OPENING UP THE FUZZY FRONT-END OF SERVICE PROCESS INNOVATION: SEARCHING CAPABILITY, CO-DEVELOPMENT CAPACITY, AND IT COMPETENCE

Thanasopon, Bundit, University of Hull, Cottingham Road, Hull, HU6 7RX, UK,
B.Thanasopon@2011.hull.ac.uk

Papadopoulos, Thanos, University of Hull, Cottingham Road, Hull, HU6 7RX, UK,
A.Papadopoulos@hull.ac.uk

Vidgen, Richard, University of Hull, Cottingham Road, Hull, HU6 7RX, UK,
R.Vidgen@hull.ac.uk

Abstract

The innovation process can be viewed as a two-stage model being comprised of “fuzzy front-end” (FFE) and “project execution”. The former is the focus of this study. Although both opening up to the outside world and use of IT in the innovation process have been suggested to have a positive impact on innovation performance by the literature, little effort has been put into studying both issues in the front-end phase. Therefore, the main purpose of this study is to address these gaps. In doing so, we develop a theoretical model and related hypotheses to examine the impact of the FFE team’s openness capabilities and IT competence on the performance of the FFE phase of service process innovation (SPI) projects measured in terms of market and technical uncertainty reduction as well as on the overall effectiveness of the SPI projects. This research is expected to make several contributions to the literature on innovation management and information systems (IS) management by providing new insights into how openness can improve the front-end process as well as how IT can facilitate a more open and collaborative approach to the FFE phase.

Keywords: fuzzy front-end, openness, open innovation, IT competence, service process innovation.
1 Introduction

In recent years, innovation in services has attracted much attention from both academics and practitioners (Alam, 2006), since it has emerged as a strategic imperative for not only service but also manufacturing firms (Chesbrough, 2011). The literature suggests two types of service innovations: “service product” and “service process” innovations (Oke, 2007). Service process innovation (SPI) is typically framed as having two major phases: the fuzzy front-end (FFE) and project execution (Alam, 2006). In this paper, we aim to identify the antecedents of the FFE phase of SPI projects.

As the FFE phase often involves high levels of uncertainty (Verworn et al., 2008), one of the main issues for front-end managers may be whether their development team has the capability to systematically reduce the uncertainty, or just simply leave them to be managed by chance. We suggest that it is useful for the managers to consider how the FFE team’s ability to open up the front-end process focusing on the team’s ability externally searching for new ideas, and co-developing with external partners (termed as “openness capabilities”) as well as how the team’s competence in using information technology (IT) can be exploited during the FFE phase to reduce the uncertainty.

Research that focuses on the reduction of front-end uncertainty by opening up the process is limited (e.g., Alam, 2006), as is research into the role of IT in opening up the innovation process and in supporting FFE activities (e.g., Gordon et al., 2008). Further, we are not aware of research that considers the opening up, the use of IT, and their combinative impact on front-end performance as well as on the project effectiveness. To address the gaps, three research questions are identified:

- Do openness capabilities affect uncertainty reduction during the FFE phase of SPI projects?
- Does IT competence moderate the relationships between openness capabilities and uncertainty reduction during the FFE phase of SPI projects?
- Do openness capabilities and IT competence indirectly affect the effectiveness of SPI projects?

To answer the questions, we develop a research model to examine the impact of FFE on SPI project effectiveness and of openness capabilities and IT competence on FFE performance. This paper is organised as follows. Based on theoretical background in the next section, a research model and hypotheses are developed in section 3. Then, data collection and analysis processes are concerned. The final section discusses limitations, and the expected contributions to both the literature and practices.

2 Theoretical Background

2.1 Services and Service Process Innovations (SPI)

Services have increasingly played an important role in the current economy. By providing better services for customers, firms can find a path to escape the pressures of commoditisation (Chesbrough, 2011). In addition to providing better service offerings, the way the service offerings are provided to the customers (i.e., “the service process”) is also important since it contains touch points with the customers and, consequently, creates customers’ experiences (Bitner et al., 2008). This suggests that customers’ experiences should be successfully managed through a well-designed service process so that the firm can differentiate itself from its competitors.

