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ABSTRACT

Creating and adopting innovations is important for the development of firms and whole economies. Several theoretic approaches are therefore dealing with innovation adoption and diffusion and the motivation of firms to innovate. Diffusion of Innovation theory explains the effect of innovation characteristics on innovation adoption and diffusion, the Resource-based View of the Firm focuses on the use of slack resources and their influence on innovation while the Behavioral Theory of the Firm predicts problemistic search as motivation for innovative maneuvers. This paper investigates how the use of slack resources and problemistic search differentially impact the effect of innovation characteristics on innovation adoption of IT service providers. The results indicate that firms' different motivations to innovate differentially moderate the effect of innovation characteristics on innovation adoption.

Keywords

Innovation, IT Service, Behavioral Theory, Diffusion of Innovation.

INTRODUCTION

Creating and adopting innovations is an important driving force for long-term firm success. The ability to generate and implement innovations is crucial for the survival of firms at the global marketplace in face of rapid technological change and increasing globalization.

Diffusion of Innovations theory (DOI) (Rogers, 1995) is often employed to investigate e.g. barriers, enablers, and inhibitors of innovation adoption and diffusion. DOI focuses on several innovation characteristics such as relative advantage to explain innovation adoption and diffusion.

The Austrian School of Economics (Schumpeter, 1934) provides the idea that superior firm performance can only be achieved by continuous innovation. Building on that the Resource-based of the firm (RBV) (Penrose, 1959) proposes the achievement of a sustained competitive advantage by employing novel services of resources controlled by a firm. Thus using organizational slack to innovate and employing novel services of resources is a key consideration of the RBV.

In contrast, the behavioral theory of the firm (BTF) (Cyert and March, 1992) is engaged in innovations and focuses on problemistic search as the driving force behind the creation of innovative solutions.

Both, RBV and BTF, are engaged in investigating the motivation, or engines driving innovations. RBV highlights learning about novel services as the engine, while BTF focuses on problems in terms of negative attainment levels (Greve, 2003).

However, research combining theoretical lenses regarding the engines of innovation with adoption and diffusion theory is rare. In this paper we shall investigate the influence of the different engines to innovate on the effect of innovation characteristics on innovation adoption and ask the following research question:

- How the different engines of innovation are connected to the adoption of IT services and what are the effects?

To address this question, we used case studies among IT Service Providers (ISPs) that are known as very innovative and successful in their markets.

The remainder of the paper is structured as follows: The next section deals with the theoretical foundation that is followed by the discussion of the used methodology. Then the case study environment and the case study sample are described, followed by the presentation of the case study results. Key findings, limitations and future research are summarized and critically discussed within the concluding section.

THEORETICAL FOUNDATION

This section first introduces the Behavioral Theory of the Firm, then the Resource-based View, and Diffusion of Innovation Theory, and finally the derived propositions.

Behavioral theory of the firm (BTF)

The Behavioral Theory of the Firm of Cyert and March (1992) aims to reveal the perception of the business firm being a so-called black box. They seek to provide insight within the internal processes of economic decision making of contemporary organizations as a unit faced with an ever-changing environment (Prietula and Watson, 2000).

In terms of explaining why and how firms innovate the theory of organizational search needs to be regarded in particular. Cyert and March assume that search within organizations is mainly stimulated by a certain problem. Thus it is strongly related to their concept of problemistic search (Pitelis, 2007). Problems are either identified by failure to achieve a certain goal or by the threat of failure in the upcoming future. As long as a specific problem is not solved, an organization will continue to search for a satisfying answer as the declared goal. Thus problemistic search is undertaken as long as the actual performance is below a certain aspiration level. This so called negative attainment discrepancy induces problemistic search (Greve, 2003; Lant, 1992).

Thus problemistic search can be defined as search that is motivated by a certain problem internal or external of an organization and aims at finding an appropriate solution.

