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ENTERPRISE SYSTEMS LIFECYCLE-WIDE INNOVATION READYNESS

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Abstract

Enterprise Systems have been touted as a key driver of delivering benefits through innovation in corporate Information Systems. The advent of such systems expects to deliver best practices that improve organizational performance. Yet, most Enterprise System installations struggle to see lifecycle-wide value of it. Considering that Enterprise Systems deliver lifecycle-wide innovation; we observe organizational readiness for lifecycle-wide Enterprise Systems innovation. The A VICTORY a-priori model compares contributions of eight constructs for organizational readiness for continuous Enterprise Systems innovation. The model is tested responses of both client and implementation partner. Results indicate that six of the eight constructs of readiness make significant contributions to organizational readiness for Enterprise Systems innovation.

Keywords: Enterprise Systems, Innovation, Antecedents of Innovation, Innovation Readiness.
1 INTRODUCTION

Globalization has changed the socio-economic background of industries and has transformed the landscape of the modern business (Gorodnichenko et al. 2010), where the changing needs of the customers, lifestyles, together with the advancements in technology, have made innovation a necessity for all businesses (Baregheh et al. 2009).

Many organizations embrace Enterprise Systems (ES) to increase the organizational performance, efficiency and most importantly to attain innovation (Gable et al. 2008; Sedera and Gable 2010). ES purportedly consists of best practices that allow organizations to change their current business processes and organizational structures radically (Seddon et al. 2010). Therefore, the adoption of an ES is considered as a radical change (Kraemmerand et al. 2003). On the other hand, ES investments are under increasing scrutiny and pressure to justify their value, especially considering the substantial resource investment. The post go-live stage is highly critical for organizations to realize returns on ES investments (Bhattacherjee 2001; Jasperson et al. 2005). However, it has been argued that in the post go-live stage, organizations rarely consider ES as an innovation, thus preventing them to realize optimal benefits (Li et al. 2013). The Standish Group reports that fewer than 10% of large ES installations succeed in using the full potential of their systems (Momoh et al. 2010). On the other hand, there have been reports too on organizations achieving high levels of lifecycle-wide success through ES, mostly by focusing it as an enabler of continuous innovation (Seddon et al. 2010).

Thus, it is not surprising that all ES using organizations strive for ES-led innovation. Herein, we argue that innovation is not simply limited to the adoption of an ES; rather ES should enable continuous innovations throughout its lifecycle. However, lifecycle-wide innovation through ES does not happen automatically with the advent of ES. It is something that requires careful planning at the outset and thorough management thereafter. Yet, lifecycle-wide innovation is seldom observed in academic literature. Some scholars suggest that to attain innovation, the ES critical success factors such as top management support, resources availability and knowledge management should be available throughout the ES lifecycle (Sedera and Gable 2010). On the other hand, implementation partners (i.e. consultant and vendor) face immense pressure, as Weeks and Feeny (2008) noted that client organizations are now expecting innovation beyond the introduction of an ES. Though, the advent of an ES is considered as one of the most significant IT innovations (Davenport 1998), rarely do these organizations plan for the lifecycle-wide requirements to drive innovation beyond the go-live phase. The potential for ES innovation, left unattended, will diminish over the time, until its next major upgrade.

In this research-in-progress paper, we argue that lack of lifecycle-wide innovation is due to the lack of organizational readiness at the time of ES implementation. We present our arguments in the following manner: first, we provide a conceptual foundation for innovation in ES lifecycle. Next, we propose the ