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Nor Hidayati Zakaria

*Queensland University of Technology*, nor.zakaria@student.qut.edu.au

Universiti Teknologi Malaysia

Darshana Sedera

*Queensland University of Technology*, d.sedera@qut.edu.au

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## Developing a Knowledge Base for Enterprise System Success: The Role of Management and Operational Staff

Nor Hidayati Zakaria<sup>1</sup>

Darshana Sedera<sup>2</sup>

Faculty of Science and Technology<sup>1,2</sup>

Queensland University of Technology

Brisbane, Australia

Email: nor.zakaria@student.qut.edu.au<sup>1</sup>, d.sedera@qut.edu.au<sup>2</sup>

Faculty of Computer Science and Information Systems<sup>1</sup>

Universiti Teknologi Malaysia

Johor Bahru, Malaysia

### Abstract

*Knowledge base is one of the emerging concepts in the Knowledge Management area. As there exists no agreed-upon standard definition of a knowledge base, this paper defines a knowledge base in terms of our research of Enterprise Systems (ES). The knowledge base is defined with reference to Learning Network Theory. Using this theoretical framework, we investigate the roles of management and operational staff in organisations and how their interactions can create a better ES-knowledge base to contribute to ES success. We focus on the post-implementation phase of ES as part of the ES lifecycle. Our findings will facilitate future research directions and contribute to better understandings of how the knowledge base can be integrated and how this integration leads to Enterprise System success.*

### Keywords

Knowledge base, Learning Network Theory, Enterprise Systems.

### INTRODUCTION

A wealth of research suggests knowledge management is a critical success factor for Enterprise Systems (ES) (Lee and Lee 2000; Pan et al. 2007; Volkoff et al. 2004). And yet, it is still necessary to better understand the relationship of ES-related knowledge and the ES performance. Much work has been focused on the pre-implementation of ES, while very little has been concerned with post-implementation even though this phase is crucial for ES success (Scott 2005). The ES post-implementation phase engages many parties from within and outside an organisation, and that makes managing knowledge in ES becomes complicated. These parties bring different knowledge bases that build a breadth of ES knowledge in the organisation. Thus, understanding how they interact is important. In this context, we need to understand how individuals' interactions contribute to the formation of a knowledge base for the ES (henceforth referred to as the ES-knowledge base), placing an emphasis on the ES post-implementation phase.

The main objective of this paper is to understand how management and operational staff play their roles in developing the ES-knowledge base concept and contributing to the ES success. We aim to empirically observe how the ES-knowledge base influences the ES success. In this study, we address two research questions that follow from our research problem: "1) How do the learning interactions of management and operational staff influence the ES-knowledge base development?; and 2) How much variance in ES success can be explained by the goodness of the ES-knowledge base?" These research questions present the context of ES utilisation (post-implementation) at the individual level where staff are key players who interact and use the ES knowledge. We employ Learning Network Theory (LNT) (Poell et al. 2000) concepts to define the ES-knowledge base, and to describe a specific mechanism where an individual learns ES-related knowledge from others' expertise, experience, insights and opinions through interactions.

This paper is organised as follows: the second section begins with an outline of the motivation for this study, followed by a discussion on ES knowledge and knowledge sources in an organisation. The next section explains LNT, and looks in more detail at the ES-knowledge base. Then, the paper provides some key observations from case studies of organisations and reports on the empirical results of a survey. We conclude with a summary of the findings and a discussion on future research directions.

## MOTIVATION

Despite anecdotes of successful ES implementation, many organisations still have difficulties in utilising an ES and getting benefit from it. The current trend of ES implementation appears to be mainly evident in developing countries (Molla and Bhalla 2006). However, many ES failures have been reported in these nations (Rajapakse and Seddon 2005). One reason for this is a lack of understanding of effective knowledge needs after the ES implementation. Within this background, this study aims to investigate the development of the ES-knowledge base through observations of knowledge interaction practices in organisations in developing countries, represented by Indian and Malaysian companies.

