

Inhibitors to the transfer of knowledge generated on projects: a case study within a construction company

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Abstract

Several studies indicate the value of knowledge management in improving organisational performance. While the benefits of effective knowledge management are undeniable, literature suggests that, due to the temporary nature of project teams, knowledge is generally not managed efficiently by project-based organisations.

This article explores the main inhibitors to effective knowledge transfer in a South African construction company. Implementation of knowledge management systems was lacking, but corporate culture and human factors had the greatest effect on knowledge transfer, and hence on project performance. In addition to inhibitors of knowledge transfer mentioned in literature, some additional inhibitors were identified and the effect that lack of knowledge transfer investigated.

Key phrases

construction projects; corporate culture; inhibitors; knowledge management; project performance

1. INTRODUCTION

The increasing number of competitive forces in the global market of the twentieth century is forcing organisations to continually look for ways to improve performance and efficiency (Yang, Chen & Wang 2012:182). Organisational knowledge can ensure a sustainable competitive advantage by improving organisational effectiveness, by accelerating innovation, and by reducing cycle time (Wang & Noe 2010:115).

Andreeva and Kianto (2012:716) found that effective knowledge management enables high performance and they consequently concluded that a positive relationship exists between a company's ability to exploit knowledge as a resource and the company's bottom line. Knowledge can therefore be considered a critical resource in today's dynamic and competitive environment.

Knowledge management is even more complex and challenging in a project-based organisation, both within an individual project and across projects (Van Waveren, Oerlemans & Pretorius 2014:1176). Due to the temporary, multi-disciplinary and unique nature of projects, project teams face specific challenges. Effective knowledge management in ever-changing project environments is highly valuable in enabling learning from projects that can lead to implementation of best practices and avoiding of similar mistakes on future projects (Pretorius & Steyn 2005:41). This can contribute to successful project completion.

Knowledge management can be defined as an organisation's ability to create, utilise and transfer knowledge within the organisation and consists of three dimensions namely, knowledge stock, knowledge practices and the environment. The environment (technological and social) can either promote or discourage practices to share and transfer knowledge (Reich, Gemino & Sauer 2012:663).

While knowledge management should form part of a project management methodology (Bell, Van Waveren & Steyn 2016:18), it is especially the social environment or corporate culture that prevents project organisations from successfully managing knowledge and becoming learning organisations (Alavi, Kayworth & Leidner 2006:191; De Long & Fahey 2000:113; Duffield & Whitty 2014:311; Gray & Densten 2005:594).

1.1 Research problem

In the project environment, knowledge practices in laymen's terms mean using existing expertise, experience and understanding to plan, develop and execute a project. Knowledge management reduces the number of unknowns and risks by learning from past mistakes and successes within the organisation. The benefits of knowledge sharing to the success of an organisation are undisputable.

It is well known that several construction projects are not completed on time and within budget. Considering the vast amount of knowledge and experience available within the construction industry, as well as the maturity of project management practices, the role of knowledge management in the success of construction projects requires investigation.

1.2 Objectives

The study had two objectives: Firstly, to investigate the effects of human and cultural factors on knowledge transfer and to determine perceptions regarding the extent that lack of knowledge transfer contributes to project failure (i.e. to determine to what extent negative outcomes of projects could have been avoided by using knowledge gained on previous projects).

Secondly, to determine perceptions regarding the main factors that prevent effective learning and knowledge transfer. As Talukhaba and Taiwo (2009:33) found that two thirds of the time, effort and money required to manage knowledge relate to the culture and the people in the organisation, and several other authors also emphasise social environment and corporate culture (Alavi *et al.* 2006:191; De Long & Fahey 2000:113; Duffield & Whitty 2014:311; Gray & Densten 2005:594), the emphasis was on these factors.

2. REVIEW OF LITERATURE

2.1 Background

Clearly, the human race has been managing knowledge implicitly for as long as there has been something to compete for. The first hunters must have been aware of how

their knowledge afforded them the competitive advantage over their counterparts and they surely shared their knowledge with the upcoming hunters in their families to ensure the sustainability of the group. Scholars have been building their careers around knowledge creation and transfer for several millennia (Wiig 1997:1). Organisations started to recognise the benefits of organisational knowledge and the effective management thereof more than two decades ago. They started to realise that they could increase their competitive advantage and position themselves favourably against their competitors by exploiting and developing the knowledge within their organisations (Ale Toledo, Chiotti & Galli 2014:73).

Organisations manage their knowledge by creating, utilising and transferring knowledge contained within the organisation. Effective knowledge management depends on three dimensions namely, knowledge stock, the environment and knowledge practices. Knowledge stock is the knowledge possessed by the organisation or its employees. Knowledge stock includes both tacit knowledge (knowledge of an individual which is undocumented and experience based) and explicit knowledge (knowledge that is converted into an understandable format and is documented) (Pretorius & Steyn 2005:41). Knowledge practices are the ways, processes and methods in which the knowledge stock is actively managed and which produces usable knowledge that is shared within the organisation.

Both the social and technological environment can promote or discourage the knowledge practices to share and transfer knowledge within an organisation. The technological environment consists of physical resources, including the IT infrastructure, intranet, project websites and communications setup. The social conditions refer to the organisational culture and values towards knowledge transfer (Reich *et al.* 2012:663).

