develop an individual's social and interpersonal skills. Levi (2001) found that working on a team with individuals with different levels of expertise and skills, should also help broaden an employee's skills. When a team member feels that the task they have been assigned is compatible with their expertise and that the task is a worthwhile contribution to the team, this will lead to increased levels of self-worth and motivation (Yilmaz, O'Connor, & Clarke, 2014). It is also important that each member of the team knows and understands their role and knows what the team expects from them.

"Team dynamics" is the term used to define how people work and interact in teams. Team dynamics are the hidden strengths and weaknesses that operate in a team between different peoples or groups and they affect how a team reacts, behaves or performs. The effects of team dynamics are often very complex (Scarnati, 2001).

Despite the significant literature on group / team types, interactions, and dynamics (see for example Forsyth, 1990; McGrath, 1984; Marks, Mathieu, & Zaccaro, 2001) and the fact that research on teams has prompted the development of many alternative taxonomies, there is little consensus on how to differentiate these (Hollenbeck, Beersma, & Schouten, 2012). However, based on a review of the literature it is possible to identify some significant team dynamic concepts as follows:

- **Personal Development:** It is important for every individual to be given the opportunity for personal development and an important aspect of every job is the opportunity to learn and develop new skills. A study (Katzenbach & Smith, 1993) found that being a member of a team has a positive influence on personal learning and development, as most of us have the potential to learn the new skills required for a team because of our sense of accountability to the team.
- **Motivation:** Our level of motivation depends on how driven we are to achieve. Triplett (1998) found that the need for achievement is the mental driving force within us and that motivation is associated with high levels of productivity. Ram (2003) found that having enthusiasm and motivation to work and learn new skills is just as important as having the required talents and skills since enthusiasm can inspire motivation in other team members.
- **Morale/Self-Worth:** Being a member of a team is beneficial to most people. Rushmer (1997) found that being a member of a team leads to a rise in self-awareness, self-appreciation, self-worth and self-confidence. She found that the extent to which the team allows the individual to feel good is the extent to which the individual feels good about the team.

- **Empowerment:** Team members will feel empowered when they feel they have control over their work, their performance appraisal and their career path. Howard and Foster (1999) found that empowerment consists of a sense of self-determination, personal meaning, competence and perceived impact.
- **Commitment:** Teamwork cannot succeed without the commitment of every member of the team, commitment to both the team and the goals of the team. Jurison (1999) found that team members display commitment to the team by their sense of loyalty and dedication to the team as committed team members are willing to devote their time and energy and make personal sacrifices for the project.
- **Trust:** is a vital factor for effective teamwork, trust between team members themselves and trust between team members and management. Studies have found that the existence of trust reduces the need for monitoring and improves team effort and motivation (Jurison, 1999) (McHugh, Conboy, & Lang, 2011).
- **Stress:** High levels of stress can lead to an inability to cope and health problems, leading to an increase in the level of absenteeism, which is detrimental to productivity. Messmer (2004) found that high performing team members are most at risk of burnout due to stress, as they are often given the most challenging tasks because of their ability and drive.

Teamwork is more effective with the existence of positive team dynamics. This will encourage a better working environment with satisfied, fulfilled employees, who will in turn be more productive. High performing teams are teams that organize themselves to perform their tasks, develop social relationships and have leaders who provide direction. Positive team dynamics are those that enable and contribute to high performing successful teams (Clarke & O'Connor, 2011). Negative team dynamics are the dynamics that create barriers preventing teams from achieving their full potential.

The absence of the positive dynamics outlined above will lead to a decrease in performance, preventing teams from achieving their full potential. If team members feel that being part of the team is not meeting their personal development needs or that their contribution to the team's success is not relevant, this will lead to a decrease in their level of motivation and commitment, which will in turn lead to a reduction in their level of productivity. When the individual roles of the team have not been clearly defined, this will lead to confusion and a sense of aimlessness (Yilmaz, O'Connor, & Clarke, 2015).

Internal and External Team Dynamics

The primary team dynamic concepts listed above can be further subdivided into internal and external dynamics. Internal team dynamics refer to the forces that exist within the team itself and external team dynamics are those that exist outside of the team, and thus are beyond the team's control, but nonetheless impact the team's performance.

From a management point of view, in software development organizations people have three types of needs that they require to be fulfilled and satisfied; social, self-esteem and self-realization. Team members will not cooperate if they do not feel that they are a part of the team (Furumo & Pearson, 2006). Ayman (2000) argues that within a team, roles and norms must be clear. Littlepage, Cowart and Kerr (1989) add that cohesiveness is essential for an effective team performance and will enhance a team's close working relationships. A cohesive team will freely challenge each other and will easily share new knowledge with other team members.

In a study of teams, Levi (2001) found that the internal social relations that build social cohesion within a team provide mutual support for team members to perform their tasks. He found that team members needed to communicate well, work cooperatively together and provide emotional support for each other. He also found that teams with high levels of social cohesion are more effective.

Each member of the team needs to know and understand the goals of the team to help keep them focused and productive and to prevent them from becoming aimless. Supporting this, Quinn, Faerman, Thompson, McGrath and Wiley (2000) found that teams can only exist within a communication structure that encourages the sharing of information. They also found that open communication encourages more participation from all members on decision-making, which will increase the sense of ownership of the product. Effective teams have a strong level of social cohesion. Conflict, which isn't necessarily always a bad thing, must be dealt with appropriately. Interdependency between team members encourages the spirit of teamwork. Project managers should encourage social activities that build a team spirit. Support from management is vital to a team's success. When team members see that management is willing to invest in the team, this will lead to an increase in team spirit, resulting in increased performance. It is also important that each team member feel that his or her effort and work are recognized and rewarded accordingly, within a fair appraisal system.

