The processes of ICT diffusion in technology projects

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ABSTRACT

Delivering technology projects on time with a specified budget and resources has emerged as a strategic imperative in the highly competitive business world. One of the project challenges is increasingly tied to diffusion (spread) of Information and Communication Technology (ICT) innovation. This paper presents an empirical study that examines how ICT innovation is diffused within technology projects. Based on the case study methodology within 12 organisations in Australia and Germany, it emerged that ICT innovation is diffused formally alongside standard project management phases and informally within informal networks. The findings are synthesised in a new framework that seeks to inform theory and practice about formal and informal processes of ICT diffusion in technology projects.

Keywords: ICT, diffusion, project management, formal process, informal process, informal network

1. INTRODUCTION

During the last decade, cost-cutting pressures, accompanied by increasing customer demands and rapid changing Information and Communication Technology (ICT) have driven companies to initiate technology projects. Productivity Commission (2004) argues that companies invest in ICT in order to boost their performance. However, the process of technological implementation involves a considerable amount of risk with respect to the diffusion of new technologies within projects. The high failure and delay rates of ICT projects have been the subject of considerable interest among academics and practitioners

(Volk 2004; Charvat 2003; Krempel 2004). Currently, there is general agreement that delivering technology projects on time with a defined budget and resources is still the principal criterion for measuring the success of technology projects (LeMay 2008). According to Andersen et al. (2006), the set project goals can be achieved through communication. However, communication is a broad term that needs further investigation. Rogers' (1995: 17) research on diffusion of innovation states that '... a particular type of communication in which the message content that is exchanged is concerned with a new idea'. In regard to this, scholars are still in dispute over

how new ideas are disseminated. While Volk (2004) emphasises the formal and planned diffusion processes within project management, Rogers (1995) highlights that diffusion of new ideas can occur either as a planned or spontaneous process. Usually, technological ideas are disseminated via informal networks in order to influence people (Kakabadse et al. 2004). This implies that informal networks play a vital role in the diffusion process of innovation (Von Stamm 2003).

Over the past 15 years, scholars have examined project management, diffusion and informal networks as separate discourses. This study is among the first which investigates how ICT is diffused within standard project management and whether informal networks are used for dissemination purposes. Moreover, it is not clear whether ICT diffusion includes the same diffusion elements such as innovation, communication channels, adoption or rejection time, and social system, which were suggested by Rogers (1995) in the general context of diffusion of innovation. Specifically, this paper seeks to address the research question: how is ICT innovation diffused alongside standard project management in order to achieve target project outcomes? In the next section, the theoretical background for the study is discussed, followed by the methodology applied. The results are then outlined and the discussion presented with conclusions.

2. LITERATURE REVIEW

Usually, a project is initiated to develop or improve products, processes and/or services within an organisation (Cleland & Ireland 2002; Hartley 2003). Keeling (2000: 2) emphasises three main identification points for projects such as 'separate undertakings', 'discrete purpose and objectives' and 'limited duration'. Kerzner (2003) adds that the termination date, limited budget, objectives and specified resources characterise a project. In other words, a project is initiated as the formal and planned process on a temporary basis in order to achieve set project goals.

There are many different project management models discussed in the literature recommending

standard procedures (Loo 2003). Similarly, the proposed project management models underline the distinct project management phases. The study, on which this paper is based, adopted the Western Australian Innovation Centre (2005) model which suggests four project management phases that proceed sequentially from 'initiation' to 'planning', 'execution' and then finally to 'close-out'. This four-phase model is widely adopted by practitioners in project management. In each distinctive project management phase, various activities are performed. In the initiation phase, the project needs to be approved. Projects concerned with product innovation are more likely to be approved (Vaupel et al. 2000). The planning phase includes commencement and completion dates, detailed plans regarding the tasks, resources and costs (Kerzner 2003). In the execution phase, the project is implemented in the target organisational settings. In the final project management phase, 'close-out', the project is evaluated as to whether the defined project goals are achieved.