Several knowledge management frameworks and methodologies have been developed and implemented across a variety of industries. They provide direction and guidance on how knowledge should be managed within an organisation. Several companies have also developed their own knowledge management frameworks based on literature and their own experience. Even though several such frameworks exist and are being used in different organisations, no established, universally accepted

methodology exists (Rubenstein-Montano, Liebowitz, Buchwalter, McCaw, Newman & Rebeck 2001:31).

The lack of a model or framework could affect effective knowledge management in organisations, but literature shows that human factors (learning, cultural and social) are most prevalent in preventing project organisations from successfully managing knowledge and becoming learning organisations. Talukhaba and Taiwo (2009:33) found that only one third of the time, effort and money required to manage knowledge in an organisation is consumed by knowledge management information technologies (hardware and software); two thirds relate to the culture and people in the organisation.

The challenge of knowledge transfer in the project environment is to capture the lessons learned and ideas generated on one project and distribute it within the organisation to other projects (Pretorius & Steyn 2005:41). This is very challenging due to the temporary nature of projects. Mueller (2012:435) found that organisations operating in a projectised structure neglect knowledge transfer between project teams, and consequently knowledge sharing on an organisation level.

The success of a project-based organisation, especially in the engineering and construction industry depends on the organisation's ability to consistently complete projects within budget, on schedule, according to the client's requirements by providing benefits as defined in the project's business case. Schindler and Eppler (2003:219) argue that, by adopting an effective cross-project learning culture, companies can complete projects faster and more cost effectively by eliminating re-work and the associated cost that result from making the same mistakes on multiple projects. This methodical remembering and documenting of project experiences, both positive and negative, enables a company to reduce the risk associated with a new project (Schindler & Eppler 2003:219).

Literature indicates that organisations can maximise their effectiveness and profitability and, as a result, their competitive advantage by exploiting the knowledge contained within the organisation as a resource. Although few studies have researched the effect of knowledge management on project performance, a positive indirect relationship

exists between effective knowledge management and completing a project on time, within budget and according to the quality requirements (Yang *et al.* 2012:182).

Although more accurate and comprehensive definitions exist (e.g. Freeman & Beale 1992:229; Shenhar, Dvir, Levy & Maltz 2001:699), for the purpose of this study “project success” is defined as project completion on time, within budget and according to the client’s requirements.

2.2 Cultural knowledge management factors and their effects

In addition to Yang *et al.* (2012:182) who found a positive relationship between knowledge management and project benefits and project performance in terms of safety, schedule, quality and cost, Reich *et al.* (2012:663) found that a technologically supportive and trusting environment has a positive impact on the development of project-based knowledge.

Mueller (2014:190) researched the cultural environment further by investigating the effect of new cultural elements on knowledge transfer between project teams. The results showed that the structure and orientation of an organisation provides the guidelines for interactions and therefore has the ability to promote or hinder knowledge sharing between project teams.

An output orientation can be beneficial, as team members focused on the team’s output are likely to request and seek knowledge from other project teams to achieve the desired project output. The appropriate structure and orientation should be accompanied by a culture that encourages out-of-the-box and innovative thinking to inspire employees to find new ways to improve their activities and to solve problems.

Factors related to human and cultural aspects cited in literature included:

- Culture of blame: To what extent is the fear of admitting mistakes due to blame-assignment or a lack of transparency inhibiting knowledge transfer? (Garvin, Edmondson & Gino 2008:Internet).
- Personality traits: How common are personality traits, such as arrogance and jealousy (not wanting other people to succeed), in the organisation and to what extent are these traits affecting knowledge transfer? (Duffield & Whitty 2014:311).

- Senior management involvement: to what extent is management driving knowledge transfer activities and emphasising the importance thereof? (Garvin *et al.* 2008:Internet).
- Employee engagement: to what extent does management engage with employees at all levels to gain comprehensive knowledge on the successes and failures of the team? (Wiewiora, Murphy, Trigunarsyah & Coffey 2012).
- Unfamiliarity and trust among employees: To what extent does unfamiliarity among employees, in other words the fact that employees do not know each other on a personal level affect the transfer of knowledge? (Meyerson, Weick & Kramer 1996).
- Knowledge is power (withholding information to retain power): to what extent do employees see their colleagues as competitors and avoid sharing their knowledge in order to maintain their competitive edge? (Duffield & Whittey 2014:311).

2.3 Knowledge transfer mechanisms

A large proliferation of transfer mechanisms or tools and techniques can be identified in the literature. In a working paper, Van Waveren, Oerlemans & Pretorius (2016:1176) identified 59 transfer mechanisms for use in project-to-project knowledge sharing and categorised these into clusters of common characteristics. For this study a smaller set of knowledge transfer mechanisms was used incorporating the common mechanisms used within the construction industry.

These mechanisms are as follows:

- social networking (Terzieva 2014:1086)
- formal training programme (Terzieva 2014:1086)
- templates and checklists (Terzieva 2014:1086)
- expert consultants (Al-Ghassani, Anunba, Carrillo & Robinson 2005:83)
- intranet and shared network drives (Terzieva 2014:1086)
- project and phase reviews (Nicholas & Steyn 2017:577)
- brainstorming (Al-Ghassani *et al.* 2005:83)
- mentoring programme (Al-Ghassani *et al.* 2005:83)
- knowledge repository (Talukhaba & Taiwo 2009:33).