The main internal team dynamics are:

- **Cohesion:** Effective teams have been found to have a high level of social cohesion (an interpersonal bond that ties the team members together). Cohen and Bailey (1997) found that the existence of a high level of cohesion within a team led to increased levels of productivity.
- **Communication:** Good communication is a key element of teamwork as it encourages the sharing of information and knowledge. Quinn et al. (2000) found that members must be willing to listen carefully to each other and share the unique knowledge and skills for which they were selected.
- **Goals:** It is important that every member of the team knows, and more importantly, understands the goals. Ram (2003) found that a group of people must not only work as a team where every member works for his/her own advantage, but every member should work as part of a team where he/she is working toward a shared goal.
- **Decision-Making:** Decision-making within teams tends to be easier and the decisions made tend to be better informed than those made on an individual basis. It is better to involve all team members in decision-making as this will encourage input from different levels of expertise and skills, rather than having just one member making the decision.
- **Team Spirit:** Team spirit includes the day-to-day interaction with other team members and the sense of fun that exists. Housel (2002) found that initially members often feel uneasy about being part of a team because they fear rejection and worry about inclusion in the group.
- **Interdependence:** Interdependency exists between members of a team when each member needs to interact with the other members in order to complete their task. Cohen and Bailey (1997) found that this facilitates the building of relationships and social cohesion within the group and also enables the transfer of knowledge.
- **Conflict: Conflict** is a part of everyday life and is usually caused by different values, goals or expectations and can have either a positive or negative impact on productivity and team effectiveness. In the past, the emphasis was on avoiding conflict, but today this emphasis has moved toward managing conflict.

- **Performance and Reward:** When team members feel that their work and efforts are recognized, valued and rewarded accordingly, this will lead to an increase in motivation and thus, productivity.

External team dynamics refer to the presence of external forces that are beyond the team's control and could impact the team performance. The intrinsic and extrinsic factors in projects may motivate the team. Intrinsic factors are the internal factors that exist in the task and team activity itself (Kirkman, Rosen, Tesluk, & Gibson, 2004). Extrinsic factors are external factors that influence the team from the outside such as rewards and recognition, feedback from the organization and customer, team member pressure, and the working environment.

If the work environment is of a substandard quality, e.g. old Porto cabins, overcrowding, poor lighting and ventilation, this will reflect management's unwillingness to invest in the team. This will lead to a decrease in morale within the team, with a reduction in their commitment, motivation and hence, performance. When the economy is going through a recession, or consumer demand changes, many organizations may be forced to restructure and downsize. This will create an atmosphere of fear and uncertainty among employees with regard to their job security and future with the organization. In turn, employees may become distracted from their tasks.

The main external team dynamics are:

- **Management Support:** For teamwork to be successful, commitment to the team is required not only from each member of the team, but also from management. If a lack of management support is evident to team members from, say, an unwillingness to invest in required training or facilities or unfair reward systems, this will lead to a lack of motivation for the team and poor team performance
- **Job Security:** Gary (2002) found that when an organization is letting employees go, individuals tend to react with fear through behavior that involves undermining a teammate's efforts and credibility, and taking the credit for somebody else's work.

Very Small Enterprises

All software companies are not the same. They vary according to factors including size, market sector, time (age) in business, management style, product range and geographical location. The fact that all companies are not the same raises important matters for those who develop both software processes and process improvement models and for those who conduct research into software development teams. However, to date, most research into team and other factors affecting the software development process has been conducted in the context of large and very large organizations, with very little research of very small companies.

In this chapter we limit our interest to companies which can be classified as "Very Small Enterprises" (VSE), which have been defined in ISO/IEC 29110 as being *"an entity (enterprise, organization, department or project) having up to 25 people*" (Laporte, Alexandre, & O'Connor, 2008). Research has found that typically such VSEs have informal team structures (Basri & O'Connor, 2011) and often there is no line of demarcation between the entire company and a team structure (Sanchez-Gordon, O'Connor, & Colomo-Palacios, 2015), where companies often refer to a 'team of everyone' to indicate the lack of formal team structure in a VSE (Basri & O'Connor, 2012).

Such micro enterprises typically have limited resources, particularly in financial and human resources, and are basically practicing unique processes in managing their business. These unique characteristics and situations have influenced VSEs in their business style compared to large companies (Mtigwe, 2005). In addition, these limitations and characteristics have made a big impact on companies' process infrastructures (Sapovadia & Rajlal, 2006). Moreover most of the management processes are performed in an informal way with decision-making, communication and problem solving being discussed orally and less documented. This indicates that people-oriented and communication factors are very important and significant in VSEs (Valtanen & Sihvonen, 2008).

RESEARCH STUDY

The software development team is a key factor in software projects, however, achieving and maintaining positive team dynamics in software development teams, especially when the software companies have fewer resources in term of people, money and time, is a significant challenge. This chapter explores the dynamics of software development teams and their impact on the software development process in order to understand the relationship between these two variables. A series of industry-based case studies were completed to explore the team dynamics that are in play in a typical software development setting.

Research Approach

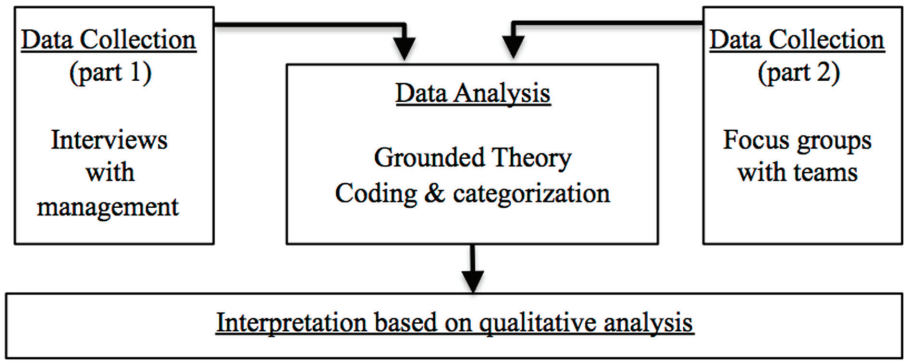
The investigation of team dynamics in an industrial software setting relies heavily on eliciting and understanding the views of those who manage and deploy the software processes in situ, the interpretation of these experiences, and the reality of the situation under study. The study therefore, naturally lends itself to the application of qualitative research methods, as they are oriented toward how individuals and groups view and understand the world and construct meaning out of their experiences. Therefore, the need for a deep understanding of the issues in software development teams calls for a qualitative research approach. The objective of the present study is more focused on creating a detailed description rather than creating a theory. Accordingly whilst a pure Grounded Theory method is not applicable, the grounded theory coding process can be used in order to analyze the present study data (Hoda, Noble, & Marshall, 2012) (O'Connor, 2012).