Chapman & Ward (2003) suggest that the risk of not achieving a planned project outcome can be calculated. However, ICT projects differ from other project types. ICT projects are becoming increasingly complex including multiple functions that require professional project management. Charvat (2003) supports the idea that an ICT project is complex by advancing three arguments. Firstly, ICT projects involve various business units with specific requirements that need to be considered. Secondly, the implementation of ICT innovation in each business unit has a different priority. Thirdly, a new software program needs to fit in with other applications that require specific skills in planning with respect to time and budget.

In the process of implementation, new technologies are diffused within ICT projects. Rogers (1995: 5) defines diffusion as '...the process by which an innovation is communicated through certain channels over time among the members of a social system'. In this study, ICT project team members and users of a particular technolo-

gy project are all members of the social system. Innovation implies novelty (Johannessen et al. 2001; Powell & Grodal 2005), but the '...sheer complexity of the technological and business environments in which firms operate also contributes to the risk and uncertainty borne of innovators' (Dodgson et al. 2005: 22). Thus, innovation has become '...a complex non-linear process' (House of Representatives Standing Committee on Science & Innovation 2006: 7) in which new actions are diffused through a social system that has complexity inherent in the communication channels. This entails '...incorporating more links, interactions and structural dimensions ...[with] high levels of non-linear interactions causing unpredictability' (Anderson 2001: 15). As a result, almost all technological innovations that are being diffused in organisations bring abnormality (Dodgson 2000; Dodgson 2008) and the complexity of ICT innovation heightens this disorder. In other words, the diffusion of innovation, particularly of ICT, brings uncertainty. In response to uncertainty in the diffusion of ICT innovation, this study aims to show how practitioners increasingly operate within informal networks.

3. METHODOLOGY

The present empirical study draws on qualitative research which exposes the professional practices regarding the diffusion and implementation of ICT innovation. Qualitative research is a suitable instrument to capture the complex nature of ICT innovation (Von Hellens et al. 2006). The empirical evidence of qualitative data provides a holistic and detailed understanding of a situation in a case study (Stake 1998). A case study methodology unites different sets of data (Eisenhardt 1989) in the context of specific settings (Yin 1993). Every case study consists of one or many cases (Hammersley & Gomm 2000; Yin 2003) which allow for the development of theory (Babbie 2004; George & Bennett 2005).

This research is based on four case studies within 12 organisations in Australia and Ger-

many. Case studies 1 and 2 were concerned with the public sector while case studies 3 and 4 focused on the private sector. In both sectors, data regarding ICT projects were collected through interviews with key project individuals and from project documents which helped to construct 41 cases. The majority of researchers gather contemporary data via interviews (Holstein & Gubrium 1995; Hunt & Eadie 1987). However, Gaskell (2000) concludes that a great number of interviews do not contribute to better quality of data. In other words, the quality of interview data is more significant than the number of interviews.

This study centred on key individuals, so-called ICT change agents, within six state agencies (public sector) and six banks (private sector) in Australia and Germany. ICT change agents initiate, manage and implement technological change (Weiss & Anderson 2004). ICT change agents are not explicitly named in organisations and are part of a hidden population. So, the identification of appropriate participants was difficult. In such situations, Henry (1990) recommends snowball sampling. 'Snowball sampling is a multistage technique. It begins with one or a few people or cases and spreads out on the basis of links to the initial cases' (Neuman 1994: 199). This implies that a participant refers the researcher to the next potential participant and so on over time until patterns clearly emerge from the snowball sampling.

Each case was analysed independently to extrapolate the insights of ICT projects' formal and informal activities. Guided by grounded theory (Glaser & Strauss 1967; Strauss & Corbin 1997), the empirical data helped to develop a new framework in order to better understand how ICT innovation is diffused within technology projects.

