

The role of a digital engineering platform (DEP) in appropriating the creation of new work-related mind-set and organisational discourse in a large multi-national company

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Highlights

- An innovative in-house organisation-wide digital engineering platform was developed and used in simplifying the operational complexity in a multinational engineering company.
- Help to regulate and control the running of engineering projects and to create a new work-related mind-set and organisational discourse. It helped the organisation to achieve compliance with major health and safety regulation and to deliver projects more efficiently.
- Research data were collected using a longitudinal case study approach that spanned over six months.
- The digital engineering platform has had real influence on working processes and employees at all levels while encouraging transparency, responsiveness, agility and accountability.
- The digital engineering platform continues to help the organisation to govern, manage and maintain good standard service but many barriers still remain. The digital engineering platform did manage to simplify the workings of different employees and change the work-related mind-set and organisational discourse, by: standardising the stages involved in running a project; serving as a single platform for undertaking engineering projects; facilitating project-related communication between project workers; introducing a new shared and company-wide discourse; suitable conformity to health and safety standards (ISO9001:2000); and defining the sourcing of materials used in installations.

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Abstract

This paper reports on a rare study involving a strategic and innovative approach to creation of an in-house multifaceted digital engineering platform (the DEP) in overcoming a multiple number of organisational problems at a multinational engineering company. The DEP was to be used strategically for simplifying the operational complexity and to create and appropriate new work-related mind-set and new organisational discourse to achieve homogenous working across the organisation, which is a huge challenge. The need for this system emerged from the need to resolve many organisational services related problems that carried phenomenal amount of processes, health and safety risks and to regulate, and, control the running of engineering project. Research data were collected using a longitudinal case study approach over a period of six months. In order to make sense of how the DEP helped the organisation we used certain elements of Extended Structuration Theory. We discovered that the system succeeded in creating and appropriating work-related mind-set and organisational discourse. It also had real influence on working processes and employees at all levels while encouraging transparency, responsiveness, agility and accountability. It continues to help the organisation to govern, manage and maintain good standard of service but many barriers still remain.

Keywords: Work-related mind-set, organisational discourse, complex engineering Projects, Extended Structuration theory, digital engineering platform, problem solving, case study

1. Introduction

This research investigates the role played by a new multifaceted digital engineering platform (DEP) in overcoming multiple problems and simplifying the operational complexity in a multinational engineering company. This paper explains the purpose of this research, the academic background, research approach taken, data analysis, discussions, recommendations and conclusions. The DEP project was led by the quality assurance (QA) team to streamline handling of major engineering projects and to help with its QA process in a complex multinational engineering organisation - Tyco Fire & Integrated Solutions Oil Gas & Marine UK and Ireland (referred to as TFIS). The requirement for DEP emerged from a need to solve a number of distinct and yet related problems with integration and homogenous working being the key challenge. These problems emerged over the years as the company matured but also due to its recent mergers and acquisitions of other firms. The key problem faced by the organisation was that there were a number of dispirit ways of working due to recent mergers and with parts of the company having their own organically evolved ways of working. In fact, in some cases some large and powerful customers were imposing their own ways of working. Furthermore, in some parts of the company engineers had developed their own habitual ways of working due to lack of training in using companywide procedures. Therefore, the company was peppered with problems associated with lack of integration, poor communication, variable work practices and often-poor responsiveness to clients. In real terms, these factors were moving the company away from fulfilling its customer needs and providing a good customer service due to its lack of flexibility and overly complex workings.

These issues were leading to a loss of revenues and image, possible lawsuits, and share price risks. It also became apparent that the quality procedures in place for contract management were being interpreted in slightly different ways. Variations on the main Tender and Contract electronic file structures were apparent, which led to inconsistencies, there were a number of reason why this was the case:

- Contract engineers working to their own systems and not following the organisational procedures for contract file structures and methods.
- Business acquisitions leading to the lack of quality management system integration leading to engineers applying the systems in place in their previous organisations.
- Engineers findings that the nature of the project being worked on required a different contract file structure to one in place at the organisation.
- Clients dictating to the engineers their preferred methods of structuring contract files
- The different nature of projects from small to large resulted in different contract file structures.
- Limited training and awareness of the organisational contract management system procedures leading to engineers using tried and trusted methods.

- Engineers working to contract file structures that they always worked to in the past, resistance to change in working practices and adoption of new ideas.

Therefore, the company's management, with help of the QA Department, sought to overcome the issues by implementing a more standardised and transparent way of working. In order to regulate and control the working of engineers as a dominant group of workers, and to appropriate mind-set and discourse in them. They also had to conform to legal, health and safety requirements, and use ISO9001:2000 standard. In addition to this, they had to make sure that all the contractual requirements were met and to keep a repository of project related transactions for legal purposes and self-learning. They decided to investigate into possible solutions, as result of which the idea for the new in-house DEP emerged. This would not only automate the processes but would also create new work-related mind-set along with common work discourse in order to create homogeneity, integration and a common culture.

