Impact of Process Capabilities on System Performance in Distributed Information System Development: Moderating Role of User Involvement

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Declaration

I Nabeel Sattar ID F2019171032,Ssession fall 2019, hereby certified that this thesis is being submitted in partial fulfillment of the requirements for the Ms project management degree in 2021 this is my original work and the data/material presented herein has not been used for acquisition of any other degree from any institute.

Researcher signature _________________

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Research Completion Certificate

It is certified that the research work contained in the thesis "Impact of Process Capabilities on System Performance in Distributed Information System Development: Moderating Role of User Involvement" has been conducted under my supervision to my satisfaction by Nabeel Sattar, ID F2019171032, of MS Project Management program.

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Abstract

Information system development is spreading continuously because of externalization and globalization. With this globally spread development of distributed information system come up with aggressive challenges of system performance in terms of user requirements, uncertainty, and some factors that influence dispersed development. This study was designed to address an issue that has arisen in the distributed development context by taking into account some capabilities of process. Existing literature claims that these capability traits have a significant impact on system performance, but there is a gap in the available findings in terms of empirical evidence. Furthermore, in this study, user involvement acting as a moderator has been added to achieve maximum system performance and better management strategies during the development process. In order to attain these results a quantitative study was conducted where data was collected from project managers of Information technology and the users of ongoing distributed projects in Pakistan. And respondent contributed in study to investigate that how rigor, agility and standardization can prove beneficial to get better and desired system performance. Moreover, findings of this study disclosed that user involvement has a significant impact on capabilities of process and system performance in distributed development.

Keywords: Distributed Information system development, Process Rigor, Process Agility, Process standardization, System Performance, User Involvement

Chapter 1

INTRODUCTION

The information systems (IS) development is spreading geographically more and more due to globalization, externalization and offshoring tendencies (Espinosa et al., 2007). Geographically distributed development has become not only viable but also desirable and compelling as a result of the increasing availability of specialized expertise, relatively low labor, and technology that bridge global distances.in result, dispersed development has emerged as some of the most important contemporary trends in information technology development. (Zhang et al., 2018). (Prikladnicki & Audy, 2010) said that The DSD is defined by the geographical and temporary distance between the individuals working on software projects. the temporal distance refers to the short time difference between locations. "These days, it's almost hard to find a fully collocated software team." Many firms have implemented DSD in order to strengthen customer connections, enter new markets, improve product and process quality, attract specialist work, decrease market time and reduce costs (Gwanhoo Lee et al., 2013). Software development teams that are globally spread encounter more than a few obstacles in their work that are related to temporal, geographical, and sociocultural distances. Geographic dispersion increases the complexity and dynamics of software development, making it more difficult for software teams to coordinate and complete tasks. The increasing usage of distributed development may hence increase IS development's relatively low success rate (Szabo et al., 2019). Although distributed systems are already commonplace in the infrastructures that support daily lives, detecting performance issues in these systems remains difficult (Sturmann, 2020). Earlier research has repeatedly demonstrated the value of software development process capabilities, Organizations have highlighted some process capabilities of different types as essential achievement characteristics for development of software over last several decades. In software development, the software process is crucial. Software teams require strong software process capabilities to deal with the issues posed by geographical dispersion and unpredictable user requirements (Lü,G et al., 2019).

Process Capabilities

The process capability that improves development process clarity, correctness, and formality primarily via comprehensive planning and documentation (Espinosa et al., 2007). Ambidexterity provides us with a proper basis for a successful system development while dealing with process capabilities. Process ambidexterity, as defined by Lee and colleague (2009) and Bot (2012), refers to a company's ability to use both alignment of process and process flexibility. Process alignment is concerned through the processes' rigor, correction, consistency. Process adaptation is concerned with the processes' agility, responsiveness, flexibility, and modification. Process capabilities are significant determinant of a company's ability to effectively implement and use IT systems. IS capabilities entail the execution of proactive planning for fast delivery and cost-effective processes and assistance. System performance capacity is positively impacted by IS capabilities. As a result, robust IS capabilities are more capable of adding value to a system by responding quickly to changes in the requirements (Nazari et al., 2020). However, in research from Friedel et al. (2020) Information System process capabilities are not involved with more than just IT; it is also concerned with enterprise applications, methods, and people in order to effectively manage information. Process capabilities are made up of complex and dynamic information. Park et al. (2020) proposed three points of view: Design of Information system architecture, Corporation and Information Technology vision, and the delivery of Information System services. Furthermore, Ramesh et al. (2012) defined the relevant IS capabilities as agility, operational performance, planning, and internal and external investigation.

Process Rigor

It is characterized by the application of formal methodologies, as well as comprehensive descriptions of roles, responsibilities, work activities, processes, and measurements, as well as exact top-down planned, in detail documentation. In IS development, rigor helps to decrease ambiguity and promote clarity and responsibility. Throughout the development lifecycle, it also allows team members to see how specific activities suitable into the overall project. Process rigor has long been regarded as a critical process capability, and organizations have worked hard to improve it (Pyster & Thayer, 2005). This is differentiated by specific roles, duties, outcomes, procedures, and measurements, as well as rigorous top-down planning, in detail documentation, and the using formal approaches. A variety of system development methodologies and approaches, including the Waterfall Model and the Capability Maturity Model, have been used to improve the rigor of software processes at both the project and organizational levels (Steven & Dominik, 2019). Rigor could also refer to the proper application of any technique for its desired uses. To eliminate defects, improve quality and efficiency, and boost user satisfaction, these organized, plan-driven development methodologies were widely used. However, because they did not allow software teams to deviate freely from the comprehensive plan given out before to the project's start, they frequently resulted in project failures (Fenton & Bieman, 2019). Although earlier research suggests that process rigor in IS development is generally beneficial, (Jalote, 1999) Its impact on system performance in distributed systems development has received minimal attention. Grodal (2020) research, specifically his analysis of the rigor scale, is a great reference for organizations or work groups attempting to figure out what level of process rigor and sophistication is acceptable for their best requirements work. The rigor and formality of procedure may correctly change based on project requirements, even within an efficient agile methodology. Strict standards often necessitate a well-structured strategy throughout the development process, including thorough audits and risk mitigation techniques (Dabney & Arthur, 2019).

Process Agility

Process agility allows information system teams to organize their reactions to changes in system needs and make essential modifications in a rapid and cost-effective way. (Athey & Schmutzler, 1995). As a result of greater uncertainty and volatility, distributed teams require high levels of agility to design solutions that fit changing customer needs. (ÅGerfalk et al., 2009). Recognizing the negative effects of a less process flexibility in development of software, Organizations tend to incorporate agile development strategies like scrum and extreme programming to strengthen development of software adaptability in the context of constantly changing needs. In result agile approaches were created to accept and manage change effectively. Agile methodologies have been found to boost the satisfaction of both consumers and developers. There is nonetheless proof that agile methodologies may not fit large businesses or projects well (Marinho et al., 2019). Along with previous practices, the broad scope of process agility allows software businesses to participate in a number of contexts to achieve process readiness, which comprises the creation, adaption, or change of process descriptions for a specific feature within a company. The use of such diverse structures can be performed out with regulation, resulting in smart systems that take advantage of the vast scope of paradigms accessible. This different mix of structures enables enterprises to select one or more characteristics to address individual needs of the organization. the productivity of performing an agile process is overly dependent on the outlined procedure's demanding changes (Butler et al., 2019).

