**Understanding the Communication and Collaboration Challenges Encountered by Technology Managers**

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**Abstract**

The purpose of this article is to enhance our understanding of the communication and collaboration challenges encountered by technology managers in their efforts towards efficient knowledge management, eradication of ‘Shadow IT’, and achieving improved rates of project success. The method employed in the research study involved qualitative analysis according to a deductive-inductive approach. This involved semi-structured interviews of practitioners engaged in knowledge management from different industrial sectors. The research identified both primary and secondary factors impacting effective collaboration and communication. The primary factors are culture conflict, visibility, demand resource balance, change management, effective leadership and motivation. The secondary factors are management training, occupational culture differences, aspire to change, autonomy, individualism, communication strategy, competence, lack of common goals, incentive and relatedness.

**Keywords**

Communication and Collaboration, Knowledge Management, Information Technology (IT), Shadow IT, Project Success.

1. Introduction

In order to remain competitive industrial companies need to adopt new technologies and the scale and pace of technology acquisition and integration continues to provide significant challenges (Philbin, 2008; Comin, 2016). Alongside technology adoption, there can also be a need for the development of new business models and customer engagement strategies and this is especially the case now that we are in a data-driven environment impacted by the rapid evolution of big data technologies (Raguseo, 2018). Moreover, companies are able to leverage the emerging benefits afforded by adopting technologies related to distributed and autonomous systems as part of the wider paradigm associated with Industry 4.0 (Frank et al., 2019). However, in order to utilize such rapid technological advancements, organizations need to constantly react and adapt to compete in the market. Consequently, this phenomenon is one the key reasons for firms to rollout large-scale integration programmes, for example, involving adoption of virtual technologies as part of the corporate enterprise system (Klochko and Brizhak, 2017). Industrial companies are also pursuing distributed business models, such as through open collaborative networks (Appio et al., 2018). In this context, technology managers face a number of challenges owing to the constant requirements for upgrade-project rollouts, legacy systems management, ensuring effective knowledge management, and coping with demand and supply imbalance (Agarwal and Ferratt, 2002). As we move further towards big data applications and corresponding data-driven business models (Vergilio et al., 2020), technology managers face additional challenges through attempting to become more data and information competent in order to create value (Vidgen et al., (2017).

There is also the need to manage large numbers of outsourced professionals and meet the expectations of service from all the other functions in the organization. In this context, technology-driven organizations need to have access to effective knowledge management systems in order to remain competitive (Wang and Wang, 2016). Indeed, studies from the literature have highlighted the importance of timely and effective collaboration and communication initiatives in order to mitigate risks arising from inefficient knowledge management (Wang et al., 2017). There is also a need to address the increased level of project failures (Gupta et al., 2019) and the prevalence of so called ‘Shadow IT’ (Huber et al., 2017)that negatively impacts the overall performance of organizations. Additionally, recent research has emphasized that even though there are specific skill-sets required for each level of an IT professional’s career (i.e. new hires, mid-managers and chief information officer), collaboration and communication skills remain crucial to all those levels (Kappelman et al., 2016).

The aim of this research is to advance our understanding of the challenges and opportunities for communication and collaboration as part of effective knowledge management, which are encountered by mid-level technology managers in their effort to address the aforementioned issues. The focus of this research study is on mid-level technology managers in largeorganizations (i.e. below the C-suit), where knowledge embodiment, dissemination and integration are more contingent on people-based interactions, e.g. through informal discussion groups, forums or workshops.

This article is organized as follows. After the introduction, the literature review focuses on building themes and a theoretical background from existing theories and identifies the areas where empirical data can add further insights into understanding the challenges for technology managers from different perspectives. This is followed by the methods section, which explains how the data have been collected and coded. The results and analysis section describes the grouping of the data into themes and sub-themes. This is followed by conclusions that include the limitations of the research as well as future work.

1. **Literature review and theoretical background**

The first part of the literature review focuses on three key issues (namely inefficient knowledge management, the rise of Shadow IT, and low levels of project success) that occur in technology-driven organizations due to the lack of collaborative and communicative efforts among IT and other functions. The second part analyzes the prior literature to identify the causes of effective collaborative efforts. Figure 1 provides a schematic view of the literature review strategy highlighting the connection between the four main areas of the literature that have been reviewed.



Figure 1: Literature review strategy.