The literature mentioned in sections 2.2 and 2.3 above, as well as models by Yang *et al.* (2012:182); Reich *et al.* (2012:663) and by Mueller (2014:190) were used to develop the conceptual model illustrated in Figure 1.

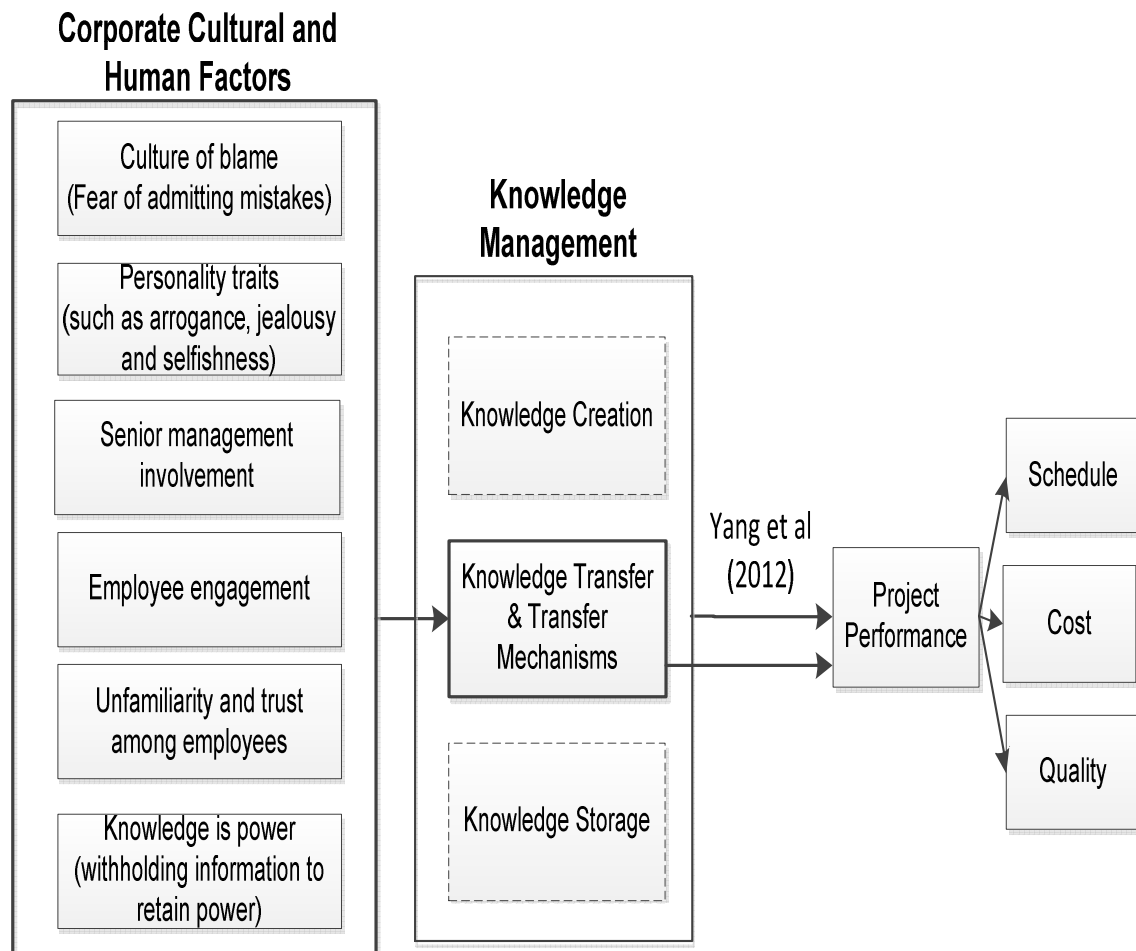


FIGURE 1: Proposed effects of human factors on project performance

Source: Derived from literature

3. RESEARCH APPROACH

A case study was performed with a single South African construction company as the unit of analysis. The company is well established within multiple sectors in engineering and construction business and consists of multiple clusters and business units. The organisation was selected, based on the following considerations:

- The company has completed multiple projects of similar nature. Although most of the project deliverables can be considered a success, a number of projects were not completed within budget or on schedule.
- The company has been in business for decades and has a low staff turnover. A wealth of knowledge, both tacit and explicit, is therefore available within the organisation.
- The organisation consists of multiple clusters and business units and operates in multiple sectors both in engineering and construction.
- This type of study requires in-depth analysis from multiple sources of data and information and the researcher had suitable access to data and information from various sources.

The data for the case study were to a large extent obtained through structured, one-on-one interviews with selected respondents. Purposive sampling was used to ensure that the data gathered were from employees in different positions, from four different business units, and included people with varying levels of experience. The employees that were interviewed were from an engineering and construction cluster and held various positions, including departmental manager, director, project manager and engineer.