Process Standardization

Standardization of processes has long been advocated as a means of improving software development efficiency. The standardization of the software process is essential for software development organizations, to ensure constant production of quality products according to predictable timetables. In the standardization process, the adoption of good practices is an important element (Yaseen et al., 2020). Differences arising from local circumstances may also be avoided by standardizing the processes at different locations during distributed development. Distributed development reduces communication and raises conflict potential, misunderstandings and communications breakdowns. It is extremely difficult for remote teams to build shared understanding since team members do not have a common basis (L'Erario et al., 2020). Standardized processes can improve coordination and communication between members of the team who are geographically dispersed and may have quite varied methods of carrying out duties (Kwak et al., 2020). The deployment and administration of Process standardization are described with the purpose of supporting GSD companies in successfully completing Process standardization procedures. It's built on existing models, and it has the ability to boost efficiency and quality (Brickner et al., 2021). According to a survey, 31.1 % of the GSD projects investigated were discarded before completion. Researchers also discovered that only 16.2% of projects were completed on schedule and under budget. The software industry faces a serious problem with the quality of GSD projects. Various process standardization models have been developed to assist software development organizations in successfully managing their procedures (Khan et al., 2017).

User Involvement

User Involvement in development of software has been regarded as one of the most critical components in building system success during the previous four decades. It was formerly widely assumed that including users in the development of software would result in user buy-in, consent, and system of success. (J & W. R, 2008). The need to link developers closer to consumers becomes increasingly important for success, particularly when users participated even in the beginning phases of development of software. This enables for the detection of conceptual and design faults, the reduction of needless development expenses, and the assurance of consumer relevance. Involvement of users in the ISD process is seen to have a favorable impact on ISD success. It appears to have a broad variety of positive effects. It has been indicated that high level of user involvement reduces user bias, fulfillment of requirements, system success. (Bano et al., 2016). Agile techniques have revolutionized software development practice since the 2001 release of the agile manifesto, stressing change tolerance, evolutionary delivery, and active end-user participation. User involvement in the creation of information systems is recognized as a key method for enhancing system quality and assuring effective deployment. (Dingsøyr et al., 2018).

Objectives of Study

1 To investigate the effect of process rigor on system performance in distributed development.

2 To investigate the effect of process agility on system performance in distributed development.

3 To investigate the effect of process standardization on system performance in distributed development.

4 To investigate the effect of process capabilities and moderation effect of user involvement on system performance in distributed development

Research Questions

Q1 Does process rigor has an impact on system performance in distributed development?

Q2 Does process agility has an impact on system performance in distributed development?

Q3 Does process standardization has an impact on system performance in distributed development?

Q4 Does user involvement in distributed development have moderation influence on process rigor, agility, standardization, and system performance??

Q5 Does distributed development project manager can assess the rigor, standardization, and agility of multiple system development strategies?

Hypothesis

H1. Process rigor positively affects system performance in distributed development.

H2. Process agility positively affects system performance in distributed development.

H3. In distributed development, standardization of processes positively affects system performance.

H4. User involvement moderates the relationship between process rigor and system performance in distributed development.

H5. User involvement moderates the relationship between process agility and system performance in distributed development.

H6. User involvement moderates the relationship between process agility and system performance in distributed development.

Problem Statement

In this era of technology information systems and technological advancement are spreading all over the world. The IT industry is evolving and discovering new subdomains. With the advancement of technology, new challenges emerge. Across the globe, distributed information system development is replacing centralized information system development. A distributed information system is confronted with system performance challenges (Szabo et al., 2019). Existing developed systems face challenges such as performance of system in distributed technology. According to existing literature, some process capabilities such as rigor, agility, and standardization can be beneficial to the growth and efficiency of information systems software (Nazari et al., 2020). Although the results are still fragmented. There is lack of empirical research to assess their impact on distributed IS development of IT sector in Pakistan. How these process capabilities are involved and interact in distributed IS development. This study aims to address a gap in existing literature. furthermore, involvement of User research is frequently predicated as per the premise that involving users in the plan of an information system takes to higher utilization of system, improved perceptions of system quality, or enhanced user information satisfaction (Dingsøyr et al., 2018). According to the literature, involvement of user is a serious part for system success as well as for performance. In this study, we will look at how user involvement moderates process capabilities and system performance in the context of development of distributed system. Additionally, this study will provide a model for assessing the rigor, agility, and standardization of different system development methodologies for information systems project managers.

Significance of study

The development of information systems (IS) is spreading geographically because of globalization, externalization, and outsourcing trends. As a result of the rising availability of specialized expertise, relatively low labor, and technology that bridges worldwide distances, geographically distributed development has become not only practical but also desirable and attractive. In result, development of distributed system has appeared as among the most important current technologies in the development of information technology. (Zhang et al., 2018). Pakistan is a developing country where technology is gradually evolving, so it is necessary to investigate the most recent technological concepts and their implementation. DIS (Distributed information system Development) is the foundation of software development. Pakistan is the most ideal location for distributed software development. There is a low-cost but incredibly competent resource available, as well as a tax break for the information technology sector, Language ability, and good internet services (Muhammad et al., 2020).

Previous research addressed a variety of issues related to distributed development, such as low system performance, communication errors, schedule, and cost. No research has specifically conducted in the context of Pakistan. This study seeks to fill a gap in the existing literature by addressing the following issues. First, prior research suggests that process rigor, process standardization, and process agility all have a positive impact on DIS development. There has been no empirical testing of the effects of process capabilities on system performance of distributed development in Pakistan's IT sector. This study has empirically identified if each of the three process capabilities has a positive impact on performance of system in distributed development. User involvement is an essential aspect of software Development which have considered important in development of information system and performance of a system. Few previous studies have provided a poor explanation for how user involvement affects process capabilities and system performance in distributed development. In this study user involvement used as a moderator in order to strengthen the relationship between process capabilities and distributed development to achieve the maximum outcome for system success and performance. Project managers in the IT industry in Pakistan manage projects on both technical and managerial level, so they perform an important role in the development of information systems. This research would also provide information system project managers with a model for assessing the effectiveness of different system development strategies in standings of rigor, standardization and agility.

Chapter 2

REVIEW OF LITERATURE

Information System Development

Theoretical views on what information system development is about have been described by activity theory. The concept "information system" is just a synonym for multiple user computer program in everyday usage. The process of facilitating some shared working tasks is known as information system development with new technology, design, execution, support and project management (Butler et al., 2019). The fast development of the software market is influenced by increased need for software packages. Presently, plenty of new software startups have launched, with more on the way. Furthermore, while acceptance tests, timeframe, and costings may change all through the entire project, risks must be carefully examined as variations in these parameters have an impact on the development method, integrity, and performance (Franco et al., 2018). For several enterprises, development of high-quality software that satisfies business objectives and system needs while staying within budget and time restrictions stays a struggle. A total of 1,471 projects were examined in the study (Wang et al., 2012). Management support, programmers and dedication, projects size and shape, project requirements, development methods, user involvement, and project leader experience are all elements that might impact software development project outcomes, according to researchers (Jitnupong & Jirachiefpattana, 2018). Despite the progress made in the field of project management in recent years, the rate of success of the project has not improved significantly. Software and information system initiatives have followed this direction, with little evidence of performance patterns overlapping across time (Tarhini et al., 2018).