The study was divided into two main phases of data collection (see Figure 1): The data analysis consisted of a series of detailed structured interviews with senior management, whilst a second data collection phase entailed conducting focus groups with software development staff from the same companies, in order to get an understanding of the issues from a non-management perspective. Finally, the grounded theory data coding process was used in data analysis to aid the interpretation and analysis of the data.

Data Collection

For quantitative data collection, two complimentary data collection methods, individual and focus group interviews, were used. Interviews and focus groups are resource-demanding data collection methods; activities such as planning, conducting and analyzing are time-consuming by nature. However, interviewing people provides insight into their world, their opinions, thoughts and feelings, and therefore we propose these as suitable data collection mechanisms. In particular, focus groups explicitly use dynamic

Figure 1. Research process



group interaction as part of the method to achieve enhanced data gathering, as it can, for example, activate details of forgotten experiences and also generate better data through a wide range of responses. This means that instead of the researcher asking each person to respond to a question in turn, people are encouraged to talk to one another: asking questions, exchanging anecdotes and commenting on each other's experiences and points of view (Patton, 2002).

The individual interview approach was used in this study in order to discuss the topics in depth, to get respondents' candid discussions on the topic, and to be able to get the depth of information of the study situation for the research context (Kvale, 2007). These structured interviews included both open-ended and specific questions and allowed the researchers to gather not only the information anticipated, but also unexpected types of data (Li, 2006). The respondents for the individual interview session are all software development managers/CTO/owner directors, and the focus group was with software development staff. The focus group interview approach was also used in this study and aimed at collective groups of team members who are the developers of the software. An advantage of focus groups of this manner is that they allow individual team members to discuss issues in a collaborative manner with fellow team members, thus allowing a consensus to emerge which facilitates detailed data gathering by researchers. Focus group interviews were also chosen because they were the most appropriate means to study attitudes and experiences; to explore how opinion was constructed (Kitzinger, 1995), and to understand behaviors, values and feelings (Patton, 2002). In order to gain more input and also to validate the above qualitative data for this study, we have developed and distributed a survey questionnaire to several Irish software VSEs. These companies were selected using personal contacts and were all directly involved in software product development for a variety of business domains.

To ensure data was collected from a homogeneous group it was decided to limit the scope of data collection to software product companies whose primary business is software development and further, given the geographical location considerations, it was decided to confine the study to Irish software product companies, which has the added advantage of restricting the study to within the same economic and regulatory regime.

Recruiting participants is a significant challenge for any research project, as they have to spend time on what is often seen as a "non-productive" activity. As the author has firsthand knowledge of the Irish software industry, potential candidates from this industry were identified through prior working relationships. In total, ten software development companies took part in the data collection phase, with

the companies all being identified based on personal contacts with the researcher. The ten companies varied in size from 3 to 18 persons and therefore all were compatible with the target profile of VSE as defined by ISO/IEC 29110 (Laporte, Garcia, Paucar, & Gerancon, 2015).

For the interviews and focus groups, respondents were divided into two categories; the managers and the software development team. For the managers we applied a face-to-face interview method and for the software development team we adopted the focus group interview method. All interview sessions were approximately 40-90 minutes in duration and were recorded with the respondents' permission. Furthermore, in order to guide the interviewer to gather specific data during an interview session, an interview guide (Taylor & Bogdan, 1984) (for both individual and focus groups) was developed. The interview guide included closed and open-ended questions and some related notes about the direction in which to drive the interview under difference circumstances.

Data Analysis

The analysis of the qualitative data (interview and focus groups) was completed utilizing the coding mechanisms of grounded theory (Kitzinger, 1995; Elo & Kyngas, 2008). This study essentially employed the Corbin and Strauss approach because the researcher has personal and professional experience in software development. It is supportive of theory building and contributes to "theoretical sensitivity," the ability to understand the data's important elements and how they contribute to theory. According to Corbin and Strauss (2014), the theory that is derived from the data is more likely to resemble what is actually going on than if it were assembled from putting together a series of concepts based on experience or through speculation.

The Grounded Theory analytical process involves a series of coding strategies, which are the processes of breaking down interviews, observations and other forms of appropriate data into distinct units of meaning, which are labeled to generate concepts. These concepts are initially clustered into descriptive categories. The concepts are then re-evaluated for their interrelationships and, through a series of analytical steps, are gradually subsumed into higher-order categories, or one underlying core category, which suggests an emergent theory. Closely following the tenets of grounded theory meant that, after initial open coding, the interviews were then re-analyzed and coded axially across the higher-level categories that had emerged from earlier interviews. Any memos or propositions that emerged through the coding process were recorded for further analysis and inclusion as questions in subsequent interviews. A consequence of this was that the interview guide was constantly updated.

We applied the Grounded Theory coding processes for the data collection as follows:

- **Open Coding:** From each interview transcript, researchers have analyzed the text using line-by-line or incident-by-incident coding before allocating an open or initial code to the text. For this activity researchers have followed Charmaz's (2014) initial codes approach which was done by using gerunds (known as 'doing words' usually verbs ending in 'ing') as this process will help the researcher to detect the process and stick to the data. After open codes have been assigned and created, lists of open codes are then sorted into categories based on how different codes are related and linked. These emergent categories are used to organize and group initial codes into a meaningful cluster.
- **Axial Coding:** is the process of relating codes (including categories and properties) to each other into subcategories (Corbin & Strauss, 2014). In this process all the general categories in open

coding process were grouped under higher ordering headings. The purpose of grouping data was to reduce the number of categories by merging those similar into broader, higher categories. In addition, the merging process provides a means for describing the situation to increase researcher understanding and to generate more knowledge. The process was continued with the abstraction process (Kohlbacher, 2006). The purpose of the abstraction process is to detail the categories by identifying the subcategories and how they link to one another. Subcategories with similar occurrence and incidents are grouped together as categories and categories are grouped as core categories. The abstraction process is an iterative process and continues as far as is reasonable.

- **Selective Coding:** is the process of selecting the core category, systematically relating it to other categories, validating those relationships, and filling in categories that need further refinement and development. In this process, the first step is to identify the main or 'core' category that relates to the collected data. The core category acts as the hub for all other identified categories. In this part, the researcher, using the Atlas.Ti tool, is creating a network diagram based on the abstraction process result as in the axial coding phase.