Although there is substantial research on learning that occurs before system implementation, there is a lack of research on post-implementation learning when a new system is implemented (Santhanam et al. 2007). Stemming from a focus on post-implementation, this investigation of the ES-knowledge base development is rooted in and guided by an understanding of the nature and types of ES knowledge and its sources, as well as the individual learning process. In this light, the ES-knowledge base is seen to be created by the client organisation, ES vendors and consultants. These internal and external stakeholders<sup>1</sup> bring their software-specific knowledge, business process knowledge and organisational knowledge to bear. However, we still do not have a good understanding of how internal staff gains knowledge of the new system to better utilise the ES in their work. To help bridge this gap in ES post-implementation research, this paper employs LNT to understand how individuals' ES-knowledge base can be developed and managed through learning network interactions among managerial and operational employees.

## THE ES KNOWLEDGE AND ITS SOURCES

Key sources of ES knowledge are people or stakeholders who make significant contributions to the formation of the ES-knowledge base. These include: (1) the client organisation; (2) the ES software vendor; and (3) the consultant or implementation partner (Gable et al. 1998; Soh et al. 2000). The ES software vendor is an important business partner who will customise, clarify, install and support an ES software system. In the other hand, the consultant will deal with the ES implementation process. To ensure the organisation is getting the right system, the vendor and the consultant work closely with each other and the client organisation.

In the ES context, Davenport (1998) identifies three types of knowledge, namely: (1) software specific knowledge; (2) business process knowledge; and (3) organisation specific knowledge. Each employee brings a different level of ES-knowledge base, where the types of ES knowledge in terms of software, business processes and organisational requirement vary for each level of employment. There are three levels of employment cohorts in an organisation: strategic, management and operational levels (Anthony 1965). The strategic level involves complex, irregular decision making and focuses on providing policies to govern the organisation. However, knowledge that is required by the management level is different from the knowledge needed by the strategic level. The management level focuses on assuring that the organisation's resources are used effectively and efficiently to accomplish the goals identified by the strategic level (Sedera 2007). In contrast, the operational level is involved in highly structured and specific tasks that are routine and transactional. With reference to Sedera (2007), Sedera et al. (2004) and Sedera et al. (2007), we conceptualise the correlation between the employment cohorts in organisations and the ES knowledge types as set out in Figure 1 below.

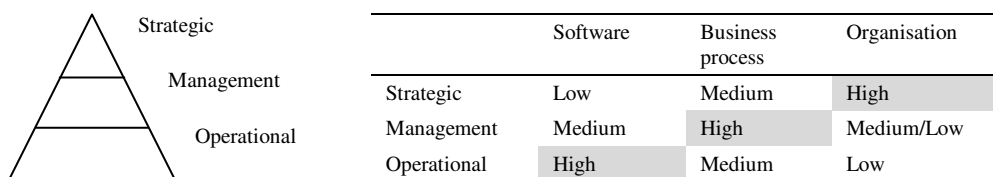


Figure 1: Correlation between employment cohorts and ES knowledge types

Figure 1 shows the three hierarchical levels of employment cohorts and describes the significance of ES knowledge types for each cohort. Organisational knowledge is essential to the strategic employees, and is less significant for the management and operational employees. At the strategic level, software knowledge is crucial for operational employees. In contrast, business process knowledge is very important for employees in management groups. It is a necessity for management staff to have a deep knowledge of business process to achieve greater efficiency and better quality of ES usage. Therefore, if the current business practices and procedures need to change, management staff can review and make innovations to the processes, services or

<sup>1</sup> Internal stakeholder refers to the client organisation, while external stakeholders are the ES vendors and consultants.

business functions which fit the ES. ES knowledge requirements vary for each level of employment. Although all staff are connected to the knowledge sources of ES, not all levels of staff need to know all the ES-knowledge. For example, organisational knowledge of the organisation is required for ES end users, and employees need to know how their tasks fit into the overall process and how the process contributes to the achievement of organisational goals (Vandaie 2008), including strategic planning, management control and operational control. More importantly, they need to be able to recognise and obtain valuable ES knowledge from other employee groups and subsequently integrate that knowledge with their existing ES-knowledge base.