Distributed Development

Distributed information and software development in becoming more frequent, owing to the internationalization of businesses and availability of modern information technologies. Development of distributed Information Systems encourages the development of information system in a coordinated approach, with numerous partners participating in the elaboration of a common solution from different locations (Anderson et al., 2018). Distributed information system development intends to increase corporate performance, lower information system developmental cost, and raise the capacity of human skills and competences, allowing for not just the exchange of information across civilizations, but also for the expansion of strategic initiatives to the global market (Heydari, 2018). In practice, such sort of method helps firms to cope with the current world economic limitations they must face, but it is not without flaws. It's indeed, the way information system products are described, created, programmed, and distributed to customers is influenced by the dispersion of processes Distributed information system is no longer restricted to large multinational corporations, it is now used by small and midsize enterprises as well. The job was done in partnership with a small business that specializes in financial information technology services, and it was done in a dispersed setting with partners located in India, Switzerland, and England (Naumova et al., 2019). Many researchers (Agerfalk et al., 2005; Kruchten, 2004; Wiredu, 2006) have intend to identify distributed software development by finding common traits in remote projects and how these features affect various project management processes. To begin with, the implementation of a distributed project entails that distinct participant are geographical spread rather than collocated. Several scholars have emphasized the significance of geographical distance (Agerfalk et al., 2005; Lindqvist et al., 2006; Paasivaara, 2003; Wiredu, 2005). Thetimeframe it takes to reach a geographical partner and share information, along with diversity in personal and corporate culture, are all essential aspects that might unnecessarily complicate to the distributed information system development project and create new challenges, according to the research. Temporal and sociocultural gaps are the terms used to describe these two features. Geographic distances among objects whether it is between firms, cities and people, assessed in terms of the cost and duration it takes to travel between them (Morozov & Proskurin, 2021). The dispersion of software development has increased in recent years due to a variety of commercial concerns. In the last twenty years, software governance, creation, and operation have moved away from a single location and become geographically dispersed throughout the world. This practice is described to variably as "distributed, "global” or "multi-site" software development. Offshoring” provided other benefits, including the availability of a vast pool of trained workers, the possibility of doing round-the-clock development, and, most significantly, enormous savings that could be realized due to cheap labor costs in underdeveloped countries (WANG, 2006).in research from Prikladnicki and Audy (2010) described that occurrence of physical dispersion between nations or countries is considered natural. Although it is presented as an environment in which activity management tends to be more complex. Using a Distributed Development approach has several advantages, such as access to a larger labor pool and a wider scope skill set, cost savings, and the ability to work around the clock. These dispersions are the outcome of the project management company's design, which generates independent production units known as sites (ŠMite et al., 2013). Modern cloud technology development trends require significant effort from developers in order to create a Distributed information system. As a result of the emergence of strategies and project management approaches, it is possible to employ new managerial approaches in order to ensure efficient and rapid development of a DIS. The several proactive and dynamic strategies help the development of an integrated system by developing in-demand complex information system products. The actual facts of DIS development management techniques demonstrate the creation of distributed IT projects, such as the creation and development of distributed information systems. This suggests that a number of extremely difficult problems will be resolved in the near future. The difficulty of these issues is directly proportional to the project's complexity, as well as a large number of complicated cross influences and interactions both inside and outside the project. Projects and their environments, on the other hand, are constantly changing and, as a result, are part of the ongoing self-modification. As a result, it's critical to research proactive management techniques and strategies for developing large distributed development projects. (kalnichenko et al., 2018). Ever since beginning, DIS has been involved in IT projects that are marked not only by structural and functional complexity, as well as by a significant series of changes in component interactions and a distinctive circumstance. The ability to avoid bad events by regulating key factors, detecting possible concerns based on weak signal. The main challenge, however, is managing a variety of components, as well as controlling and forecasting, both of which are fairly costly budget-wise. The monitoring and analysis procedure should also include aspects of the project and related parts, as well as interactions between components or modules, because projects of this nature frequently involve knowledge of numerous disciplines and the usage of multiple technologies. Apart from that, we must not overlook project participants' requirements. (Kaltenthaler et al., 2018). According to Goodhue (1995) and Jr. and Franz (1999), when users participate in IS development activities, the outcome of the Information System is more acceptable and pleased in terms of user satisfaction and usefulness.

Rigor and information system development

The set of activities carried out during the development of an information system is referred to as an IS development process (Curtis et al., 1992). Interactions between people, technology, methods, and procedures are all part of these activities (Humphrey, 1989). Process rigor has been identified as a critical dimension of process capability. Quality, maintainability, and efficiency are expected to improve as a result of the rigorous development process (Austin

& Devin, 2009). Even before distributed development became popular, the significance of process rigor was understood (Pyster & Thayer, 2005b). It is defined by full comprehension of positions, tasks, work activities, processes, and measures, as well as in-depth top-down preparing, paperwork, and the use of official techniques. (Krupp, 1999). It is emphasized in specific by organized, strategy approaches to IS development, and it is supported by approaches such as the Model of Integrated Capability Maturity (CMMI)Ramesh et al. (2006) Structured, strategy development strategies were widely used to prevent deficiencies, enhance efficiency and quality, and boost user satisfaction. In practice, process rigor is difficult to attain; according to one survey, only 6 percent of software engineers strictly follow to pre described methods (Fitzgerald, 2000). Although earlier research suggests that process rigor in IS development is generally beneficial, Jalote (1999b)**.** There hasn't been much research into how it affects system performance in distributed development. As a consequence, in the reference of distributed development, the beneficial result of process rigor on system performance should not be assumed and should be empirically tested. In dispersed IS development environments, rigor appears to be significant, because members of a distributed team do not interact as frequently as participants of a collocated team, task monitoring and management are more difficult. (Herbsleb & Mockus, 2003). In IS development work, rigor aids in the resolution of conflict as well as the enhance of clarification and management. It also allows teams to see just how their roles and responsibilities help the overall effort all across the development lifecycle. Rigor can also mean the correct use of any method for its intended purpose. Rigor relates to either the manner in which an assessment is conducted and the manner in which it is presented. authors will be unable to assess the rigor of the evaluation if the details of specific project are not sufficiently stated (Gregory, 2018). A reviewer or other reader cannot judge whether the details has been conducted in a rigorous approach when it is not represented adequately, the requirements rigor becomes meaningless since it is not provided properly (Camfield, 2018).

Failure to properly describe the detail also restricts the ability of other researchers to comprehend and replicate or repeat it for analysis. Rigid guidelines often require a fairly structured approach all across scope of development operations, including rigorous inspections and risk mitigation techniques. To eliminate defects, improve quality and efficiency, and boost user satisfaction, these organized, plan-driven development methodologies were widely used. However, because they did not allow software teams to deviate freely from the comprehensive plan given out before to the project's start, they frequently resulted in project failures (Fenton & Bieman, 2019). Although earlier research suggests that process rigor in IS development is generally beneficial (Dabney & Arthur, 2019). In research from Grodal (2020) particularly his assessment of the scale of rigor, represents a great guide for firms or work groups trying to figure out what extent of process rigor and technicality is appropriate for their best requirements work. Even inside effective agile approach, the rigor and formality of procedure may appropriately vary based on project requirements.

