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A Preliminary Research Study of the Implications of Web Services Innovation for General Adopters: Findings and Recommendations

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Abstract

Among emerging Service-oriented technologies, Web Services as representative of such innovation has gained increasing attention and received extensive studies from both academia and industry. In this study, we look at Web Services innovation from a more theoretical viewpoint. Based on hypothetical presumptions, we propose a dual-core model that treats such innovation at a strategic level according to its peculiar characteristics. We question the validity of using two prevailing innovation theories, Tornatzky and Fleischer's contextual framework, and Swanson's innovation typology respectively. We argue that simply apply either of above theories would miss important attributes of Web Services; if use both, it would be too complex and lose the foci. We therefore compose a synthetic viewpoint, on the basis of Web Services primary characteristics in order to obtain a thorough understanding of this innovation and give recommendation to general adopters. We also suggest that adoption of IS innovation is conjectured to be patterned in terms of the scope of e-business enablement across organizations, particularly in small and medium-sized enterprises (SMEs). The argument is exemplified through the diffusion of Web Service innovation in order to make our analysis focused on a representative case of IS innovation among organizations as well as keep generalization for articulating further research into issues which share common attributes of Web Services.

Key words: Web Services, Information Technology, Technology Innovation, e-Business, IS Adoption.

1. Introduction

Web Services are becoming the primary way in which business processes are exposed and accessed in the enterprise. As these processes are exposed, it will become easier for organizations to integrate their business operations with those of their partners. At the same time, portals have rapidly emerged to become the Web user interface of choice for accessing enterprise-wide heterogeneous data and applications. The central challenge for IT has been, and will continue to be, the integration of inter- and intra-enterprise applications. To stay competitive today, businesses needs to be able to instantly and easily interoperate with different divisions within organization - as well as reach outside to customers, partners, and suppliers. But barriers such as inconsistent platforms, languages, and protocols often stand in the way. Web services break through these barriers by providing loosely coupled, language-neutral, and platform-independent methods for connecting people, processes, and applications behind or outside the firewall. The term "Web Services" refers[1] to the technologies that allow for making connections. More specifically, Web Services is "any service that is available over the Internet, uses a standardized XML messaging system, and is not tied to any one operating system or programming language." (Cerami 2002). Hence, Web Services[2] are perceived as building blocks that fundamental for creating distributed applications, which are able to be published and accessed over the Internet, as well as corporate intranets. Understandably, from this conceptual viewpoint, Web Services could be thought to construct co-operative Inter or Intra-Organizational Systems (IOS) that allow trading partners to conduct transactions through connecting separate computer applications. IOSs are telecommunication-based computer systems that are used by two or more organizations to support the sharing of data, and sometimes applications, among users in different organizations (Barrett and Konsynski 1982; Cash 1985). In order to be classified as a full-fledged IOS, Web Services must be deployed at departmental level within an organization; or at organizational level among firms. However, due to the fact that each individual organization has varied perception and policy towards introducing new technologies to existing information systems, thus the adoption depth and breadth of Web Services innovation in organizations may vary considerably. However, with no exception, such decisions are all inherently consistent with each firm's adoption strategy which is

[1] When use singular form of Web Services, it denotes a special term of an IS innovation;

[2] We address that a service is the endpoint of a connection, which has some type of underlying computer system that supports the connection offered. Web Services herein used as a plural form to emphasize a whole subset of their functionalities.

affected by contextual factors. A number of research work studying the adoption of IS innovations is using this fashion towards contributing knowledge to general innovation theory. As an emerging technology, theories about Web Services innovation and its adoption in organizations are still lacking. It is presumable that classical technological innovation theories can provide useful guidelines for studying Web Services innovation; new findings are able to be gained by applying empirical frameworks in Web Services study. Nonetheless, any borrowed theories should be tailored to particular context in studying a specific innovation. Implications of this proposition suggest that, when featured variants are introduced to certain empirical frameworks with respect to distinct characteristics of each innovation, the research methodology should be reconsidered, and the early frameworks might subsequently need to be amended in order to design an appropriate research model which is used to conduct the later study. In accordance with these considerations, in the study of Web Service innovation, we first identify its unique characteristics which make it distinct to all other innovations; we then examine the appropriateness of two prevailing models in studying the Web Services innovation. We later recommend a dual-core research model in order to clarify the ambiguity in understanding the adoption of Web Services innovation in organizations. During this approach, this article addresses two issues: (1) what are the major determinants affecting the scope and pattern of Web Services adoption in organizations; (2) what is the role of Web Services providers and how can they assist in constructing unified e-business platform for organizations, particularly SMEs to participate in large-scale e-commerce practices.