The interviews were structured around specific projects and various employees involved in the same project were interviewed. The outcomes of the projects were available from the organisation's records and were used to develop the interview questions. The project team was asked penetrating questions regarding the use of information and knowledge from previous projects in the execution of their project.

As case study research requires multiple sources of evidence, (Yin 2014:120), the organisations' intranet and shared network were also examined to obtain information about knowledge storage and dissemination within the organisation.

Data from in-depth interviews with ten people were transcribed, qualitatively analysed, and – together with evidence gathered from sources such as organizational intranet, shared network and various documents – led to a comprehensive narrative of the case.

4. RESULTS

4.1 Project performance

As mentioned earlier, for the purpose of this study, “project success” is defined as project completion on time, within budget and according to the client’s requirements. In order to determine whether the interviewees viewed project performance similarly, they were asked to provide a definition for project success and 80% of them quoted completion on-time and within budget as criteria for project success.

In conducting the interviews, it became clear that pure-construction projects are more frequently reported to be finished on-time and within budget than Engineering, Procurement & Construction (EPC) projects because, in the case of pure construction, the company is able to claim for idle time and associated costs caused by delays from other parties. In the execution of EPC projects, the organization is much more exposed to risk, as the projects are completed on fixed cost and fixed time basis and the risk of delays can very seldom be attributed to a party outside of the EPC contract scope. (It should also be noted that the organization has been involved in pure construction projects for a longer period than in the case of EPC projects). Since the cost and time goals are easier to meet on a pure construction project, a good client relationship seems to be valued more by the interviewees as a criterion for success on these projects.

In order to determine perceptions regarding relationships between knowledge transfer and project outcomes, interviewees were asked to list the main factors that contributed to the successes and failures of the projects. To ensure that the interviewees were not guided by the research topic, but rather provided an unbiased opinion of the factors, factors that influence project performance were determined without specifically enquiring about the effect of knowledge management.

The involvement of people with the right knowledge at the right time in the project was considered critical to project success by the interviewees and “right people” was listed by most interviewees. This includes people internal to the organisation with the relevant experience, as well as external expert consultants when needed. Several respondents also mentioned that incorrect pre-project estimates, engineering design

as well as systems and procedures lead to project failure. The negative effect of these factors identified can be eliminated or at least reduced by increasing the level of knowledge transfer and management in the organisation. For example, pre-project estimates can be improved by using information from completed projects. Similarly, project management, engineering design and procedures and systems should become more sophisticated as the company ages and learns from previous experience.

Based on the responses, it is evident that at least an indirect relationship exists between level of knowledge transfer and project performance. One respondent, for example, said: *"We pay school fees over and over again, which is exactly what we want to avoid. It has a direct impact on your bottom-line."*

While Yang *et al.* (2012:182) indicate the contribution of knowledge *management* in general to project performance, this finding highlights the specific contribution of knowledge *transfer*.

4.2 Knowledge transfer mechanisms

Specific questions about knowledge transfer mechanisms in the company were examined.

Interviewees were asked to state whether the knowledge transfer mechanisms identified (see section 2.3) were being used in the organisation and to what extent. Respondents were also encouraged to mention any additional factors and visits to similar project sites (currently being used by the organisation) was identified as a commonly used transfer mechanism within the organization.

The responses of the interviewees are indicated in Figure 2.

A formal knowledge repository is obviously not being used and was therefore removed from the results and analysis. Considering the other nine knowledge transfer methods, the responses from the interviewees indicate that 43% of the methods are currently being used and are considered effective and 57% are not used or not used effectively. Interestingly, the methods considered effective decreases to 32% if the responses from the senior managers are discarded.

This indicates that management may be under a somewhat false impression about the extent that the systems and procedures are effective and are being used in the case investigated.