Process standardization and information system development

Another important process capability for improving IS development performance has been identified as process standardization. Process standardization, like process rigor, was identified as a critical component of process alignment. Quality, maintainability, and efficiency will all benefit from a thorough development process. Process standardization is unique to distributed information system development because it makes reference to the consistency and uniformity of development processes throughout different locations. The majority of prior research has focused on standardization throughout different locations besides standardization throughout different locations within the same project (Austin & Devin, 2009). However, in a previous study process standardization was described as the strict adherence of of methods, equipment, strategies, frameworks, and work practices all over development sites (Oshri et al., 2008). Distributed development reduces the quality and level of communication while also increasing the likelihood of dispute, confusion, and communication barriers (Chudoba et al., 2005). Because members of remote teams do not stand on "same ground," it is difficult for them to create mutual understanding (Cramton, 2001). The standardization of development methods and frameworks throughout distant areas, as per a case study of a large offshore IT supplier, facilitates knowledge transfer in geographically dispersed teams by overcoming differences in work schedules and techniques derived from different regional contexts (Oshri et al., 2008). Standardized processes allow participants to establish shared understanding, develop a deep understanding of each other's work, and more effectively coordinate their actions, resulting in more successful system integration. Moreover, standardized processes can assist overcome differences arising from various geographical settings, minimize the adverse influence of staff turnover, and promote a consistent organizational culture (Nidumolu, 1996). Because GSD is distributed, the reliability of software appears to be a key consideration. Multiple large-scale GSD projects have produced disappointing results, dealing a blast to the industry (Khan et al., 2017). A survey and found that 31.1 percent of the GSD projects they looked at were abandoned before completion. They further discovered that just 16.2 percent of projects were finished on time and on budget. The quality of GSD projects poses a severe problem to the software industry. To help software development businesses efficiently manage their procedures, various process standardization models and have been developed (Khan et al., 2017). The quality of GSD projects poses a severe problem to the software industry. To help software development business efficiently manage their procedure various process standardization models and have been developed. One such model is the capability maturity model integration (CMMI), which includes systematic and rigorous processes for process evaluation and improvement (Lieven et al., 2020). SD standards and guidelines have also been produced by the International Organization for Standardization (ISO). A variety of strategies, notably software process standardization, have been developed to manage and regulate the development process (Handa et al., 2019). However, in the context of GSD, process improvement standardization models and standard have not been extensively defined, and as a result, process improvement attempts have had little success (Dang et al., 2020). Process standardization implementation and administration are discussed, with the goal of assisting GSD organizations in completing Process standardization operations successfully. It is based on existing models and has the potential to improve quality and efficiency (Brickner et al., 2021).

Process agility and information system development

Although geographic distribution significantly increases the project environment's complexity and volatility, distributed team members may require flexibility and agility to be effective (Royce, 2005). The ability of a process to identify and respond to new requirements is referred to as process agility (Conboy, 2009). Recognizing the devastating effects of a deficiency of process adaptability in the late 1990s and early 2000s, organizations started implementing agile development methodologies to increase the agility with which information systems are developed in response to ever-changing requirements (Kruchten, 2011). Process agility is seen as an essential capability for IS development by organizations, based on the rapid adoption of agile development approaches. Agile development practitioners put an emphasis on adaptability over rigor and standardization, claiming that extremely rigor and standardized methods do not always prove beneficial and may even poses risk (Beck & Andres, 2004). The advantage of process agility has primarily been proved for collocated or small projects, and the generalization of such findings to distributed development has yet to be proven. in result, the importance of process agility in dispersed development is misunderstood (Cusumano, 2008). Because of process agility, Information systems teams can develop a strategy their solutions to changing system needs and implement required changes in a timely and cost-effective manner. Recognizing the negative effects of a less process flexibility in development of software, Organizations tend to incorporate agile development strategies like scrum and extreme programming to strengthen development of software adaptability in the context of constantly changing needs. In result agile approaches were created to accept and manage change effectively. Agile methodologies have been found to boost the satisfaction of both consumers and developers. There is nonetheless proof that agile methodologies may not fit large businesses or projects well (Misra et al., 2012). Changes in system requirements are unavoidable in business and technological environments due to inherent uncertainties (Krishnan & Bhattacharya, 2002). Process agility is required when required modifications are neither predicted or fully described at the start of the project (fet al., 2006). Supervisor support, programmers' inspiration and dedication, project size and composition, project complexity, development technology and tools, user participation, and project manager experience are all elements which might impact software development outcomes, according to researchers (Hoffmann et al., 2020). Group the explaining factors into these mentioned categories: institution setting, personnel and activities, process of development, and content of project. Though some studies model project outcomes as a function of several factors and the mediating and moderating relationships that occur among them, some of others model outcome of project as independent measure (Kukreja et al., 2018). Some scholars propose a contingency approach to managing software development projects, which is consistent with the latter notion that project results are influenced by the complex interrelationships and interactions among numerous components. Along with conventional methods, the broad range of process agility allows software companies to have various context with which they can bring out process preparedness, which entails the formation, adaptation, or adjustment of process descriptions for a particular feature within a company. Use of such different structures can be conducted out through their standardization, resulting in the creation of hybrid solutions, advantage of a wide range of frameworks available. This vast array of structures allows organizations to choose between one or multiple signifiers to identify particular organizational requirements. According to some evidence, the efficiency of executing an agile process depends in significant part on the rigorous adjustments made in the described procedure (Butler et al., 2019). Plan-driven to change-driven project life cycles are examples of management methodologies based on project characteristics. Extensive, predictive life cycles; early detailed estimations of finances, timetable, and effectiveness; structured change management procedures; measurement processes for recognizing deviations and taking appropriate measures; and a central command management style portray the plan-driven approach, also known as plan-based (Cerón Hernández, 2017). Project outcome is influenced by the interactions among project complexity, project dynamism, and project management approach. A change-driven methodology, referred to as agility-based in this case, emphasizes flexible (agile) life spans, iterative specifications, changing hypotheses, and restrictions, short - term planning loops that span a feature, release, or iteration, quality management achieved through feedback, perceptions, and sprint review, and a collaborative and interactive decision-making style. Author urges against categorizing project management techniques into opposites, such as agile vs. plan vs. agile He claims that businesses are aware of a scale between the two approaches, and that their project management procedures are often a mix of both adaptability and management (Islam & Ferworn, 2020).