Resource-based view of the firm (RBV)

The starting point for RBV is the assumption of the heterogeneity of resource endowments across firms that explain performance variations (Peteraf, 1993). Thus, a firm's competitive position results from bundles of unique resources (Rumelt, 1984) that are not perfectly mobile (Spanos and Lioukas, 2001). The RBV, therefore, explains sustainable competitive advantage (SCA) by means of the resources controlled by a firm. The firm itself is viewed as a collection of productive resources guided by the administrative function (Penrose, 1959) required for market competition. These resource bundles are found to be immobile, firm-specific, and are developed in a path-dependent way (Teece, 1993). The growth of a firm depends on exploiting existing resources and developing new ones (Penrose, 1959; Wernerfelt, 1984).

Regarding the core concept "resource", a basic idea of Penrose (1959) is that the same resource can render many different services depending on how it is used and depending on the level of knowledge concerning the possible services (Foss, 1999). "A resource, then, can be viewed as a bundle of possible services" (Penrose, 1959, p. 67). With subsequent operations knowledge of the services a resource can render is accumulated. With this knowledge the exploitable opportunity set of the firm is enhanced and excess resources can be put into different services (Penrose, 1959). These slack resources, then, enable innovation and even motivate its use for innovative purposes as long as the management pursues profit maximization and excess resources can be put into service at no extra cost (Pitelis, 2007).

Diffusion of Innovation Theory

When studying innovation diffusion and adoption Diffusion of Innovations theory (DOI) is often employed (Rogers, 1995). DOI has been applied in several contexts such as organizational innovation (Mustonen-Ollila and Lyytinen, 2003), total quality management, (Ravichandran, 2000), e-Health (Atkinson, 2007) and disruptive IT innovations (Lyytinen and Rose, 2003),

Rogers (1995) observed several innovation characteristics that influence innovation adoption. One characteristic is "the perceived net benefit the innovation offers has an important effect on the organizational adoption" (Frambach and Schillewaert, 2002, p. 163) which is called relative advantage. Other innovation characteristics affecting the rate of adoption are trialability, compatibility, complexity, and observability.

Relative advantage is defined as "the degree to which an innovation is perceived as being better than the idea it supersedes" (Atkinson, 2007). It is the net benefit an innovation delivers when compared to an existing solution. Relative advantage is seen as positively correlated with the adoption rate of innovations. An example is a graphical user interface employing new technology to guide users without having knowledge about transaction codes which is more convenient for users than an alphanumeric interface and reduces investment in training.

Trialability is defined as "the degree to which an innovation may be experimented with on a limited basis" (Atkinson, 2007), which is also positively correlated with the rate of adoption of innovation.

Observability has a positive influence on the adoption rate and refers to the visibility of the relative advantage to others (Rogers, 1995).

Compatibility is the "degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (Atkinson, 2007) and positively correlated to the rate of adoption of innovation.

Complexity has a negative effect on the adoption rate and refers to difficulty in understanding and using an innovation (Rogers, 1995).

In the following sections we will focus on relative advantage and trialability.

Propositions

The BTF focuses on search activities to resolve conflicts or problems. This problemistic search, then, leads to the discovery and implementation of innovative solutions. Innovation takes place in case of immediate problems to be solved and as a means to alleviate conflict in other cases (Pitelis, 2007, p. 483).

In the RBV innovations are enabled by slack resources, i.e. by newly discovered and exploited services rendered possible by the resources of a firm (Penrose, 1959). That points to the importance of intrafirm learning for the RBV. Through learning new uses of resources are discovered and exploited. Thus, in growing firms, excess resources are present leading to perennial search for innovation (Pitelis, 2007, p. 483).

Slack search involves learning processes that take time to evolve while problemistic search is directed towards searching for solutions for immediate problems which typically involves high pressure of time. Problemistic search is successful completed when a solution to the problem was found which might not be the best solution. The need to trial prior to the adoption decision might be lower compared to slack search because of the time pressure and an inclination to satisfying solutions rather than to come up with an advanced and superior solution. Similarly, it can be argued that the net benefit of an innovation (relative advantage) is less important in case of problemistic search, because the solution of an immediate problem is in focus rather than a maximum net benefit.

Therefore we propose the following propositions:

Proposition 1: The effect of relative advantage of a new service on adoption is more salient for slack search than for problemistic search.

Proposition 2: The effect of trialability of a new service on adoption is more salient for slack search than for problemistic search.