These data analysis methods also have been recommended in qualitative data research (Patton, 2002) in order to guide researchers in analyzing the qualitative method more systematically. We argue that there is a need for a systematic approach to analyzing data from interviews and focus groups and that the grounded theory coding approach is a suitable one that adds value in terms of academic rigor of approach and provides for validity in terms of traceability from initial data coding to final result. In defense of this approach, it is worth noting that Halaweh, Fidler, and McRobb (2008) comment that these procedures of data analysis are rigorous and robust.

Based on the prior experience (Coleman & O'Connor, 2007) of the researcher in applying grounded theory coding, the Atlas.Ti software tool (Muhr & Friese, 2004) was utilized. This is a tool designed specifically for use with grounded theory and allows for the linking, searching and sorting of data. The interview transcripts from the preliminary study stage were entered into the Atlas database. Having the ability to assign and allocate codes with quotations from multiple interviews speeded up the process dramatically and eased data management significantly. It also created an easier 'visual plane,' which enabled clearer reflection and energized proposition development.

Research Findings

As stated above, by following the coding mechanisms of grounded theory, the researcher can formally document data concepts, which are clustered into descriptive categories surrounding a central core category. The findings for this study are illustrated in Figure 2 and are represented by the core category of Software Development Process and four supporting categories, each of which is discussed in detail in the following four sub-sections.

Figure 2. Main category diagram

Management Style

The analysis has shown that the team structure and process category impact VSEs' working and management styles. It indicates that staff members have autonomy over their work which makes them more self-dependent, self-responsible and self-learning as in Figure 3.

The results from the analysis emphasize that tasks are orientated more toward individuals and/or assigned according to their expertise. This situation has been defined as a '*team of one'* by one of the interviewees. The formal interactions between team members are more in the strategic areas such as problem solving or knowledge sharing, in particular, strategic issues that relate to the software development. But most other interaction or communication is more indirect, casual and very informal. This situation gives an indication that the notion of teamwork appears or happens in an informal way on a periodic basis. In relation to autonomous work, the analysis also indicates that the people in VSEs also exercise an autonomous communication style in performing their work. Informal communication, less structure and direct communication, self-learning and exploration, frequent informal guidance and informal meeting codes that arose from the data analysis indicate that this autonomous communication process happens in firms. The analysis process also indicates that there are similar management styles adopted within firms. Our study shows that the small team size elements in firms also had an impact on the management style in the companies. Trust, relationships, flexible environment, and loose project management are the subcategories that indicate the base management style in teams. This type of management approach can be defined as an 'Embrace and Empower' regime (Coleman & O' Connor, 2008) as similar to the 'Theory Y' management style (McGregor, 1985). In this context the ideas and opinions of all subordinates have a value and have been adopted in the development process and policy. These are also indicators of the element of trust in development teams and their ability to carry tasks with less direction.

Team Structure

Our analysis shows that the team environment in VSEs can be divided into two categories: the organization and team structure category, and the team process category, and five further themes, as illustrated in Figure 4. The organizational and team structure category indicates that, due to the small number of

Figure 3. Management style category diagram

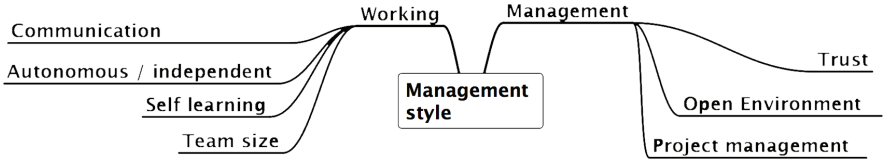
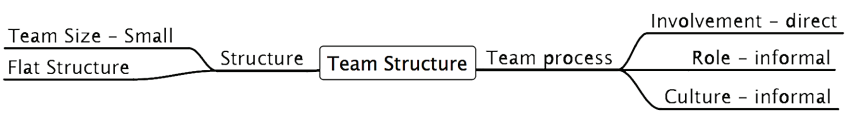


Figure 4. Team category diagram



people working in the VSE, the team size is also small, which leads to a flat team and organizational structure. The interview analysis indicates that all interviewees explained that the companies have no formal team structure, or, on occasion, a team structure only exists as required for a particular project. Our analysis uncovered that, due to issues such as the small number of employees, flat organization and team structure, and informal working environment, the interviewees perceive that all people in the company are at the same level. Furthermore, the analysis shows that they have similar levels of working experience and skills, and very much depend on each other in performing their tasks. In addition, findings such as a close physical working environment, and the high frequency and informal nature of communication, also influence this perception. Such a combination of factors has led VSEs to a more informal environment with a small gap between management and team members. The following extracts from interviews/focus groups clearly depict this situation:

There are really two levels; the level above me is IT manager and General management. But it's such a small company almost like family here, so there is not really a divide here.

and

The management and staff relationship is very close… It is probably because we are of similar age and interests. Nobody works in this company that is not interested in what we do.

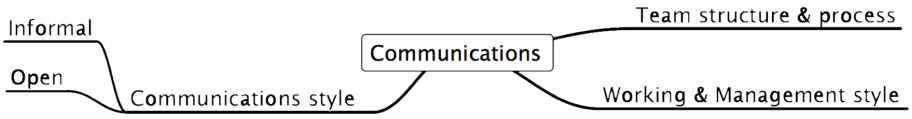
Another important factor, that of team process, indicates that team role, team involvement, and team culture issues are significant. The analysis shows that the staff role, which includes the role in a team and the task they perform in the development process, is conducted in a very informal manner. This implies that the development staff can work or be assigned a different role at any time in the development project. In addition, they can also work with different people and different positions, as and when, they are required. These situations have explained that the team involvement process in VSEs is direct and informal in development activities. The following extract from an interview with a CEO clearly describes these issues:

As a CEO, I am not sure how others see me and my brother [who is the CTO]; either the same as others or not… We have done a lot of development work, so they should see us as one of the programmers… One staff member probably sees himself as the head of new staff due to his experience in the company, but actually there is no real title and rank in our company.