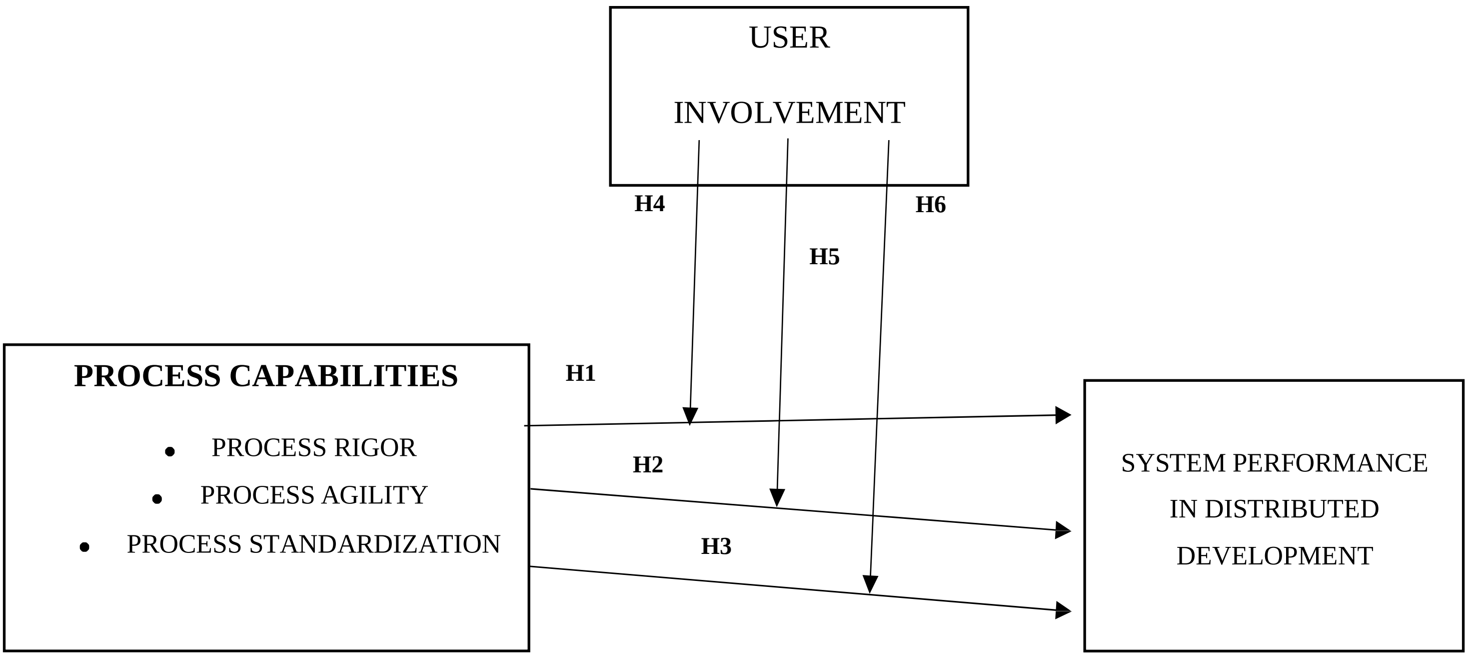
User Involvement and information system

Despite the fact that commercialized computer systems have been operational for over three decades, several of the systems currently in development may be classified as failures. One of the most commonly mentioned components of effective system development is including users in the design and implementation process (tait & Vessey, 2018). The engagement of users in software development has been considered one of the most significant components for system success during the past four decades Generally, consumer integration throughout the life cycle of software development was considered to lead to user buy-in, authorization and system success (J & W.R, 2008). User involvement study is usually based on the assumption that involving users in the configuration of an information system tends to increase system usage, individual progresses of system quality, or high user information satisfaction. (Féris et al., 2017). User involvement in the ISD process is considered to have a positive impact on ISD success. It appears to have a wide range of beneficial impacts. It is suggested that a high engagement in user involvement reduces user favoritism. Users who participate in the ISD process should become familiar with the methods, strategies, and processes included to build systems and explore that there is "nothing at all to fear but fear its own. Some users feel forced to become more "engaged" after witnessing the influence other users have by contributing. Yet, the final outcome in terms of ISD success is less obvious. Constantly changing needs and scope changes are two frequent hazards associated with user involvement (Burda & Teuteberg, 2015). In research from McCarthy et al. (2021), authors provide ISD practitioners, by characterizing five modes of involvement e.g., incorporating, challenging, neglecting, defining, and finalizing with a framework for considering about the challenges of participation in distributed ISD and demonstrates that user engagement is a critical component of developing a distributed information system for addressing development problems and conflicts. The need to link developers closer to consumers becomes increasingly important for success, particularly when users participated even in the beginning phases of development of software. This enables for the detection of conceptual and design faults, the reduction of needless development expenses, and the assurance of consumer relevance. Involvement of users in the ISD process is seen to have a favorable impact on ISD success. It appears to have a broad variety of positive effects. It has been indicated that high level of user involvement reduces user bias, fulfillment of requirements, system success. This study also defines, an earlier attempt to improve system quality and ensure successful IS execution was to explored the influence of user participation on information satisfaction. In a study by Sappri et al. (2016), authors discovered that involvement of user has a major impact on IS development when looking at a specific type of information system called a human resource management system. According to empirical research, user involvement performs an important role in influencing IS implementation in enterprises of today. Based on a user satisfaction instrument developed by Bailey and Pearson (1983), the results showed that UI was critical in leading to increased system usage and user satisfaction in IS. Since then, UI has become increasingly important in determining IS development.

Theorical Framework

Using complexity theory as a reference frame, this study has used the implications of complexity theory on the design and development of distributed information systems. Complexity science recognizes that systems can exist in one of three states: stable, chaotic, or somewhere in between. (Lewin, 1992). These are the terms identified in some studies "melting zone" (Kauffman, 1993), "critical complexity" (Cramer, 1993), or "area of emergent complexity" (Kauffman, 1993) are all terms used to describe the middle state (McKelvey, 1999). Many authors argue that complexity theory can help managers deal better with continuously evolving non-linear competitive contexts (Goldstein, 1994; Stacey, 1995; Brown and Eisenhardt, 1998; Kelly and Allison, 1999). These concepts are clearly important in the subject of information systems, and they are especially relevant to ISD. According to Benbya and McKelvey (2006) Complexity Science focuses on a small segment of all systems; a subset that is abundant and serves as the foundation for all novelty. This is evident in biology, chemistry, physics, as well as the social, technical, and economic domains. Previous studies recognize information system development (ISD) as a complex process. Such complexity is largely caused by the constant change in customer requirements as a result of changing company's objectives in changing external competitive positions. If all this increasing complexity is not handled correctly, information systems will fail. Previous research has also discovered a significant relationship between information system development and complexity theory Damasiotis et al. (2018) have described that Because of the number of different developments of software techniques, it is neither viable nor essential to provide a comprehensive critical analysis because the primary objective is to discuss the overall complexity of development of software methodologies. We've demonstrated that all software processes, as well as the context in which they operate, are complex factors to consider. We dug deeper into complexity theory found significant and similarities between the challenging task of aligning a software process with its frame of reference and the fundamental complexities related to complex systems as described in complexity theory. In research from Turner and Baker (2019) implications of complexity theory on information design and implementation. Complexity science, particularly research on self-organized emergent behavior, provides important insights for dealing with the emergent nature of IS. Complexity theory is now more widely recognized in the literature, and it serves as an opportunity for disciplines studying complex systems.

Conceptual Framework



Chapter 3

Methodology

Research Philosophy

The post positivism research philosophy is used. The effects of process rigor, agility, and standardization on system performance in distributed development were investigated in this study. Theory has been used to support hypotheses that have been generated and to seek objectivity in order to detect potential impacts. Post positivism are aware of a social reality that surrounds them. The end outcome of post positivist research generalizations of results on the population or the research's target organization, similar to how natural scientists generalize physical laws. The researcher's observations will result in accurate data. The researcher investigates relevant theories and formulates his hypothesis based on such theories. (Saunders et al., 2009, p. 113). Positivists construct knowledge by establishing casual relationships (Saunders et al., 2009, p. 119).

Research Approach

This study takes a deductive approach. A deductive technique is used in studies that employ literature to construct a framework and consists of empirical findings. In order to give empirical evidence, the developed hypothesis was tested to find the relationship between process rigor, agility, standardization, user involvement and system performance in distributed development. Furthermore, the strategy under this approach is designed to evaluate the hypothesis. It includes establishing a theory that is put to the test (Saunders et al., 2009, p. 124).

Purpose of Research

The purpose of this research an explanatory. The purpose of this research is to look into a problem or situation in order to understand the relationships between variables. (Saunders et al., 2009, p. 141). Explanatory studies explain why a phenomenon is observed in descriptive investigations (Cooper, 2014, p. 22). The literature facilitated the identification of variables incorporated in both conceptual and theoretical frameworks, as well as the operationalization of selected constructs. In this study, it is endeavored to investigate relationship between Process capabilities and system performance in distributed information system development.

Data Collection Method

As a data gathering method, this study used a questionnaire. Researcher applied the findings of this study to generalize on entire population (Kothari, 2004, p. 5).

Time Horizon

The study is carried out in a cross-sectional manner. Cross-sectional research looks at data from a group of people at particular time. This method is widely employed to find potential connections or to collect preliminary data in order to facilitate further investigations. (Saunders et al., 2009, p.155). Survey of study was carried out among those companies who operate on dispersed software projects. The data collecting tool delivered to 540 respondents mainly to users and their project managers of the dispersed development project after filtering 244 responses were ready and correct to analyze. The survey was voluntarily finalized by the participants. The questionnaire was completed by several employees during spare time after work. The surveys comprised population variables and assurance, which described the aim of the study and ensured confidentiality and anonymity for respondents. The data was extracted by users and project managers separately. Moreover, In the first round, project managers responded to question regarding process capabilities, which included rigor, agility, standardization, and system performance in distributed development with a good response rate. Then, one week later, all Project Managers who took part in the first survey were asked to circulate the second survey on system performance and user involvement among distributed development project users and sponsors. The survey was anonymous and did not demand participants to disclose any type personal information except their G-mail account. Respondents are assured that the information they submit will not be shared by anyone in the organization, and that their personal information will not be shared, in order to meet the questionnaire's ethical criteria and maintain the integrity of the ensuing data. In project-based organizations, people rarely give unfavorable feedback on project managers. Respondents were encouraged to submit honest comments in order to gain a better understanding of the project's many features. The software used for the data analysis is SPSS. The index was designed to assess how well dispersed Teams applied to a structured IS development process.