**2.1 Inefficient knowledge management**

Knowledge has been defined as “*a fluid mix of framed experience, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information*” (Davenport and Prusak, 1998). It is generally created by individual organizational units and unless shared and documented, its codifiability, observability and embeddedness lies only within those units (Barki and Pinsonneault, 2005). This un-networked knowledge therefore brings little benefit to an organization and ideally it should be shared and channeled through relevant relationships (Subramaniam and Youndt, 2005). This leads to the definition of knowledge management, which can be viewed as the process of identifying, understanding, capturing, sharing and leveraging knowledge (Davenport and Prusak, 1998).

Effective knowledge management increases intellectual capital and enhances organizational performance, and is one of the key intangible sources of competitive advantage (Von Krogh et al., 2000), whereby data-driven decision-making becomes the norm. Indeed, as we now see massive levels of data generated by organizations, there has been a proliferation of new approaches and models to enable effective knowledge management (Mittal and Kumar, 2019).

Moreover, research studies have identified that intellectual capital can have a significant impact on knowledge management as part of the innovation process (Obeidat et al., 2017). On average, data-driven decision-makers are 5% more productive and 6% more profitable than their competitors (McAfee and Brynjolfsson, 2012). It is therefore apparent that because of the inherent nature of the knowledge management process, information technology plays a key role in building knowledge repositories and ensuring the effectiveness of knowledge management initiatives, which is why 70% of the knowledge management literature up until 1998 had IT as the key thematic area of interest (Hislop, 2005). However, technology has evolved at an increasingly fast rate, for example, solid-state storage technology is finding increasing adoption in enterprise and data center environments due to both the high level of reliability as well as a reduction in the technology cost base (Sarkar and Peterson, 2019). Furthermore, the role of ‘people’ or social factors have secured attention in the literature associated with knowledge management (van Dijk, 2016). This includes studies on the influence of social capital on knowledge management maturity of nonprofit organizations (Miković at al., 2019) and research on the relationship between knowledge management and social capital with organizational health in educational hospitals (Aryankhesal et al., 2020). Furthermore, research studies have highlighted that ineffective collaboration and communication among employees can be a key impediment to knowledge management initiatives in organizations (Edwards et al., 2005) and a potential solution to this situation is the adoption of social media technologies to facilitate improved communication and joint working (Nisar et al., 2019). The literature that has been reviewed in the area of inefficient knowledge management has allowed the following research proposition to be synthesized. *Proposition (1)*: A lack of collaborative and communicative efforts among IT and other functions leads to inefficient knowledge management.

**2.2 Rise of Shadow IT**

A lack of effective collaboration and communication not only affects knowledge management, it can give rise to so called ‘Shadow IT’ (Fürstenau et al., 2020), which is a topic that has been a concern among academic and practitioners alike (Sillic, 2019). Shadow IT represents hardware, software, or any other solutions used by employees inside the organizational central infrastructure, which have not received any formal approval from the central IT department (Behrens, 2009; Györy et al., 2012; Silic and Back, 2014). This practice (Walters, 2013) introduces risks, challenges and expenses arising from compliance issues, duplication of efforts, inconsistent business logic, data protection breaches and reputational damage.

Despite such concerns, Gartner’s 2012 projection showed that 35% of organizations’ IT expenditure would still take place outside the corporate IT budget (Gartner, 2012), due to cloud based collaborative and analytical tools adopted by users (King, 2012) unless immediate mitigation efforts were adopted. Trying to better understand the practice, Silic and Back (2014) concluded that users extensively adopted Shadow IT software, e.g. organizational-social-media (OSM) tools to enhance collaboration and communication facilities, but were not aware of the risk factors discussed above, which are inevitable in the long run. Even from a more historical technology perspective, further misunderstanding among teams can potentially be introduced through OSM if quick text messaging is employed to exchange key messages as non-verbal signals, i.e. tone-of-voice (38%) and body-language (55%), have a higher impact than words (7%) (Mehrabian, 1981). This emphasizes the need for effective communication and collaboration among business units, where all parties are well aware of the challenges incurred by Shadow IT. For instance, where adoption of Shadow IT based knowledge management systems result in challenges for cross-unit knowledge sharing due to the covert nature of the Shadow IT system (Klotz et al., 2019).

Enforcing restrictive policies can be considered as a countermeasure for Shadow IT but will not necessarily be a sustainable solution to this problem (Silic and Back, 2014). Consequently, technology-driven organizations today need to find an improved way to secure alignment with the evolution of technological advancements that supports operational optimization and competitiveness (Walters, 2013). Recent studies have highlighted that there is a rising plethora of research on both Shadow IT and business-managed IT, but such studies are largely based on existing reference theories and consequently there is a need for enhanced theorizing in the area of Shadow IT and business-managed IT (Klotz, 2019). The literature that has been reviewed in the area of Shadow IT has allowed the following research proposition to be synthesized.