Hence this research aims to evaluate the role of the new in-house DEP as such systems are crucial in engineering organisations to help to remain competitive (Lowe et al., 2004; Leonardi et al., 2016). Our aim was to fill several gaps, firstly, there are limited studies on how technology gets embedded into practices in detail; secondly, there are limited number of studies on ISO27000 has been incorporated operationally into work practices of employees. Thirdly, the use of EST to work out how the technology affects employees' work-related mind-set and work-related discourse. Therefore, this research explains how the DEP came to regulate the workings and became embedded into the working practice of employees and created new meanings related to the work of employees – a new discourse. Thus in this organisation the goal of the new system is much greater that it would relay and appropriate the fundamental fabric of work-related mind-set and organisational discourse and communication. The DEP would help in its management of engineering projects and to store and share quality information. Thus, it would serve as a bridge between human and technical resource (Bostrom and Heinen, 1977; Zhao et al., 2008; Woods, et al. 2017; Hollnagel, 2017), while also facilitating the adoption/implementation of ISO9001:2000 quality standard.

To make sense of the relationship between the DEP, its users and their appropriation of technology, the Extended Structuration Theory (EST) (Orlikowski, 1992; Brookes, 2008; Schmitz et al., 2016) is used. EST is based on the original Structuration Theory of Giddens (1979, 1984; Bryant & Jary, 2014; Schmitz et al., 2016) which has been adapted to focus on the structures created and re-created by advanced technologies and that influence human actions (Jones, 1999; Hussain & Cornelius, 2009; Halperin, 2017). Using aspects of EST as a sense-making device helps to show how the DEP was designed and then how it came to control and govern the actions of project engineers by facilitating a new standardised way of working. We look at how the DEP influences the institutional working of employees of TFIS by

reinforcing or changing the structure of signification, domination and legitimation. It enables us to explain how the DEP incorporates the informal organisational professional norms, standards and ways of operating or routines within it as well as the formal ones. The data was collected from three TFIS's UK branches, involving 18 interviews and observations. We also participated in meetings and reviewing documents containing notes and minutes. Different levels of workers, including engineers and QA works were chosen. Overall, there are limited interpretive studies that look at the implications of major engineering systems in detail for example this research.

2. Academic Background

The purpose of the DEP was to simplify complex jobs of TFIS engineers and also the Quality Assurance employees. Technology allows employees to work efficiently, effectively, creatively and affects organisations (Murphey et al., 2012; Yeow, 2014; Galliers and Leidner, 2014). In business like TFIS with complex settings and work arrangement systems can indeed be used as sense making devices (Reynolds, 2015). Systems can also enable organisations to share emotional sense about organisational process between managers and employees, thus the discourse. Because technology can influence employees' work and change the boundaries of work immensely (Yeow, 2014). According to Edwards & Ramiraz (2016), the technology could have many intended and unintended effects on employees that could determine their degree of uptake and their acceptance of technology. Murphy et al. (2012) found that business systems could affect users' job characteristics. Hence, have major impact on the workings of employees. They can even change the use of work-related discourse (Hodgson et al., 2016).

In this research, we use aspects of Orlikowski's (1992) interpretive work that extends the structuration theory (Orlikowski, 2000; Pozzebon and Pinsonneault, 2005; Brookes, 2008). She believes that knowledge, norms, rules and resources are 'embedded' in technologies created by knowledgeable individuals. She believes that technology is made up of "material artefacts" (1992:403) and that it is "interpretively flexible", where its configuration depends on the preferences of human beings and requirements of the institutional context. There is a need for an interface between technology and the work activities of employees. Orlikowski (2000) revisits the theory of structuration so as to replace the notion of embedded properties for enactment (use). The 'practice lens' permit one to examine how people interact with technology in their ongoing practices, enact structures which shape their emergent tasks and situated use of technology (Stillman, 2006; Halperin, 2017). The use of technology could result in many effects according to Edwards & Ramirez (2016): un/intended, in/direct, degree of reconstitution in use, immense, degree of success, and degree of discontinuity with the past. Hence, the DEP is likely to involve all these aspects (Majchrzak et al., 2016). Hence, the new technology affects the nature of work activities, relationships and affects discourses used by employees (Majchrzak et al., 2016; McKelvey et al., 2016; Halperin et al., 2017).

According to Murphy et al. (2012), there is a complex relationship between job design, user job roles and a system. They notice that system design may drive immediate attitudes as it may have long-term attitudinal and behavioural consequences, which is the reason for undertaking this research over a longitudinal period of six month. They believe that user acceptance can take a long time to achieve. They focus on operational and managerial users and both groups felt more comfortable with the old system because it was more forgiving to them when they made any mistakes, whereas the new system did not. They argued that the enterprise system they looked at, was, intended to standardise workings and its use resulted in reduction in job enrichment for operational users while resulting in an increase in job enrichment for managerial users. On the other hand, Yeow (2014) conducted a case study looking at how the system in her research organisation enabled project-based organising and how professional knowledge workers managed their boundaries through use of technology. They show how the technology extended the work-home boundaries, as in this case it extended the work sphere to home. Hence, it extended the real-virtual boundaries of work, involving project-based context.