Unit of Analysis

An individual, i.e., a project Managers and users of distributed information system are the unit of analysis in this study.

Sampling Technique

The sampling technique used for this research is snowball sampling. Sometimes it is appropriate to select a sample on the basis of data of the population, its way or area of working, and the purpose of the research.in this study project manager of distributed development was identified first then further reference of users of the distributed information system was provided by identified managers.in snowball sampling available respondents provide the information for further respondents in order to gather most related and accurate responses. (Babbie, 2012). The target population for research is Software firms involved in the development of distributed information systems in Pakistan.

Sample size

In research from Krejcie and Morgan (1970), The sample size is responsible for the quality of generalizability. This study used table of Morgan and krejcie in order to identify sample size and 540 relevant questionnaires were designed to distribute among potential respondents. Before collecting, data researchers must carefully deliberate on the number of people to include in the research (Hair & Bush, 2002, p. 43). Many researchers stated subject to the variable- ratio for analysis of factor. Analysis of Factor is a statistical test, required to test causal variables. Hair et al. recommend the rule of 20:1 i-e; 20 respondents for each variable in the study (Hair et al., 1995). there Should be 10 respondents for each question used in the research instrument (Event, 1975; Kunce, Cook, & Miller, 1975; Everitt, 1975; Nunnaly, 1978, p. 276; Marascuilor & Levin, 1983). This indicates dissimilarity in Literature as far as the perfect sample size for factor.

Data Collection Instrument

This study's instrument is a questionnaire. The post positivist approach allows for the examination of theories using numerical measurements. (Saunders et al. 2009). The stress of positivists is a questionnaire to test the theory that is made up of variable relationships. (Easter by-Smith etal., 2008). The tool used first collects demographic responses from participants, such as gender, education level, age of respondents, and experience. This will assist in gaining a clearer understanding of the respondent's background. The questionnaires on process capabilities and system performance are based on workdone by Lee et al in (2010). User involvement was taken from a study done by Santosa et al in (2005). Process rigor, process agility, and process standardization are comprised of 4 items. In addition, there are 3 elements for DV system performance in distributed development and 4 items for moderator user involvement. All questions are rated on a Likert scale of five points (strongly disagree = 1, Somewhat disagree = 2, Neutral = 3, Agree = 4 and strongly agree = 5). The data collection items for this study are provided as an appendix

Chapter 4

RESULTS AND INTERPRETATIONS

Demographic

Table 4.1: Demographics of study participants, including frequency and percentage

Demographic Items	Frequency	Percent
Gender		
Male	161	66.0%
Female	83	34.0%
Age		
20 - 24	12	5%
25 - 29	63	30%
30 - 34	49	20%
34 - 39	72	30%
40 - 44	36	15%
45+	12	5%
Education Level		
Intermediate	1	.4%
Graduation	111	45.5%
Masters (MS/M.Phil.)	117	48.0%
PHD	15	6.1%
Total	244	100%

The overall number of responses collected from the IT software development industry included 244 validly completed questionnaires, and their data collected was analysed. The demographics section revealed that 161 (66.0 percent) of the 244 respondents were males and 83 (34.0 percent) were females. As shown in Table 4.1, all respondents are from Pakistan and are related to our study. Our study included project managers and users of distributed information systems who had prior experience working with and using distributed information system development. The age group 25 – 29 and 34 - 39 had the highest percentage of respondents (30 percent), while those over 45 and below 25 had the lowest percentage (5 percent). Respondents' education levels were divided into four categories. Interestingly, 48.8 percent of our respondents have a Master's degree (MS/M.Phil.). The outcomes are shown in Table 4.1.

4.1.1 KMO Test

Kaiser Mayer Olkin

Table 4.1.1

Constructs	KMO Index	Goodness of Fit Significance Value
Process Rigor	.599	.003
Process Agility	.710	.000
Process Standardization	.645	.002
User Involvement	.690	.001
System Performance in Distributed Development	.760	.000

(Lee et al, 2010)

The Kaiser Mayer Olkin (KMO) test is the basic test for factor analysis capability. KMO values vary from 0 to 1. A value around 1 denotes that the data is more important for analysis, a value between 0.5 and 0.7 indicates that the data is appropriate for interpretation, and any number less than that indicates that it is not adequate. The significance value of Bartlett's test of sphericity is less than 0.05, indicating that the data is quite well. The exploratory factor analysis was performed on survey data. Table 4.2 displays the analysis results. The KMO index values for Process Rigor, Agility, Standardization, User Involvement, and Performance of system in Distributed Development were 0.599, 0.710, 0.645, 0.690, and 0.760, indicating that the data is significant for analysis. Furthermore, the significance value of the Bartlett's Test is p= 0. 003, 0.000, 0.002, 0.001, 0.000, respectively which is less than 0.05, confirming the appropriateness of the sample data.

Reliability Test

Table 4.2.1

Reliability Test

Constructs	Cronbach's Alpha	N of Items
Process Rigor	.690	4
Process Agility	.760	4
Process Standardization	.735	4
User Involvement	.792	4
System Performance in Distributed Development	.650	3

(Lee et al, 2010)

A Cronbach's Alpha test was used to ensure scalability. Cronbach's Alpha has a lower limit of 0.5. (Gaskin, 2013; Doloi et al., 2011). Table 3 displays the reliability outcomes. The Cronbach's Alpha coefficient for Process Rigor was 0.690, 0.760 for Process Agility, 0.735 for Process Standardization, and 0.792 for User Involvement, and650 for Distributed Development System Performance according to the results of reliability coefficients for all variables studied.

Table 4.3 summarizes the findings, which show that each of the constructs has effective internal item reliability.

Descriptive Analysis

The descriptive analysis focuses on providing summary information for all variables (IV, DV, and Moderator). The descriptive analysis of all variable mean and standard deviation values is shown in Table 4.5 below. For all variables, the sample size was 244. Process Rigor has a mean value of 5.5252 and a standard deviation of 1.00950. The mean for the 'Process Agility construct is 4.0530, with a standard deviation of 0.69109. Process Standardization has a mean value of 4.0820 and a standard deviation of 0.72552. The mean value of User Involvement is 4.0840, with a standard deviation of 0.83089. Ultimately, System Performance in Distributed Development has a mean value of 4.0930 and a standard deviation of 0.82156.

Correlation Analysis

Table 4.4.1

Correlation

	Process Rigor	**Process Agility**	**Process Standardization**	**User Involvement**	**System Performance in Distributed Development**
Process Rigor	---	.610**	.622**	.672**	.594**
Process Agility	.610**	---	.647**	.720**	.647**
Process Standardization	.622**	.647**	---	.729**	.650**
User Involvement	.672**	.720**	.729**	---	.701**

System Performance in Distributed Development	.594**	.647**	.650**	.701**	---
N	244	244	244	244	244
Mean	5.5252	4.0530	4.0820	4.0840	4.0930
Std. Deviation	1.00050	0.69109	0.72552	0.83089	0.82156

Pattern Matrix

The matrix contains coefficients for the variables' linear combination. Loading of factors should be greater than '0.5', as suggested by the researcher's judgement. All questions have factor loading, and the results are added in below Table 4.5.