Communications

Based on our analysis of the communication process in VSEs, it can be seen that communications can be separated into two major categories, namely communications style and communications mechanisms, both of which are highly influenced by the VSE's team structure and process and the working and management style, as illustrated in Figure 5. In terms of communication style, the open and informal nature or style of communications was a significant issue. This can be seen in the way meetings are conducted, which are mostly in an informal manner, on an ad-hoc basis, and often one-to-one. In addition, the data reveals that in VSEs, day-to-day communication between team members is always direct and autonomous

Figure 5. Communication category diagram



due to the nature of the working environment in the VSE. This situation was confirmed by many study participants who cited small team size, working style, and culture of VSEs as being conducive toward this style of communication. The following interview extracts are representative of this situation:

It is informal when we discuss development stuff like over coffee… We have informal meetings for a few minutes just to inform others regarding process before we start our tasks.

We have a daily stand up meeting and we have iteration planning meetings but it is fairly loose. Generally, communication is very informal on a daily basis.

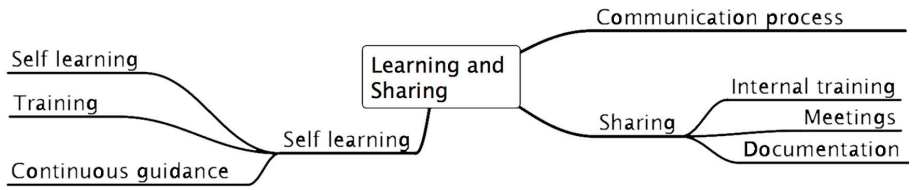
Our data analysis also shows that the relationship between team members in the company also has a significant influence on the communication process in VSEs. The nature of the relationships (friends and family), a flexible environment, and frequent social interaction between team members, coupled with the flat organization structure, has a major impact on the communication process in VSEs. In addition, the physical proximity of working space and high frequency of sharing activities contribute to the communication process in VSEs. Two examples from the data supporting this are:

We work very close, meet for morning coffee. We always mix together and are very dynamic because we are small and easy to communicate with each other." and "Programmers are friendly and they socialize with each other. They get on pretty well and can easily exchange ideas.

Learning and Sharing

Our data analysis elaborates how the learning and sharing process occurs in VSEs, with two main categories; namely the self-learning category and the sharing category which are also influenced by the communications process as illustrated in Figure 6. The category of self-learning in VSEs shows that there is little or, more often, no formal training provided to employees to establish and/or enhance their knowledge and skills. VSE management explains that informal (often internal) training, sharing and self-

Figure 6. Learning and sharing category diagram



learning happens and they indicate that staff in VSEs are more dependent on self-learning in mastering the technology or process that is used in the organization. In addition, on the job training, self-exploring and continuous guidance from an expert (mentoring) within the companies are the main processes that are frequently practiced to enhanced staff knowledge and skills. For example, these interview/focus group extracts demonstrate this point:

They have to do on the job training; they have to educate themselves on the job by doing it.

In VSEs the knowledge sharing process happens in three ways: informal training, informal meetings, and document sharing. Informal training happens through informal guidance from experts (mentoring), peer-to-peer programming guidance sessions, shared books and others material, internal training, frequent open and direct discussion between team members, and online sharing with others. The data analysis indicates that the learning and sharing process in VSEs has been influenced and shaped by three main factors which are: VSEs team size and process, which are small team size and flat organization structure; working and management style, which are more toward autonomous work and macro management process; and communication processes, which are indirect and informal. In addition, from the interviews, data analysis shows that in general, knowledge sharing activities, either via electronic or personal means, are important in maintaining and evolving VSEs' current software development processes. The data extracts below are representative of the learning and sharing process.

Knowledge is shared sometimes in peer programming activities. It doesn't happen a lot but it can happen when problems arise and we sit down to explain and discuss.

DISCUSSION

This research sought to identify the effect of team dynamics in the context of software development teams and its impact on the software development process activities in the context of VSEs. This investigation was achieved through a set of structured interviews and focus groups with VSEs, where the data was rigorously analyzed using the coding mechanism of grounded theory and a framework produced.

The findings of this research indicate that VSEs unanimously agree that the software development process used within their company is constantly evolving over time. Furthermore, they also state that they regularly assess and update their development processes. In addition, the findings show that these processes are informal, indirect, highly reactive, and dependent on/linked to customer requirements, developers' initiatives, and technology changes. From a team perspective, the data also indicates that VSEs' operating processes were highly influenced by the team structure and process, which is very flat and informal. These issues have determined the level of formality in the software process improvement activities undertaken within VSEs. Furthermore the data indicates that these issues also affect the other main categories, which are related to VSEs' software development processes.

The close working relationships described by VSEs between the software development team members and frequent informal communications help to create a high level of positive team dynamics and knowledge sharing activities in software development activities, as shown in the communication, learning, and sharing categories. In addition, the management style has also contributed to the formation of a conducive environment for the software development teams in VSEs.

Additionally this study has shown that all respondents believe that there exists a high level of positive team dynamics within the software development team. This could be identified from how the communication, relationships, and learning and sharing environment is operating in the VSEs who participated in this study. The results also indicate that the smaller the team in VSEs, the higher the level of team dynamics present in the organization. In addition, the analysis also indicated that VSEs' staff have all the important criteria such as high skills, high motivation, active in sharing, direct involvement, and open communication that are important in the software development process.

From the analysis of team development issues, it can be seen that VSEs employ a very small number of staff, operate a very flat team structure, and operate in an informal manner. The analysis showed that due to the small team size and an open working environment, team dynamics in VSEs are very high. Even though some of the employees are working remotely (separate geographical location), the results show that the team relationship, socializing, information/knowledge sharing, and interpersonal skill levels are high.