METHOD AND DATA

In the following sections, case studies carried out among IT Service Providers (ISP) are presented, focusing on the emergence of innovations. During design and preparation of case studies it is important to make the research question, propositions and unit of analysis explicit (Dubé and Paré, 2003; Yin, 2003). The research question employed for this research is: How the different engines of innovation are connected to the adoption of IT services and what are the effects? How and why questions are considered appropriate for case studies (Yin, 2003). The propositions used in the cases are theoretically grounded as depicted in the following section. The unit of analysis is the firm.

In order to carry out a case study we developed case and interview protocols, and discussed the approach within the research community prior to the actual interviews. Afterwards, the adapted documents are used for the case studies (Eisenhardt, 1989; Yin, 2003). The interviews lasted in average two hours. The transcripts of the cases were compiled into a case protocol.

To evaluate the transcribed interviews NVivo was applied. NVivo is software designed to support qualitative data analysis and simplifies rich text handling through facilitating sorting, arranging and classifying information. This functionality makes it easier to compare answers to specific questions across the case study partners and to trace back constructs and hypotheses to individual answers.

After finishing the case studies a final presentation was created and both sent by e-mail to the contact partners and presented within a workshop.

THE CASE

We conducted case studies with interviewees of IT Service Providers (ISPs). Table 1 summarizes some characteristics of the sampled firms.

Characteristic	ISP1	ISP2	ISP3	ISP4
established	1996	1984	1975	2004
size (workforce) 2007	130	180	300	80
Type	LLC	LLC	LLC	Inc.
shift in sales ('03-'05)	n.a.	+ 8%	+ 17,7%	n.a.
interviewee	managing director	managing director	divisional director	CEO

Table 1. Case Study Sample

CASE STUDY RESULTS

Within the following subsections the cases will be discussed, first focusing on problemistic search and then on slack search.

Problemistic search and adoption

Proposition 1 and 2 state that intrafirm conflicts and the presence of immediate problems lead to innovations to resolve the problem and this problemistic search will have a lower effect of trialability and of relative advantage on innovation adoption.

An example for immediate problems being a driver for a firm's innovative activity is ISP3, a provider for high-quality desktop services. This desktop service includes delivery and exchange of desktop hardware and software components according to a defined service catalogue with online configuration and ordering, the management of these components in a centrally located service center, guided by service level agreements and supported by a service organization based on ITIL v2.0-functions. The desktop service is offered to a range of predominantly mid-sized but also large companies and was implemented four years ago for the first time. Recently, a large chemical firm as an important customer of ISP3 strives to meet its special requirements by searching for new functionalities of the desktop service. Due to special regulatory requirements security features must be integrated and provided by the desktop service allowing the management of desktops by simultaneously ensuring that encryption services are managed by the chemical firm. This requirement should be fulfilled and implemented as fast as possible. ISP3, then, had to search for a solution that would allow running the desktop service with defined service levels by simultaneously ensuring an encryption service running on its desktops and not managed by ISP3. This situation is rather complicated because the encryption service may interfere with the rest of the desktop service eventually causing outages or long response times. ISP3 did come up with a solution that was based on a process innovation in the field of service provisioning which included both the creation of a master service desk integrating personnel of the customer and personnel of ISP3 as well as the introduction of a customized root cause analysis tool able to quickly identify service problems and to address the right service personnel.

This service innovation was developed and adopted by ISP3 on request of a major customer. Due to the pressure from the customer ISP3 was urged to find a solution within a short time and thus focused on a few possible solutions. ISP3 did not carry out a systematic market survey e.g. for analysis tools, but relied on what some of its service specialists recommended based on their prior experience and advice from their peers of other firms. Since ISP3 was under pressure to solve the problem quickly, it had a lower need to trial the service beyond the functionality tests before the decision was made to adopt the service. Due to the pressure, ISP3 was ready to adopt the innovation shortly after the basic tests were successful.

Similarly, the relative advantage of the service innovation was a no-brainer, because it solved the current problem in some way and provided at least the core functionalities required by the customer.