## THE LEARNING NETWORK THEORY

The Learning Network Theory places a great emphasis on networks of actors (referred to as stakeholders), who form learning groups and create learning programs with each other (Poell et al. 2002). The LNT demonstrates how learning networks are produced and reproduced by the interactions of learning actors, who act purposely on the basis of their own theories and interests with respect to work-related learning. There are internal learning actors (such as members of work teams, staff from strategic, management, operational and technical groups), and external learning actors (such as consultants and ES vendors) who organise learning.

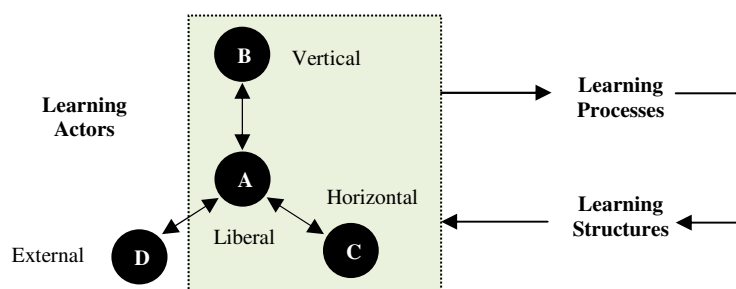


Figure 2: Learning interactions

Figure 2 shows the theoretical types of learning interaction networks where the ES-knowledge base is developed from learning programs. A liberal network refers to a situation where employees individually create their own sets of learning activities. In this situation, employees freely determine the ES learning program to meet their ES knowledge needs, which is labelled as unstructured and individually oriented (Koornneef et al. 2005). By identifying whose knowledge they need, employees can use these learning networks to help them lower knowledge barriers. Employees in a liberal network may involve others in shaping their own learning, decide what they want to learn, create their own learning programs and organise their own support network of individuals and organisations to help them (Krogt 1998).

Learning programs in a vertical network are strictly planned and delivered to employees based on the learning policy of management. Management, including supervisors, can act as mentors to employees in such a learning program. They may organise a kick-off meeting or brainstorm session, talk to other workers in various departments, hold intake sessions with participants, and set up the learning program with the help of well-informed key players within the organisation. In the post-implementation phase, external parties (consultant and ES vendor) will normally transfer their expertise of the ES to top and middle management through training or courses. Subsequently, the management staff transmit the ES knowledge to their subordinates either in teams, units, or to individuals. In order to get the maximum benefit of the ES, the manager has to manage all relevant learning needs by holding formal training sessions, facilitating and promoting employees' learning so they can quickly learn to use the ES. The management has to decide which concepts are more salient and deserve attention (Sathish 2006). Thus, they effectively manage employees' ES knowledge requirements by identifying the relevant learning program with relevant contributions to their employees' ES-related knowledge.

The horizontal network is characterised by teams learning on the job, with groups of learners forming their own learning programs as they solve complex work problems. This learning activity develops incrementally and is executed by experience. The group may consist of members with different views and responsibilities. For example, superiors and employees may learn together about the planning of their work (Poell and Krogt 2003). Members of a learning group in a horizontal network must have a desire to learn together to improve their performance as members of the work organisation. A learning program begins when an actor learns about a particular theme within a group. The team members express what they expect from each other and learn to set up and execute a new learning program. Here, all of the members share the focus on solving complex work-related problems. They cooperate to facilitate their learning about the ES. For example, when there are changes in the ES, this new ES knowledge is transferred to reduce knowledge barriers between members of the group.

In this study, our focus is on the interactions of the three learning network types that occur within an organisation, namely, the liberal, vertical and horizontal networks. These are known as the internal stakeholders' interactions. This focus is due to our belief that, during ES post-implementation, the involvement of external actors is minimal.