The data collected was analyzed to investigate similarities in the findings from the different teams. The analysis also attempted to validate findings from research as to which dynamics enable high performing successful teams, and which create barriers to success. These include:

- With respect to goals, it was found that clearly defined goals keep the team focused and motivated to achieve these goals. It was found that regular feedback is essential to keep the team focused on achieving their goals and leads to an increase in motivation, productivity and performance. It was also found that it is important to relate each team member's personal goals to the overall goals of the organization, to enable a better understanding of each member's contribution to the overall organization. These findings concur with research.
- In relation to job-satisfaction, it was found that that job-satisfaction has a positive impact on the level of commitment, and that challenging and varied work was rated as being the most important factor influencing job-satisfaction. This supports the research findings. All firms involved senior engineers/managers and none reported salary as the most important factor, which also supports research findings. It was also found that management support results in an increase in the level of self-confidence, confirming research findings.
- All firms indicated that when personal development needs are met, there is an increase in the level of commitment, which is in accordance with research findings. They also found that a fair and equitable performance and appraisal system has a positive impact on the level of commitment to remain with the organization and that organizations that provide both a technical and a management career path have a higher level of commitment to remain with the organization, which supports research findings.
- In relation to the nature of work, it was found that the assignment of challenging tasks results in an increased sense of recognition, which leads to higher levels of motivation, as reported in research. It was also found that the assignment of a complete task, from beginning to end, results in an increased sense of ownership and thus responsibility, and the assignment of a variety of tasks results in an increase in levels of motivation, supporting research findings.
- Although none of the firms interviewed mentioned stress, the data reported that a person-job fit results in an increase in motivation, job-satisfaction and efficiency, all of which have been shown to have a positive impact on productivity, thereby supporting research findings. The data reported also supports research findings that strong relationships/bonds with a team lead to a strong sense of cohesion within the team.

CONCLUSION

There are a number of findings supported by the research. Firstly, having clearly defined goals keeps the team focused and motivated and it is important to relate each team members' personal goals to the overall goals of the organization. Regular feedback is essential to keep the team focused on achieving its goals and leads to an increase in motivation, productivity and performance. It was also found that job-satisfaction has a positive impact on the level of commitment with challenging and varied work rated as being the most important factor influencing job-satisfaction.

Furthermore, the fulfillment of personal development needs, the possibility of both a technical and a management career path, as well as a fair and equitable performance and appraisal system, results in an increase in the level of commitment. The assignment of challenging and varied tasks results in an increase in levels of motivation, and the assignment of a task from beginning to end results in an increased sense of ownership. It was also discovered that a person-job fit results in an increase in motivation, job-satisfaction and efficiency, and in addition, strong relationships/bonds with a team lead to a strong sense of cohesion within the team.

Limitations and Future Work

There are two limitations which merit particular discussion. Firstly, the sample size of ten may be considered small from a perspective of statistical significance. However, the practical issues of getting a large number of companies involved in an in-depth interview process are well understood. Notwithstanding this fact, a larger scale study could yield more accurate results. Secondly, the organizations selected in the present study are all Irish based VSEs and therefore represent a limited geographical business environment spread. With this in mind, an enhanced version of this study, taking these factors into account, would be of merit. This study, even with the limitations described above, has supported research findings.

There are a number of areas for further research, such as: The use of organizational psychologists, for the assignment of roles and tasks within a team. Comparisons could be made between teams that were assigned roles/tasks in the traditional manner compared to those that used psychologists. Also, the changes in dynamics within a team that is maturing could be compared with the dynamics of a more junior team. Further, because challenging and varied work was indicated in this research as the most important factor in job satisfaction, further research could identify ways of providing and maintaining this challenge.

REFERENCES

Ayman, R. (2000). Impact of team diversity on collaboration dynamics. Paper presented at the *Collaborating across Professional Boundaries Conference*. Retrieved from http://www.stuart.iit.edu/ipro/papers/pdf/ayman.pd

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120. doi:10.1177/014920639101700108

Barnum, C. M. (2000). Building a team for user-centred design, *Proceedings of 2000 Joint IEEE International and 18th Annual Conference on Computer Documentation* (pp. 325 – 332). ACM Press.

Basri, S., & O'Connor, R. (2012). A study of knowledge management process practices in very small software companies. *American Journal of Economics and Business Administration*, *3*(4), 636–644.

Basri, S., & O'Connor, R. V. (2010). Evaluation of knowledge management process in very small software companies: A survey. *Proceedings of the 5th International Conference on Knowledge Managemen*t, Kuala Terengganu, Terengganu, Malaysia (pp. 1-6).

Basri, S., & O'Connor, R. V. (2011). A study of software development team dynamics in SPI. In R. V. O'Connor, J. Pries-Heje, & R. Messnarz (Eds.), *Systems, software and service process improvement* (pp. 143–154). Berlin, Heidelberg: Springer-Verlag. doi:10.1007/978-3-642-22206-1_13

Beaver, J. M., & Schiavone, G. A. (2006). The effects of development team skill on software product quality. *Software Engineering Notes*, *31*(3), 1–5. doi:10.1145/1127878.1127882

Charmaz, K. (2014). *Constructing grounded theory*. London: Sage.

Clarke, P., & O'Connor, R. V. (2011). The meaning of success for software SMEs: An holistic scorecard based approach. In R. V. O'Connor, J. Pries-Heje, & R. Messnarz (Eds.), *Systems, software and service process improvement* (pp. 72–83). Berlin, Heidelberg: Springer-Verlag. doi:10.1007/978-3-642-22206-1_7

Clarke, P., & O'Connor, R. V. (2012). The situational factors that affect the software development process: Towards a comprehensive reference framework. *Information and Software Technology*, *54*(5), 433–447. doi:10.1016/j.infsof.2011.12.003

Coff, R. W. (1997). Human assets and management dilemmas: Coping with hazards on the road to resource-based theory. *Academy of Management Review*, *22*(2), 374–402.

Cohen, S. G., & Bailey, D. E. (1997). What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management*, *23*(3), 239–290. doi:10.1177/014920639702300303

Coleman, G., & O'Connor, R. (2007). Using grounded theory to understand software process improvement: A study of Irish software product companies. *Information and Software Technology*, *49*(6), 654–667. doi:10.1016/j.infsof.2007.02.011

Coleman, G., & O'Connor, R. V. (2008). The influence of managerial experience and style on software development process. *International Journal of Technology. Policy and Management*, *8*(1), 91–109.

Corbin, J., & Strauss, A. (2014). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. London, UK: Sage publications.

Dreyfus, H. L., Dreyfus, S. E., & Athanasiou, T. (1986). *Mind over machine: The power of human intuition and expertise in the era of the computer*. New York, NY: Free Press.