The phrase "Web Services" in this paper denotes the architecture that consists of a set of Internet-accessible software components, which are able to extend organizations' Information Systems (IS) to broader external business environments. While empirical researches contributed foundations towards understanding IS innovation and its role in organizational and business process innovation in general; however most studies of such relations were confined to examining separate technological silos and their impacts within a single organization or among few organizations. Nevertheless, existing literatures explain little about the strategic adoption of those innovations at inter-organizational level within a given context. In this paper, we suggest that adoption of IS innovation is conjectured to be patterned in terms of the scope of e-business enablement across organizations, particularly in small and medium-sized enterprises (SMEs). The argument is exemplified through the diffusion of Web Service innovation in order to make our analysis focused on a representative case of IS innovation among organizations as well as keep generalization for articulating further research into issues which share common attributes of Web Services. We identified that two main patterns are associated with the dimensions of Web Services adoption: Pattern I adoption confined to integrating discrete business processes within enterprises; Pattern II adoption is implemented across enterprises boundaries to wider business environments. Web Services herein is posited to be layered throughout organization's information systems in an amorphous manner which is fundamental for fluid e-business functionalizing. The vantage point of each adoption pattern is associated with organization's e-business strategy and also consistent with firm's vision towards Web Services innovation in a long term run. Implications of this paper are tow fold. First, the characteristics of Web Services are identified to be openness and modularity; second, a dual-core adoption model is developed accordingly as a road map that organizations could use to help make adoption decision. Finally, we expect longitudinal studies and qualitative case analysis in order to examine our theory. In considering these issues, we reviewed empirical researches on strategic information systems and IS adoption literatures. Based on our preliminary findings on primary characteristics of Web Services, we then present a dual-core research model. Variables and factors for evolving the adoption between patterns are also identified.

2. Literature Review

Information technology usage has been recognized by many researchers as a key dependent variable in MIS research (e.g., DeLone and McLean, 1992; Karahanna and Straub, 1999). Historically, its determinants have been empirically examined in wider contexts (e.g., Adams et al 1992; Davis 1989, 1993; Mathieson 1991; Moore and Benbasat 1996; Taylor and Todd 1995; Thompson et al 1991; Iacovou et al 1995). Most of studies have used the diffusion of innovation theory (Rogers 1983) to identify attributes of innovation that influence its adoption, however many researchers have questioned the validity of its application to complex technological innovations at the organization level (e.g., Attewell 1992; Downs and Mohr 1976). Nevertheless, empirical innovation studies attempt to investigate either individual's or firm's beliefs and attitude towards innovation and its adoption consequences, therefore, the temporal dimension of most adoption studies has been confined to explaining the diffusion of innovation and the interaction with single adopter (e.g., often an individual or organization unit).

However, with exceptions, there are also quite a few of researches which have assessed the adoption of IS innovation at organizational level among organizations (e.g., Swanson 1994; Rai and Howard 1993). Notwithstanding this point, as stated in a study of Open Systems adoption (Chau and Tam 1997), current diffusion theories yet not explain completely the inconsistency in report results when generalizing findings of individual adoption to the organization level

if considering the differences in unit of analysis, environment, and technology characteristics. Furthermore, as Zmud (1982) notes in his studies of the diffusion of modern software practices among IS development groups that, a set of heterogeneous innovations might be influenced quite differently by the same factors in a single organizational context; and a lack of homogeneity in either innovations or organizational contexts may result in inconclusiveness of any certain type of diffusion framework in a variety of business environments with specific organizational context involved. Thus, simply use the empirical contextual framework (e.g., Tornatzky and Fleischer 1990) to analyze innovation process would not capable to tackle a complex technological innovation, and not able to explain clearly its diffusion pattern in organization with respect to the emphasis on the other contextual factors that existing in the same framework.

In dealing with this, Fichman (1992) argues in a review of empirical IT innovation studies that classical diffusion variables by themselves are unlikely to be strong predictors of adoption and diffusion for complex organizational technology, suggesting that additional factors, either as independent or control variables, should be added to organizational level innovation adoption studies.