## **DEVELOPMENT OF THE ES-KNOWLEDGE BASE**

As illustrated in Figure 2, the LNT conceives that the method in which the knowledge base is produced is determined by three components: actors, structures and processes. Individuals (actors) interact with each other through the three learning processes: learning policies (what and in what way people should learn); learning programs (sets of activities); and the execution of learning programs (i.e. solving problems, job coaching, receiving instructions). When people have been interacting over a longer period of learning, certain more stable patterns tend to develop that can be observed by learning structures. The learning structure includes the learning programs available to the organisation's members either in formal or informal learning, on-the-job learning and incidental learning (Krogt 1998). The structure also comprises the tasks and responsibilities by the various actors that address questions such as: 'Which actor tends to play which role?' and 'Who is authorised to do that?' It is also reflects the prevailing norms and values with regard to learning in the organisation such as 'What are the normal ways to go about learning?' As shown in Figure 2, learning actors (i.e. actors A, B, C) develop their knowledge bases through learning types that reflect to their work whether liberal, vertical and/or horizontal.

As actors interact with each other on the basis of their own beliefs and interests throughout the learning process, they adapt and adopt new ES knowledge. They create and store their own dynamic ES-knowledge base as they learn in learning programs that are executed in the learning process. When knowledge of the ES or the business process is shared, the ES-knowledge base then changes, which triggers the process of producing and reproducing the knowledge of the ES during interactions. Managers may engage in discussions with operational staff on the consequences of the software problem as they try to develop a solution and fix the ES. This interaction enables them to obtain knowledge about the system bugs and knowledge about misalignment between the system design and actual practice (Santhanam et al. 2007). With this knowledge, managers can better align the ES with the organisation's business processes. When this occurs, previously created ES-related knowledge becomes the input in a new round of ES-knowledge base creation: managers apply the ES-knowledge base, and the evolutionary process continues.

Over the course of time, various training and learning activities are conducted in the organisation. This gradually develops into a learning structure. This learning structure provides the starting point for the actors (ES stakeholders) to undertake new ES learning activities. They then form learning group together in multiple ways (liberal, vertical or horizontal) and carry out activities to create learning programs. The learning programs are various, as they are organised by the different learning group types. For that reason, we argue that the development of ES-knowledge base should incorporate all learning actors and all learning network types, as discussed in the previous section. Therefore, in studying the influence of management and operational staff interactions on ES-knowledge base development, the following literature is considered: (1) the sources of knowledge as identified by Gable et al. (1998) and the knowledge types (software and business process) as identified by Davenport (1998) and Sedera et al. (2003); (2) the knowledge management process defined by Alavi and Leidner (2001); and (3) the role of learning theory as extrapolated by Poell et al. (2000). Based on this literature, we define an ES-knowledge base as:

A combination of knowledge from software and business processes that is brought to bear by consultant, vendor and client in the organisation through the learning programs that execute the process of knowledge creation, knowledge retention, knowledge transfer and knowledge application.

Although this definition recognises that the ES-knowledge base involves both human and machine entities, this research focuses on the knowledge of Enterprise Systems from the human side.

## **CASE STUDY OBSERVATIONS**

Guided by the importance of understanding and explaining the development of the ES-knowledge base within the framework of LNT, this research employed five case studies. This is considered an effective approach that allows us to address the "how" and "why" research questions (Eisenhardt 1989; Stuart et al. 2002).

### **Case Study Method**

In the first instance, the case study questions were pilot-tested with an academic with expertise in knowledge management. Comments on item wording and suggestions for improved clarity were incorporated based on the expert's feedback. Respondents were then chosen from several companies in India. The respondents were staff at

managerial level, who were actively involved in ES usage in their work, and who had more than one year's experience in their job. The data from the respondents is believed to be pertinent as the selected individuals are involved in daily interactions regarding their organisation's ES and use the system regularly. Three of the companies use SAP, while the two other companies use RAMCO and were looking forward to SAP implementation. Informal communication via email was exchanged with the respondents to get a better understanding of the respondents and their organisations, including background information about the organisation's ES implementation. Interviews were then conducted via telephone appointments made by prior arrangements. The interview sessions lasted 45 minutes to an hour, and were tape-recorded and transcribed. Interview transcripts were prepared before proceeding to data analysis.