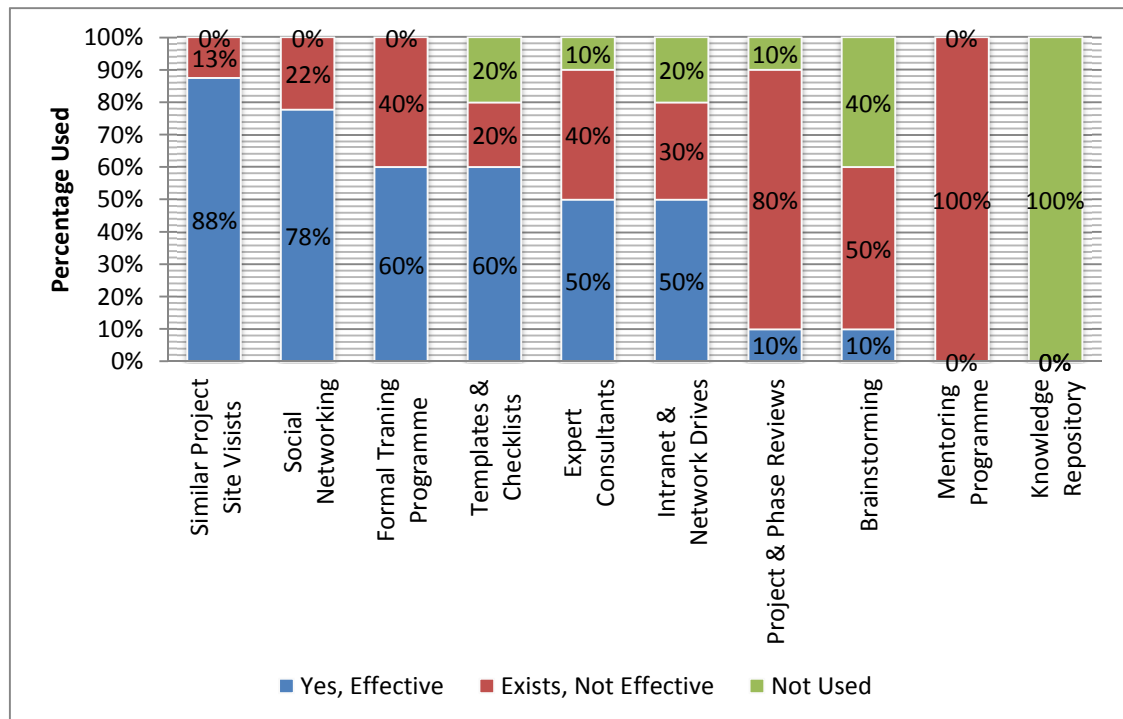


FIGURE 2: Use of knowledge transfer mechanisms

Source: Derived from interviews

4.2.1 Project closeout and project phase reviews

Project phase reviews are not used at all. The interviewees were all aware of the reviews at the end of the project, but 90% stated that the sessions are seen as a formality; they are not structured and are not paid the necessary attention.

This supports the finding by Pemsel and Wiewiora (2013:31) as well as Nicholas and Steyn (2017:577) that lessons learned sessions at the end of a project are often viewed as superfluous, since the project team may already be assigned to new projects and is not committed or focused on the review session. It is clear that there is very little reflection on the experience, successes and failures during or after completion of projects in the organisation. As stated by Nicholas and Steyn

(2017:577), it is therefore likely that the project team members will not learn and that valuable project experience will quickly get lost.

4.2.2 Intranet and shared project drives (network drives)

The interviewees' responses regarding the effectiveness of the shared project drives in transferring knowledge varied drastically depending on the business unit. This aspect was investigated further by studying the network drives and it was found that the quality and management of the drives were much better in the older business units. There was almost no fixed folder structure in some of the younger business units and information was very difficult to find. One respondent remarked: "...you need someone with know-how of the previous projects to find the relevant information. A newcomer will find it very difficult to find information."

Upon further investigation, it was found that access to project drives is limited within business units. In general, access is limited to the project team. The access to shared project drives between business units is even more limited and supports the finding in that there does not seem to be an openness to transfer knowledge between business units.

4.2.3 Mentoring programme

All of the interviewees were aware of the official mentoring programme, but none were actively taking part in it. A lack of time seems to be a significant contributor. This supports the hypothesis by Mueller (2014:190) that the time available for knowledge-related activities affects the level of knowledge transfer.

4.2.4 Formal training programmes

One respondent described the training programme as "*excellent*" and says it "*Sets [the] company apart from other construction companies*". Even though all of the interviewees indicated that the company is very supportive of formal training, 60% of the interviewees stated that the standard of courses, especially technical training, at the formal in-house training school is not sufficient. It seems as if all levels of employees are taking senior management courses, which may not be the most

appropriate level of training. Mueller (2014:190) hypothesised that a learning orientation in an organisation will positively affect knowledge sharing, but it seems as if the orientation alone is not sufficient. To maximise the value, management should also be intimately involved in the selection of training courses.

4.2.5 Expert consultants

The use of expert consultants can be highly beneficial for short term success of the project, but also for long term success of the organisation if the employees succeed in extracting the knowledge from the experts. The interviewees indicated that the biggest concern with using expert consultants is the expense. Contracting experts tends to be costly and the project budget seldom allows for the expenditure. This is a good example of where the pressure to complete the project within budget could lead to a decision that could have a negative outcome on the project in the long run. It also relates to two additional performance influencers; “right people” and “pre-project estimate”. The estimate has to make allowance to have the right people perform the project.

The pre-project estimates for most of the organisation’s EPC projects are generated by an estimating team that are not involved in project execution. It seems as if the project budget inherited by the execution team is in most cases inadequate and results in cost and schedule overruns. There seems to be little feedback from the execution team to the estimating department during or upon project completion to improve the accuracy of future estimates. As predicted by Bresnen, Edelman, Newell, Scarbrough & Swan (2003:157) the knowledge transfer is inhibited by the fact that the project teams change as the projects moves through the project life cycle.

4.3 Current level of knowledge transfer in the company

Once the interviewees were more familiar with the concept of knowledge transfer and some of the typical methods, they were asked to rate the current level of knowledge transfer in the company (1 – very common, 5 – not at all). All the interviewees reported that the current level of knowledge transfer is not sufficient, as is evident by the average rating of 4. One respondent, for example, said: “*There is people transfer, but*

not knowledge transfer. We use the same person on similar projects, but the knowledge stays with the person” while another remarked: “...we’re having the... exact [same] problems as we had on previous projects”.

Of the interviewees, 60% did however state that it was improving and that, during the past couple of years, there has been a drive from executive management to become more of a learning organisation.