Table 4.5.1

Pattern Matrix (Process Rigor, Process Agility, Process Standardization, System Performance in Distributed Development)

	Factor				
	1	2	3	4	5
System requirements were documented in detail	0.61 5				
Project team responsibilities were clearly defined and communicated	0.76 0				
Project team created a detailed project plan	0.77 3				
Project team used a formal software development process	0.65 0				
Project team was able to sense user requirements changes effectively		0.590			
Project team was able to strategize its response to user requirements changes effectively `		0.610			
Project team was able to make effective decisions to cope with user		0.642			

requirements changes	
Project team was able to incorporate user requirements change into the system effectively	0.680
Common project management practices were used consistently across sites.	0.710
Common project planning methods/techniques were used consistently across sites	0.849
Common communication methods/technologies were used consistently across sites	0.790
Common project performance review methods/processes were used consistently across sites	0.599
This system supports different browsers	0.798
This system is visually appealing	0.760

I feel satisfied with my visit of this system	0.612
I feel satisfied with my visit to this system	0.693
The system had many defects	0.788
The system met technical requirements/specifications	0.659
The system was a success (SysPerform3)	0.628

Regression Analysis

Linear Regression Analysis

Table 4.6.1

Direct and Interaction Effects for Independent Variable. Table 4.7 shows an example of regression analysis in the form of three basic models. A linear

Independent Variable	**Basic 1st Model**	**Basic 2nd Model**	**Basic 3rd Model**
R	.799	.719	695

Adjusted R^2	.634	.517	715
ΔR^2	.445	.513	502
t	12.234	8.59	10.68
β	.663	.635	0.605
F	238.412	231.390	220.320
p	0.00	0.00	0.00

Regression was used to assess the direct effect of Process rigor, Agility, and standardization on system performance in distributed development. Implementing linear regression analysis helped estimating the 'Basic Models'. The analysis results show that for Basic Model 1, the independent or predictor variable Process rigor does have a direct impact on dependent or system performance in distributed development. ((β=0.663, p-value=0.000< 0.01). When the value of the coefficient of determination, R square, rises slightly, so does the statistical significance of model fit.

In Basic Model 2, the independent variable Process agility does have a direct impact on dependent or system performance in distributed information system development. (=0.635, p-value=0.000 0.01). When the value of the coefficient of determination, R square, increases slightly, so does the statistical significance of model fit. The independent variable Process Standardization does have a direct impact on dependent or system performance in distributed development in Basic Model 3 (=0.605, p-value=0.000 0.01). When the value of the coefficient of determination, R square, rises slightly, so does the statistical significance of model fit. As a result, these three models are statistically significant with F value and p 0.05. Because there is statistical significance between variables of the model fit for the three Basic Models 1, 2, and 3, process moderation analyses can be performed (Hayes, 2017).

Andrew Hayes Process" Moderation Analysis

A moderator is a variable that indicates how much an independent variable affect the dependent variable. It mostly refers to the phrase "interactions," which is used to influence the intensity between two variables. The influence of a moderating variable, namely user involvement, on process rigor, agility, and standardization was evaluated using an extension called "Andrew Hayes Process."

Table 4.7.1 ANOVA[a]

Model		dF	Mean Square	F	P
1	Regression	1	14.992	20.549	.001[b]
2	Regression	2	16.569	21.138	.000[c]

a. Dependent Variable: System Performance in Distributed Development

b. Predictors: (Constant), Process Rigor

c. Predictors: (Constant), Process Rigor, User Involvement

Table 4.7.2 ANOVA[b]

Model		dF	Mean Square	F	P
2	Regression	1	18.242	19.549	.002[b]
2	Regression	2	19.71	22.412	.001[c]

a. Dependent Variable: System Performance in Distributed Development

b. Predictors: (Constant), Process Agility *c. Predictors: (Constant),* Process Agility, User Involvement

Table 4.7.3 ANOVA[c]

Model		dF	Mean Square	F	P
3	Regression	1	17.456	20.489	.001[b]
2	Regression	2	18.050	22.517	.000[c]

a. Dependent Variable: System Performance in Distributed Development

b. Predictors: (Constant), Process standardization

c. Predictors: (Constant), Process standardization, User Involvement

Chapter 5

5.0 DISCUSSIONS

Using the theory as a foundation, the current study investigates the effects of process rigor, agility and standardization on system performance in distributed development in the information technology industry, while user involvement acting as a moderator. The research proves positive relationships between process capabilities and distributed information system development, with the three capabilities mentioned above providing a better systematic and authentic way to achieve high system performance in distributed development. Because of fragmented and unclear requirements, user involvement is critical and essential in leading to increased system usage and user satisfaction in IS. This is especially true when users are involved in the early stages of information system development. This allows the identification of conceptual and design flaws, as well as the reduction of unnecessary development costs, as explored in the study from (Bano et al., 2016). Six hypotheses are formulated in advance based on existing literature. In this study, methodology with the adopted instrument (questionnaire) was used to collect data to test these hypotheses. In terms of analysis, a total of 244 respondents were chosen using a random probability sampling technique, of which 66.0 percent are males and 34.0 percent are females, with the majority being between the ages of 15-30. (60.7 percent). The findings demonstrate that the KMO Index for process rigor, agility, standardization, user involvement and System Performance in Distributed Development are 0.599, 0.710, 0.645, 0.690, and 0.760, with significant values (p=0.000) for all four variables studied. It denotes that the sample-driven data is adequate for analysis. In furthermore, the descriptive analysis for Process Rigor yielded a mean value of 5.5252 and a standard deviation of 1.00050.

Process agility has a mean value of 4.0530 and a standard deviation of 0.069109, whereas process standardization and user involvement have mean values of 4.0820 and 4.0840, respectively, with standard deviations of 0.72552 and 0.83089. Furthermore, the dependent variables system performance in distributed development has a mean of 4.0930 and astandard deviation of 0.82156. Because Cronbach's Alpha is near to 1, the reliability test for all constructs revealed strong internal item reliability. The findings corroborate previous research. rigor, agility, and standardization, all process capabilities are correlated and have a significant positive relationship, including the moderator user involvement and the dependent variable system performance in development of distributed system. To improve performance of system, these all-process capabilities and user interaction have a direct and indirect relationship with distributed information system development. As Rajapathirana and Hui (2018) observed out, the creation of distributed information systems (IS) is highly problematic, such as communication and coordination issues, increased user need ambiguity, and increased work complexity. Distributed Information system teams seek to construct effective development process capabilities such as process rigor, process standardization, and process agility to deal with such issues. As a result of the ambiguous requirements and importance of user interaction in IS development, it is crucial and highly important. Importantly, this research has identified the direct impact of rigor, agility, and standardization on system performance in dispersed development, as well as the interaction effect of user's involvement. In the past, no empirical test had been conducted in Pakistan. The impact of UI on information satisfaction enhancing system quality and assuring successful IS deployment, user involvement in IS development has an impact on IS success (Behutiye et al., 2020b). This study explains the value of each of the three process capabilities in DIS to information system project managers. In distributed projects, developing these process competencies improves the probability of system success. In addition, linear regression analyses were used to see if the predictor had a considerable variability over the criterion. The "Basic Models" and "Interaction Models" were estimated using linear regression analysis. Process rigor was used as a predictor, while system performance in distributed development was used as a criterion in Basic Model 1. Process capabilities have a direct substantial and positive relationship with criterion system performance in distributed development, as evidenced by the values of Basic Model 1, R (0.799), AR2(0.634), t (12.234), F (238.412), and p (0.000). Process agility was used as a predictor, while system performance in distributed development was used as a criterion in Basic Model 2. It has R (O. 719), AR2 (O. 517), t (8. 59) and F (231.390). Process agility has a significant and positive relationship with criteria system performance in distributed development, as indicated p (0.000) value. Process standardization was used as a predictor, and system performance in distributed development was used as a criterion in Basic Model 3. It has R (O.695), AR2 (O.715), t (10.68) and F (220.320). Process agility has a significant and positive relationship with criteria system performance in distributed development, as indicated p (0.000) value. According to previous research, process capabilities have a positive or negative impact on system performance in distributed development. In diverse contexts, Espinosa et al., (2007), Rajapathirana and Hui (2018), and Nazari et al., (2020) found considerable positive impact, however no similar empirical study was discovered in Pakistan. This research supports the empirical findings in the context of Pakistan. Furthermore, it supports the study's (H1) hypotheses one, (H2) hypotheses two, and (H3) hypotheses three.