### Case Study Findings

We link our findings about individual ES-knowledge base development to a theoretical model by observing the case studies through key elements of the LNT framework, as follows:

#### Liberal, Vertical and Horizontal Learning Interactions

Good communication in the workplace between managers and teams, divisions and individual employees takes place in liberal, vertical and horizontal interactions. The communication in these interactions covers all kinds of ES knowledge bearing on day-to-day operations in the organisation. Effective interaction helps managers to manage better, and enables employees to become more familiar with the ES and thus work more effectively. For example, in one case study involving a pharmaceutical company, it is seen that employees value the importance of knowledge transfer. Thus, communication among them is very effective. The working culture is highly cooperative, with high levels of willingness to share knowledge. The interactions occur between managers and employees in the same division and also with other divisions, and include discussions about how to use the ES and learn new ES knowledge, which improves their ES-knowledge base.

A similar situation was found in another case study, which involved a petroleum-based company. The level of communication among employees in the organisation is very high. Employees in this organisation freely share their ES knowledge, discuss problems related to their ES knowledge, and give feedback. In contrast to the proactive learning in these two organisations, the opposite situation was revealed in one of the case studies, which was a power supply company. Although employees in this organisation learn during interactions among them, the interactions are limited and staff do not have a supportive working environment. Communication only occurs when they run into problems. As a result, we found that the exchange of ES knowledge from learning interactions between liberal and vertical networks and along the horizontal network could not be recognised. As noted by the respondent in this case study, *"we should not try to call to other departments for help, every time if we have a problem. Everyone write their own processes down. This is what my boss tells me. So, I don't have to ask..."* From this insight, we conclude that successful learning needs a positive lead from management (vertical). It is necessary for management to ensure learning policies and practices are properly maintained and well understood by those involved. Poor communication causes ineffective learning by disregarding knowledge interactions among employees, which in turn affects the goodness of the ES-knowledge base.

#### Management Roles

The neglect of sufficient user training may cause an ES failure. Employees have to learn to handle the great number of business processes and high functionality of ES. Employees have to learn how to handle the ES on the level of data entry and report requests. Employees also need to understand the business processes that lie behind the ES in order to realise the impact of their work on the organisation. They need to know in what ways their organisation is affected by the ES. For example, one respondent from a techno-commercial company, reported receiving one month's training in SAP. Although some of the training was unstructured, it involved lots of employee interactions. In these interactions, staff discussed different understandings. They raised required reports and discussed the reports. As a result, the respondent, who did not have any prior experience in ES, found the ES to become easier to use eventually. As we were told, *"before that I don't know about the system, and after a while...I found it's easier for me. I know where to go, I know about parameters, and recently I can conduct the parameters, I can select and I get precisely what I want"*. This indicates that adequate ES training that includes extensive employee interactions during the session can help employees learn how to use the ES effectively. It improves and increases employees' understanding, and ensures consistency and quality in ES performance. Here, the vertical learning network is essential so that management recognise an effective ES training package that will provide sufficient ES knowledge to their employees. Such training ensures employees understand the ES procedures and processes, and know how best to respond to ES problems. Besides increasing the value of ES performance itself, the ES training may also increase levels of commitment of employees to use the ES optimally.

While training is formally provided by management in organisations, knowledge from experience plays an important role, in the form of tacit knowledge. Individuals, in the liberal network may initiate their own method to gain knowledge which is not officially provided by their organisations. Our findings show that most employees

are free to choose the best method to increase their ES-knowledge base. For example, one respondent who lacked ES experience initiated close knowledge sharing with a skilled senior to ensure he can pull his weight alongside others in the company. Another respondent, a system manager in a power transmission company, reported that she sought out a colleague who she believed was very much a master in the ES operation to help her in problem-solving and other ES issues related to her job. This expert passed his ES knowledge to others as part of his daily work on the basis of his own experience. As the respondent noted, *“thorough training for six months, there was a senior (who will look) after training. We were given practise assignments, running report analysis, concentrate on monitoring technical training and practical component”*.

As reported by the case study respondents, interaction also occurs through meetings that involve lively discussion and open dialog on the real issues of the ES. The meetings engage all participants, reach decisions and clarify follow-up actions. The meetings gather interest groups to decide on matters of common concerns through compromise, resolution, and votes. Individuals gain their ES-knowledge base in these meetings as they gain information and instructions, and clear up misunderstandings by integrating the ideas and views expressed in the group. The working situation described by a pharmaceutical company's respondent, highlighted the importance of the horizontal learning network type. This respondent reported that they seek others' advice about ES problems through interactions that are formal (organised by management) or informal (initiated among staff). These interactions can take the form of brainstorming, analysis and group consensus, with the purpose of establishing understanding and clarifying responsibility.