*Proposition (2)*: A lack of collaborative and communicative efforts among IT and other functions can facilitate circumstances leading to adoption of Shadow IT.

**2.3 Low levels of project success**

The rate of project failure (or lack of success) can be another indication of ineffective collaboration and communication in projects (Antony and Gupta, 2019). The purpose of any project is to convert organizations from the current state to the desired or improved one (Rezvani and Khosravi, 2019). Therefore, if such endeavors fail to realize the desired project outcomes, it will in some way hinder or compromise the overall performance and productivity of organizations. However, according to the Standish Group’s survey (1994), only 16.2% of IT projects deliver on time and within budget. While this figure was later challenged by Glass (2006), recent survey data still paints a gloomy picture; unfortunately, 45% of all large IT projects (with an initial budget exceeding USD $15 million) experience budget overruns, 7% run overtime, and deliver 56% less value than envisaged (Bloch et al., 2012). Various approaches have been explored in order to help improve project success, such as the adoption of a broader (i.e. systemic) perspective of project outcomes (Shenhar and Dvir, 2007) as well as the development of a diagnostic framework and health check tool for engineering and technology project (Philbin and Kennedy, 2014).

In their venture to identify the key risks for such devastating failures, researchers (Keil et al., 2002) adopted the Delphi-method (namely multi-pass group decision-making) to rank the risks according to impact on project failure through a group of participants. The most highly ranked risk perceived by IT project managers was identified as the ‘lack of management commitment to the project’, which can be argued as the consequence of the lack of collaboration between project stakeholders. The second highest ranked risk was ‘misunderstanding of user requirements’, which can be viewed as an outcome of ineffective communication. Further complications were identified where users’ rankings were very different to those stated by technology project managers. Such conflicting perceptions can potentially create dramatic alignment and integration issues when technology projects are underway. Perception is salient here as research studies have posited that during IT project implementation, staff members who are usually profiled as facilitators of such endeavors may acquire a so called ‘nemesis-type’ profile if it is perceived that their situational IT needs are not fulfilled by the proposed solution. This arrangement can jeopardize the implementation of strategic IT in organizations (Walsh, 2013) and lead to further organizational misalignment during performance enhancement efforts.

Recent studies based on a systematic literature review of failed projects has identified the need for more research on project failure predictions under dynamic scenarios (Gupta et al., 2019). The researchers also found that less effort has been directed towards analyzing both the similarities and differences associated with project monitoring and performance assessment approaches under diverse scenarios (e.g. process improvement, R&D, etc.). Furthermore, we can consider a specific case of project failure, which is the implementation of electronic health records (EHRs) by healthcare organizations as a potential service solution (Ebad, 2020). In this case the researchers identified that the factors influencing project failure can be divergent in nature and include both technical and managerial issues. Studies have highlighted how project management success can be positively impacted by the level of collaboration and corresponding trust between project team members (Bond-Barnard et al., 2018). Other researchers have identified how most of the success factors for projects related to global software development are associated with the human resource knowledge area (Niazi et al., 2016). The literature that has been reviewed in the area of low levels of project success has allowed the following research proposition to be synthesized.

*Proposition (3)*: A lack of collaborative and communicative efforts among IT and other functions can lead to low levels of project success.

**2.4 Possible causes of lower quality collaboration and communication**

The next part analyzes prior literature to identify the causes of effective collaborative efforts, namely culture, motivation and leadership style. Culture shapes behavior and can provide structure to one’s perception of the world (Alder, 1997); it is the ‘collective programing of the mind’ (Hofstede, 1980) that causes disjoint in people’s values and norms in nations, organizations or even in sub-groups (e.g. occupational culture). In this regard, communication efforts between IT professionals and other business functional managers can be affected due to the occupational culture differences between the parties (Jacks and Palvia, 2013) and regardless of the type of their role, IT professionals have a common set of attributes that define their cultural dimensions. Indeed, there is an ongoing need to understand the linkages between an organization’s leadership, structure, culture and behaviors and how these artefacts can influence the firm's knowledge management architecture (Mansouri et al., 2018). In related studies, it has been found that while technology infrastructure can be an important aspect of any knowledge management initiative, an effective integration of knowledge into management decisions and corresponding practices ultimately relies on the extent to which the organizational culture supports or hinders the key knowledge processes (Intezari et al., 2017).