Quotes of the ISP-managers are listed below:

Case	Exemplified quotes
ISP3	Innovation: "The challenge to meet was to modify the desktop service in a very specific way […] We have managed to combine customer-specific security features with our standard desktop service that are normally nearly impossible to combine."
	Trialability: "At the time we developed the solution we were lucky that some of our engineers had ideas how to approach the problem. There was no time to expatiate on possibly better solutions…. Just after the first tests signalled a positive result and I had the impression that our organization could do it, I decided to proceed in the way proposed and not to invest resources into the search for other possible solutions."
	Relative Advantage: "We demonstrated the required core functionalities and I promised to deliver the additional, but non-core functionalities in a second step. This was accepted by the customer. Thus the presented solution was okay for the customer; therefore it was also okay for me. Mission accomplished."
ISP1	Innovation: "Some customers wanted to have full transparency of our provided services so that they could trace performance parameters as well as interruptions of service. We developed it, and it was such a good solution that we could market it to other customers, too."
	Trialability: "Our firm faces strong competition, in particular from firms within our home region. Therefore we were eager to develop the specific features requested by our customers before someone else would have this idea. … I asked our developers to come up with a solution as fast as possible. A few weeks later, when we decided to adopt the solution at hand and not to experiment further."
	Relative advantage: "There is one of our customers who is almost always engaged in testing our new solutions. When this customer tested our new trace features and only had minor suggestions, we immediately decided to announce the new service offering."
ISP1	Innovation: "Sometimes we are forced by external suppliers. […] For some parts of our provided services we rely on special knowledge of one ERP supplier. This supplier informed us there will be a reorientation in the short run regarding its programming and modification service. And now we have to figure out if our service needs to be reconfigured."
	Trialability: "Frankly spoken, our supplier was not willing anymore to provide the services on which we have been relying for several years up to now. Therefore we were forced to look for another supplier, to settle a contract, to build a process, etc. within a very short time to not interrupt our service to customers. … I activated some of my peers and then decided to focus on one of their recommendations."
	Relative advantage: "Although our internal service arrangements changed quite drastically, there was only a short rough time. We informed our key customers about the new constellation and assured service as usual."

Table 2. Problemistic search

The statements of our case study partners show, that an important driver of a firm's innovative activity is the pressing need to search for solutions for problems. Being faced with a certain problem all forces are concentrated on turning a deficiency fastest possible into a benefit for the organization, it's customers, and/ or further stakeholders. An example of an immediate problem causing problemistic search is a customer-specific order that involves finding solutions for specific requirements, typically within a short timeline, because the customer presses to get e.g. the product as fast as possible. The statements depicted in table 2 show that the innovation characteristics trialability and relative advantage are not of great importance.

Slack search for innovation and adoption

An example for slack search and the propositions 1 and 2 is ISP4, a firm providing data base services for technical data for the automobile industry.

One idea of ISP4 was not just to check incoming invoices by an information system for the management of vehicle fleets, but to add additional functions to this already available system. Using the competencies already available, these additional functions were laid out to streamline the process of car maintenance by avoiding the print-out of different forms at each maintenance step, automatically listing recommended maintenance measures according to the specifics of the car, and to provide a report covering the complete maintenance process. Thus ISP4 developed an online tool for managing all maintenance procedures of a fleet without any printing required. This includes the registration of a certain vehicle at a garage, plausibility checking according to the car's manufacturer's specifications as well as the approval. At the end of the process the fleet manager can generate a detailed report for a review if needed.

The idea for the service innovation depicted above was introduced by the sales department and discussed with the R&D department who agreed to think about the idea. After three weeks the monthly meetings of all department heads was used to report the idea and discuss it. It was decided to elaborate on this idea. The R&D department head got the job to develop the idea further and to coordinate meetings with other departments where appropriate. Combining competencies of the R&D department regarding technological solutions and competitor products with competencies of the sales department regarding the needs of the customers of ISP4's direct customer, several ways for a solution could be detected. These different solutions were evaluated by assessing technological and market opportunities and risks and focused on the two most promising solutions. At the monthly meeting it was decided to elaborate further these two solutions because there was a higher need to trial before adopting one of the solutions. After clarifying further technological and market aspects, a final report was created comparing and assessing the alternatives. This report also assesses the advantages provided by the recommended solution compared to the current system and rated the market opportunities. Based on this report it was decided to adopt the recommended solution.