#### Operational Staff Roles

Management and operational teams (vertical and horizontal) can give suggestions on how to improve ES utilisation and how employees can improve their jobs in relation to that. Employees may inform their managers about their task satisfaction, productivity and problems, and discuss their experiences honestly as required. Individuals gain knowledge by receiving clarification of expectations and accurate information. One respondent, an assistant manager in a marketing department, stated that he realised the importance of feedback in his work as a good method to gain knowledge. He reported that he regularly receives feedback on the strategies that should be taken for marketing, and maps sales feedback in response to his marketing report and analysis. The feedback is received by tele-conversation with relevant individuals. Any reports, decisions or issues are discussed through this channel. Another respondent reported that by getting and giving feedback, they can measure the outcome of the ES, learn how to make improvements and increase their ES-knowledge base, which overall enables them to work more effectively. This is supported by another respondent who explained how employees in his company use feedback to support each other, including different operational groups. They give and receive feedback with regard to the ES, including design, complaints and responses. The feedback is used to determine whether staff are satisfied and whether there are any issues to counter. This situation contrasts with the testimony of one respondent, an assistant manager in the power industry, who reported that he suffered from the lack of feedback. As he noted, *“IT department never ask. They never ask how we can add value to it and what other problems we have. They never ask me how I do my work, how to improve it, what problems am I facing...”* As a result, this respondent disclosed that he had not added value to the ES, nor contributed any innovation, due to his limited ES-knowledge base. As these positive and negative reports of workplace communication show, management and operational staff clearly need each other. Operational staff need more information than the basic instructions needed to carry out their work, and both groups should know how their jobs can contribute to the organisation. Feedback from and between managerial and operational staff is useful to inform staff of their duties and equip them with the information required to carry out those duties.

Operational teams (horizontal network) have the capability to develop a number of knowledge types. A team is formed to generate new ideas, solutions, manage changes, or to generate consensus through collective input, investigation and negotiation (Huang and Newell 2003). One respondent, a system manager of operations, reported that he is happy with the cooperation among SAP team members in his company, as the operational staff are truly experts; who provide knowledge about programming issues, how to discover the costs of his project and how to get the right market. Besides working closely with this SAP team, he also works in group with a very cooperative members. For every issue that exists, they resolve it together and share their knowledge. If a meeting is held to handle an issue, they send a group member as their representative and then get input from that person. Although working in the team requires effort and diligence to face any issue, the knowledge returns can be dramatic. The knowledge that is gained from teamwork improves performance in terms of individuals, the ES and the productivity of the organisation. That is how a managed team can perform creative problem solving and better decision-making.

On the basis of the case study findings, it can be argued that the ES-knowledge base is created in a process where knowledge is developed by key stakeholders, retained by the organisation and its employees, transferred to where the knowledge is required through learning interactions and is applied throughout the ES lifecycle. During the ES post-implementation phase, employees bring together their prior work experience, work values, norms,

philosophies and problem-solving approaches. The combination of all the knowledge, both tacit and explicit, creates the ES-knowledge base.

## SURVEY OBSERVATION

From case study observations, we suggest that the goodness of an individual's ES-knowledge base is a causal factor of ES success in an organisation. As people interact and integrate their ES knowledge with each other, they bring their own ES software-specific knowledge, business process knowledge and organisational knowledge. They then adapt and adopt new ES knowledge, and create and store their own dynamic ES-knowledge base.

### Survey Method

The survey involved 188 respondents in 6 different large companies in Malaysia. Only companies that had been using an ES were chosen. The questionnaire used existing measurement scales where possible. A few measures were amended for the purposes of this research based on theoretical explanations. The questionnaire was refined through rounds of feedback from some key staff in those organisations, including administration officers, executives and managers. Responses were measured using multi-item seven-point Likert scales. In the first phase, the companies were contacted prior to the questionnaire distribution to seek approval to involve staff in this study. After we received approvals, interviews were conducted with key staff from managerial groups to further understand the ES utilisation and any problems. We received 196 responses from the 300 forms distributed, with a 65.3% overall response rate, and retained 188 after cleaning the data. Since our focus was on the knowledge base of ES utilisation, our respondents were mainly from managerial and operational employment groups. Managerial staff represented 40.4% of respondents, while 52.7% were from operational groups.