Menor et al. (2002, p. 138) define a service innovation as “an offering not previously available to a firm’s customers resulting from the addition of a service offering or changes in the service concept that allow for the service offering to be made available.” This definition implicitly suggests two main types of service innovations: the service offerings themselves and the process used to produce and deliver them to the customers – “service process innovation” (SPI). A SPI can be defined as a new or improved sequence of activities undertaken to deliver a service offering to the customer (adapted from...
Oke, 2007). Not only service but also manufacturing firms generally have some kind of service processes that can be exploited if the firms can develop new, innovative service processes or improve the efficiency and effectiveness of the existing processes (Chesbrough, 2011). Therefore, we argue that SPI is crucial for all kind of firms if they are to attract and retain customers.

In general, the process of innovation comprises of two main phases: “fuzzy front-end” (FFE) and “project execution” (see Figure 1) (e.g., Alam, 2006; Verworn et al., 2008). However, we focus on the former since, in comparison to the execution phase, the FFE provides greater potential for improvements with less effort (Kim and Wilemon, 2002). Moreover, the front-end of SPI projects will likely be even fuzzier than it would be for other types of innovation, which may be caused by the intangibility and inseparability of services (Alam, 2006). In addition, to provide a seamless experience to customers, early collaboration among firms in the supply chain may be crucial.

2.2 The Fuzzy Front-End (FFE)

The FFE phase is the first stage of the innovation process, which mainly involves three activities: idea generation, idea screening and concept development (Alam, 2006). Such phase is crucial since success often depends on a new product/service concept, which is an outcome of the FFE phase (Kim and Wilemon, 2002). Moreover, if the project is not carefully planned during the early phase, undesirable consequences (e.g., project delays, over budget, etc.) can follow (ibid). Furthermore, studies taking an information-processing perspective have suggested that managers should be concerned if front-end uncertainty is high (e.g., Moenaert et al., 1995; Verworn et al., 2008). Interestingly, Moenaert et al. (1995) discover that, in successful innovation projects, uncertainty has been reduced during the FFE phase on average as much as it has during the whole cycle in unsuccessful projects.

Scholars have identified several antecedents of the FFE phase, such as external knowledge sourcing (Chesbrough, 2011), co-creation with customers (Alam, 2006), co-development with other organisations (Kim and Wilemon, 2002), and use of IT (Gordon et al., 2008). Accordingly, we propose that if the front-end process is to be successful, the development team must possess high levels of the abilities to perform these activities effectively during the FFE phase.

2.2.1 Openness

According to Chesbrough (2011), there are two kinds of openness: outside-in and inside-out. The outside-in openness allows a firm to provide additional aspects to its service offerings beyond the firms’ own knowledge and expertise. For example, by collaborating with third-party merchants, Amazon is able to provide more value and one-stop service for its customers. In line with Chesbrough, Enkel et al. (2009) propose an open innovation archetypes framework (i.e., outside-in process, inside-out process and coupled process), which frames this study. However, only the outside-in and coupled processes are focused because they are relevant to idea generation, whereas the inside-out process concerns earning profits from the generated ideas (ibid). Accordingly, two capabilities supporting the two processes – searching capability (related to the outside-in process) and co-development capacity (related to the coupled process) – are postulated to influence FFE performance. This is also supported by Lichtenthaler and Lichtenthaler’s (2009) capability-based framework for open innovation. The
framework suggests that a firm’s ability to explore external knowledge and to retain knowledge in inter-firm relationships is crucial for managing external knowledge in open innovation process.

As the discussion above asserts, in this study, the term “openness” is defined as the extent to which the front-end team open up their processes by externally searching for new ideas, and co-developing with external partners (e.g., suppliers, customers, competitors, etc.). Empirical studies suggest the application of openness and uncertainty reduction at the project level. For example, by studying financial innovation projects, Lievens and Moenaert (2000) posit a positive relationship between communication flows between project members and outside sources, and uncertainty reduction.

2.2.2 IT Competence

According to Wade and Hulland (2004, p.109), “information systems exert their influence on the firm through complementary relationships with other firm assets and capabilities”. The literature has explored the impact of IT capabilities on success of business processes. For the FFE process, both the existence of effective IT systems (Kim and Wilemon, 2002) and the developer’s IT competence (Gordon et al., 2008) are suggested to positively affect front-end performance. However, we focus only on the latter. “IT competence” is defined as the extent to which FFE team are aware of what IT functionalities and tools have to offer and effectively utilise those functionalities and tools to support a more open and effective approach to the front-end phase (adapted from Pavlou and El Sawy, 2006).

3 Research Model and Hypotheses

Front-end uncertainty involves market and technology (Verworn et al., 2008). By studying 497 innovation projects, Verworn et al. (ibid) discover that an early reduction of market and technical uncertainty positively influences project’s effectiveness. Moenaert et al. (1995) also empirically suggest that front-end uncertainty reduction is related to commercial success of innovation projects. Therefore, to achieve a high level of SPI effectiveness, front-end uncertainty must be mitigated.

H1a: SPI effectiveness is positively affected by market uncertainty reduction in the FFE.
H1b: SPI effectiveness is positively affected by technical uncertainty reduction in the FFE.

With regard to the first FFE antecedent (i.e., searching capability), prior studies have suggested the impact of knowledge sourcing on innovation performance. Alegre and Chiva (2008) suggest that high levels of organizational learning capability, which is partly associated with external knowledge search, lead to high levels of product innovation performance. More recently, Oliveira and von Hippel (2011) discover that 44% of today’s computerised retail banking services were first developed by individual users for their own use; thus searching for users’ innovative ideas is likely to be fruitful. By looking outside, the firms may be able to, for example, learn from competitors’ mistakes or avoid reinventing the wheel. Specifically, if the FFE team has the ability to gather and assimilate ideas from outside of the firm, front-end uncertainty related to market and technology will be likely to be reduced.

H2a: Market uncertainty reduction in the FFE is positively affected by searching capability.
H2b: Technical uncertainty reduction in the FFE is positively affected by searching capability.

Firms are likely to cooperate for innovation with suppliers, intermediaries or competitors when they do not have all the necessary resources or competences internally (Ettlie and Pavlou, 2006). Further, to fulfil the ever increasing needs of customers, firms should be more open in order to provide high quality services and a wide range of service offerings (Chesbrough, 2011). Moreover, early customer involvement is crucial since customer’s experiences are the essence of service processes (Alam, 2006).

Scholars have suggested that cooperation with other organisations and customers can help lower front-end fuzziness, development time and costs (Kim and Wilemon, 2002; Alam, 2006). Further, “co-development capacity” formed by absorptive capacity, coordination capability and collective mind is
required to perform cooperative activities (Ettlie and Pavlou, 2006). These capabilities have also been independently suggested to affect innovation performance. Fosfuri and Tribo (2008) find that firms with superior potential absorptive capacity obtain larger shares of their sales from new or significantly improved products. Lorenzoni and Lippariani (1999) argue that the firm’s ability to interact with other companies accelerates its knowledge access and transfer with relevant effects on growth and innovativeness. Hargadon and Bechky (2006) suggest that an innovation team with collective mind has the capacity to generate creative solutions by drawing from participants’ past experiences.

H3a: Market uncertainty reduction in the FFE is positively affected by co-development capacity.

H3b: Technical uncertainty reduction in the FFE is positively affected by co-development capacity.

Furthermore, searching capability and co-development capacity are proposed to constitute “openness capabilities” which refers to the FFE team’s ability to effectively open up the front-end process focusing on the ability searching outside, and co-developing with external partners.

IT competence concerns the team’s awareness of and ability to use three generic IT systems: knowledge management systems (KMS), cooperative work systems (CWS) and project and resource management systems (PRMS). Prior studies suggest that these systems can facilitate a more open and effective way of innovation development. The use of KMS can help reducing front-end uncertainty as it can be used to collect information on past experiences, market and technology changes; as well as can support knowledge sharing (Kim and Wilemon, 2002). Further, collaborative work with external partners can be supported by CWS (Gordon et al., 2008). Also, effective use of PRMS provides smooth integration of resources and tasks from various sources (Pavlou and El Sawy, 2006). We therefore argue that the front-end team equipped with IT skills are likely to be able to seek relevant information as well as efficiently and effectively collaborate with others. This, in turn, is expected to have an impact on front-end uncertainty reduction. Thus, the hypotheses are:

H4a-b: The relationship between searching capability, and market and technical uncertainty reduction in the FFE is positively moderated by IT competence.

H5a-b: The relationship between co-development capacity, and market and technical uncertainty reduction in the FFE is positively moderated by IT competence.

Figure 2 summarises the research model and the proposed hypotheses.

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**Figure 2:** Research model

### 4 Data and Methods

To measure the constructs, existing scales from prior studies will be used (see Table 1). The target respondents of this research are SPI project managers who had supervised at least one completed SPI
project during the past two years and the level of analysis is at SPI project level. Therefore, special
care will be taken to ensure that the items suit SPI managers and measure at the project level.