The interviewees contributed the lack of knowledge transfer mainly to the culture within the organisation. The overwhelming opinion of the interviewees was that there was no openness or willingness to learn within the organisation. The fact that 90% of the interviewees mentioned human factors when describing the level of knowledge transfer in the company is noteworthy, since it supports the notion that the corporate culture of a company significantly affects the organisation’s ability to effectively manage knowledge. This supports findings by several other authors (Alavi *et al.* 2006:191; Duffield & Whitty 014:311; Gray & Densen 2005:594).

4.4 Corporate culture towards learning

The prevalence of the human factors reflected in Figure 1 was rated on a 5-point Likert scale (1 = non-existent, 5 = extremely common). The results are provided in Figure 3. Most of the factors considered prevalent by the interviewees pertained to the interaction between business units. The most significant of which are blame culture and personality traits with an overall rating of 2 and 2.7 respectively. 50% of the interviewees considered blame culture as extremely common, 80% of these mentioning that this is due to the culture and relationships *between* business units.

One of the largest hurdles in becoming a learning organisation for the company seems to be the divide between the business units. Several of the interviewees indicated that the animosity between business units started at the directors’ level. There was a perception that the business unit management teams promoted the interest of their individual business units above that of the company. It seems as if this can in part be attributed to the historical subcontracting relationships between the business units. In the principal-subcontractor relationships one business unit typically used the other’s

mistakes for its own gain. This contracting strategy therefore removed the incentive to transfer knowledge between the business units.

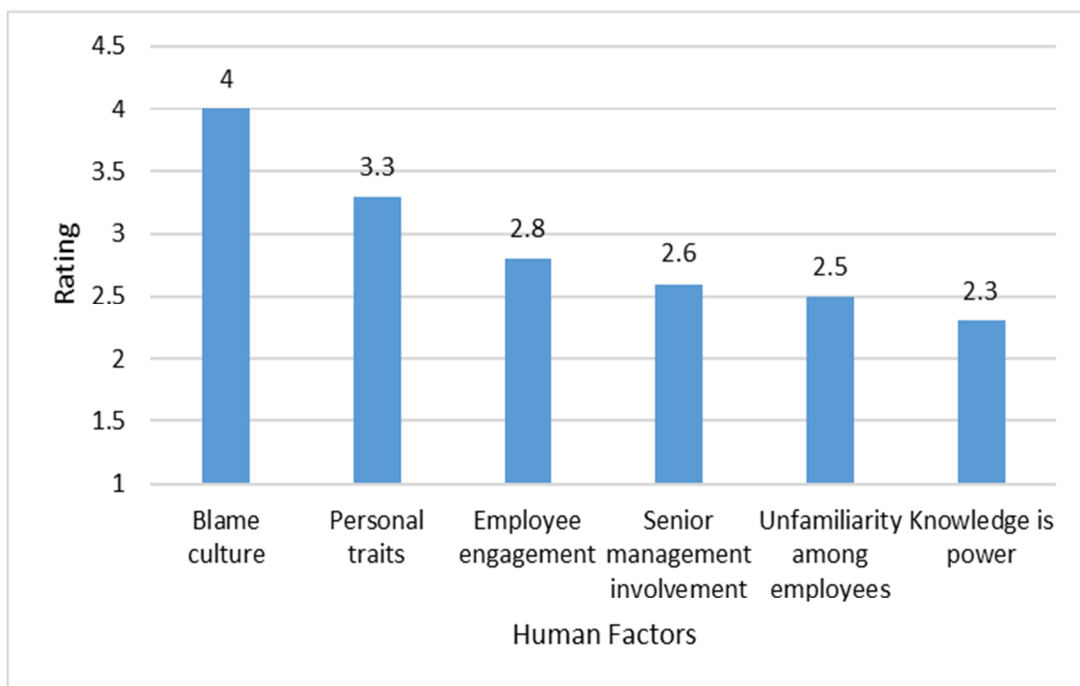


FIGURE 3: Rating of human factors

Source: Derived from interviews

The interviewees were asked to provide any other factors regarding the corporate culture or the current systems that they believed were affecting knowledge transfer in the organisation. These factors are provided in Figure 4. The majority of the factors mentioned related to the corporate culture and are shaded in the figure. This supports previous findings that human factors have the largest impact on effective knowledge management (Talukhaba & Taiwo 2009:33).

Some of the inhibitors and promoters identified support previous findings (Duffield & Whitley 2014:311; Mueller 2012:435), including:

- Bad mouthing: Hallway talk and gossip seems to be a big problem in the organisation, both from the interviewees' perspective and also from general observation by the researcher. Senior management indicated that campaigns will

be implemented to reduce bad mouthing due to the significant negative effect on the company morale. It has an equally negative effect on the openness to share knowledge within the organisation. (Duffield & Whittey 2014:311) identified a culture of *respect* and of *helping people* as promoters of knowledge management. The lack of these elements in the organisation's culture is inhibiting knowledge transfer.