### The Empirical Results

The empirical results were tested through data gathered from 188 respondents. In terms of formative constructs, the internal consistency of constructs was performed by the multicollinearity test and test of indicator validity (path coefficient significance) (Petter et al. 2007). The magnitude of multicollinearity can be examined by the variance of inflation factor (VIF) and the tolerance value which is reciprocal of the VIF by using SPSS 16.0. The VIF statistic was used to determine if the formative indicators were too highly correlated. Pallant (2005) suggests that if VIF values are above 10, this indicates multicollinearity that can destabilise the research model (Roberts and Thatcher 2009). The VIF values for the construct of the *ES-knowledge base* ranged from 1.576 to 1.877. Thus, the measure items of this formative construct are valid. The tolerance values also suggest that there is no possibility of multicollinearity threats, where all the values are close to 1 (0.530 and above). For the *ES success* construct, the VIF values were varied, but still well below the cut-off value of 10 with the maximum value being 6.540. For example, the system quality component shows the VIF values ranging from 1.773 to 5.485. The VIF values for the information quality ranged from 2.224 to 3.047. The individual impact had its maximum value at 6.008, while the maximum VIF value of organisational impact was slightly higher at 6.540. The tolerance values for all the variables in the construct of *ES success* suggest no possibility of multicollinearity, with all the values above the threshold of 0.1. In this study, all measures are below the cut-off of 10, indicating we have not violated the multicollinearity assumptions. Thus, all variables are retained. This paper does not analyse the reliability for the constructs of *ES-knowledge base* and *ES success* as these formative constructs were not expected to be internally consistent (Bollen 1989; Roberts and Thatcher 2009).

The Partial Least Squares (PLS) technique was then used to validate the structural model and to test our hypothesised relationship between the ES-knowledge base and the ES success. The significance of the path coefficients was statistically tested using a t-test. A test for coefficient significance and calculation of the t-statistic were performed by applying the bootstrapping procedure (Henseler et al. 2009).

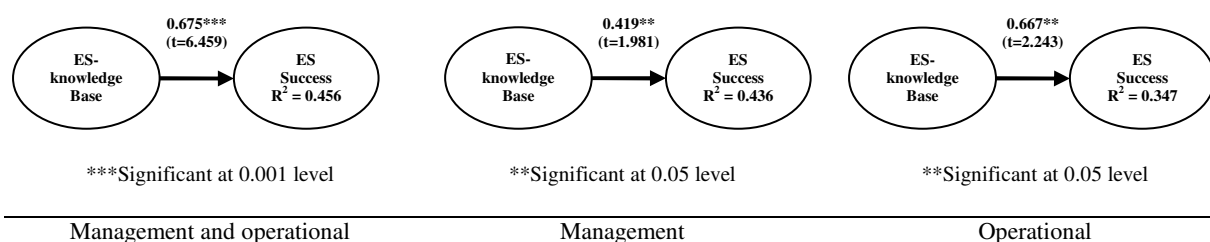


Figure 3: The relationship between ES-knowledge base and ES success



The results in Figure 3 evidence the existence of a strong, positive relationship between ES-knowledge base and ES success. To make a comparison, we grouped the results in three categories. In the first category, we analysed the data for both managerial and operational groups, with a path coefficient =0.675 and significance level at 0.001. With this sound path coefficient, the ES-knowledge base explains 45.6%, almost half of the variance of the ES success ( $R^2=0.456$ ). The result shows that the individual ES-knowledge base is a critical success factor for the success of the ES in an organisation. In the second category, the analysis shows that the management group contributed 43.6% of the ES success in our sample. The path coefficient is also strong, with a value of 0.419 at 0.05 significance level. The results from the third category of operational staff also show the significance of their ES-knowledge base towards the success of ES, as it explains 34.7%. The path from ES-knowledge base and the ES success was significant ( $\beta=.667$ ,  $t\text{-value}=2.243$ ,  $p<0.05$ ). The findings set out in Figure 3 show that management staff made more contribution towards ES success compared to the operational group by a lead of 9%. However, both groups are shown to make a significant contribution to ES success. Thus, the results are consistent with our previous argument about the importance of ES-knowledge base for ES success.