Furthermore, Hodgson et al. (2016) examines how discourse related to project-based work has impacted employees. They have sought to investigate the far-reaching existential consequences for project workers. They found that project discourse is produced and reproduced by specific interconnection of perception, knowledge, relatively subtle manifestations of power.

=====INSERT FIGURE 1 HERE=====

Figure 1 shows that technology can only influence an organisation through human appropriation, although it is a medium of human action. It does this by constraining and enabling, thus conditioning social practices. EST would enable us to understand how the digital platform, as a tool could become embedded into the daily workings of employees, thereby changing the nature of their work. Understanding such interaction of the system with employees' activities is important. It would help to reveal how the DEP could be used to structure their work routines, activities and even how it affects their communication by impacting their use of language/phraseology. Also, whether and to what extent would become a medium of employees. It could help to focus on how it could regulate and dictate the operational working but also serve as a strategic tool for managing project-related work and monitoring. It would help to see how the DEP could become a common ground for engaging with the project work; facilitate work related communication both in written, graphical and verbal forms. In addition, how it could possibly determine their workings and gain the necessary project-related approvals within good time frame.

3. Methodology

Research Context

The researched organisation is a large complex multinational engineering company (TFIS) that operates in a number of worldwide geographical regions. The unit of analysis is its UK and Ireland Division that consists of a corporate team of senior directors and general managers responsible for the management of the various business units by Regional General Managers. There are also a number of corporate management positions to support the operating units in achieving their objectives. TFIS head office in Manchester (UK) specialises in specific aspects of fire and safety systems. TFIS provides specialist control technology engineering, safety systems and communications for a variety of industries. Examples of industrial sectors in which TFIS operates are marine, oil & gas, infrastructure and, petrochemicals, and it offers solutions ranging from supplying multi-million pound turnkey projects to component spares. The key problem faced by TFIS which led to it searching for a new solution arose largely from the challenges faced in the management of its contracts and projects, as explained earlier in this paper.

Research Approach

The data was collected using a case study approach over a longitudinal period of six months, in order to take into account the system interaction with institutional properties. The necessary organisational and academic ethical requirements were met. An interpretivist case study approach was chosen as an overall methodology within which a variety of other methods could be used and undertaken over a period of six months. An interpretive case study approach was chosen from other approaches available (Galliers, 1995:49). Case study research is more suitable for looking at the social and organisational aspects of IS (Walsham, 1993; Cronin, 2014; Yin, 1989, 2017; Cheng et al., 2017; Yinga et al., 2018; Tan et al., 2018).

A case study can be conducted in a variety of ways; it can be used to study a situation or to build a new theory over a variable period of time (Cronin, 2014; Yin 2017). We aimed to learn about assumptions, beliefs and values and mind-set held in the minds of eighteen engineers and QA employee based across three different sites of the company. For instance, Giddens (1984:327) proposes four types of research for investigating: attitudes and conducts of actors, symbolic nature of social culture, normative morality, authority, deviant behaviours, context and social grouping. These four types of research are:

- Hermeneutics elucidation of frames of meaning (1)
- Investigation of context and forms of practical consciousness (the unconsciousness) (2)
- Identification of bounds of knowledgeability (3)
- Specification of institutionalised order (4)

Giddens (1984) states that those advocating qualitative empirical research are most likely to choose methods 1 and 2 and those advocating quantitative research may choose methods 3 and 4. Our research conforms to research methods 1 and 2, since it is interpretive and qualitative. One of the main reasons for adopting the interpretive stance is the benefit of discovering social beliefs, which is why there is a general

increase in interest in this stance (Dagwell and Weber, 1983:987). The most suitable research method for applying the chosen theoretical approach was a case study approach, as the unit of analysis is one organisation and the research matter requires detailed explanation (Walsham, 1995a; 1996:195-196).

In order to make full sense of the DEP consequences, EST was used to infer and elicit, the technology-enabled re/reproduction of structures that show workers behaving these using. The organisational issues were considered and attempts were made to understand personalities, characters and aspirations influencing the design and use of the DEP were also assessed. So the following methods of data collection were used:

- (1) Interviews and observations of project-related meetings, seminars, events and discussions. These were documented systematically. A large number of visits were made to different parts of TFIS.
- (2) A semi-structured questionnaire based on EST was used in interviews with twelve selected individuals concerned and usually highly involved with the DEP development where they described certain action(s) associated with its development and use. Questionnaire was used to collect data at the end of the project focusing on the usefulness of the DEP for stakeholders.
- (3) Business documents, such as minutes of meetings held at UK headquarters concerning the design, implementation and use of the DEP were scanned. Appropriate actions concerning the DEP were noted and further investigated in the interview and questionnaire.