Alternatively, besides continuous attempts to optimize such empirical contextual framework, Swanson (1994) proposed a three-layer IS innovation typology model. Swanson claimed that the IS innovation itself could be typed according to its usage in different organization hierarchies. The IS task-nature is a key determinants to decide the type of each IS innovation. His study contributed a new ground towards understanding IS innovations through making analysis with focus on IS innovation itself; the innovation type is associated with organizational contexts, and implies the further usage of an IS innovation. Swanson's work bridges the IS innovation characteristics and its usage, and served as a roadmap to assist understanding new IS innovations within organizational context.

However, in the study of Web Services innovation, the appropriateness needs to be examined when considering applying the above two prevailing theories to the present study. A temporal hypothesis is therefore arising that:

H1:

The empirical innovation process framework looks at a single IS innovation in three contexts (respectively: the external environmental context, the technological context, and the organizational context); while Swanson's typology theory categorizes IS innovations in terms of their tasks and organizational hierarchies. For Web Services innovation, according to its peculiar technological characteristic and thereafter implications for further adoption, either of above theories may not able to provide complete explanation; thus a new model that blended above two with a synthetic manner is expected, in order to leverage the foci, and fit the Web Services research.

Web Services Innovation Characteristics

Cerami (2003) describes that the role of today's World Wide Web (WWW) has transformed to what now is regarded as an intermediate platform which is "for interactive access to documents and applications … such access is by human users, typically working through Web browsers, audio players, or other interactive front-end systems. The Web can grow significantly in power and scope if it is extended to support communication between applications, from one program to another". To this end, Web Services is defined and invented to bridge the gap to such paradigm. We herein use both capital (majuscule) letters to indicate this phrase is a special term. Web Services was initiated by leading IT vendors [3] and soon became standards of W3C[4]. Regardless each vernacular use of this phrase that practitioners tout with, the story of Web Services is the story of connecting systems of diverse types. Conceptually, Web Services represents a model in which discrete tasks within e-business processes are distributed widely throughout a value net; and Web Services is consist of a stack of emerging standards that describe service-oriented, component-based application architecture. Succinctly, from a technical viewpoint, Web Services is reified by loosely coupled, reusable software components that semantically encapsulate discrete functionality and are distributed and programmatically accessible over standard Internet protocols. Unlike other technological artefacts studies in previous IS research which have a specific application, the scope of Web Services is wide, affecting every component of an IS infrastructure. Again, as Sleeper and Robins (2001) and Cerami (2003) suggested, a complete Web Services is interpreted in many aspects, and summarized as:

1. Web Services are reusable software components;
2. These software components are loosely coupled and discoverable via a simple find mechanism;
3. Web Services is able to semantically encapsulate discrete functionality;
4. Web Services can be accessed programmatically through a standardized XML messaging system;
5. Web Services are distributed over the Internet by making use of existing, ubiquitous transport protocols.

[3] Examples of representative Web Services are Microsoft .NET; SUN ONE (Open Network Environment); IBM Web Services; Oracle Network Services.

[4] World Wide Web Consortium. http://www.w3c.org

Identifying the Primary Characteristics of Web Services Innovation

The organizational context describes the characteristics of an organization, such as firm size, degree of centralization (or diversity), formalization, complexity of its managerial structure, and the quality of its human resources, and the amount of slack resources available internally (Chau and Tam 1997, p4; Swanson 1994, p1080). Such characteristics would have substantial influence on organization's propensity to adopting certain innovations; and the evidences about the links of these two have been reported in Tornatzky and Fleischer's (1990) study. Likewise, the adoption of Web Services innovation and its impact on organizational changes should also be consistent with classical diffusion theories. Differentiating from trade press, due to the fact that Web Services is a type of recent innovation brought to academic agenda, therefore, literatures of systematic and scholarly studies on Web Services innovation are relatively scarce. Nonetheless, in a preliminary research study, Wu and El Sawy (2003) reported that a wide range of business benefits is proposed for Web Services adoption, including easier, faster and cheaper enterprise application integration (EAI), dynamic business partnership, lowering of market entry barrier, and even industry structure change. Through their study and thorough review of existing innovations characteristics; the four salient characteristics of Web Services are identified to be:

1. IS technological process innovation: Web Services practices are currently IS technological process innovation;
2. High compatibility: Web Services has its roots in three existing IT trends (match with existing values; inheritance of past experience; compatible with other Web Services characteristics);
3. High divisibility: Web Services is a loose-bundle innovation with multiple visions and multiple associated products;
4. High customizability: Reinvention of Web Services occurs inevitably.