 The other possibility of hindrance for IT managers may arise from a different cultural dimension, indeed Hofstede’s (1980) individualism/collectivism dimension shows that different countries can have differing cultural orientations. Therefore, working across these different cultural orientations can present further collaboration challenges for international technology projects and corresponding teams.

Motivation, a well-researched subject area in organizational behavior, is a key requirement to perform well in one’s job and can be related to the nature of the organizational culture (Fernandes, 2018). However, from the discussions above it is apparent that IT professionals are potentially more likely to have deficiencies in some of the crucial components of self-determination theory (SDT) when building relations with other business functions. Work on SDT by Gagne and Deci (2005) encapsulates the elements of so called need theories (Maslow, 1943; Alderfer, 1972) and proposes that employee engagement, well-being and long-term commitments are achieved through fulfilling three psychological needs. Here the goal is to drive the employees through the continuum of ‘absence of motivation’ towards the state of ‘intrinsic motivation’, where employees engage for the rewards inherent in the job itself.

The first requirement of SDT is to ensure employee competence**.** However, the deficit in effective collaboration and communication skills among IT professionals is observable throughout the discussions above. Autonomy, is the second requirement of SDT and IT occupational culture demands autonomy through the ‘control’ dimensions (Jack and Palvia, 2013), but it is crucial to gather information on the level of autonomy of control currently given to mid-level IT managers. The third requirement of SDT is relatedness, which promotes the sense of belonging. Moreover, Grant (2008) showed that often employees are isolated from information about how their efforts make a difference in their organization. Therefore, one can argue that in the absence of a collaborative environment, where strong communication links are not the norm, IT professionals’ relatedness will suffer severely. This can leave such professionals with little reason to proactively contribute towards improving organizational performance through effective knowledge management, eradicating Shadow IT and improving the likelihood of project success.

While motivation can be viewed as a catalyst to improve the probability of IT professionals’ involvement in productive relationships with other business functions, there are other important tools to consider in terms of the internal organization, e.g. existence of effective incentive systems. As posited by Gerstner (2002): “*People don’t do what you expect but what you inspect”.* Hence incentivizing collaborative efforts and knowledge sharing should be prioritized and not just individuals’ sole achievements.

The theory of transformational leadership (Bass, 1985) highlights that promising attributes can intrinsically motivate technology managers through mechanisms such as goal-setting, intellectual stimulation, individualized considerations and appropriate incentives. Moreover, all the dimensions discussed here can be encapsulated in Markides’ model (1999), in that four key environmental elements, namely culture, people, structure and incentive systems, work together to influence and drive human behavior by 70% (Ross, 2011). Leaders can therefore leverage each element optimally and adapt ideal management styles through taking account of the situational context (McClelland and Burnham, 2003) of task, relations and environment (Northhouse, 2007) in order to obtain the expected outcome. Furthermore, studies have highlighted how project managers' transformational leadership can also help to drive project success and improved project outcomes (Aga et al., 2016).

According to Goleman’s (2000) work, four leadership styles were identified that have a significant impact on organizational climate and performance. Authoritative style charts a new course to a long-term vision; affiliative style builds emotional bonds; democratic style forges consensus through participation; and coaching style develops people for future. Consequently, effective leaders are able to transition fluidly from one style to the other based on the context and requirements.

It can be further observed from the aforementioned discussions that in this technological age ‘data driven organizations’ are required to respond to emerging opportunities through leveraging innovation and developing new business models (Hartmann et al., 2016; Shamim et al., 2019). This leads to the need to produce measurable performance improvements and deploy effective knowledge management as a vital means to acquire improved integration through effective cross-foundational collaboration and communication. The literature review that has been conducted in this research study has identified that there is a gap in the literature in regard to understanding how the lack of collaborative and communicative efforts among IT and other functions can impact the challenges for technology managers in large organizations – this includes inefficient knowledge management, the rise of Shadow IT, and low levels of project success.Therefore, the primary goal of this research is to add value to the literature by advancing our understanding of the views and opinions of technology managers on the key challenges and opportunities they may encounter in their efforts to contribute towards improved knowledge management, thereby keeping Shadow IT at bay and increasing the project success rate. It is suggested that technology-driven organizations utilize this knowledge to recruit, develop and retain strategic IT managers who are able to focus on proactively building social capital and technical performance while improving organizational effectiveness.