However, we show that user involvement contributes to system performance. Table 4.7 or ANOVA 1 In distributed development, user interaction has a large direct and moderating influence on system performance, with p=0.00. As a result, the findings support hypothesis four (H4). Table 4.8 or ANOVA 2 In distributed development, the direct and moderation effects of user interaction with agility are considerable, with p=0.00. As a result, the findings support hypothesis five (H5). Table 4.9 or ANOVA 3 The direct and moderation effect of user involvement in standardization on system performance in distributed development is significant, with p=0.00. As a result, the findings support hypothesis six (H6).

Conclusion

In this study impact of process capabilities such as process rigor, agility, and standardization on performance of system in distributed development is investigated, as well as how user participation strengthens the impact of process capabilities on system performance. In distributed development, the study discovered a link between process rigor, agility, standardization, and system performance in distributed development. Using defined planning, roles, polices, and processes in accordance with defined process rigor, the performance of the system can be improved, and the system will be a success. If the system follows agility, the system will lead to correctness and perfection, process agility provides a method to deal with ambiguity and constantly changing requirements, and development of distributed project will be able to provide tiny finished project modules, resulting in improved system performance and success. Due to process standardization, the information system will be efficient and produce quality output in a predictable timeline as in the particular process, basics standards for development and rules or policies for best practice for system creation is defined. Furthermore, this study discovered that user involvement can be a significant factor in system success because if an information system is designed to meet the needs of its users, it will function well and produce high-quality results. If users are involved, the system will give better and desired outcomes for them, because requirements will be properly specified, and requirements will not be fragmented. Hence user involvement is essential aspect at every phase of system development. Hereafter this study addresses the primary issues and complexities arising in system performance of distributed development, by covering communication, coordination, development and maintenance through the all-developmental aspects describe in process capabilities.

Theoretical Implications

The study was one of the first to combine literature from these three key areas: capabilities of processes, user involvement and system performance in distributed development. This research helped to develop a model for the drivers of distributed information system development. In distributed technology, existing developed systems face challenges such as system quality and performance. Some process capabilities, such as rigor, agility, and standardization, Some capabilities of processes such as rigor, agility, and standardization, according to existing literature, can be beneficial to the growth and efficiency of information systems (Nazari et al., 2020).in IT industry user involvement and plan driven model is accepted but implemented as a separated artifacts as founded that, The use of such diverse structures can be carried out with proper use of formal rules and policies, resulting in smart systems that make use of the wide range of frameworks available(Butler et al., 2019). This study provides an integrated framework of user participation and process capabilities in Pakistan's IT sector. Through the interaction of user involvement, efficient utilization of rigor, agility, and standardization leads to improved performance of distributed systems.

Managerial Implications

This study is centered on the information technology industry, and it has many implications for the IT industry. Focusing on the impact of process capabilities in managing professional relationships between process rigor, agility and standardization finding suggests distributed development need to adopt mentioned management capabilities of process for projectsuccess. Completion of projects on time, at specific quality, performance of system and within specified budget are compulsory for smooth and efficient project management processes. Similarly, distributed information system development with poor communication and lack of clear requirements are unable to win the satisfaction of clients and users therefore developed system face. Since user involvement is an important predicate of information system development. The IT industry must optimize increased user participation in system development phases. To maintain system performance, consistent service quality and a smooth experience are essential. Organizations should place an emphasis on providing exclusive services that result in efficient performance and the intended results for their potential users. AS project management Procedures and project results were discovered to be very significant in the case of information system development. IT industries use project plans to develop a baseline for monitoring and evaluating IT projects in terms of project management scope, schedule, and budget. This firm strategy, procedures, and managerial performance, all of which have a direct impact on performance of system in distributed development. The Project Management Institute (PMI) has created a comprehensive project management capability, as well as other software for coordination and teamwork such as Clickup, Trello, MS Office, Primavera P6, and numerous other applications. According to Besner and Hobbs (2006), every project is unique and necessitates a distinct attention to detail when it comes to project formation. Project planning, implementation, monitoring and controlling, and closing are all important aspects of all initiatives.

Practical Implications

In the IT industry, information system developers, practitioners, and managers can benefit from the detailed description and requirements obtained through the application of capabilities on distributed system development. If users are involved, the system will provide better and desired results for the users, requirements will be clearly defined, and there will be no fragmented requirements. After the applying of process rigor, a detailed document will be created that includes individual roles and responsibilities, methods, measurement, and activities that can be used for system development. Process agility will give a path way to cope up with uncertainty, rapidly changing requirements, and developer can come up with small completed modules of project which leads to better system performance and success. Finally, by implementing defined standards and best practices, practitioners can achieve quality outcomes, efficiency, and predictable timelines.

Limitations Future Recommendations

This study was conducted in a cross-sectional manner. Future studies can be conducted over a longer time horizon, allowing the development team to analyze the impact of all studied capabilities on the overall development cycle in the context of different time frames and long-term information system development projects. On other hand it is compulsory for development team to balance these capabilities at the time of application. Future research can be conducted on the complexity and balancing of process capabilities in order to achieve a higher level of system performance in the dispersed development within Pakistan in longitudinal data settings.

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Preliminary appendix

Respondents are welcomed to take part in a study titled "Impact of Process Capabilities on System Performance in Distributed Information System Development: The Moderating Role of User Involvement." Nabeel Sattar and his research committee from the Department of School of Professional Advancement at the University of Management and Technology are conducting this study. Respondents will be requested to complete an online questionnaire as part of this study. Your participation in this survey is entirely voluntary, and you have the right to withdraw at any stage. The survey should take no more than 4 to 5 minutes to complete. There have been no consequences involved in taking part in this research. The questionnaire does not collect any identifiable information from respondents. The completed questionnaires will all be recorded anonymously. Whereas there will be no direct advantages to your participation, the data gathered in this research may aid the information technology occupation in the future. Please contact Nabeel Sattar or his supervisor, Dr. Warda Gul, if you have any queries about the questionnaire or this research project overall. Besides submitting the required survey, you indicate your willingness to participate in the study. Your participation is greatly valued.

Process rigor

1) System requirements were documented in detail

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2) Project team responsibilities were clearly defined and communicated

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3) Project team created a detailed project plan

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4) Project team used formal software development process

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

(Jalote 2000) and (Ahern et al. 2008)

Process agility

1) Project team was able to sense user requirements changes effectively

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2) Project team was able to strategize its response to user requirements changes effectively

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4) Project team was able to make effective decisions to cope with user requirements changes

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5) Project team was able to incorporate user requirements changes into the system effectively

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Lee and Xia (2005).

Process standardization

1) Common project management practices were used consistently across sites

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2) Common project planning methods/techniques were used consistently across sites

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3) Common communication methods/technologies were used consistently across sites

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4) Common project performance review methods/processes were used consistently across sites

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

(Lee et al, 2010)

Process agility

1) Project team was able to sense user requirements changes effectively

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2) Project team was able to strategize its response to user requirements changes effectively

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3) Project team was able to make effective decisions to cope with user requirements changes

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4) Project team was able to incorporate user requirements changes into the system effectively

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

(Lee et al, 2010)

System Performance

1) The system had many defects

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2) The system met technical requirements/specifications

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3) The system was a success

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

(Lee et al, 2010)

University of Management and Technology, Lahore

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