Edwards, J. S. (2003). Managing software engineers and their knowledge. In A. Aurum, R, Jeffery, C. Wohlin, & M. Handzic (Eds.), Managing software engineering knowledge (pp. 5–27). New York, NY: Springer. doi:10.1007/978-3-662-05129-0_1

Elo, S., & Kyngas, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, *62*(1), 107–115. doi:10.1111/j.1365-2648.2007.04569.x PMID:18352969

Forsyth, D. R. (1990). *Group dynamics*. Pacific Grove, CA: Brooks, Cole.

Furumo, K., & Pearson, J. M. (2006, January). An empirical investigation of how trust, cohesion, and performance vary in virtual and face-to-face teams. *Proceedings of the 39th Annual Hawaii International Conference* (Vol. 1, p. 26c). New York, NT: IEEE Press. doi:10.1109/HICSS.2006.51

Gary, L. (2002). Fighting the enemy within. *Harvard Management Update*, *7*(2), 3.

Halaweh, M., Fidler, C., & McRobb, S. (2008). Integrating the grounded theory method and case study research methodology within IS research: A possible 'road map'. *Proceedings of ICIS 2008* (p. 165).

Hall, T., Beecham, S., Verner, J., & Wilson, D. (2008). The impact of staff turnover on software project: The importance of understanding what makes software practitioners tick. *Proceedings of ACM SIGMIS CPR Conference on Computer Personnel Doctoral Consortium and Research* (pp. 30-39). New York, NY: ACM. doi:10.1145/1355238.1355245

Hoda, R., Noble, J., & Marshall, S. (2012). Developing a grounded theory to explain the practices of self-organizing agile teams. *Empirical Software Engineering*, *17*(6), 609–639. doi:10.1007/s10664-011-9161-0

Hoegl, M., & Proserpio, L. (2004). Team member proximity and teamwork in innovative projects. *Research Policy*, *3*(8), 1153–1165. doi:10.1016/j.respol.2004.06.005

Hollenbeck, J. R., Beersma, B., & Schouten, M. E. (2012). Beyond team types and taxonomies: A dimensional scaling conceptualization for team description. *Academy of Management Review*, *37*(1), 82–106.

Housel, D. J. (2002). *Team dynamics*. Cincinnati, OH: South-Western College Publisher.

Howard, L. W., & Foster, T. S. (1999). The influence of human resource practices on empowerment and employee perceptions of management commitment to quality. *Journal of Quality Management*, *4*(1), 5–22. doi:10.1016/S1084-8568(99)80093-5

Humphrey, W. S. (1989). *Managing software process*. Reading, MA: Addison Wesley.

Jeners, S., Clarke, P., O'Connor, R. V., Buglione, L., & Lepmets, M. (2013). Harmonizing software development processes with software development settings–A systematic approach. In F. McCaffery, R. V. O'Connor, & R. Messnarz (Eds.), *Systems, software and services process improvement* (pp. 167–178). Berlin, Heidelberg: Springer-Verlag. doi:10.1007/978-3-642-39179-8_15

Jeners, S., O'Connor, R., Clarke, P., Lichter, H., Lepmets, M., & Buglione, L. (2013). Harnessing software development contexts to inform software process selection decisions. *Software Quality Professional*, *16*(1), 35–36.

Jurison, J. (1999). Software project management: The manager's view. *Communications of the AIS*, *2*(3es), 2.

Katzenbach, J. R., & Smith, D. K. (1993). *The wisdom of teams*. New York, NY: HarperCollins.

Kirkman, B. L., Rosen, B., Tesluk, P. E., & Gibson, C. B. (2004). The impact of team empowerment on virtual team performance: The moderating role of face-to-face interaction. *Academy of Management Journal*, *47*(2), 175–192. doi:10.2307/20159571

Kitzinger, J. (1995). Introducing focus groups. *British Medical Journal*, *311*(7000), 299–302. doi:10.1136/bmj.311.7000.299 PMID:7633241

Knauber, P., Muthig, D., Schmid, K., & Widen, T. (2000). Applying product line concepts in small and medium-sized companies. *Software, IEEE*, *17*(5), 88–95. doi:10.1109/52.877873

Kohlbacher, F. (2006, January). The use of qualitative content analysis in case study research. *Forum Qualitative Sozialforschung/Forum: Qualitative*. *Social Research*, *7*(1), 21. Retrieved from http://nbn-resolving. de/urn:nbn:de:0114-fqs0601211

Kvale, S. (2007). *Doing interviews: The Sage qualitative research kit*. Thousand Oaks, CA: Sage.

Laporte, C., O'Connor, R., Garcia Paucar, L., & Gerancon, B. (2015). An innovative approach in developing standard professionals by involving software engineering students in implementing and improving international standards. *Standards Engineering: The Journal of SES*, *67*(2), 2–9.

Laporte, C. Y., Alexandre, S., & O'Connor, R. V. (2008). A software engineering lifecycle standard for very small enterprises. In R. V. O'Connor, N. Badoo, K. Smolander, & R. Messnarz (Eds.), *Software process improvement* (pp. 129–141). Berlin, Heidelberg: Springer-Verlag. doi:10.1007/978-3-540-85936-9_12

Levi, D. (2001). *Group dynamics for teams*. California: Sage Publications.

Li, J. Y. (2006). *Process improvement and risk management in off-the shelf component-based development* [Unpublished doctoral dissertation]. Norwegian University of Science and Technology, Trondheim, Norway.

Littlepage, G. E., Cowart, L., & Kerr, B. (1989). Relationships between group environment scales and group performance and cohesion. *Small Group Research*, *20*(1), 50–61. doi:10.1177/104649648902000104

Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team processes. *Academy of Management Review*, *26*(3), 356–376.

McGrath, J. E. (1984). *Groups: Interaction and performance* (Vol. 14). Englewood Cliffs, NJ: Prentice-Hall.

McGregor, D. (1985). *The human side of enterprise: 25th Anniversary Printing*. New York, NY: McGraw-Hill/Irwin. doi:10.1016/B978-0-12-054752-4.50008-7

McHugh, O., Conboy, K., & Lang, M. (2011). Using Agile practices to build trust in an Agile team: A case study. In J. Pokorny, V. Repa, K. Richta, W. Wojtkowski, H. Linger, C. Barry, & M. Lang (Eds.), *Information systems development* (pp. 503–516). New York, NY: Springer. doi:10.1007/978-1-4419-9790-6_40

Messmer, M. (2004). Are you burning out your best employees? *Strategic Finance*, *85*(11), 12.