The literature that has been reviewed in the area of possible causes of lower quality collaboration and communication has allowed the following research proposition to be synthesized.

*Proposition (4)*: The possible causes of lower quality collaboration and communication can be attributed to a broad range of factors that exert influence in a systemic manner.

1. **Methods**

**3.1 Research methodology**

The overall methodology adopted in this research study is summarized in Figure 2.



Figure 2: Research methodology including main stages.

Stage 1 was the formulation of the objectives for the research study and this resulted in the decision to focus the research towards identifying the challenges in cross-functionalcollaboration and communication encountered by technology managers in large organizations. This was followed by the literature review (Stage 2), which was undertaken in order to provide a framework for subsequent analysis and as the basis for the questions to be asked in the interview stage. Stage 3 involved the semi-structured interviews that were carried out through a series of open-ended questions. Stage 4 was the deductive analysis of the data from the interviews, where specific insights were synthesized from the general material based on the frequency of responses from the interview participants. This was followed by Stage 5, which was the inductive analysis, where broader generalizations were synthesized from the specific points based on the frequency of responses from the interview participants. Finally Stage 6 involved further consideration of the experimental findings through discussion and conclusions.

**3.2 Research procedures**

Data was collected from 19 interviewees (*N* = 19) from different industrial sectors working for large organizations. Interviewees were contacted through networks of the lead researcher but they self-selected to participate in the study after considering the research overview. The researcher was particularly interested in speaking to employees from large organizations since collaboration and communication challenges can be more probable in such configurations due to the sheer size of the organization. In these settings, numerous projects tend to operate simultaneously in a distributed manner in an effort to upgrade existing business processes and systems or introduce new capabilities. The projects often require effective technological support and assistance from IT managers in order to improve organizational performance.

The NVivo software system was used to support and organize the empirical analysis and the data management process. This approach provided transparency in terms of the coding and subsequent analysis. The analysis was based on a qualitative method composed of two parts (Stages 4 and 5), with the first being deductive and the second being inductive. The literature review provided a framework for analysis, thereby allowing the quotations from interviewees to be grouped into empirically derived themes. Additionally, new themes and further dimensions of existing themes arose during the data coding phase allowing deeper insights to be elucidated.

The average length of the semi-structured interviews was approximately 60 minutes, where the participants were asked open-ended questions on the challenges of cross-functional (IT and other functions) collaboration and communication initiatives that have the capacity to impact on knowledge management, Shadow IT practice and project lifecycles. This allowed the data collector to capture views and opinions from different dimensions and perspectives. While the participants had the freedom to cover many areas, the researcher provided probes and loose guidance to ensure the scope of the discussions were still related to the research questions and the themes, while allowing additional details to surface. The participants were asked about their experience of a successful project and an unsuccessful project but not all participants had examples of both and some preferred amalgamating their overall experiences into a single unit of description.

**3.3 Descriptive statistics**

There were 19 participants in the research study (*N* = 19) and Table 2 provides a summary of the data subject statistics. The sample included 8 IT professionals (42%), 8 business professionals (42%), and 3 professionals who worked in both functions (16%). The gender breakdown of the sample was 4 female participants (21%) and 15 male participants (79%), and the sector breakdown was 9 private sector participants (47%) and 10 public sector participants (53%). Table 2 provides further details on these breakdowns according to the IT, business, and both sub-areas.

|  |  |  |
| --- | --- | --- |
| *Characteristics* | *Gender* | *Sector* |
| **Background** | **No.** | **Female** | **Male** | **Private** | **Public** |
| IT | 8 | 1 | 7 | 1 | 7 |
| Business | 8 | 3 | 5 | 6 | 2 |
| Both | 3 | 0 | 3 | 2 | 1 |

Table 2: Data subject statistics.

1. **Results and analysis**

**4.1 Structure of this section**

This section has been structured according to the two main empirical stages, which were based on deductive analysis followed by inductive analysis. The deductive-inductive approach employed in this study builds on existing applications of this qualitative methodology described in the literature, for example, by Fereday and Muir-Cochrane (2006), and Pope et al. (2000). The deductive-inductive methodology allows the raw data from the interviews to be codified and categorized, while capturing contextual and inter-related data and information. Consequently, deeper insights are possible leading to advancement of the state of the art in this field of management research.