The following table depicts specific quotes from ISP4 and further ISPs centering on the search for innovative uses:

Case	Exemplified quotes
ISP4	Innovation: "We asked ourselves, how the printing of an invoice could be avoided. We've called up the warranty systems of one of our customers where everything works well without any bills."
	Trialability: "We scrutinized several alternatives both in terms of technology and in terms of market acceptance. After testing prototypes within our R&D department we involved further departments to test the most promising alternatives. Additionally, we discussed with customers which advantages such a system could have and how these advantages would be assessed by the customers. … Several rounds of such discussions took place. … After having positive feedback predominantly from R&D, sales, and customers, we then decided to adopt it."
	Relative advantage: "When we develop new services we use a formal process to assess the alternatives and also to make explicit what is the main difference to older solutions, why should a customer decide to buy the new solution, what is the unique selling point, etc. Based on this evaluation we pick the most promising alternative."

Table 3. Search for innovative uses

ISP3	Innovation: "Around already developed key components we build a service portfolio in order to provide new solutions for our customer." Trialability: "We permanently extend our service portfolio to offer value-add to our customers. For that, we scan the market, customers and competitors, to identify new needs, trends, or offerings which could be adapted to our service. Similarly, we motivate our employees to come up with new ideas. All this input is consolidated and evaluated. Our bi-monthly innovation meetings serve as a discussion platform and to pick the best ideas which then are developed further. We employ sort of project management process to evaluate and to test innovative ideas until only a few are remaining." Relative advantage: "When deciding on whether or not a specific solution should be adopted it is important to have a good information basis regarding the possible market success. In our firm we account for this by preparing a report that compares our new solutions to solutions on the market and to our own portfolio."
ISP2	Innovation: "Related to our business innovation is the utilization of well-known techniques and software components in a new way. E.g. things always being made monolithic we create out of components and configurable as a new variant with different properties." Trialability: "We always have extensive trials before we decide to adopt something. This is a must. There are so many ideas out there which have to be consolidated, elaborated, and tested. … It has to fit in our portfolio. … Without trials, nothing will happen." Relative advantage: "We evaluate ideas based on the forecasted customer value-add. Ideas with insufficient value-add are eliminated in an early stage."
ISP1	"In the past it (= the user interface, the authors) was menu-driven. […] We have conducted a few ergonomics studies. Now it is intuitively usable and fits most user requirements." Trialability: "…, we had the idea to create a more attractive user interface which similarly should facilitate the use of the system, thereby reducing the amount of user training. … We always look for appropriate alternative solution scenarios which we assess. Once attractive scenarios are found we typically develop prototypes and test it, using cross-functional teams." Relative advantage: "It is very important to us that we provide new solutions that are really new, that is, solutions that depart essentially from prior offerings. This was also the case for our new user interface which was a great leap forward."

Table 3. Search for innovative uses (continued)

At first look the data collected from the cases revealed that most firms looked for new combinations of their resources in order to better serve their markets. The statements depicted in table 3 show that the innovation characteristics trialability and relative advantage are of great importance and in case of slack search have a high impact on innovation adoption.

CONCLUSION

From the cases presented in the previous section we have found support for the propositions to several degrees.

When facing immediate problems to be resolved ISP1 and ISP3 are inclined to adopt innovative solutions as fast as possible. The pressure, e.g. from a major customer to provide a solution within a short time frame, seems to lower the effect of trialability and relative advantage on the adoption of the new service.

In turn, ISP1 to 4 when carrying-out slack search are inclined to elaborate on solutions, to provide alternative solutions, to evaluate alternatives with respect to the market, and to trial alternative solutions. Here, it can be inferred from the statements that the effect of trialability and relative advantage on the adoption of new services is higher than in case of problemistic search.

Using case studies among service providers we found indications that the type of motivation to innovate moderates the effect of some innovation characteristics on the adoption of innovations.

More in-depth studies are needed to better understand in which situations and under which conditions problemistic search, slack resources, or both influence the effect of innovation characteristics on adoption of innovations. For example the observed innovations are all incremental in nature. It would be interesting to see if the results are different in case of radical innovations.

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