11-20-2008

Strategic IT Experiments and Organizational Renewal: Getting There Faster By Taking Smaller Steps

Christopher T. Street
University of Manitoba, Chris_Street@umanitoba.ca

R. Brent Gallupe
Queenâ€™s University, bgallupe@business.queensu.ca

芽|Sprouts Working Papers on Information Systems ISSN 1535-6078

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Christopher T. Street
University of Manitoba, Canada

R. Brent Gallupe
Queenâ s University, Canada

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Keywords: strategic IT experiment, organizational renewal, longitudinal case study

Permanent URL: http://sprouts.aisnet.org/8-15

Reference: Street, C.T., Gallupe, R.B. (2008). "Strategic IT Experiments and Organizational Renewal: Getting There Faster By Taking Smaller Steps," Proceedings > Proceedings of JAIS Theory Development Workshop . *Sprouts: Working Papers on Information Systems*, 8(15). http://sprouts.aisnet.org/8-15

Strategic IT Experiments and Organizational Renewal:
Getting There Faster By Taking Smaller Steps

Christopher T. Street
Assistant Professor
I.H. Asper School of Business
University of Manitoba
Telephone: 204-474-9783
Fax: 204-474-5233
Chris_Street@umanitoba.ca

R. Brent Gallupe
Professor
Queen's School of Business
Queen's University
Telephone: 613-533-2361
Fax: 613-533-2013
bgallupe@business.queensu.ca

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Introduction

Regardless whether one is responsible for guiding a Fortune 500 corporation, a small company or a public sector organization, decision-makers face a largely unavoidable reality: organizations often fail if they do not periodically renew themselves (Fligstein 1990). Prior research supports the hypothesis that experimenting with sufficiently innovative knowledge and technology is an important factor in producing the types of innovations that could lead to technological breakthroughs in an industry (Rosenkopf & Nerkar 2001, Phene, Lindquist & Marsh 2006). The types of information technology (IT) experiments that are more likely to lead to organizational renewal over time, however, is not as well understood and represents a current research gap. The purpose of this paper is to develop practical theory on whether different categories of Strategic IT Experiments – trials of innovative, high-potential new information technologies within established organizations – influence the likelihood of organizational renewal occurring over time.

The theory presented in this paper is illustrated using three case studies to show the effects of different categories of strategic IT experiments on successful and unsuccessful renewal outcomes. Results suggest that different categories of strategic experiments are associated with varying degrees of renewal success. These differences are explained using the Theory of Requisite Variety (Lengnick-Hall and Sanders 1997, Skyttner 2002) and a set of five propositions are presented to describe the relationships between strategic experiments and organizational renewal.

This paper is presented in four parts. The first section provides definitions and summaries of key terms. Four categories of Strategic IT Experiments (brokering, reviving, learning and discovery experiments) are then presented and the anticipated effects that each type of experiment has on renewal is discussed. Three longitudinal case studies are then presented to illustrate differences between strategic IT experiments and

successful as well as unsuccessful renewal outcomes. The final section presents a set of propositions for future research.

Literature Review

Organizational renewal refers to a continuous, knowledge-oriented process as opposed to episodic change (Steinstra et al. 2004, Huff, et al. 1992). The term focuses on organizational reconfiguration or rejuvenation and the process of how resources are transformed into product markets as opposed to how existing processes are strengthened or improved (Ravasi and Lojacono 2005). Based on these characteristics we define organizational renewal as: *a path-dependent organizational process that involves promoting, accommodating and using new knowledge and innovative behavior in order to change an organization's product market domain [what they do] and/or its core competencies [how they do it]*.

An example of the influence of IT on organizational renewal might be the New York Times Co. forming New York Times Digital to build and launch an online version of the New York Times on the Web, which involved developing and adopting new Internet-based news reporting practices and competencies to develop a profitable online news division (Govindarajan and Trimble 2004).

Origins of Renewal – Process, Experimentation & Requisite Variety

Our theory is premised on the idea that organizational renewal relies on certain types of IT experiments to provide novel product markets and core competencies. This premise has been inferred in the MIS literature but never directly addressed; researchers have touched on how technological experimentation influences organizational change and competitiveness but have not yet addressed the types or characteristics of IT experiments that are more or less likely to result in strategic changes in an organization. Ross and Beath (2002) suggest that part of a successful IT investment strategy should include allocating resources to experiment with IT, such as launching an Internet-based customer service

system in order to determine how extensively customers will use a self-serve website. Wheeler (2002) similarly proposes that experimenting is an important exercise to develop capabilities in effectively choosing appropriate information technologies. Similarly, Sambamurthy, et al. (2003) proposed that experimentation increased the likelihood that opportunities for innovation in competitive markets would be detected and seized upon. Extending into the IT alignment literature, Van der Zee and De Jong (1999) wrote that a degree of experimentation along with a continuous process of adaptation and learning was important in managing the fit between IT and the business. MIS literature provides explanations for a link between IT experiments occurring and subsequent long-term growth but a practical question must be asked about *how much* or *what type* of experimentation best balances the opposing needs of effectiveness and efficiency. Given that experimentation can be useful, how should one balance between enough IT experimentation to generate a suitable level of innovation but not so much as to needlessly expend resources? The next section seeks to address the question of *how much* and *what type* of experimentation is likely to lead to organizational renewal in a real-world context.