4. EMPIRICAL RESULTS

Table 1 shows the results of the snowball sampling. It reveals the process of ICT diffusion within public and private sector technology projects in

Australia and Germany. In both sectors, new ideas were diffused in every project management phase. For the diffusion of ICT innovation, change agents used formal and informal communication channels. The core formal communication channels were face-to-face, email and phone. Occasionally, change agents also communicated via fax, interactive software or sent project documents via post. The communication on an informal basis occurred predominately face-to-face. If face-to-face conversation were not possible, change agents used the phone, email or interactive software for communication within informal networks. The majority of change agents communicated with internal and external team members. The extent to which those ideas were adopted depended on the person who made the suggestion, the target group and the type of ICT innovation. Nevertheless, the behaviour of each team member did not affect groups in the same way. Some individuals had a leading role in the diffusion process, for example, opinion leaders. So, when new suggestions came from an opinion leader of a group, a group was more likely to adopt the innovation.

By comparing the distinct case studies, Table 1 shows some similarities and differences between sectors. In both sectors, in every project management phase the new technological ideas regarding ICT innovation were diffused via formal and informal communication channels. Nevertheless, it took time until those ideas were adopted by distinct adopter groups. The first adopter group was the project team, followed by external team members and users. Due to the standard project management methods, it is evident that in both sectors, change agents applied similar core formal communication channels. In contrast, informal conversations were outside of standard processes. Therefore, change agents were more likely to foster face-to-face communication in order to exchange tacit knowledge or spread new ideas. Certain circumstances, for example, political agendas in the public sector or increased market rivalry in the private sector, drove change agents to use additional communication channels on

demand. A further difference between sectors is reflected in change agents' participation. Public sector change agents were more likely to participate in the first three project management phases while their private sector counterparts tended to engage in execution and close-out phases.

Each of the four diffusion elements (ICT innovation, communication channels, adoption or rejection time and social system), together with the informal networking, took place along distinct project phases. These elements are discussed next.

ICT innovation

In both sectors, every ICT project involves different degrees of novelty. In every project management phase, change agents suggest new ideas which are related to new ICT technologies. Nevertheless, the purpose of ICT innovation depends on the sector. In the public sector, organisations aim to improve services for the communities, whereas private sector companies intend primarily to boost profits.

Formal and informal communication channels

In every project management phase, change agents rely mainly on formal communication channels, which are: face-to-face, email and phone in both sectors. While those channels remain constant over the project management phases, the additional channels vary. On the other hand, the core informal communication channel is centred on face-to-face communication. While this core informal face-to-face communication is applied in all project management phases, the use of other additional informal channels fluctuates.

Adoption/ rejection time

Some individuals adopt new ideas quicker than others. How fast the ideas are taken on by employees or clients depends on: i) the person who made the new suggestion, ii) the adoption group, and iii) the nature of the innovation. It emerges that in both sectors, the adoption of new ICT technologies is primarily centred on a project team. An

TABLE 1: THE PROCESSES OF ICT DIFFUSION IN PUBLIC AND PRIVATE SECTOR TECHNOLOGY PROJECTS

Case study 1 (Cases within three Australian state agencies)

Change agent (CA)	Suggested a new idea	Adoption time of CA's new idea	Involvement in core project management phase	Nature of project communication	Formal communication channel	Informal communication channel	Used informal network (Yes/No)
CA1	Yes	9 – 12 months	Planning	Internal and external	Face-to-face, email, internal post, external post, phone, fax, interactive software	Face-to-face, email, phone, interactive software	Yes
CA2	Yes	Not adopted	Planning	Internal and external	Face-to-face, email, internal post, external post, phone	Face-to-face, email, phone, interactive software	Yes
CA3	Yes	Not adopted	Initiation	Internal	Face-to-face, email, phone	Face-to-face, email, phone	Yes
CA4	Yes	3 days	Execution	Internal and external	Face-to-face, email, external post, phone, fax, using an other person as a messenger	Face-to-face, email, phone, using an other person as a messenger	Yes
CA5	Yes	Not adopted	Initiation	Internal and external	Face-to-face, email, internal post, external post, phone	Face-to-face, phone	Yes
CA6	Yes	Not adopted	Execution	Internal and external	Face-to-face, email, phone	Face-to-face, email	Yes
CA7	Yes	Not adopted	Planning	Internal and external	Face-to-face, email, phone	Face-to-face	Yes
CA8	Yes	3 months	Initiation	Internal and external	Face-to-face, email, internal post, external post, phone, interactive software	Face-to-face, phone	No
CA9	Yes	1 months	Close-out	Internal and external	Face-to-face, email, external post, phone	Face-to-face, email	Yes
CA10	Yes	Not adopted	Execution	Internal and external	Face-to-face, email, internal post, external post, phone	Face-to-face, email, phone	No