## DISCUSSION AND CONCLUSION

The concept of the ES-knowledge base is relatively new. This paper has explored this concept in relation to ES success. Since the ES-knowledge base has not yet been fully theoretically addressed, we have employed LNT to cover these issues. LNT is chosen because it is able to explain conceptually the creation and re-creation of the ES-knowledge base through the interaction of the multiple stakeholders in the organisation, specifically in the ES context. In articulating LNT for the ES context, the creation of the ES-knowledge base reflects the interaction of the employees' knowledge base wherein the knowledge of the ES continuously produces and reproduces as the learning process occurs through the interactions. The goodness of the ES-knowledge base helps individuals know how to use the ES effectively. It improves and increases their understanding, and ensures consistency and quality in ES performance. Moreover, a high-level ES-knowledge base ensures staff understand the ES procedures and processes, and know how best to respond to the ES problems. In addition, it may increase their commitment to use the ES at optimal levels.

Our case study observations show that the interactions between management and operational staff in organisations contribute to the formation of individuals' ES-knowledge base. Training, gaining ES knowledge from experts, meetings, feedback and teamwork are among the aspects of how employees gain their ES-knowledge base, as seen from the LNT perspective. The involvement of liberal, vertical and horizontal learning network types with those aspects are clearly substantiated in our observations. The findings not only describe the importance of management's role in developing operational staff and their ES-knowledge base, but also show how staff create their learning arrangements from interactions among themselves that contribute to ES success.

To further investigate the roles of management and operational staff in the success of ES by developing their ES-knowledge base, the survey data from 188 respondents was analysed. In order to make a comparison, three situations were applied to have a better understanding of how the ES-knowledge base contributes to the ES success (refer to Figure 3). As hypothesised, all the conditions met our assumption with the results showing that the goodness of ES-knowledge base had a statistically significant effect on the ES success. Some disparities were evident in our findings whereby managers played a larger role in the ES success and operational staff contributed less. Management staff made a higher level of contribution, which can be explained by the nature of their roles as key players in their organisations. Employees in both groups interact with each other and depend on each other to develop their ES-knowledge base. Thus, the learning interactions lead to a higher level of ES-knowledge base for better success of the ES.

Our key findings point to future directions in industry practice regarding the importance of the ES-knowledge base and its relationship to continuous improvement of the ES in organisations. Industry practices can be enhanced by the focus, as in this study, on how the ES-knowledge base is created between and within management and operational staff in organisations, and why and how much it influences the success of the ES. The results can be used to improve confidence in the ES by providing best practice to develop the ES-knowledge base of managers and operational staff. It can also be used by managers in planning innovative approaches that take into consideration a broad range of activities to increase ES-knowledge base among employees. The views expressed in this research suggest the need for further research into how management and operational staff can better understand and meet their obligations in ensuring the success of the ES. Despite the traditional focus on the role of management to take responsibility for this success, we suggest that operational staff as a core employment cohort can more proactively improve their ES-knowledge base to best meet the needs of the ES and ensure its success. We also suggest that formal and informal knowledge interaction practices should be highly valued by the organisations.

In conclusion, we present our case study and survey observations on how the ES-knowledge base is developed that shown to be an important factor on the ES success from management and operational perspectives. The ES-knowledge base at the management level makes a greater contribution to ES success, but success does not solely

rely on management staff as interactions with operational staff help to develop better ES-knowledge among management staff and vice versa. The concept used in this paper will facilitate our next research direction towards understanding the relationship between ES-knowledge base integration and ES success. In this direction, our future work will concentrate on knowledge application, specifically in the context of knowledge integration issues such as how ES knowledge can be integrated and how this integration can contribute to the ES-knowledge base for ES success.

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