Strategic IT Experiments

Generally speaking, experiments are activities or procedures carried out under controlled conditions in order to discover an unknown effect (Merriam-Webster On-line Dictionary, 2008). In many organizations there are often subsets of experiments that are regularly carried out to determine the effects of new processes or technologies that might have the potential to modify the competitive environment of an established firm; these experiments are 'strategic' in the sense that the outcome could add to or change the critical resources, competencies or product markets that a firm uses as its basis for competition (Govindarajan and Trimble 2004).

Different types of strategic IT experiments can be differentiated in terms of the novelty of the technologies to the firm and whether they are being applied to satisfy requirements in a new versus an existing situation or context. iTunes illustrates how strategic IT experiments generally involve some

fundamental or central enabling technologies, such as Internet-based music libraries. Prior knowledge and experience with the technologies being explored can already exist within the organization or it can be new to the firm, as Rosenkopf & Nerkar (2001) demonstrated in their study of optical disk development in the digital storage industry. Phene, Lindquist & Marsh (2006) use a similar distinction between technologies that are new to the firm versus not new in their study of the categories of knowledge that lead to breakthrough innovations in the biotech industry. Whether the technologies being explored are new to an organization or not is one dimension defining different types of strategic experiments.

Strategic IT experiments can also vary in whether the experiment is oriented toward applying technologies to satisfy requirements in a new versus an existing situation or context. The iTunes service represents Apple applying computer technologies in the online music industry, a product market context that was new to the company and where the technical and market requirements for the service could be expected to not exist or be largely uncertain for Apple. Whether or not knowledge of the requirements regarding the characteristics or demand of a potential new product, service or core competency currently exist for the organization is a second dimension defining different types of strategic experiments.

Strategic IT experiments differ from one another along these two dimensions: (1) those that involve information technologies that are new to the organization versus those that are not new; and (2) those where the outcome of the experiment is intended to satisfy an existing organizational requirement versus those where existing requirements are not yet understood. These dimensions provide a 4-way categorization of strategic IT experiments that our empirical results suggested are associated with varying likelihood of organizational renewal success (Figure 1).

		Requirements	
		Existing	**Not Existing**
Information Technology	**Not new to Organization**	**Reviving** *IT Experiments*	**Brokering** *IT Experiments*
	New to Organization	**Learning** *IT Experiments*	**Discovery** *IT Experiments*

Figure 1. Categories of Strategic IT Experiments

Reviving experiments refer to situations where an existing and understood organizational requirement is matched with a technology (process or product) that an organization is already familiar with. In many cases these experiments involve restoring something that was done in the organization's past and for whatever reason was stopped, only to be later reinstated. IBM's reorientation in the 1990s as an information services company could be considered a reviving experiment in light of how the business had historically defined itself as a information services company and only gradually evolved into a computer hardware company in the 1970s and 1980s (Maney 2003). Brokering experiments refers to the category of experiments where existing technologies from one part of the organization are introduced and tested in another part where the organizational requirements are not so well understood as they might be in the original context. Hargadon and Sutton's (1997) description of how the IDEO design studio takes existing designs and products from old projects and reapplies them in new project designs is an example. Learning experiments are those where new information technologies are tried out within an organization to address some existing and well-understood business requirement. Finally, Discovery experiments refer to situations where the organization has little or no knowledge and experience with either the information technologies or the requirements for a new product or process.

Successfully accomplishing an experiment is only part of the challenge. One is also concerned with whether the experiment will provide the proper degree of innovation and learning to drive renewal. Since

successful renewal is dependent on generating new knowledge (Crossan & Berdrow 2003), we are concerned how novel or innovative the use of the information technology is to the organization. To address the subject of generating *enough, but just enough, innovation* through strategic IT experiments we turn to the Theory of Requisite Variety.

Theory of Requisite Variety

If innovation is conducive to organizational renewal then more innovation should be better and the most innovation therefore the best. This statement, notably extreme, is of course flawed since experience tells us that the most innovative ideas and products are seldom the most successful. Phrases such as 'before its time' and 'unrecognized genius' are reserved for just such examples of too much novelty applied too early. The Theory of Requisite Variety (Lengnick-Hall and Sanders 1997, Skyttner 2002) is often used to understand what a 'requisite' amount of innovation might be in a particular situation or environment. Requisite Variety explains that the 'variety' in an organization, the number of options or opportunities that exist at a point in time, should be *at least, but no more than,* the same as the variety in the external environment. One interpretation of this theory is that for successful adaptation to occur an organization should be capable of generating a requisite number of alternatives for IT-based change as can be effectively used in the organization or marketplace. Excessive experimentation in an organization then creates alternatives that are not required or capable of being used in an organization or marketplace and represents wasted resources.

Applications of this theory have shown relationships between the amount of diversity in top-management teams and firm performance (Kilduff, Angelmar and Mehra, A. 2000), and the effectiveness of diverse student teams in management education (Lengnick-Hall and Sanders 1997). A lack of requisite variety is also associated with organizational rigidity and failure (Weick 1997). One way of conceptualizing this theory as it applies to organizational renewal would be that that innovation is good for organizational renewal but that too little or too much is detrimental.

We can apply this theory to make some predictions about the relationships between organizational renewal and categories of strategic IT experiments. In applying the principles of Requisite Variety we hypothesize that successfully completing an experiment is not necessarily enough: you could successfully complete an experiment but it may not lead to renewal if the outcome of the experiment is either too innovative or not innovative enough. Referring to Figure 1, simply completing a Discovery or Revival experiment might not lead to successful renewal if, (a) the outcomes are so novel that no market arises for a new product or core competency (Discovery Experiments), or (b) so ordinary that they do not lead to new product markets or core competencies being developed (Revival Experiments). Organizational renewal likely fails to occur in either case.

We expect that successful organizational renewal would be more likely to occur from experiments that generate the highest degree of innovation and new knowledge (i.e. provide variety) but that balance the potential of creating either too much or creating too little innovation and new knowledge. Following the categorization of experiments from Figure 1, we expect that Brokering and Learning experiments would be more likely to lead to organizational renewal and Revival and Discovery experiments to be less likely to lead to renewal. The next section presents narratives from three case studies that help illustrate this theory.

Methodology

The purpose of the case studies was to illustrate links between different categories of strategic IT experiments that led to organizational renewal occurring as well as not occurring. A multi-site comparative design consisting of three retrospective case studies was selected (Yin 1994). The case study method was selected because they are considered to be a very useful technique for exploring and testing complex, multi-faceted research concepts (Yin 1994) and because organizational strategic development is known to be a complex process involving multiple influences within a single firm (Hax 1990; Mintzberg

and Lampel 1999). Case studies also provide a valid structure to interact with organizational executives and understand the phenomena from their perspective.

Three organizations were approached and subsequently agreed to take part in this research project. Case #1 involved a cluster of ministries in a Canadian Provincial Government, case #2 involved a high-tech company in the motion-picture visual effects industry, and case #3 involved a private healthcare franchise organization. Table 1 provides descriptions of the sites.

Characteristic	Case Site #1 "GOV"	Case Site #2 "TECH"	Case Site #3 "HEALTH"
Employees	~1000	70	~70
Annual Budget/ Revenue (2005)	$250M+ ($CDN) (budget)	$10M ($CDN) (revenue)	~$80M ($CDN) (revenue)
Sector	Government	Digital Post-Production	Healthcare
Age	~100y	8y	21y

Table 1. Case Study Sites

Following the criteria of obervability and tangibility in the organizational innovation literature (Amabile et al. 1996), renewal success was indicated as either (1) adopting and continuing a distinctive new product/process or (2) entering and remaining in a new product market. Identifying strategic experiments involved identifying the decisions and activities that were involved in developing *(planning, conceptualizing and performing)* an IT-based process that was either new to the organization or where an existing market did not exist so far as the organization was aware.

The specific context of the study involved strategic experiments with information technology (IT) and as such the study included individuals from both the senior executive as well as the IT departments of the three organizations. Informants were identified by first interviewing the most senior executives from the business and IT functions of each organization and progressing downward through the organizational

structure using a snowballing technique where initial interviewees identified other relevant informants. Data collection was conducted between December, 2004 and September, 2005. Data came from three primary sources; interviews, internal documents such as annual budgets and newsletters, and external documents such as newspaper and magazine articles and newswire reports. Interview protocols were used in all three cases and the dataset maintained using ATLAS-ti (v5.0).

A four-step process was used to move from raw data to completed timelines: step 1 – initial analysis of transcripts and supporting documentation; step 2 –coding of transcripts; step 3 – development of the individual timelines; step 4 – across-case analysis.

Several methods were used to heighten reliability and validity in the case study results based on recommendations from Yin (1994), Krippendorf (2004) and Golden (1992, 1997). Validity was assessed by searching for multiple perspectives on constructs (multi-informant, multi-organizational level), triangulating data sources (interviews, assessment & performance data, internal and external documents) and key informant reviews of draft case summaries. Reliability was maintained through the use of structured interview protocols, using qualitative analysis tools (ATLAS-ti) to assist in maintaining and structuring the data in an auditable fashion, and by having a random selection of datasources independently coded by a research assistant. Following recommendations by Krippendorff (2004) reliability testing was conducted by using documents from cases 1 & 2 for coder training and calibration and a sample of documents from case 3 were used for calculating interrater reliability *(% agreement = 74.3%)*. These results from the three cases are presented in the next section.

Results

Relationships between experimentation and renewal were observed in the case studies where Brokering and Learning experiments at two of the organizations preceded Organizational renewal while Discovery experiments at the third organization did not result in renewal. Revival experiments, which conceptually

round out the theoretical framework in Figure 1, were not found in the cases. Effects and potential implications from this finding (or lack of finding) are discussed in the limitations and future research. These results follow most, but not all, of the predictions made above. The three case studies are presented in the remainder of this section.

Case #1: GOV. GOV is the largest provincial government body within Canada and is comprised of 23 individual ministries operating with a combined budget of $81.2B (CDN$). One of the most significant events to affect GOV's IT function over the last 15 years was the move to a semi-centralized organizational structure. Ministries that delivered programs and services with common themes (e.g. commercially-oriented ministries such as Labour or Business Services; resource-oriented ministries such as Agriculture or Natural Resources) were grouped together into 7 clusters and provided with their own IT departments comprising a total of approximately 3,831 staff. An important goal for these clusters was to help transform GOV's service delivery into "e-government" – a client-centric approach to providing government services to civic constituents through electronically-mediated channels. E-government was meant to address a long-standing issue with traditional government service delivery – while most ministries are structured to focus on the information and services most important to the mandates of the specific ministry, most constituents prefer integrated access to information and services that cut across ministry boundaries. E-government, motivated by the vision of a more transparent and accessible public service, created an increasing requirement to provide e-mediated government services and a 'horizontal' view of familiar and pre-existing ministry services to constituents.

At least six strategic experiments occurred between 1998 and 2004 (see Table 2).

Strategic Experiment	Year	Data
Inspector Notebook Providing field workers (e.g. health inspectors) with laptop computers and mobile internet for 'real-time' field work.	1998	*"Inspector Notebook … started out as a pilot, they used a couple of pieces of software, they got it up and running quickly (IT Cluster Executive)* *"Even when I talk about the Notebook project that I spoke of, it, the initial phases of that probably looked like dabbling. We got half a dozen Notebooks, we tried some and we gave it to a few people, you know that kind of approach but it wasn't speculative, it was based on a strategic direction and it was trying to sort out the details of the solution. … a way to understand and analyze the requirements (IT Cluster Manager)*
Mobile Worker / Mobile Office Piloting IT networks and systems so that employees can access GOV systems at home or outside GOV offices (in the field)	2002	*"We also do some business pilots where we are trying to give people some devices, for example an IPAC to try and have them fill out a check form … and synchronize it back in with the legacy databases. So, there is a business pilot element in some of these things as well where if we do have an early adopter or someone who is keen to try it out we would like to use them as an early adopter and just do some evaluation or assessment and after 6 months do an assessment to see how it worked." (IT Cluster CIO)* *"I think one of the easier ones [to describe] is the whole Mobile strategy. … mobile workers. Some people who don't come into the office very often. … they need access to information and they need to be able to not only receive but submit information remotely and the more we can empower them to do this in various ways and get them out of the office and even work from home" (IT Cluster CIO)*
Collaboration Systems Software and user trials with selected collaboration and communication systems	2002	*"Somebody in the Ministry heard about e-rooms and tried it out. … I liked it so I … said 'I have heard that people are interested in this type of software, can we get a focus group together to talk about generally what your needs are around collaboration tools?' … they came up with three suggestions. … e-rooms, … NetMeeting and … a Blog. So, we are going to try and experiment with the Blog. … what that becomes is almost an example or a model project for others, they can see what it can do and they decide Blogs are a waste of time or decide that it is something that they want us to spend more time on. (IT Cluster Executive)*
Data Management Legacy system redevelopment	2002	*"We also have some R&D things that are very much [to] try a new tool we haven't tried before. … There is also some work we are doing with particular synchronization products again as recognition of a business direction that we certainly will have to rebuild the legacy back ends for the Ministry of Labour. … So very much an R&D technology type of research project." (IT Cluster CIO)*
Service Counters Pilot project to create centralized IT-enabled access to all gov. services in distributed communities	2003	*"The Integrated Service Centre Project ("Service Counter project") was initiated to create an integrated services centre in a major community that would deliver a suite of in-person services and access to on-line services for businesses and individuals. The implementation of the Service Counter project was a key step in the implementation of the Integrated Services Delivery (ISD) strategy to provide integrated services through multiple channels to the customers." (Service Counter Project final report)*
New Form Application Generator Reusable programming template system for developing Web applications faster and more reliably	2004	*"We are doing stuff now with content management and we have done some piloting. We are waiting for the procurement process to catch up with us now. We built something called a New Form Application Generator." (IT Cluster Manager)* *"Content management, same thing, it won't be throw away, we aren't looking to throw things away. … it is in recognition typically of a business driver." (IT Cluster CIO)*

Table 2. Strategic Experiments at GOV

In terms of strategic IT experiments, according to both informants and internal documentation the outcomes of these experiments were generally successful in the sense that they were completed and implemented as planned and were rarely cancelled. The focus of these experiments typically followed a pattern where new technologies were introduced into the process of providing a familiar service or product internally for day-to-day operation of the government or externally to constituents. For example, the R&D oriented Inspector Notebook and Service Counters pilot projects applied information technologies that were new to GOV in order to provide existing and familiar public-facing services. GOV engaged in several Learning experiments between 1998 and 2004 as they worked toward the goal of e-government.

In terms of organizational renewal, by 2003 GOV considered themselves as having successfully transformed themselves into an e-government organization. By their own admissions they were not yet at 100% e-service delivery but they were recognized internationally as being an e-government leader and several ongoing initiatives were in place to continue the progress: *"Today 73% of [GOV's] services are available through at least one electronic channel; client satisfaction is high and growing; and [GOV] has been recognized internationally for its transformation through many awards and incoming delegations. In 2002, for example, [GOV] won the Commonwealth Association for Public Administration and Management (CAPAM) Gold Award for Innovation – working together in a connected organization." (McCalla 2003, p1).* In GOV's case, Learning experiments between at least 1998 and 2004 preceded a organizational renewal from decentralized, dis-integrated 'big government' to centralized e-government service delivery, creating the public-sector equivalent to a new product market for GOV's constituents.

Case #2: TECH. TECH began in 1997 as a company involved in producing computer-generated visual effects for television commercials in the range of $1,000 to $10,000 per project for the local business community in a major Canadian city of 700,000 people. By 2005, TECH has since grown from the

original commercial and visual effects functions into an established production company having won several national and international technological achievement and artistic awards, including an Emmy nomination for visual effects. The visual effects industry is a highly capital-intensive sector for businesses to operate in and TECH was forced to operate within this context. Creating and delivering computer-generated effects involves, broadly speaking, two major processes, the artistically-oriented creating/drawing of the effects by artists and the combining or 'rendering' of these effects into the existing film. The first process involves the use of specialized, often highly-specialized, software while the second involves the use of high-speed, high-capacity computer server networks, often as many as 100+ individual computer servers linked together into a single 'virtual rendering computer' also known as a 'computing grid'. The requirement to have access to these types of expensive and quickly depreciated resources places a significant capital burden on businesses wishing to break into or excel in the industry and leads to competition against major companies like Pixar Animation (Toy Story, Toy Story 2) and Industrial Light and Magic (Star Wars movies) being largely based on the most efficient development and utilization of both software and hardware systems. Strategies and development plans for these businesses are significantly influenced by how well they can source and build their IT infrastructure.

Table 3 describes the strategic IT experimentation occurring at TECH between 1998 and 2005.

Strategic Experiment	Date	Data
VFX Software Extensions (artistic) Adapting and extending lower-cost artistic vfx software into new areas of use.	1998	*"…we started getting into doing a lot of procedural [software development] work, so you have a [movie like] 'The Core', you have a scene [where] you have this ship smashing into the crystals so you have this physics dynamic and it is all animation, and they were going to try and use a miniature and we said that we thought we could do it all digitally, …We saw a way to deal with the [shading] that we were going to use for the crystals, so we found an efficient way to deal with that [by adapting the software] … every single job we have done since then has been more and more programming and technical work and I think we are evolving more into a technical company. … you have to be able to offer something that they [Hollywood] haven't seen before, or do something that is mundane very efficiently and find faster ways to do lots of stuff. (TECH Founder & COO)* *a lot of these [software] tools … are tested at television resolution. When you start getting into film, things start to break, you have to get support*

		from the developers to figure that stuff out. . (TECH Founder & COO) *"The open architecture of Digital Fusion will allow the in-house programming talent at TECH and [TECH Partner] to work together to research and develop applications far beyond anything currently available," TECH said in a statement. "New products developed will improve Digital Fusion and TECH's ability to provide new and exciting images for film and television." (press release)*
High Speed Computer Networking	2000	*"we were maybe a little blind learning this but, … we experimented with different types of networking qualities to figure out what works and our software is also very unique and it put some very weird demands on what we do. . (TECH Founder & COO)* *"[at one point in a project] we had like 48 [servers] plugged on and we were running through the [same network controller] and it was no wonder these machines are so slow, we have got to free these things out. … Once again, it was trial and error. . (TECH Founder & COO)*
High Capacity Grid Computing	2001-2002	*from a systems side, probably about 30% of their [IT department] time is spent on experiments (TECH Founder & COO)* *"the new [computers], we tested before we ordered them, we set up and brought in a few new things … we started to grow and we had all of these servers. We wanted to distribute the load for all of the different projects across these servers. … Well, that gets complicated because if you have got 10 shots, 1 shot could be over here, one could be over there, so it is just complicated to keep track of all of that, so we found a solution and first we tried, it is pretty scary, you could face losing production for a week while you sort it all out. So, we rolled it out to see how it worked, and it was OK, so we brought it to the next project and we definitely try things out before we roll them out." (IT Manager)* *"we are always testing new equipment because you never know when the next project is coming … we are getting more and more into getting new technologies and trying them before we necessarily need them because there is always value in having your own self-experiment. You can read stuff online and look at papers and specs, but inevitably equipment never really operates 100% how they claim it does, so you have got to understand how to tweak it to make it work the way you want it to work." (TECH Founder & COO)*

Table 3. Strategic Experiments at TECH

TECH's IT experiments were successful in that most technology trials resulted in new software or faster and larger networks and server grids being tested. While relatively infrequent, some experiments did not succeed: *"… I can only think of like one or two [experiments that failed], so I would say rarely. … We will bring a bunch of artists in and say, 'OK, we want to do this', and they will say, 'oh, you are crazy'. So, that really didn't get started, we had an idea and they didn't like it." (IT Manager)* In contrast to GOV's Learning experiments, TECH's experiments typically applied existing and familiar technologies

(vfx software, networks and servers) and reconfiguring them to operate differently in new contexts. TECH tended to experiment by brokering existing technical knowledge (e.g. about computer server configurations) into new areas (e.g. maintaining high capacity server processing grids). The results of these experiments were impressive in regard to how large the IT infrastructure became at TECH:

"it is pretty crazy the amount of disc space we have at work and just for the amount of computer power we have but we draw I think a third of the power coming into the building. … a friend of mine works at [the electric company] and says that our building draws more power than any other building other than the big ones downtown." (IT Manager). TECH engaged primarily in Brokering experiments as they worked toward transforming from a small locally-oriented animation company to a dominant producer of Hollywood-style visual effects.

In terms of organizational renewal, TECH was recognized as having been transformed into a visual effects business capable of contributing to major motion picture projects alongside much larger, and better financed, international companies: "*TECH was named a Canadian Innovation Leader due in large part to the successful seven month effort TECH's Research and Development (R&D) put into creating the technology used to develop the unique computer generated Tar Monster character seen in Warner Brothers' movie, 'Scooby Doo 2: Monsters Unleashed'. The Tar Monster character, comprised completely of tar-like liquid, was generated by unique, patent pending fluid simulation technology developed by TECH's R&D." (Federal Government press release)*. Brokering experiments between at least 1998 and 2004 preceded a organizational renewal from local producer to innovative international business. These experiments led to innovative new core competencies in developing and extending their IT infrastructure as well as defining a new product market for their specialized vfx software systems.

Case #3: HEALTH. HEALTH began in 1984 as a small business in a community of 60,000 people in central Canada when the company's founder recognized a business opportunity in providing home-based nursing care for clients who required nursing assistance but were not considered sick enough to remain in

a hospital . After being approached in 1987 by a fellow nurse interested in opening a branch office in a neighbouring community, the founder and her husband made the decision to attempt creating a national franchise network of HEALTH offices. Today, HEALTH is a privately-held corporation operating as a home health care franchisor operating a network of a little more than 50 franchise and corporate offices across Canada with total franchise annual revenues exceeding $40M (CDN$). The number of franchises varied between 1988 and 2005, beginning with 3 franchises in 1988 to as many as 60+ offices around 1999, finally declining to the approximately 50 offices in operation today. In 2005, the HEALTH franchise employed approximately 5000 health care professionals and was the largest Canadian-owned home health care provider.

Table 4 shows the IT experiments conducted at HEALTH between 1999 and 2004.

Strategic Experiment	Date	Data
Web-based Applications	2001	*"I think we pioneered this … rather than just drop brochures at doorsteps … I said, 'let's do something more interactive, [a] self-assessment', so we invented a form and a senior or a family member can fill it out and it covers everything from how do I get out of bed in the morning, … all these things that we would normally be doing when assessing the client. It was moderately successful, we got a few, but that is when we put [it] on the new Internet. (HEALTH CEO)*
Home Tele-Health Providing healthcare and health monitoring services remotely through electronic monitoring equipment and computer networking	2002	*"A pilot study conducted by [HEALTH], March Networks, Aliant Telecom, and the Health Telematics Unit at the University of Calgary … Chronically ill clients with respiratory, cardiac or cancer illnesses were recruited and monitored weekly through remote visits by HEALTH nurses utilizing two-way voice, video and data transmission from a client's home to a HEALTH nurse. (HEALTH press release)* *"What this did in essence was allow nursing staff to be able to get clients to plug in to phone and be able to send blood pressure and those sorts of things remotely as opposed to going out in a rural setting and visit. (IT Manager)* *"we did the largest home telehealth [pilot] … we took 80 clients in [Canada] with this March Networks, we had the software apparatus and … clinical measuring devices,… you could put a [blood pressure cuff] on, I had it on my arm here in Toronto and the … nurse, … was down in Montreal, … she blew it up in Montreal and I could feel the pressure. Anyway, I could see on the screen my pulse rate. It was magic." (HEALTH CEO)* *"I had great confidence in the success of this trial," states [the] CEO of HEALTH. "The main question at hand was 'Will it be accepted?' As we are*

		seeing from the findings, acceptance from both the clients and the nurses was extremely high, showing all of us the overwhelming success we have on our hands." (HEALTH press release)
Mobile Workers Piloting IT networks and systems so that employees can access HEALTH systems at client's home	2003	*"We have to keep charts on everything we do… so a chart is left in the clients home. It has to be delivered back to the local office as well so that we have records of what we are doing in the home … why can't we do that electronically? We toyed with it and turned it down, it sounds like a pretty simple device, but for practical reasons we had to turn it down. … We toyed with the idea of using the client's digital phone." (HEALTH CEO)* *"… a system called Harmony. Great in theory … the caregiver walks into the home, calls an 800 number so there is no cost related to the client and what it registers is that the caregiver has arrived with the client at X time and the caregiver leaves they call so it tags on the amount of time they have spent with that client … it mechanizes the billing process and the payroll process." (HEALTH COO)* *"we want to … use wireless devices for some of our higher level services that we provide. For example, nursing staff, the ability for those folks to receive assignments via pager and confirm their ability to take shifts by pager. We will probably be piloting something like that." (IT Manager)*

Table 4. Strategic Experiments at HEALTH

In terms of organizational renewal, and in contrast to the first two cases, these experiments met with mixed success. Web-based applications went from trial into actual use and were successful in this regard, although HEALTH's CEO indicated that the number of new clients being identified through this channel was much less than hoped for. Mobile worker experiments were either discontinued before completion or their trial dates pushed back in time. HEALTH's largest experiment, home tele-health, was unsuccessful in that HEALTH later indicated that no clients opted to continue using the system after the initial experimentation trial period and no other communities adopted the system since 2002. Web-based applications and home tele-health, in combining new technologies as well as potentially new and undefined product markets, represent two examples of the HEALTH engaging in Discovery experiments which were, as expected, not successful. It is not clear whether the mobile worker trials were examples of Discovery or possibly Learning experiments; it possibly falls somewhere in between if one considers that new technologies were being tried out in a context where it was largely unknown whether clients would accept new practices that involved HEALTH employees asking to use their own private home telephones.

There were certainly no client-based requirements for such service delivery practices. Overall, HEALTH was engaged in primarily Discovery-oriented experiments that received relatively lower success rates.

Results Summary. A review of the results of this study compare to the original conceptualization of Strategic Experiments as follows:

		Requirements	
		Existing	**Not Existing**
Technology	**Not new to Organization**	*Reviving Experiments* *-- not tested --*	**Brokering Experiments** **TECH** (renewal[a])
	New to Organization	**Learning Experiments** **GOV** (renewal[b])	**Discovery Experiments** **HEALTH** (no renewal[c])

[a]. *RENEWAL: YES – became a major producer of Hollywood visual effects from local commercials and animation. TECH continually extended existing knowledge and competencies into new areas of the business (infrastructure, competing with grids, developing and eventually marketing their own software).*

[b]. *RENEWAL: YES – went from paper records-based physical and decentralized service delivery to e-government. GOV experimented with new technologies in order to centralize and increased shared access to familiar constituent services.*

[c]. *RENEWAL: NO – home telehealth mobile workers and web application experiments have not resulted in any significant lasting effects. The technology was not excessively complicated but was new to HEALTH (e.g. 'plug-and-play' medical devices); they learned a great deal but the experiments did not appear to generate new client markets or lead to new competencies.*

Five strategic IT experiment propositions based on these results are presented in the following discussion.

Discussion

We have proposed that the likelihood of organizational renewal occurring successfully is related to the type of strategic IT experimentation that takes place over time. This theory was supported by the results of our multi-site case study. Renewal occurred when organizations pursued an experimentation process that maximized innovation and knowledge while minimizing risks associated with trying new things over time. Innovation, and eventually renewal, was developed and managed successfully in the organizations that conducted Brokering and Learning experiments and was not successfully managed in the organization that pursued Discovery experiments. The Theory of Requisite Variety helps explain why this might have occurred.

Requisite Variety explains that for an organization to thrive they must have at least the same number of potential alternatives for change as the environment has potential threats or opportunities to create change. GOV and TECH provide illustrations of this in how their success was tied to the experimentation practices that provided the new knowledge and products that were in demand in their organizational setting. Excessive variety in an organization, however, creates alternatives that are not needed for 'neutralizing' environmental threats and represent wasted resources. HEALTH demonstrated this in how their style of experimentation provided 'too much' innovation, knowledge and products that were not recognized or demanded within their business environment. GOV, TECH and HEALTH all experimented, gained new knowledge, and developed new products and services but only the first two were able to transform strategic experiments into organizational renewal. The fundamental nature of these relationships is presented next in a preliminary theory of strategic IT experiments.

Strategic IT Experiments and Balancing Variety

Figure 1 described two primary dimensions of experimentation, whether the technologies were new or not new to the organization and whether the requirements for a product or service existed or did not exist. The

case studies provide examples of these dimensions. GOV experimented heavily with technologies that they were historically unfamiliar with such as the Internet and mobile computing but at the same time these experiments were consistently geared to meet familiar and well-understood constituent requirements. TECH experimented heavily with technologies that they were very familiar with but conducted continuous trials to apply these technologies in new situations where clear requirements did not exist. GOV's and TECH's experimentation process created novel competencies and products without going too far away from an existing base of knowledge and the results of their experiments were recognized and adopted quickly into practice. Applying the principles of Requisite Variety, one reason that their strategic experiments were successful could be because they created options for doing new things that corresponded in time and place with opportunities in their respective business environments to capitalize on those options. At the same time, anchoring the experiments in either familiar technology or familiar requirements acted as a restraint in creating a level of innovation or variety that was in excess of what could be, or would be, required in their specific business contexts. In contrast, HEALTH's experimentation process tested unfamiliar technologies as well as unfamiliar requirements in the home tele-health and mobile worker trials. HEALTH provides examples of excessively innovative experiments that went too far into the unknown and were either ended early or did not result in tangible success. Across-case comparisons of GOV and TECH reinventing themselves and HEALTH not having the same outcome supports the theory described earlier in this study that successful experiments are associated with successful renewal. The following two propositions are meant to represent the interaction relationship between the technologies and requirements involved in strategic IT experiments and the likelihood that the experiments will lead to innovative IT-based processes being adopted in an organization.

Proposition #1: *Strategic IT experiments where unknown requirements exist are more likely to succeed when pre-existing technologies are used and less likely to succeed when new technologies are used.*

Proposition #2: *Strategic IT experiments with new technologies are more likely to succeed when known requirements exist and less likely to succeed when unknown requirements exist.*

The Theory of Requisite Variety and the case study results both go on to suggest that unrestrained innovation can be detrimental to renewal as well. Innovation is commonly defined as some thing (e.g. product, service or practice) that is novel or new-to-the-world (Amabile et al. 1996). Given their differences, GOV, TECH and HEALTH nevertheless all conducted innovative experiments but they were not all equally successful. GOV was most innovative in developing technologies that were novel within government while TECH was most innovative in exploring novel products and markets. HEALTH, however, demonstrated with the home tele-health trial in particular that it was exceptionally innovative in simultaneously piloting new technologies and exploring novel product markets. These case observations support the theoretical differences between the categories of strategic IT experiments set out earlier; maximizing innovative potential is not sufficient for renewal. Requisite Variety principles suggested that renewal is more likely to occur when the right amount of innovative potential is manufactured; a 'sweet-spot' exists where experiments that stand a good chance of succeeding provide new competencies or product markets that stand a good chance of being adopted. From a theoretical standpoint, Requisite Variety goes further to explain that *too little* innovation should also result in creating an insufficient level of variety and options for an organization to successfully adapt over time. Just as excessive variety is counterproductive, successful experiments would not necessarily be a sufficient cause for renewal to occur if the experiments do not produce *enough* variety. Just as too much innovation restrains organizational renewal, too little should as well:

Proposition 3: *Newness of the technology and existence of requirements interact such that, relatively speaking, Revival and Discovery experiments are the least likely to result in organizational renewal, and Brokering and Learning experiments are the most likely to result in organizational renewal.*

This proposition provides somewhat of a challenge to a prior study in the strategic management literature. Ahuja and Lampert (2001) reported evidence suggesting that the most innovative experiments led to the most innovative outcomes, in their case the production of highly influential new patents in the chemical industry. The case studies suggest that when the focus shifts to the firm's overall experimentation process

and the effects that process has on organizational renewal over time at the organizational level that excessive innovation is perhaps detrimental as opposed to beneficial.

Relative differences with respect to the interaction between novelty of the technology and existence of requirements have a particularly interesting consequence. To the extent that these differences exist and that organizational renewal is a key factor in organizational longevity and high performance (Fligstein 1990), one implication might be that the rate of certain types of strategic IT experiments might also be related to performance differences between firms:

Proposition #4: *The rate of Brokering and/or Learning experiments is higher than the rate of Revival and/or Discovery experiments in high-performing organizations.*

Proposition #5: *The rate of Revival and/or Discovery experiments is higher than the rate of Brokering and/or Learning experiments in low-performing organizations.*

These propositions imply that the most daring and innovative business experiments often receive respect and centre-stage when they work but may not be the best prescription for renewal and longevity. Propositions 4 and 5 suggest that not only experimentation but also the category of experimentation is an important predictor of long-term performance.

Conclusion

The purpose of this paper was to develop functional theory on how different categories of strategic IT experiments influence the renewal process. Three case studies were presented to illustrate the effects of different types of organizational experimentation on successful and unsuccessful renewal outcomes. Three categories of Strategic Experiments – Learning, Brokering and Discovery – were associated with varying degrees of renewal success and these relationships were described in a set of three propositions and two corollaries.

The findings from this study were intended to offer three specific contributions. Strategic IT experiments as an important factor in strategic management literature was fully defined and distinct categories of experiments were theoretically and empirically identified for the first time. A theory explaining how and why these experiments are related to organizational renewal was developed and evaluated and five propositions linking experiments to renewal and high-performance organizations were presented. Finally, we believe that the findings from this study can offer potentially valuable insight into the practical management of organizational renewal and experimentation.

Practical insight could be offered in at least two areas of interest to an executive audience. First, these results could be applied as a portfolio management style technique for evaluating strategic IT experiments, commonly referred to as trials or pilot projects in a corporate setting. Internal business committees are often used to screen and evaluate pilot project proposals as a part of risk management and funding processes and the distinctions between experiment categories could be used to inform risk/reward decisions in simple terms of technological novelty and existence of business requirements. Such techniques could provide insight regarding how to evaluate potential risks and returns as well as relative success rates of different types of trials. Second, suggestions regarding how to evaluate or manage the expectations of strategic experiment outcomes could also be offered. For example, the expectations associated with Revival experiments might be best set at 'higher success at the cost of lower potential impact' while those associated with Discovery experiments might be better set at 'higher potential impact and learning potential at the cost of a lower probability that adoptable results would emerge quickly'. Managing expectations is a vital role in the organizational renewal process and few would likely want to be in the shoes of an uninformed executive advocating Discovery experiments with a high probability of success.

Our efforts at theory development in this study are subject to at least three limitations regarding generalizability, exclusion of Revival experiments, and our ability to rule out serendipity or chance effects between experimentation and later changes in renewal. Efforts were taken to study case sites that included

a very large organization (GOV) and a small organization (TECH) as well as different industries (government, health care and high tech). Regardless, future research should be conducted using larger and more diverse samples of organizations in order to establish the extent to which these results truly do generalize to a larger audience. Additionally, while the theoretical framework suggests four categories of experiments, one category of experiments (revival) was not evident in the design. At this point it could be that (1) we failed to include an organization in the case study set that conducts revival experiments; (2) revival experiments don't normally occur in the real world; or (3) revival experiments do occur but are not considered by the organization to be 'experiments', pilot projects, etc. We currently suspect that the reason is most likely (1), but regardless of the cause it would be interesting to further investigate revival experiments to see if they also correspond to the theoretical framework in the manner suggested by the propositions. Doing so would increase the likelihood that a useful management tool for planning and monitoring IT experiments could be developed. Lastly, we can not account for serendipity or chance effects between changes in experimentation and later occurrences of renewal. This leaves the study open to specific questions related to both the determination of boundary conditions to the theory and alternate explanations for the results. Future research should compare alternate explanations as well as testing the conditions under which these propositions might hold or be unsupported. Interesting new boundary conditions regarding the organizational renewal process might become evident as a result.

Finally, to summarize, our results indicate that more innovation does not necessarily lead to successful organizational renewal over time. Strategic experiments that balance an organization's context and IT capabilities tend to have a better chance of leading to successful renewal than do experiments that push the organization too far into the unknown. In this respect, we suggest that the more successful strategy toward IT-based organizational renewal favours getting there faster by occasionally taking smaller steps.

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Working Papers on Information Systems | ISSN 1535-6078

Office:
Sprouts
University of Amsterdam
Roetersstraat 11, Room E 2.74
1018 WB Amsterdam, Netherlands
Email: admin@sprouts.aisnet.org

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