The last point of Wu and El Sawy's findings is not a contingency; this reflects again what has been suggested by Rogers (1983) and Swanson (1994) in their earlier studies, where Rogers (1983) contends that reinvention occurs at the implementation stage for certain innovations and for certain adopter; and Swanson (1994, p1079) states "Significantly, innovations of all three types are likely to evolve over time across their domains, as they are successively adopted. Both strong-order and weak-order effects provide impetus for this evolution, which is marked by incremental changes to the innovation's feature composition. New features are likely to be introduced to complement existing features, reconfiguring the concept and often facilitating the adoption process".

From a broader viewpoint, on the basis of preliminary research findings and the ground on which Web Services was initiated, as well as classical innovation theories depict, Web Services innovation does not necessarily need to have a fixed form or construct in the organizational adoption context; rather, it exists ubiquitously within the infrastructure of enterprise information systems in an amorphous manner, and therefore, we term this attribute as **polymorphism**[5]. Therefore, the primary characteristics of Web Services innovation, apart from those which have already been studied, are perceived as openness and modularity. Consequently, as a result, the deployment of Web Services among organizations would present many variations through each diffusion practice, which are selective adoption and creative implementation. The former allows potential adopters to select necessary and critical components to fit in more appropriately to the task requirements respectively; while for the latter, due to large diversity of each task's specification, Web Services implementation also needs to be configured individually that tailors to adopters' needs (for example, enterprise application integration-EAI).

3. Dual-core Research Model

The power and presence of information technology (IT) have expanded at a rapid rate that reaching every level in organizations and it has been viewed as a resource ever more critical to the success for host organizations (Carr 2003). Thus, information systems (IS) featured with increasing ubiquity are perceived to be of more strategic value. Different levels in the management hierarchy are now using IT where once its sole domain was at the operational level. The aim now is not only to improve efficiency but also to facilitate e-business effectiveness. On a more strategic level, information may be passed from an organization to its suppliers or customers in order to gain or provide a better service (Cash 1985), that assure to stay ahead in a short term than competitors and gain a long-term advantage by continual improvement. Such competitive forces include (Somogyi and Galliers 1987): (1) building barriers against new entrants; (2) changing the

[5] This term is initially dedicated to explaining the concept that different objects do "the right thing" through an example of how a Pegasus class bridges between a Horse class (horse can whinny and gallop) and a Bird class (bird can fly) in object oriented programming (i.e., in C++ programming language). We "borrow" its meaning here in order to address that Web Services is application-centric and task-oriented vehicle for facilitating e-business automation, and adopters no necessarily need to know how it works or its implementation details. References for definition and examples of polymorphism are found at Liberty (2001, p10, p111-114, p376, p435).

basis of competition; (3) changing the balance of power in supplier relationships; (4) tying in customers; (5) switching costs; (6) creating new products and services.

These perceived benefits may best explain, to a certain extend, the reasons that motivate organizations to swiftly adopt new IT innovations as a planned approach to making their information systems additional strategic value; and continually invest in IS may therefore be posited as a business strategy in order to compete in marketplace. This however might result in a dilemma in the end – most of companies realize the importance of IS and follow the investment pattern associated with new emerging information technologies, believing this is their proprietary resource to assure a leading competition position by ruling out the threat from the others who do not possess such advantage. However with comparatively less focus on continually enhancing their core business, companies would finally realize that such IT developments policy will not provide increased profitability. In fact, it is presumable that as the utilization of information technologies is becoming increasingly ubiquitous for all stakeholders in marketplace, the strategic importance of enterprise information systems would diminish to a level of what earlier technologies have reached, and the competitive advantages brought by such gradually infrastructuralized [6] information systems would therefore become less salient than the initial expectations. Nonetheless, interestingly, we noticed the recent progress achieved in software engineering community for migrating the use of powerful high performance computing (HPC) from dedicated scientific instrument to commoditized, pervasively used mainstream business IS infrastructure, viz. Grid Web Services Provisioning, through parties external to the host organization – vendors and providers of outsourced services (Foster et al 2001; Juhasz 2002; Xu and Hackney 2003), which is all the attempts to turn the above assumption into reality. As Attewell (1992) highlighted that the role of the innovation suppliers which in our study the service providers are to facilitate significantly in the knowledge transfer process, now are seen to be of critical importance in facilitating the process of IS infrastructuralization through service-sharing on a lease or rent basis (Xu and Seltsikas 2002).

New Approach for Web Services Research

[6] This term herein refers to the IS services and technologies that are becoming commonly used and commoditized basic facilities that functionalize enterprises e-business process. This is represented by Web Services and available most often through outsourced service provisioning. However, the source and path of such technology diffusion may vary considerably (i.e., the theories of Rogers 1983; and the study of Attewell 1992).

The peculiar characteristics of Web Services innovation shape its adoption profoundly. First, Web Services permeates both the information technology itself and the business processes it serves. Thus, Web Services innovation spans both technological and business process domains and is unlikely to be characteristic of innovation of either. Second, Web Services integrates disparate applications within an enterprise through EAI [7], but it is also rapidly elaborating and possessing an unusual degree of plasticity for informational layering and inter-organizational linking that articulates collaborative e-business and e-commerce. In this sense, Web Services makes enterprise information systems no longer proprietary; indeed, Web Services may be conjectured as an IS infrastructural innovation that will reshape the pattern for enterprises running e-business. Analyzing Web Services from this vantage point may help organizations obtain solid understanding of this innovation that assists making adoption decision, and subsequent adoption process. Therefore, the second hypothesis is:

H2:

Web Services is basically an IT infrastructural innovation. In order to clarify ambiguity, and interpret precisely the large variation of subsequent IS innovations that derived from Web Services innovation, the research model should be associated consistently with Web Services primary characteristics; and the research direction is led by the emphasis on the scope of e-Business enablement.

(1) Proprietary Core.

Where the IS is decentralized within a company into smaller units, and there is a stronger need to integrate disparate IS applications, the pattern 1 proprietary core is most likely taken. Web Services may be thought as a means for re-engineering organizations existing applications in order to achieve integrated e-business process (i.e. EAI) and the internal information systems retain a proprietary nature. From this viewpoint, companies would concentrate on their core-business by addressing sustainable competence with increased IS infrastructure effectiveness. In addition, this adoption pattern also allows companies to develop and maintain fairly customized software applications in order to serve particular business contents, as well as keep advantageous added-value through the differentiation. Web Services innovation is therefore understood as technological process innovation (type **1b**), which is seen as an IS infrastructural optimizer that glue previously disparate business processes; and constant IS availability is therefore assured.

[7] We herein refer to 'standard' EAI, which is based on a common set of software protocols include WSDL, SOAP, UDDI through XML messaging.

(2) Infrastructural Core

Where IS is centralized and as a slack resource with economies of scale, pattern 2 infrastructural core is likely to happen that companies retain marketing advantages with extended connectivity among business partners. Web Services adoption is represented by outsourcing infrastructuralized e-business processes that facilitated by service providers. Web Services is obtained through commoditized sharing network of application service provisioning (ASP or xSP of all kinds) community. Within such virtual organization (VO), enterprise is able to gain best of breed e-business functionalities, and conduct e-commerce activities within unified e-business environment. Although the ASP/xSP business model has received considerable debates, however, with the rise in the availability of scalable network technologies and resources, ASP/xSP has become increasingly more feasible sources for obtaining IS services (Foster et al 2001; Jayatilaka et al 2002; Xu and Seltsikas 2002; Xu 2002). This is illustrated in

Thus, prevalent adopters of pattern 2, particularly SMEs, are technologically with the 'lagging-edge' philosophy during the diffusion of innovations (Huff and Munro 1985); by taking up the role-shifting to ASP/xSP, pattern 2 adopters are given the flexibilities to meet their business issues with solution, as Clark (1992) pointed out that the most consistent adoption strategy ought to be through a planned approach to systematically integrate fortuitous business issues with the occurrence of technologies. The service provisioning is thus likely to increase the probability of such opportunistic match.

(3) Intermediate Middle Layer

Where the enterprise IS is integrated by Web Services for providing consistent IS availability that keeps proprietary but would selectively connect to external business environment, the third pattern intermediate core is most likely to happen. As Tornatzky and Fleischer (1990, p. 161) argued, because organizational slack is fungible, it therefore implies IS centralization or decentralization. The installed application system portfolio of the IS unit provides another foundation for its innovation (Swanson 1994). As a result, beyond above two recommendations, a minor domain describes a blended adoption strategy, where the enterprise mission critical information systems are connected to business partners through Web Services interface, in order to expedite e-business automation in a broader dimension.

We illustrate the domain of Web Services innovation adoption in organizations with a dual-core representation in Figure 2. in order to obtain a more intuitive perception of their relationships.

In this study, the organization's IS management strategy is identified as a major determinant that affecting the adoption pattern of Web Services innovation; and this should also be taken into account for organizations in considering the adoption dimensions in terms of the scopes of e-business enablement with hypothesis that the above presumption holds.