There will be two main phases of data collection. The first phase involves semi-structured interviews
with five SPI project managers focusing on the front-end phase of their recent SPI projects. The main
purposes of the interviews are to evaluate the viability of the research model. In the second phase, a
pilot study and an email survey incorporating an online questionnaire will be conducted. The sampling
frame of this study is a list of 758 companies that are categories as “software providers and
consultants” from the database of Thailand’s ministry of commerce. 100 firms will be randomly
selected. The CEO of those firms will be contacted by phone asking for their participation. Those who
are willing to participate will be asked to distribute the questionnaire to all of their project managers.
In terms of data analysis, partial least squares (PLS), which is a components-based technique, will be
used as such a technique is more robust to violations of normality, can handle small sample sizes, and
is suitable for estimating formative constructs (Hair et al., 2011).

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<tr>
<th>Constructs</th>
<th>Sources of Measures</th>
<th>Operationalisations</th>
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<tbody>
<tr>
<td>SPI effectiveness</td>
<td>Verworn et al. (2008)</td>
<td>The extent to which the SPI project’s outcomes achieve the objectives set by the innovating firm during the FFE phase.</td>
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<tr>
<td>Market uncertainty</td>
<td>Verworn et al. (2008)</td>
<td>How well the FFE team know about customers’ needs, price sensitivity and market situations.</td>
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<td>reduction</td>
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<tr>
<td>Technical uncertainty</td>
<td>Verworn et al. (2008)</td>
<td>How well the FFE team know about technology specification and technical requirements, and potential technical problems in the development phase.</td>
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<td>reduction</td>
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<tr>
<td>Searching capability</td>
<td>Alegre and Chiva</td>
<td>The team’s ability to acquire and assimilate external information and knowledge.</td>
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<td></td>
<td>(2008)</td>
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<tr>
<td>Absorptive capacity</td>
<td>Ettlie and Pavlou</td>
<td>The team’s ability to recognise the value of new, external information, assimilate it and apply it to commercial ends.</td>
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<td></td>
<td>(2006)</td>
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<tr>
<td>Coordination capability</td>
<td>Ettlie and Pavlou</td>
<td>The team’s ability to synchronise knowledge, resources and tasks to create superior new way of executing the FFE.</td>
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<td>(2006)</td>
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<tr>
<td>Collective mind</td>
<td>Ettlie and Pavlou</td>
<td>The team’s ability to integrate disparate resources with heedful contribution, representation, and subordination.</td>
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<td></td>
<td>(2006)</td>
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<td>Effective use of KMS,</td>
<td>Pavlou and El Sawy</td>
<td>The extent to which FFE team members are aware of what PRMS, KMS and CWS functionalities and tools have to offer and effectively utilise those specific functionalities and tools supporting IT-enabled FFE activities.</td>
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<td>CWS, and PRMS</td>
<td>(2006)</td>
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Table 1: Measures of the constructs

5 Expected Contributions and Limitations

This study is expected to make three contributions to the literature. Firstly, this study proposes a
framework integrating capabilities supporting open innovation practices. While prior studies on
innovation management have identified various capabilities required to reduce innovation uncertainty,
little has applied open innovation theories and frameworks. The second contribution is an explanation
of a moderating effect of IT competence on the relationships between openness capabilities and FFE
effectiveness. Although the potential of IT in supporting open innovation has been suggested, the IS
literature has done little to inform theory and practice about the issue. Finally, this study provides new
insights into the FFE phase of SPI projects; thus it may benefit SPI literature.

For SPI managers, our findings are expected to identify which of the capabilities are significant and
important to the FFE of SPI projects. Managers can then turn their attention to the development of
such capabilities within their FFE team. Managers are also recommended to nurture a collaborative
culture among the stakeholders and encourage their team to search externally for new ideas. Further,
this study will provide an insight into the role of IT competence in supporting a more open approach to
the front-end. The results will help advise front-end managers on raising project team’s awareness of the benefits of available IT systems and on the importance of building the team’s IT capabilities. However, since it is in early phases, there are risks of the parties may not want to disclose information where trust is still to be built. Therefore, beyond this study, future research could also seek to identify a set of recommended practices for reducing such risks during the front-end phase.

References