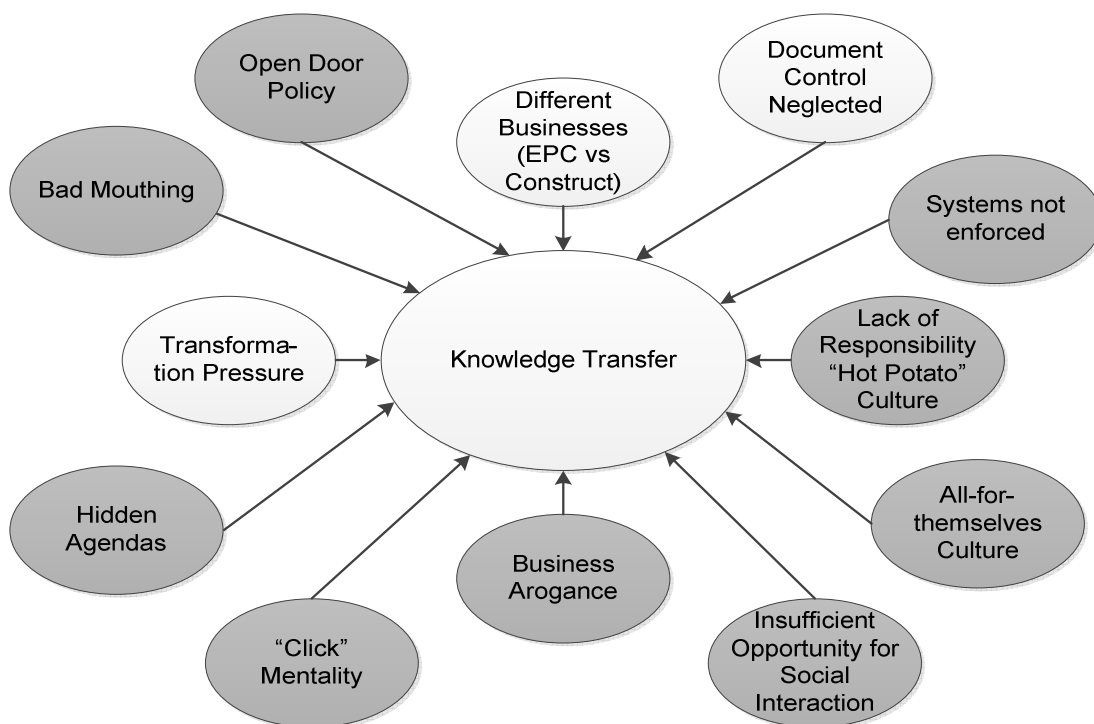


FIGURE 4: Additional inhibitors and promoters of knowledge transfer

Source: Derived from interviews

- Insufficient opportunity for social interaction: Even though unfamiliarity was rated as 2.5 by the interviewees (refer to Figure 3) the fact that the employees from different business units do not know each other emerged as a problem in the open discussion. Creating more opportunities such as social events to promote interaction may be beneficial.
- As stated by Bresnen *et al.* (2003:157) establishing social networks where people can get to know each other, where trust can be cultivated and where values and

norms can be shared will promote open sharing of experiences and lessons learned and will improve the transfer of tacit knowledge.

In addition to the factors already recognised in literature, a lack of responsibility was identified as an inhibitor to knowledge transfer in the case study. There seems to be a “hot potato” culture in the organisation. The lack of responsibility leads to a sense of complacency and often means that there is no drive to do things right the first time. While knowledge may therefore be available, the motivation to find and use it is lacking.

The fact that the organisation operates in various business sectors also complicates knowledge transfer, specifically with regards to procedures and systems. One system does not necessarily fit all businesses. This also relates to the concept of business arrogance. Since the organisation has been in operation for several decades, there seems to be a perception at management level that the company does not need to invest in learning. This is a bigger problem in the newer business units where the company does not have extensive experience. The organisation should be conscience of the fact that it may be necessary to source external knowledge and information.

4.5 Knowledge transfer and project performance

Finally, the interviewees were questioned regarding the correlation between project performance and knowledge transfer and 90% of the interviewees believed that knowledge transfer played a role in the outcome of their projects.

Some of the interviewees were selected because of their experience on multiple projects of similar nature. They were asked whether the knowledge of one project was used to increase the chances of success of the other. The common viewpoint was that, even though previous experience and knowledge were used to an extent, mistakes were still repeated. The knowledge transfer should have been more effective and should have had a bigger impact considering the similarities between the projects. Similarly to the findings in section 0, the ineffectiveness was contributed mostly to arrogance of teams and individuals.

Excessive cost and time pressure in projects also played a role in poor decision making by the project management team in terms of using knowledge from previous

projects. This supports the finding by Lindner and Wald (2011:877) that a project team's focus on short-term goals may lead to ineffective knowledge transfer.

Several of the individuals made reference to a specific project that is, in terms of monetary value, the largest project failure in the history of the specific business unit.

The technology combined with the size of the project made it a first for the company, the client and the country. And whilst several factors contributed to the failure of the project, the fact that there was no one to learn from played a significant role in the poor outcome. The extent of failure could certainly have been avoided had management realised the importance of gaining and managing the appropriate knowledge on such a unique project.

5. LIMITATIONS AND RECOMMENDED FURTHER WORK

The study focused on only four business units within one organization. The responses of the employees in these business units may not be representative of the entire organisation or industry. It is recommended that the study should be repeated within other construction companies and also within other industries.