According to these dispersed visions of enterprises strategies towards information systems development, our study of Web Services innovation spans two domains: proprietary and infrastructural respectively. How should Web Services innovation be understood in each domain? Recalling the above discussions, Web Services innovation may involve a new IS work technology confined to enterprise boundary that remains proprietary or as a private technology; it may also involve a new collaborative service across enterprises boundaries that residing on a common standardized information systems infrastructures, forming virtual e-marketplace through joining members, and expediting integrated inter-organizational e-business processes. Each of these reshapes the content, extent, and organization of the IS task. Both two domains are not exclusive to each other. A middle layer is of permeable that exists, in the case that company may view the mission-critical information systems proprietary, and the other part as infrastructural interface linking external e-business environments.

4. Implications and Future Research Directions

In this study, we look at Web Services innovation from a more theoretical viewpoint. Based on hypothetical presumptions, we propose a dual-core model that treats such innovation at a strategic level according to its peculiar characteristics. We question the validity of using two prevailing innovation theories, Tornatzky and Fleischer's contextual framework, and Swanson's innovation typology respectively. We argue that simply apply either of above theories would miss important attributes of Web Services; if use both, it would be too complex and lose the foci. We therefore compose a synthetic viewpoint, on the basis of Web Services primary characteristics in order to obtain a thorough understanding of this innovation and give recommendation to general adopters.

Qualitative research will also help obtain additional findings and discover new features. Hypothesises arising in this article need to be further examined through appropriate methodologies. The implications of the present work will also extend to other innovation domain. We attempt to generalize a research model that is useful for the study of new innovations sharing commonalities. The implication of Web Service innovation for service providers (xSPs) is not included in this study.

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Appendix 1

Existing literatures of innovations characteristics (Reviewed by Wu and El Sawy, 2003)

Zaltman et al. (1973)	75 Articles reviewed by Tornatzky et al.	Tornatzky et al. (1982)	Rogers (1983)
•Cost •Returns to investment •Efficiency •Risk and uncertainty •Communicability •Compatibility •Complexity •Scientific status •Perceived relative advantage •Point of origin •Terminality •Status quo ante •Commitment •Interpersonal relationships •Publicness vs. privateness •Gatekeepers •Susceptibility to successive modification •Gateway capacity •Gateway innovations	•Relative advantage •Association with major enterprise •Clarity of results •Compatibility •Communicability •Complexity •Continuing cost •Cost •Divisibility •Ease of operation •Flexibility •Importance •Initial cost •Mechanical attraction •Observability •Payoff •Pervasiveness •Profitability •Radicalness •Rate of cost recovery •Regularity of reward •Reliability •Riskiness •Specificity of evaluation •Saving of discomfort •Saving of time •Scientific status •Social approval •Trialability •Visibility	•Compatibility •Relative advantage •Complexity •Cost •Communicability •Divisibility •Profitability •Social approval •Trialability •Observability	•Relative advantage •Compatibility •Complexity •Trialability •Observablity

Appendix 2

IS Innovation Taxonomy (Summarized by Grover, Fiedler and Teng 1997; Originally adapted from Swanson 1994)

Subtype	Innovation Core	Description	Illustration from Swanson (1994)	Illustration used for Current Study
Type 1a	IS Administrative Process Innovation	Innovation that focuses on the management and administrative support for IS work	CIO Maintenance Systems Programming CASE	IS Outsourcing
Type 1a	IS Technological Process Innovation	Innovation that focuses on the technical task, i.e., changes the nature of IS work	DBMS ChiefProgrammer Team Data Administration Prototyping	CASE OOPS Large Scale Relational DBMS
Type 2	IS Product and Business Administrative Process Innovation	Innovation involving IS products and services that affect the administrative core of the host organization	Accounting Systems Payroll Systems Executive Information Systems Information Centres	Executive Information Systems Teleconferencing Expert Systems E-Mail
Type 3a	IS Product and Business Technological Process Innovation	Innovation involving IS products and services that affect the core work processes of the host organization	MRP Systems CIM Systems Airline Reservation Systems	CAD/CAM
Type 3b	IS Product and Business Product Innovation	Innovation involving IS products and services that are inherent to or imbedded in the host organization's products or services	Interorganizational Systems with customer Airline Reservation Systems	None
Type 3c	IS Product and Business Integration Innovation	Innovation involving IS products and services that affect the integration or coordination of the host organization with its suppliers, distributors, or customers	Interorganizational Systems EDI	EDI