The combined triangulated collection of data through observations and interviews from eighteen engineers and QA employee based across three different sites of the company has facilitated a better sense-making. The number involved from each site were rough similar around six. These methods were used to: (1) cross-reference stakeholder responses with the researcher's observations and perceptions, and (2) gain better understanding of the situation and stakeholders' viewpoints. Finally, the data collection involved focusing on the actual interaction and use of the DEP by engineers and QA workers, who are unit of analysis. A particular attention was paid to production and reproduction of structures of legitimation, domination and signification to work out the deeper effect of the system on employees and their relationship with their work. This stage not only captured the workings but also reactions and views about the system.

The data analyses entailed referring to technology-enabled re/reproduction of structures and presenting the structures of signification, domination and legitimation. These were then presented in more detail by providing a narrative of discussions held with relevant stakeholders – engineers and QA managers. The data would be analysed to focus mainly on the system use, to evaluate its usefulness in simplifying the

workings of engineering and QA employees. The use of the DEP by the engineers and the influence of the organisational properties would be explained by using Orlikowski's framework (1992:415) adapted and depicted in Figure 2.

=====INSERT FIGURE 2 HERE=====

The data analyses involved using theoretical deduction involving re/production of structure resulting from the use of the DEP. This would be done by presenting the structure of signification, domination and legitimation concerning the DEP in Tables 1 and then discussing these in more detail. This discussion would involve providing a narrative of discussions held with relevant stakeholders – engineers and QA managers.

4. Findings and Data Analysis

The results are presented to reflect the use of the DEP showing the production and reproduction of structures. It will become apparent as to how the DEP influences its execution by users, how the institutional properties affect the system execution and finally how the system influences the institutional properties. The use of the DEP by the engineers and the influence of the institutional properties on its uses are explained in Table 1:

=====INSERT TABLE 1 HERE=====

The DEP was generally well received, where views conveyed by interviewees about the DEP suggested that they agreed with having the system, and believed it was potentially very suitable for their organisation and that it had a lot of promise. Some of the positive reactions were to build on a simple concept, increased efficiency, increased transparency and enabled ease of auditing. Also, to have a central repository of project and quality management manuals and procedures. It enabled a better integration of quality and project management process where the necessary job forms and resources are stored centrally, which streamlines and simplifies the process of completing project-related documents. Furthermore, these resources are provided in a logical order depending on the nature of engineering projects. This is particularly useful for large projects that involves team working. The subsections of this section will discuss the key points highlighted in Table 1.

The DEP influences project engineers

Firstly, a number of new structures of signification were produced when the DEP became operational. It influenced the nature and content of the project and quality-related communication and information transfer. It is used by the majority of project engineers in the UK branches from which data were collected. They were using the DEP as a new medium to communicate, archive and disseminate project-

related information to each other, management and the QA personnel. One respondent said: *“Engineers are always conscious of the fact the DEP is the way things are done, therefore it’s in the back of the mind that everything related to a project has to be managed and controlled via the platform”*. Another respondent confirmed that: *“The documents completed during the projects are filed in the manual contracts files and sometimes scanned on to the systems (about 10%)”*. Many workers testified that the DEP was a useful medium for project-related communication, but they highlighted a number of interpretation and sense-making problems. For example, a project engineer commented: *“It helps to overcome the issue of individualist culture”*. Because the DEP involves sharing and communicating information between project engineers. As a senior designer commented: *“The drawings folder in the DEP is very useful to keep the records. As long as everybody else does their bit”*. He also said that he was motivated to use the systems because: *“It’s there, and it’s systematic!”*. He confirmed that it was easy to work from sub-directories within the system than had been the case in the past. So if anyone wanted an access to a project drawing for example, they could simply open the project file and access the files. They were using the DEP for downloading project forms and had memorised their numbers, project-related information and regulations, and information about other similar projects; linking/automating transfer of data between the DEP and the e-mail systems; and reporting back to and seeking/obtaining authorisation from management. The content of these forms and specific usage of terms, phrases and acronyms in the system were used by the engineers and had recently become part of their daily vocabulary. For example, numbers of the forms available on the DEP were constantly referred to by engineers in their communication between them and researchers. The DEP screen was also referred to in a similar manner. The DEP was also used to communicate with suppliers, through direct ordering, and with customers through feeding cost-related information into their system.

As far as the structures of domination are concerned, the DEP mainly leads to re/production of management control. Given its potential benefits and ease of use and the expectations of its use by management, the DEP now had to be used in all large and/or complex projects to increase the transparency of transactions by engineers. Here engineers report their workings to management, leading to an enhancement of management control over engineers and making sure that they are following the current process in managing the project. The DEP eliminates any incorrect practice or misconduct. A senior project engineer confirmed that: *“If you don’t fill in the form you will get a warning for non-conformity”*. Another project engineer said: *“There isn’t enough admin. Support. Service departments make our job hard. It’s their imposition of restrictions - bureaucracy”*. For example, a manager said: *“In order to proceed to the next stage of a process in relation to project management the necessary approval would have to be sought first, this is visible within the platform.”* The DEP allows organisational management and quality assurance managers to audit and check the work of engineers by accessing their project files and checking project progress systematically. This could be done remotely with great ease. As

a senior QA manager confirmed: *“The DEP would facilitate remote checking, without having to physically travel to different sites to check through the paperwork”*. However, there are several usability issues hindering the use of the platform. As a Project Manager (LW) confirmed: *“The system has a slightly poor usability for example, you have to click on the form to get an explanation on the side”*, and *“The DEP is useful but it needs to be refined and needs to be pruned down to decrease the number of forms”*.