(Continued)

Case study 2 (Cases within three German state agencies)

Change agent (CA)	Suggested a new idea	Adoption time of CA's new idea	Involvement in core project management phase	Nature of project communication	Formal communication channel	Informal communication channel	Used informal network (Yes/No)
CA18	Yes	Not adopted	Initiation	Internal and external	Face-to-face, email, internal post, external post, phone	Face-to-face, using another person as a messenger	Yes
CA19	Yes	8 months	Planning	Internal	Face-to-face, email, phone	Face-to-face, email, phone	Yes
CA20	Yes	Not adopted	Execution	Internal and external	Face-to-face, email, internal post, external post, phone, using another person as a messenger	Face-to-face, phone, using another person as a messenger	Yes
CA21	Yes	? year	Initiation	Internal and external	Face-to-face, email, internal post, external post, phone, fax	Face-to-face, email, phone	Yes
CA22	Yes	1 year	Execution	Internal and external	Face-to-face, internal post, external post, phone, fax, using another person as a messenger	Face-to-face, email, internal post, external post, phone, fax	Yes
CA23	Yes	6 months	Close-out	Internal and external	Face-to-face, email, internal post, external post, phone	Face-to-face, email, phone	No
CA24	Yes	1 year	Initiation	Internal and external	Face-to-face, email, internal post, phone, interactive software, using another person as a messenger	Face-to-face, email, phone	Yes
CA25	Yes	Very fast	Execution	Internal	Face-to-face, email, internal post, external post, phone, fax	Face-to-face, email, phone	Yes
CA26	Yes	Not adopted	Execution	Internal and external	Face-to-face, email, internal post, external post, phone, interactive software, using another person as a messenger	Face-to-face, email, phone	Yes
CA27	Yes	Not adopted	Execution	Internal and external	Face-to-face, email, phone	Face-to-face	Yes
CA28	Yes	1 year	Planning	Internal and external	Face-to-face, email, internal post, external post, phone	No	No
CA29	Yes	1 months	Initiation	Internal	Face-to-face, email, internal post, external post, phone, using another person as a messenger	Face-to-face, email, phone	No

(Continued)

Case study 3 (Cases within three Australian banks)

Change agent (CA)	Suggested a new idea	Adoption time of new idea	Involvement in core project management phase	Nature of project communication	Formal communication channel	Informal communication channel	Used informal network (Yes/No)
CA11	Yes	Not adopted	Close-out	Internal	Face-to-face, email, interactive software	Face-to-face, email	Yes
CA12	Yes	Not adopted	Close-out	Internal and external	Face-to-face, email, phone	Face-to-face, phone	Yes
CA13	Yes	6 weeks	Planning	Internal and external	Face-to-face, email, phone	Face-to-face, email, phone	Yes
CA14	Yes	Quite immediate	Execution	Internal and external	Face-to-face, email, phone	Face-to-face	Yes
CA15	Yes	5 months	Planning	Internal and external	Face-to-face, email, phone, using another person as a messenger	Face-to-face, email, phone, using another person as a messenger	Yes
CA16	Yes	5 months	Initiation	Internal and external	Face-to-face, email, phone, video conferencing	Face-to-face, phone	Yes
CA17	Yes	Quite immediate	Planning	Internal and external	Face-to-face, email, phone	Face-to-face, phone	Yes

Case study 4 (Cases within three German banks)