**4.2 Deductive analysis**

The deductive analysis identified a series of primary factors that impact effective collaboration and communication across organizations and these factors were codified as part of the qualitative analysis process and subsequently the frequency of occurrence of the factors from the interview transcripts was recorded. The primary factors are as follows: culture conflict (*f* = 15), demand resource balance (*f* = 24), effective leadership (*f* = 45) and motivation (*f* = 59). Figure 3 depicts the primary factors (moving from left to right according to an increasing frequency number).

The analysis also identified secondary factors, which are sub-areas of the aforementioned primary factors. These secondary factors were also codified as part of the qualitative analysis process and subsequently the frequency of occurrence of the factors from the interview transcripts was recorded. The secondary factors are as follows: occupational culture differences (*f* = 6), autonomy (*f* = 8), individualism (*f* = 9), competence *(f* = 19), lack of common goals (*f* = 19), incentive (*f* = 26) and relatedness (*f* = 32). Figure 3 also depicts the secondary factors.



Figure 3: Themes and factors identified from deductive analysis.

Culture conflict

The data analysis revealed a significant level of comments from the participants in regard to culture conflict impacting on collaboration and communication (*f* = 15). The national cultural aspect of individualism (*f* = 9) was observed a number of times, which demonstrates the attitude towards knowledge sharing and collaborative working. Participants stated responses such as the following: “*It is a competitive environment and one has to promote oneself and prove that they have better capabilities than others…knowledge is power and sharing is not particularly rewarded and sharing will make one less critical in the organization*” as well as “*what’s in it for me?*”.

A number of references to occupational culture differences (*f* = 6) confirmed the existence of occupational culture conflict. Comments included the following examples: “*The business world wants things done faster but IT wants to make sure things work properly... IT's priority is to ensure the best quality of the solution that can be supported and maintained in the long run. Indeed, businesses may not understand or appreciate such aspects of IT*”. Another IT manager reflected on the need for standardization (i.e. an IT occupational culture attribute) and said the following: “*New independent solutions* (i.e. Shadow IT)*; I imagine are not linked to central active directory, and will not talk to other systems we have. Standardization and inconsistencies will be a common issue here*”. Interviewees from a technology management background also spoke about not being supported, and not having transparent communication with senior managers, which is not appreciated in the IT occupational culture: “*Staff-members are not recognized for their work toward the organization, valued or even protected or supported*”, and “*Selective reporting is another issue in communication, not everything is communicated to mid managers*.” Conversely some interviewees from the private sector noticed resistance from IT managers when it came to change requests: “*The initial response usually is not positive and they come up with reasons or excuses for not doing the project and push back our requirements*”.

Demand resource balance

A number of interviewees highlighted an imbalance in demand and resources (*f* = 24). On the topic of demand, interviewees mentioned that they “*have too many competing demands on their time. Naturally, IT departments are simultaneously supporting various implementations. If they are delivering too many then that’s a challenge*”. On the topic of resource availability, interviewees acknowledged that, “*It is important to save money from every possible dimension due to budget cuts and IT is no exception*” but they also pointed out that “*because of a lack of funding, staff have been given inadequate resources e.g. old laptops, old versions of software, which creates inefficiencies and there is always more to do but very limited resources available*”. One interviewee explained that “*IT is slow in delivering projects because a lot of time is spent on managing backdated systems but business requirements keeps on growing and our budget is being cut every year*”. Another interviewee stated that for them, the IT budget is “*only 2.5-3%*” but they needed at least “*2-3 times more*” to manage the demand level. On budget allocations, an interviewee suggested to reflect on long-term goals when allocating funding, not just short-term ones by saying “*if you considered the total costs in terms of the reduced efficiency in longer-terms …it potentially has bigger cost impacts anyway*”.

Effective leadership

The importance of effective leadership (*f* = 45) in collaboration and communication effort toward all three areas in question (i.e. knowledge management, Shadow IT and project success), occurred frequently in the interview narrations. Interviewees said that “*collaboration encouragement should come from the top of the organization, which is not happening right now*”.

There were a number of interviewees who expressed views and opinions on the incentive system (*f* = 26) that supports collaboration or communication. Interviewees found individual rewards necessary, such as “*In this economic climate people tend to market their own brand, they are rewarded for the final deliverables not for their efforts for effective collaboration of communications*” on the other hand, the issue in the public sector appeared to be that “*there is a pay gap compared to the private sector in top level IT or leadership roles which create a shortage of talented individuals at the strategic level who recognize the need to improve organizational performance*”. However, it was pointed out that “*no process in place that needs people to share information and there is no advantage in doing so either. Collaborations outside the organization is appreciated though as it brings recognition*”.