Finally, the system would enable quicker authorisation of project-related activities and would mainly involve reproduction of legitimation structures. For example, project engineers constantly purchase materials to complete their jobs and need the approval of their line management or the Purchase Department. Having all details of the project on the DEP helps them to get a quicker approval to purchase materials, through electronic authorisation. Furthermore, the DEP is linked to other systems and feeds data into them. For example, the expenditures in a particular project can be obtained on time and then updated because the DEP feeds data into Mentos – an ERP financial management module.

Influence of organisational institutional properties on project engineers and QA Managers through use of the DEP

Firstly, the DEP is used systematically to make notes and comments on actions taken during the project concerning the re/production of signification structures. So it has come to serve as a medium for information sharing and business communication, where engineers use it to query and clarify aspects as they proceed through their projects. This enables them to avoid the risk of failure or financial loss. The DEP not only enables communication between engineers that is used by different project workers to record events, it has now become a central medium for recording and retrieving data with clearly defined means of interpreting these data which can be understood by project engineers, quality managers and other relevant workers.

However, a number of engineers have commented that there are too many pressures on them to fully utilise the DEP. As a senior project engineer remarked: *“... engineers are too busy... They [engineers] don't have time to fully learn about the DEP”*. On the other hand, some project engineers found the DEP: *“reasonably easy to use”*, although he himself said that he could do with more training on making use of more advanced features. Other engineers commented that the current IT infrastructure of the company, especially the network, poses a lot of problem in using the DEP remotely. Hence these need to be eliminated. Given the size of some of projects, their cost could run into millions of pounds, therefore recording of costs and an engineer's time and actions is important. The DEP provides accountability of all project-related activities, so the DEP compels the engineers to take, perform and then record all project-related action: *“The DEP is used for commissioning”*. Another engineer also confirmed its use for

commissioning. Also that it allows them to use and validate electronic signatures. The actions of engineers can then be monitored and observed by management in line with the existing line of authority. It also enables an easy enforcement of quality standards, where the actions performed by project engineers in relation to assuring quality are recorded, helping to make sure that appropriate standards have been conformed to and they can be audited with ease. Any quality lapses are easily picked up and questioned. This helps the management to reduce risks and to enforce conformity.

The DEP is used to authorise the different actions of project engineers, such as sending out an estimate, purchasing materials and requiring further time and resources. Any approvals for work are given quickly and the authorisation can happen remotely in different time zones. This is very convenient for project engineers and their management. By completing relevant forms throughout the project, the quality management can also check the content with regard to which of the quality standards have been conformed to, for instance what sort of cable has been used for connecting smoke sensors and the position of water sprinklers in a building. Finally, all project-related decisions and authorisations are documented in the platform. This increases the transparency of projects and helps project engineers to achieve approval of seniors. It also helps the organisation to deal with risks of lawsuits against it.

However, there are a number of factors which could hinder the acceptance of the platform, such as extensive pressures on engineers to complete the projects. One engineer (SF) commented: “*We live in a real world*”. He added: “*It’s practicable, if we work as a team*”. A senior project engineer (JM) pointed out: “*You could be spending all day on one of those files [DEP functions]*”.

DEP influences institutional properties after being routinely used in the organisation

The DEP is now being used *de facto* and accordingly the vocabulary becomes widely used. It is now used for recording project events, actions of engineers and project-related archive information. A senior project engineer confirmed: “*The DEP is very useful and has a high potential but there are too many forms and not enough training*”. The lack of training was further confirmed by other project engineers. However, the DEP is referred to as a point of reference for not only checking the projected details but also information about them. As a senior project engineer said: “*New workers would find the DEP very useful to look at the past project. But they would need training*”. The use of the DEP has led to the development of standard vocabulary associated with engineering, project management and QA. For example, the forms on the DEP have become part of the daily language of engineers, who automatically refer to relevant form numbers when conversing. Interestingly, management and QA management can interpret and use appropriate terms and phrases to make sense, judge progress and check success of a particular project.

Due to the use of the DEP, it comes to control the daily workings of engineers and many other employees involved in a project, as it has to be used in completing its different activities. Its use is now a requirement, although engineers handling smaller and/or simpler projects do not have to use it. The new recruits of the organisation are familiar only with the DEP and can use it alone in their daily work. Hence it can control and monitor their work. Finally, the DEP has begun to influence the organisational culture of greater accountability and a tighter project management. This has yielded a certain amount of resistance and some of the engineers show this in the form of dislike of the system or portraying it as an extra burden upon them and others.