CA30	Yes	14 – 21 days	Close-out	Internal and external	Face-to-face, email, phone, interactive software	Face-to-face, email, phone	Yes
CA31	Yes	14 days	Close-out	Internal and external	Face-to-face, email, phone, interactive software	Face-to-face	Yes
CA32	Yes	Not adopted	Execution	Internal and external	Face-to-face, email, external post, phone	Face-to-face, phone	No
CA33	Yes	3 – 6 weeks	Execution	Internal and external	Face-to-face, email, internal post, phone, fax, interactive software	Face-to-face, email, phone	Yes
CA34	Yes	3 weeks	Planning	Internal and external	Face-to-face, email, phone	Face-to-face, email, phone	Yes
CA35	Yes	6 months	Planning	Internal and external	Face-to-face, email, phone, fax	Face-to-face, phone	No
CA36	Yes	Fast	Execution	Internal and external	Email, internal post, phone	No	No
CA37	Yes	3 – 4 months	Initiation	Internal and external	Face-to-face, email, phone	Face-to-face, email, phone	Yes
CA38	Yes	3 – 6 months	Execution	Internal	Face-to-face, email, phone, interactive software	Face-to-face, email, phone	No
CA39	Yes	Not adopted	Initiation	Internal and external	Face-to-face, email, phone, fax	Face-to-face, email, phone	Yes
CA40	Yes	2 – 3 months	Initiation	Internal and external	Face-to-face, email, phone	No	No
CA41	Yes	Fast	Execution	Internal	Face-to-face, email, phone, interactive software	Face-to-face, email, phone, interactive software	Yes

effect of this approach is that mainstream potential adopters who need to use new ICT technologies are excluded from the formal process.

Social system

Both sectors show the existence of different adopter groups who are part of a social system reflected in an ICT project. A technology project consists of a visible formal social system including a formal structure and a hidden informal social system reflected in its own informal structure. It is apparent that an ICT project in both public and private sector settings is the standard process which engages team members on a formal basis from various departments. In both sectors, every project is part of the vertical organisational hierarchy where formal leaders are acknowledged according to an organisational chart. On the other hand, informal structures are hidden and led by opinion leaders. Usually, every group has a different opinion leader who influences group members towards adoption or rejection of innovation. It emerges that change agents who do not only rely on standard project procedures learn from their previous project experiences and engage opinion leaders who accelerate the diffusion and adoption of new technologies.

Informal networks

It is evident that the informal networks are used in both sectors for three main reasons. Firstly, via informal networks the process of ICT diffusion can be accelerated. Secondly, the fast-changing ICT innovation drives ICT change agents to exchange knowledge and learn from experiences of other informal network members. Finally, know-how gained from informal networks is free of charge.

5. DISCUSSION

In reviewing Rogers' (1995) general diffusion process, including innovation, communication channels, adoption/rejection time and a social system, it was not evident *a priori* whether these elements also apply to the process of ICT diffusion within a project management framework. In

order to test Rogers' (1995) diffusion process in every project management phase, there was a need to investigate whether in every case the diffusion elements emerged.

This research discovered that in every project management phase, change agents spread ICT innovations via communication channels and it took time until those new suggestions were adopted or rejected by a social system. These four elements that underpin the process of ICT diffusion and the networking within technology projects are discussed below.

The nature of ICT innovation

Dodgson (2000) observes that innovation includes dysfunctional and abnormal processes which are non-linear. This is especially the case when multiple innovations occur at the same time (Jorde & Teece 2005). This paper suggests that multiple innovations emerge in every ICT project phase as proposed by ICT change agents and the new ideas are usually about ICT innovation. This practice is not acknowledged in the guidance towards successful project management as suggested by Mantel et al. (2005). The standard project framework suggests rule-following approaches (Buttrick 2005), whereas the present study found that multiple ICT innovations disconnect with project management phases and, for a certain period of time, create disorder. In response to these turbulent processes, ICT change agents communicate via formal and informal channels.

The nature of formal and informal channels

This research discovered that ICT change agents use various communication channels to suit the situation. ICT change agents rely on three core formal communication channels: face-to-face, email and phone in every project management phase. Similarly, in both sectors, the core informal communication channel is face-to-face, which is enriched by other media such as email, phone or interactive software when required within informal networks.

The nature of informal networks

The findings by Swan et al. (1999) suggest that informal networks are pivotal for new projects because of knowledge acquisition. This research confirms their findings by providing an argument for why the mainstream ICT change agents operate within informal networks. The reason is deeply grounded in ICT innovation. The nature of ICT innovation is characterised by a short life cycle (Tidd et al. 2005). As a result, ICT change agents need to be swift with knowledge acquisition, implementation and diffusion of ICT technologies. In other words, the hyper-speed of ICT innovation drives ICT change agents' activities towards informal networks. Informal networks provide their members with new information that is free of charge and quickly accessible.

The nature of adoption/rejection

In discussions with different types of ICT change agents, it became apparent that academics and practitioners apply different terms for people who need to adopt innovation. While academics (Bass 1969; Rogers 1995; Brown & Venkatesh 2003) label them adopters, practitioners call them users. Distinct terminology and argumentation impact differently on academic and practitioner approaches. For example, Rogers (1995) observes that these groups differentiate themselves in behaviour towards the adoption of new ideas which are grounded in their different beliefs.

On the other hand, research by Rangaswamy & Gupta (2000) has argued that a large number of practitioners are not used to academic diffusion thinking and, therefore, they cannot utilise it in their day-to-day activities. This paper suggests that this is also the case to date, for example, public and private sector organisations regard different adopter groups as one large group labelled as users. This approach is derived from a standard project management framework. This standard project management approach rules that the project team members need to adopt ICT innovation over distinct

project management phases, while the users are expected to adopt a new technology quickly after implementation. Therefore, this paper has identified the need to fuse Rogers' (1995) model with the practitioner framework (Western Australian Innovation Centre, 2005) because both approaches look at a social system from different perspectives.

The nature of a social system

Technology projects are run in accordance with the planned and formal processes (Badiru & Pulat 1995). As a result, there is a strong focus on the controlling mechanism to calculate risks as proposed by Chapman & Ward (2003). Despite a standard project management framework, the participation of team members is influenced by their organisational settings. For example, the public sector is more process-oriented and, therefore, change agents focus on activities in the early project management phases, whereas private sector change agents operate predominately in the last two project management phases due to profit-orientation aimed to deliver a project outcome that has commercial benefit.

Apart from standard project management (Western Australian Innovation Centre, 2005), this present research has shown that in every ICT project management phase, the processes of diffusion and adoption take place. As noted previously, diffusion consists of planned and spontaneous processes (Rogers 1995), which implies that, through diffusion and adoption or rejection of innovation, change in peoples' behaviour needs to take place. Hence, the social system includes uncertainty because it is not clear whether people will adopt new ideas based on their previous experiences of ICT innovation. This study found that ICT change agents who selected opinion leaders with similar values as future adopters were able to accelerate the process of ICT diffusion and adoption. The influence of opinion leaders is well documented in the literature (He et al. 2004; Chaney 2001).

6. IMPLICATIONS FOR RESEARCH AND PRACTICE

A large number of valuable academic works exist for the ICT industry. However, those research studies need a practitioner interpretation because academics apply a different language to practitioners. Distinct language serves different purposes. For example, Professor Monro, when interviewed, noted that academics are focused on process while practitioners are outcome oriented (Karena 2006). These different approaches span the gap between these groups. To narrow that gap, universities need to take the initiative and offer contemporary courses which can assist in training practitioners as linkers. Linkers understand the language and approach of both groups and are in charge to create new solutions aimed at connecting them (Rogers 1995). With the rise of ICT innovation, linkers act as ICT change agents who develop innovative practices and diffuse innovation on a formal and informal basis (Jagodic 2008).

Lack of utilisation of academic diffusion knowledge by practitioners (Rangaswamy & Gupta 2000) and the absence of training of contemporary ICT change agents' at universities results in highlighting rigid formal and standard project management approaches in organisations. As a

result, the set organisational standards neglect the essence of innovation, which is that innovation itself is dysfunctional by nature (Dodgson 2000). This dysfunction includes chaotic processes which interrupt the continuity of set organisational rules and require a new method of handling them.

This research shows that in both public and private sectors, an ICT project is characterised by interrelated elements (project management phases) and processes (ICT diffusion, informal networks). Figure 1 illustrates that ICT innovation is disseminated according to Rogers' (1995) diffusion of innovations. The ICT diffusion process is, therefore, the hub of a system of technology project management including ICT innovation, communication channels, adoption/rejection time and a social system within project management. As depicted in Figure 1, the formal process of ICT diffusion is visible within organisation settings, whereas the informal ICT diffusion process is hidden and takes place outside of formal guidance. This means that the formal process of ICT diffusion is guided by planned project management phases while the informal process of ICT diffusion is grounded in informal networks and occurs as a non-linear concept spontaneously. Consequently,

FIGURE 1: PROCESSES OF ICT DIFFUSION IN TECHNOLOGY PROJECT

informal networks offer the diffusion of new knowledge quickly and free of charge.

Organisations have already incorporated the formal processes (Buchanan & Huczynski 1997; Wood et al. 2006) and are challenged to use informal networks in order to deliver set project outcomes swiftly. According to Cross & Thomas (2009), there is strong evidence that informal networks reinforce formal performance of organisations by ensuring that collaborations deep within organisations support strategic objectives as efficiently as possible. Nevertheless, the informal approaches often contradict set standard formal organisational guidelines that were developed prior to the recent intensification of globalisation. With the emergence of strong globalisation forces and cutting-edge technologies which create complexity and unpredictability, organisations need to address the importance of informal networks in order to remain effective in diffusion of innovation and be competitive. In this context, the project management framework set out in Figure 1 aims to assist in effective ICT management, implementation and diffusion that highlights the conjunction of a linear process (project management phases) and non-linear concept (formal and informal diffusion) in order to deliver project outcomes on time. This framework can also guide further research to investigate the extent to which public and private sector organisations are able to integrate informal networks into the process of ICT diffusion in technology projects without losing the integrity of these organisations.

7. CONCLUSION

This research is among the first that has investigated the relationship between ICT diffusion and project management. It emerged that key individuals such as ICT change agents diffuse ICT innovation in every project management phase in the form of planned or spontaneous processes by using formal and informal communication channels and much time can elapse before ICT technology is adopted or rejected by people. Similarly, in both sectors, ICT change agents apply identi-

cal formal and informal communication channels, for example, the core formal channels are face-to-face, email and phone, while the core informal channel is face-to-face. In both sectors, distinct groups exist that need to adopt ICT technology. While a standard project management framework emphasises participation in an ICT project according to an organisational chart, nevertheless, informal structures exist in both sectors. Those informal groups are led by opinion leaders who have the power to influence other group members towards the adoption of new technologies in particular organisational settings.

Rogers' (1995) diffusion model is more likely to be applied by academic researchers, whereas practitioners tend to use a project management framework along the lines of the Western Australian Innovation Centre (2005). While these distinct approaches have been discussed separately in the literature, this study shows that both approaches are practised in technology projects in order to achieve set formal project goals. The project management framework is used as a formal process aimed to assist in budget, resources and timeline planning, whereby, the diffusion process serves practitioners to communicate their technology ideas on a formal or informal basis. In other words, project management is more likely to be viewed as a formal and planned process while ICT diffusion encompasses the planned, spontaneous and informal processes. This research argues that ICT change agents rely on both approaches in the diffusion, management and implementation of ICT innovation in technology projects. Further research guided by quantitative methodology is needed to investigate whether Figure 1 can set a benchmark for a new project management framework in public and private sector ICT projects.

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