Highlighting the importance of incentivizing collaborative efforts, interviewees acknowledged that “*Incentives should be on the amount of time spent on engagement sessions with non-IT functional members and information sharing etc.*”, and “*the other way would be that if you share you get to keep your job that would be a ruthless way to see this though, if there are issues around knowledge sharing through collaboration then having knowledge sharing as of the key KPIs can be helpful*”.

Several interviewees commented on the lack of clear or common goals (*f* = 19) when working together. Moreover, interview questions consistently indicated narratives such as “*Sometimes functions have a lack of common understanding of the organizational goal and this creates challenges*”. One interviewee argued that “*without the business and its operations there would be no need for IT*”. Yet in many cases “*IT moves on to bigger and better solutions, looking 5 years ahead of time but then they don’t have resources to support our current systems!*”. Whereas, IT managers argued that “*business only worries about their own problems and short-term needs and are less interested to have an organizational wide knowledge based system*”. Another interviewee added that it is particularly difficult when “*sometimes departments don’t really know what their short-term requirements or long-term goals are*”.

Motivation

The data analysis revealed a significant level of comments from the participants in regard to the IT managers’ motivation to collaborate and communicate across functions (*f* = 59). According to the data, several IT managers recognized that their own and team members’ competence (*f* = 19) in communication, collaboration and business knowledge needed to be improved further in order to work more closely with other business functions. Interviewees pointed out that “*IT professionals are not naturally talented communicators but surely there are exceptions*”. However, a senior business manager argued that: “*It could very well be a self-fulfilling prophecy. If your expectation of IT people is that they have poor communication skills, then you would end up subconsciously designing initiatives where they simply don’t get the opportunity to communicate or collaborate*”. This highlights the need for IT workers to be given the opportunity to develop their communication skills and this can be supported for instance through progression into project management roles, which would provide the opportunity for such development.

From the perspective of autonomy (*f* = 8), mid-level technology managers’ limitations on autonomy was, for example, expressed by the following statement: “*Top executives decide what or how they want to run their function and mid-level managers convey that message to the operations level, they don’t make decisions*”.

Relatedness (*f* = 32)is the last psychological requirement of SDT. Data shows that in their efforts to build good collaborative relationships during project developments both IT and business professionals frequently encountered a ‘lack of common language’. This is noticeable from the quotes from business managers such as, “*I feel that we are not speaking the same language when dealing with IT team*” and “*IT team are very technical and you would need to know the right technical terminology to communicate with the department and I have found that the language could be a barrier*”. Conversely, technology managers say that “*It sometimes is difficult to understand business terminologies, especially when they differ from one department to the other and they expect IT to understand their jargons by default*”.

**4.3 Inductive analysis**

The inductive analysis (see Figure 4) identified a series of primary factors that impact effective collaboration and communication across organizations and these are as follows: visibility (*f* = 18), and change management (*f* = 25). The analysis also identified secondary factors, or sub-areas, which are as follows: Management training (*f* = 5), aspire to change (*f* = 6), and leaders’ communication strategy (*f* = 14).



Figure 4: Themes and factors identified from inductive analysis.

Visibility

A number of interviewees commented on the lack of visibility (*f* = 18). Some narratives recurred frequently during the interview process, highlighting the lack of visibility among functions regarding organization structure, ongoing projects, people’s expertise, and processes. In this regard, a business manager remarked the following: “*In our global organization, we find it difficult to understand who is the right person to start the conversation with about the problem we have. This is a generic problem which extends beyond IT*”. Also an IT manager said: “*sometimes I do know who to go to if I have worked with them before, but it does take time if I haven't and there are issues which could delay finding the right contacts for IT-projects in large organizations*”. These statements clearly identify a need for improved visibility.

Change management

The importance of managing change in the context of effective collaboration and communication was identified a number of times (*f* = 25). On this matter, a lack of management training (*f* = 5) was noted by some interviewees, for instance the following was remarked by one participant: “*Senior managers are mostly IT professionals not trained in management and therefore mid-managers and their subordinates do not get proper guidance, direction and motivation from their line managers*.” It should be noted that management training can also have broader implications beyond change management. In regard to an aspiration to change (*f* = 6), one interviewee stated: “*New staff-members are focused and motivated to solve a problem when they join however, the working culture dominated by few protected individuals always block their way and put a barrier to any changes and eventually demotivates the new comers*”.