The use of the DEP assists in getting a project signed-off as all project-related actions are already recorded into the system. It shows the conformance to standard of project-related activities and quality management. Therefore, QA is made easier as the entire conformance to the quality requirements can be checked. All levels of management, some more senior than others, have bought into the idea of using the DEP in the working of engineers and QA teams.

Therefore, it becomes apparent that the benefits of the DEP to the organisation are significant. However, during the interviews, a few issues arose which could be resolved through relatively simple actions. Needing attention are screen layout/usability, increased understanding and effectiveness through further training and clarification of system objectives.

In the long term, the DEP will run online in the form of a live process map to facilitate a further ease of use. The form could be completed and then the links to these could change colour once completed. Online completion of the forms would also minimise the input of basic project-related data by users. This would also make it easier to transfer information to other systems and departments, such as purchasing. However, due to complexity of the organisational processes, this further enhancement to the system will be time-consuming and would require a significant resource commitment within the context of an overall IS/IT strategy (Leonardi et al., 2016)

Secondly, although there has been some training for users since the implementation of the system and there have been attempts to raise the awareness of staff on the benefits, system use has however increased and the training needs likewise. There is now a need for further training to maximise the benefits of the system and to promote a single company-wide approach. Along with training there is a need to raise awareness of staff about the DEP and its benefits. This could be achieved through an organisational newsletter, reporting its benefits to engineers, and e-mails concerning relevant developments/updates of the system. Overall, there is a need to raise user awareness and to link this to training and development.

This can be achieved through processes such as having a system-related intranet site and sending system-related electronic newsletters.

Finally, the DEP appears to have a range of objectives rather than an overall objective and purpose. Some see it as a simple download site whereas others see it as an information site. Therefore, it is important to have clarification about the system: (1) purpose and objectives based on the system's strategic significance to the organisation and (2) the system's overall fit into the applications portfolio of the organisation. In order to clearly define and create a sense of purpose of the system there is a need to clearly link it to an IS strategy. This strategy should take into account at broad and detailed levels the business and IS focus. It should clearly define the business application portfolio of the organisation and should provide a set of steps to proactively improve systems, in particular the platform, in line with future business directions and pressures from its environment.

5. Discussions

This section provides the discussion by highlighting the contribution to theory and implications for practice.

5.1. Contribution to Theory

The use EST enabled the mapping of assumptions made in creation and use the DEP, as Orlikowski (1992; 2000) believes that knowledge, norms, rules and resources are 'embedded' in technologies created by knowledgeable individuals. Her work enabled us to show the interface between technology and the work activities of employees (Orlikowski, 2000; Pozzebon and Pinsonneault, 2005; Brookes, 2008). The use of EST has helped to reveal the organisational dynamics and has served as a 'practice lens' to examine how people interact with technology in their ongoing practices, enact structures which shape their emergent tasks and situated use of technology (Stillman, 2006; Halperin, 2017).

Hence a number of factors have emerged from this research that will be discussed crossed checked against the literature. Firstly, it was discovered that the DEP did get embedded into the organisational workings and facilitated the appropriation of mind-set structures, concerned with: work as an on-line process; online project repository, the DEP determines engineer actions; system used for work monitoring and audits; online work approvals. Furthermore the projects are seen as 'live' and being visible to all; relevant QA processes need to be followed at given stages of the project, with quality being in the workers' mind-set; and, obtaining online authorisation. In fact, this is in line with the views of Murphy et al. (2012) who found that business systems can affect user's job characteristics. Also with the views of Orlikowski's (1992) who believes that knowledge, norms, rules and resources are 'embedded' in technologies created by knowledgeable individuals. She believes that technology is made up of "material artefacts" (1992:403)

and that it is “interpretively flexible”, where its configuration depends on the preferences of human beings and requirements of the institutional context. She later writes that there is a need for an interface between technology and the work activities of employees. Orlikowski (2000) revisits the theory of structuration so as to replace the notion of embedded properties for enactment (use).

Secondly, the DEP appropriated the organisational discourse such as: system screens/forms used in work communication; online processes referred to in talks; quality assurance processes linked to the system in new vocabulary and communication; and, the use of words and phrases concerning project approval, tracking and auditing. Hodgson et al. (2016) also found that discourse emerges from a system, for example, for project-based work and has a major impact on the workings of employees. They can even change the use of work-related discourse (Hodgson et al., 2016). Technology influences employees’ work and changes the boundaries of work immensely (Yeow, 2014).

Thirdly, the system helped to simplify the operational complexity, given that most projects are multifaceted and range from £100K-£1M, with many being extremely complex. The DEP automated the process and made all the aspects clear and quantifiable. In so doing, all project materials or processes is clearly identifiable. For example, Reynolds (2015) states that a system can be used for in complex settings and can be used as sense making device. Edwards & Ramirez (2016) note that technology could lead to many effects according to un/intended, in/direct, degree of reconstitution in use, immense, degree of success, and degree of discontinuity with the past. In fact, the DEP also affects the nature of work activities, relationships and affects discourses used by employees as found by several other researcher in resent years (Majchrzak et al., 2016; McKelvey et al., 2016; Halperin et al., 2017).