Mora, M., Gelman, O., O'Connor, R., Alvarez, F., & Macías-Luévano, J. (2008). An overview of models and standards of processes in the SE, SwE, and IS disciplines. Information technology governance and service management: Frameworks and adaptations (pp. 364-380).

Mtigwe, B. (2005). The entrepreneurial firm internationalization process in Southern African context: A comparative approach. *International Journal of Entrepreneurial Behaviour and Research*, *11*(5), 358–377. doi:10.1108/13552550510615006

Muhr, T., & Friese, S. (2004). User's manual for ATLAS. ti 5.0. Berlin: ATLAS.ti Scientific Software Development GmbH.

Nyberg, A. J., Moliterno, T. P., Hale, D., & Lepak, D. P. (2014). Resource-based perspectives on unit-level human capital: A review and integration. *Journal of Management*, *40*(1), 316–346. doi:10.1177/0149206312458703

O'Connor, R., & Coleman, G. (2009). Ignoring 'best practice': Why Irish software SMEs are rejecting CMMI and ISO 9000. *Australasian Journal of Information Systems*, *16*(1), 7–30.

O'Connor, R. V. (2012). Using grounded theory coding mechanisms to analyze case study and focus group data in the context of software process research. *Research Methodologies, Innovations and Philosophies in Software Systems Engineering and Information Systems* (pp. 1627-1645).

O'Connor, R. V., Basri, S., & Coleman, G. (2010). Exploring managerial commitment towards SPI in small and very small enterprises. In A. Riel, R. V. O'Connor, S. Tichkiewitch, & R. Messnarz (Eds.), *Systems, software and services process improvement* (pp. 268–279). Berlin, Heidelberg: Springer-Verlag. doi:10.1007/978-3-642-15666-3_24

Patton, M. Q. (2002). *Qualitative evaluation and research methods* (3rd ed.). Newbury Park, CA: Sage.

Phongpaibul, M., & Boehm, B. (2005). Improving quality through software process improvement in Thailand: Initial analysis. *Software Engineering Notes*, *30*(4), 1–6. doi:10.1145/1082983.1083299

Ployhart, R. E., & Moliterno, T. P. (2011). Emergence of the human capital resource: A multilevel model. *Academy of Management Review*, *36*(1), 127–150. doi:10.5465/AMR.2011.55662569

Quinn, R. E., Faerman, S. R., Thompson, M. P., McGrath, M. R., & Wiley, J. (2000). *Becoming a master manager: A competency framework*. New York, NY: Wiley.

Qumer, A., & Henderson-Sellers, B. (2008). A framework to support the evaluation, adoption and improvement of Agile methods in practice. *Journal of Systems and Software*, *81*(11), 1899–1919. doi:10.1016/j.jss.2007.12.806

Ram, L. V. (2003, May 10). *Guidelines on team-building*. New Straits Times-Management Times.

Rushmer, R. (1997). What happens to the team during team-building? Examining the change process that helps to build a team. *Journal of Management Development*, *16*(5), 316–327. doi:10.1108/02621719710174507

Ryan, S., & O'Connor, R. (2012, October 11). Social interaction, team tacit knowledge and transactive memory: Empirical support for the agile approach. Proceedings of Researching Agile development of Information Systems (RAISE) Conference. London, UK.

Ryan, S., & O'Connor, R. V. (2009). Development of a team measure for tacit knowledge in software development teams. *Journal of Systems and Software*, *82*(2), 229–240. doi:10.1016/j.jss.2008.05.037

Sanchez-Gordon, M. L., O'Connor, R. V., & Colomo-Palacios, R. (2015). Evaluating VSEs viewpoint and sentiment towards the ISO/IEC 29110 standard: A two country Grounded Theory study. In T. Rout, R. V. O'Connor, & A. Dorling (Eds.), *Software process improvement and capability determination* (pp. 114–127). Berlin, Heidelberg: Springer-Verlag. doi:10.1007/978-3-319-19860-6_10

Sapovadia, V., & Rajlal, K. (2006). *Micro finance: The pillars of a tool to socio-economic development*. Retrieved from http://ssrn.com/abstract=955062

Scarnati, J. T. (2001). On becoming a team player. *Team Performance Management: An International Journal*, *7*(1/2), 5–10. doi:10.1108/13527590110389501

Stelzer, D., Mellis, W., & Herzurm, G. (1996). Software process improvement via ISO9000. Result of two surveys among the European software houses. *Software Process Improvement and Practice*, *2*(1), 197–210. doi:10.1002/(SICI)1099-1670(199609)2:3<197::AID-SPIP47>3.0.CO;2-C

Taylor, S. J., & Bogdan, R. (1984). *Introduction to qualitative research method*. New York, NY: John Wiley & Sons.

Triplett, N. (1998). The dynamogenic factors in pace-making and competition. *The American Journal of Psychology*, *9*(4), 507–533. doi:10.2307/1412188

Valtanen, A., & Sihvonen, H. M. (2008). Employees' motivation for SPI: Case study in a small Finnish software company. In R. V. O'Connor, N. Badoo, K. Smolander, & R. Messnarz (Eds.), *Software process improvement* (pp. 152–163). Berlin, Heidelberg: Springer-Verlag. doi:10.1007/978-3-540-85936-9_14

Wernerfelt, B. (1984). A resource based view of the firm. *Strategic Management Journal*, *5*(2), 171–180. doi:10.1002/smj.4250050207

Yilmaz, M., O'Connor, R. V., & Clarke, P. (2014). An exploration of individual personality types in software development. In B. Barafort, R. V. O'Connor, & R. Messnarz (Eds.), *Systems, software and services process improvement* (pp. 111–122). Berlin, Heidelberg: Springer-Verlag. doi:10.1007/978-3-662-43896-1_10

Yilmaz, M., O'Connor, R. V., & Clarke, P. (2015). Software development roles: A multi-project empirical investigation. *Software Engineering Notes*, *40*(1), 1–5. doi:10.1145/2693208.2693239