A number of interviewees commented on the need for an effective communication strategy (*f* = 14). A lack of communication on existing project development was noticeable from statements such as, “*IT don’t communicate about their projects…We have developed or procured technology but no one uses it as they didn’t know that IT have such solutions*” and “*In IT we need to thinks about what type of communication is suitable for which situations, we never do that in our department but it is important to do it*”. Although an IT manager also argued that attempts are made but “*Most of the departments are busy with their day-job and an additional email from IT about new products and benefits are always low in their priority list so that email doesn’t get noticed*”.

Some interviewees experienced the introduction of a strategic bridging layer between IT and non-IT functions that aimed to facilitate improved collaboration and communication: “*We have introduced digital partners, a middle layer who spoke to people to find out about their long-term goals and conveyed the message back to IT*”.

**4.4 Summary of frequencies**

Figures 5 and 6 provide bar chart summaries of the frequencies (*f*) of issues identified from the deductive and inductive analysis stages and they are grouped according to being primary and secondary factors respectively. The primary factors in Figure 5 are as follows: culture conflict (*f* = 15), visibility (*f* = 18), demand resource balance (*f* = 24), change management (*f* = 25), effective leadership (*f* = 45) and motivation (*f* = 59). The secondary factors in Figure 6 are as follows: management training (*f* = 5), occupational culture differences (*f* = 6), aspire to change (*f* = 6), autonomy (*f* = 8), individualism (*f* = 9), communication strategy (*f* = 14), competence (*f* = 19), lack of common goals (*f* = 19), incentive (*f* = 26) and relatedness (*f* = 32).



Figure 5: Frequency of primary factors identified from qualitative analysis.



Figure 6: Frequency of secondary factors identified from qualitative analysis.

1. **Conclusions**

The research study involved qualitative analysis supported by frequency analysis (quantitative) and this allowed evidence to be assembled in order to evaluate the propositions synthesized from the literature review as follows:

* *Proposition (1)*: A lack of collaborative and communicative efforts among IT and other functions leads to inefficient knowledge management. This proposition was supported.
* *Proposition (2)*: A lack of collaborative and communicative efforts among IT and other functions can facilitate circumstances leading to adoption of Shadow IT. This proposition was supported.
* *Proposition (3)*: A lack of collaborative and communicative efforts among IT and other functions can lead to low levels of project success. This proposition was partially supported but only via inference from interviewee findings.
* *Proposition (4)*: The possible causes of lower quality collaboration and communication can be attributed to a broad range of factors that exert influence in a systemic manner. This proposition was supported.

This research study has revealed that in the modern high-tech era, technical managers in diverse sectors aspire to build effective collaboration and communication in complex organizations in order to manage knowledge efficiently, improve project success rates and where necessary eradicate Shadow IT. However, our research has identified that technology managers encounter significant challenges in collaboration and communication as part of effective knowledge management from many dimensions, e.g. lack of motivation, demand-resource imbalance, limitation on cross-functional visibility and leaders’ ability to set common goals as well as incentivize effective collaboration and communication. The study has revealed that there are a range of interconnected factors, which have varying capacities to impact the effectiveness and efficiency of collaboration and communication as part of the knowledge management process in technology-driven organizations. Adoption of a deductive-inductive research methodology identified both primary and secondary factors. The primary factors impacting effective collaboration and communication are culture conflict, visibility, demand resource balance, change management, effective leadership and motivation. The secondary factors are management training, occupational culture differences, aspire to change, autonomy, individualism, communication strategy, competence, lack of common goals, incentive and relatedness.

These factors that impact knowledge management are interconnected and systemic in nature. Implicit to this frame of analysis is the need for technology organizations and the individuals working in such organizations to be cognizant of how these factors can manifest in technology projects and the processes that require implementation to support effective knowledge management. Awareness and recognition of these systemic factors is the first step to improving the performance of large and often complex knowledge-driven global organizations and thereby supporting effective knowledge management processes, with further steps required to harness positive factors (i.e. increasing areas such as motivation, change management and leadership competencies) and mitigate the negative factors (i.e. decreasing the effects of occupational culture differences and minimizing the impact of a lack of common goals).

In regard to limitations of this research study, while empirical data provided deep insights on the views and opinions of the participants, additional sources of data (e.g. observation of communication strategy and other related documents) would have been helpful to understand the dimensions of this topic better. Therefore, future research is suggested that incorporates additional sources of data in order to triangulate the research findings. In terms of specific areas of future research, the above recommended aspects are proposed as part of a multi-organizational research study based on a mixed method. Such a study would provide deeper insights into the collaboration and communication challenges for technology managers in complex organizations.

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