Finally, the systems has successfully standardised the organisational workings and has made the processes more transparent. Here the DEP standardised the dispirit ways of working and has given the workers clear indication of what needs to be carried out and when. It has enabled a better regulation and control of legal, health & safety, and QA aspects. It allowed the management and QA to enforce the regulations concerning the installation of fire equipment, chemicals and materials. It has also helped to plan and undertake servicing, and to control the workings of engineers and QA. Here several researchers have concluded that technology allows employees to work efficiently, effectively, creatively and impact organisations (Murphey et al., 2012; Yeow, 2014; Galliers and Leidner, 2014). Therefore it is apparent that the DEP has led to creation of new mind set and new discourse that would enable the company to achieve a homogenous working.

5.2. Implications for Practice

A number of useful implications or practice can be made as a result of this research TFIS, firstly, they need to carry out relevant training needs to be provided to end users, includes and QA professionals. This will increase the use of the system and would further encourage uninformative ways of working. Hence this will impact the level of system use and could be a cause of anxiety for many users. Hence, secondly, they need to make better attempts to achieve better system ownership from user base. This ought to involve more consultations with employees and listening to their viewpoints and resolving any issues. It will enable them to see the DEP as an agent for change and an improvement to their working.

Thirdly, the company can use the DEP as a learning device, as it will hold data about past and current projects and could serve as a knowledge repository. These could be used as an example of success and failure by existing staff but in particular the new staff. New engineers and QA staff can be trained using the data already held in the digital platform. Fourthly, , they can launch a technology-based newsletter to portray a new technical direction and to encourage all employees to be more pro-technology. This will help to introduce the system related discourse amongst employees. They will then begin to embed new concepts and utilise the language in their work processes. This, hope fully, will encourage a better acceptance of the platform. Finally, they can use the DEP as a common platform to align employees of newly acquired TFIS ways of working. The DEP can serve as a common platform, and its functionality and usability to be enhanced further. Relevant technical and end-user documentation should be created to maintain the use of the DEP in the years to come.

6. Conclusions

The purpose of the DEP was to automate the processes and to create new work-related structures along with common organisational discourse in order to create homogeneity, integration and a common culture. Also to simplify complex jobs of TFIS engineers and also the Quality Assurance employees. Some of the specific challenges it faced included: a) engineers working to their own systems and not following TFIS standard quality procedures, b) business acquisitions leading to lack of integration, resulting in engineers' relying on and applying previous systems in place in their former organisations, c) clients dictating to engineers their preferred methods of working, and d) limited training and awareness of contract and project management system procedures. The DEP would also serve as a strategic tool in managing engineering contracts, and with help implementation of the quality standard (ISO9001:2000). In some cases, technology can make work of routine workers more complex (Marler & Liang, 2012). However, system would help in replacing many informal and habitual practices of different groups of employees (Hodgson, et al., 2016). Thus, the system would help to standardise, regulate and govern the core organisational workings. It would help to standardise TFIS's contract management and QA processes as the organisation has to conform to ISO9001:2000. The overarching purpose of the system was to help the

organisation to become more responsive, agile and to increase the accountability of stakeholders managing the engineering projects.

Therefore the system has had a tremendous impact on all core aspects of work in the long run including appropriation of new work-related mind-set and organisational discourse. The system has removed many of the complexities involved in engineering projects and has enabled better communication of different parties involved in technical projects. Thus, reducing the organisational risks, achieving better employee performance and sustaining enhanced organisational performance. Therefore the DEP succeeded in enabling effective project management of engineering contracts came to dominate the organisation by regulating, standardising the work of different professional groups of employees. Overall, the DEP has had a dramatic impact on TFIS employees and has changed the management of engineering-projects in the long run.

The new mind-set include workers recognising the new online processes that has automated the data concerning every project. They now can see that all the data is transparent and online and that they are accountable. They have to perform standard activities that “stick” in their minds and they put them into action. Likewise, they use QA terms, words and phrases in running the engineering projects. The new discourse would integrate the whole where different stakeholders can understand each other. This has minimised the chance of misinterpretation. The discourse shows that new standard vocabulary has been developed where new terms such as DEP, online data and form repository, information recording and quality assurance have been introduced. Along with many new phrases and acronyms. As Table 1 shows that DEP now serves a common communication medium and has become a de-facto. The system would also allow people with authority to audit projects for expenditure, completeness and conform to quality standards and controlling the working of workers. Finally, it shows that the DEP will be used to obtain legitimation, approach, authorisation of management, here all decision are transparent and justified, where any signing off of the project is clear and accountability and conformance has to be shown.