Two of the business units researched were established less than a decade ago and are mainly functional in the EPC market. The other two business units have been in operation for several decades and the majority of their projects are completed on a pure construction basis.

Of the interviewees 70% were employed by the EPC business units. It is therefore not possible to determine with certainty whether the lack of knowledge transfer is more prevalent in the newer and riskier EPC business units. It may be of interest to perform an in-depth review of the level of knowledge transfer in the individual business units, without considering the bigger organisation.

It would be valuable to delve deeper into the differences between the two types of businesses and their ability to learn. A recommendation of this study is to analyse the differences between pure construction and EPC projects further with regards to the importance, as well as the ease of learning.

6. CONCLUSIONS

6.1 Practical aspects related to the case

The results indicate that, although many of the knowledge transfer methods investigated exist in the organisation, less than half is currently being used effectively. The number of methods considered effective decreases to less than a third if responses of senior management are discarded.

Similar to findings reported by Pretorius and Steyn (2005:41) in the banking industry, it was found that the organisation fails to capture and distribute the information generated by one project across different projects within the organisation. The organisation should develop the skill of recognising valuable knowledge and applying it on future projects, as suggested by Bakker, Cambré, Korlaar & Raab (2011:494).

Organisations should be aware that the existence of knowledge transfer systems is not sufficient. The systems should be implemented and enforced by management and its use should be promoted and monitored throughout the lifecycle of the project. In the case studied, one respondent, for example, said: *“There are good systems in place, but individuals need to use it. Management ... needs to drive it.”*

Some specific findings from the case and recommendations in this regard are discussed next.

(a) Project closeout and project phase reviews

The company investigated should pay serious attention to close-out procedures at project milestones and also at project termination. Policies and procedures for these reviews should be imbedded in the project management methodology.

(b) Network drives

The use of shared project drives is a very effective way to store and distribute knowledge within an organisation. It was found in the case study that knowledge transfer by means of the intranet and shared project drives is inhibited by the lack of structure in some business units, but also by the fact that the access is restricted to a large extent within the organisation. Openness promotes knowledge sharing (Mueller 2012:435) and all data bases should be open to all employees.

(c) Mentoring and lack of time available

Practical learning by observing and guidance in a mentorship programme may be equally or more beneficial than the classroom learning that is often promoted to a greater extent by organisations. In the case studied, the mentorship programme is being neglected due to insufficient time available. This supports the finding by Mueller (2012:435) that the poor knowledge transfer is often due to a lack of time. The results also show that phase and project reviews are neglected, at least partly due to time pressures. In order to improve the level of knowledge transfer, it is crucial for organisations to ensure that time is dedicated specifically for knowledge management activities.

(d) Formal training programmes

The investigation shows that the company is very supportive of formal training programmes, both internal and external to the organisation. The results however also show that the training may not have the necessary and expected impact on the knowledge base in the organisation. This may be due to the level or standard of training provided, as well as the relevance of the courses being attended. Organisations should monitor course and training selection closely to maximise the value of formal training programs.

6.2 Confirmation of the importance of human factors

The results from the case study indicate that, even though the company lacks the proper implementation of the systems to structure and simplify knowledge transfer, it is the so-called human factors that have the most significant effect. The case study results support the notion that the corporate culture of a company affects the organisation's ability to effectively manage knowledge significantly (Alavi *et al.* 2006:191; De Long & Fahey 2000:113; Duffield & Whitty 2014:311; Gray & Densen 2005:594) and that it is the human elements that have the largest impact on effective knowledge management.

This supports findings by Talukhaba & Taiwo (2009:33). Of the human factors investigated, a blame culture and personality traits, such as arrogance and egotism seem to have the largest negative effect. In interviewing the employees, it was evident

that the culture in many instances was seen to be driven by the attitude of individuals, sometimes at senior management level. Companies should be aware of the negative effect that a few “bad apples” could have on the overall culture in the organisation.

6.3 Additional inhibitors uncovered

In addition to promoters and inhibitors already identified in literature, a lack of responsibility was identified as an inhibitor to knowledge transfer. The lack of responsibility leads to a sense of complacency and often means that there is no drive to do things right the first time. Companies should be conscience of the fact that the availability or existence of knowledge is not sufficient. A drive to locate the information and to use it to improve performance and the companies’ chances of success is critical.

A significant additional contributor to the lack of knowledge transfer in the organisation was found to be the presence of animosity and competitiveness between the business units. The senior managers are seen to be more concerned with the success of their own business units rather than that of the company. It may be necessary for the executive management team to review the incentives of the senior management to perform at a company level and not only at a business unit level.

6.4 Relation to project performance

The investigation indicates that the likelihood of project success is increased by the use of knowledge management tools. The results also indicate that completing a project where all parties are novices can be very challenging. Yang, *et al.* (2012:182) indicated that, in the IT industry, a correlation exists between knowledge management practices and project performance. This study supports the notion that, in the construction company, knowledge transfer specifically relates to project performance. There are normally a variety of factors and combinations of factors that contribute to the success or failure of a project. It is therefore difficult to state whether the outcome of the project could have been changed completely by more effective knowledge transfer.

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