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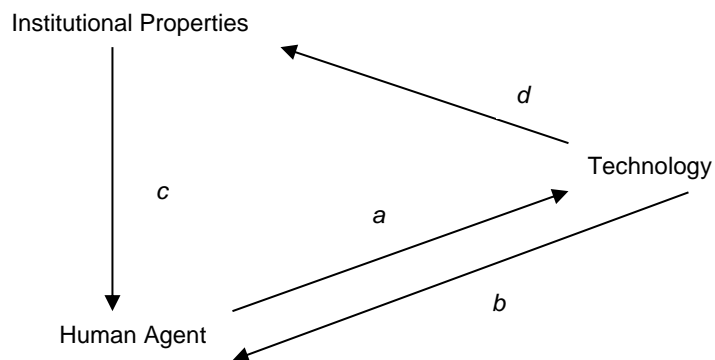
TABLES

Table 1: Use of DEP Stage

	Arrow 1 (see Figure 2)	Arrow 2 (see Figure 2)	Arrow 3 (see Figure 2)
	DEP influences its execution by project engineers and QA managers	Influence of TFIS's institutional properties on project engineers and QA managers through use of platform	DEP influences TFIS's institutional properties after being routinely used in organisation
Signification-interpretive scheme-communication	<ul style="list-style-type: none"> DEP serves as common communication medium for Project Engineers and QA Managers to manage <i>contracts</i> (P). 	<ul style="list-style-type: none"> TFIS expects most engineers to document project notes and comments using the DEP (R). Different project workers use relevant functions of DEP in fulfilling their project requirements (R/P). 	<ul style="list-style-type: none"> DEP used as a <i>de facto</i> (P). Standardised vocabulary widely used by project engineers and QA managers (P). DEP forms referred to by their reference number in daily discourse of project managers and QA managers who are all familiar with terminology (P).
Domination-facility-power	<ul style="list-style-type: none"> DEP determines action of project engineers (more so of 'large' project engineers) (P). Through DEP, organisational management can audit workings of project engineers (R). 	<ul style="list-style-type: none"> All project activities should be accounted for and DEP facilitates this (R). Quality has to be checked in line with quality management standard (ISO9001:2000) (R). 	<ul style="list-style-type: none"> DEP widely used and controls daily workings of many workers (P). DEP is only way that some new workers are familiar with how to carry out their work tasks in relation to project management (R). DEP is central piece forming organisation culture in terms of managing projects (P).
Legitimation-norms-sanction	<ul style="list-style-type: none"> Using DEP enables quicker approval of project-related activities by different management and QA managers which minimises delays in project timescales (R). Authorisation/approval for procuring project related materials (R). 	<ul style="list-style-type: none"> All projects authorised through use of DEP (R). All quality requirements met through use of DEP (R). Ensures all key decisions made and documented within DEP (R). 	<ul style="list-style-type: none"> Only way to get project signed off is to conduct it through DEP to show e accountability and also conformance to Quality Management (P). QA made easier through use of DEP (P). Demonstrates that all levels of management have bought into use of DEP as all are involved at various stages (P).

Key: (R)= Reproduction of old structure, (P)= Production of new structure

FIGURES



Arrows	Types of influence	Nature of influence
a	Technology as a Product of Human Action	Technology is an outcome of such human action as design, development, appropriation, and modification.
b	Technology as a Medium of Human Action	Technology facilitates and constrains human action through the provision of interpretive schemes, facilities, and norms.
c	Institutional Conditions of Interaction with Technology	Institutional Properties influence human in their interaction with technology, for example, intentions, professional norms, state of the art in materials and knowledge, design standards, and available resources (time, money, skills).
d	Institutional Consequences of Interaction with Technology	Interaction with technology influences the institutional properties of an organization, through reinforcing or transforming structures of signification, domination, and legitimation.

Figure 1: Orlikowski's (1992:410) Structurational Model of Technology

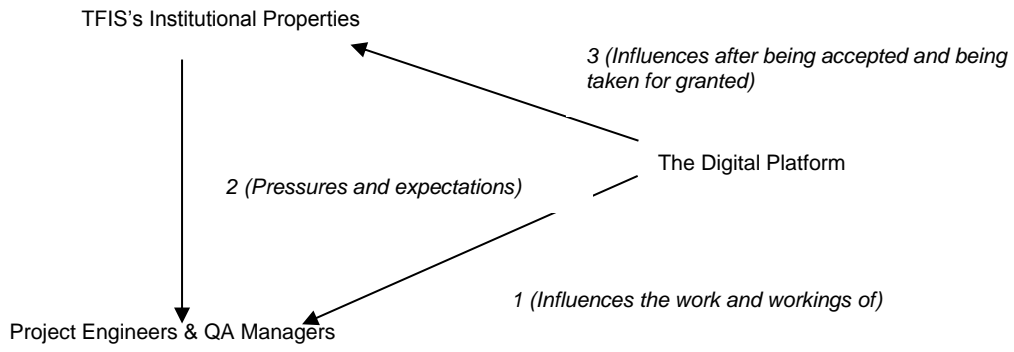


Figure 2: Institutionalised Use of the Digital Platform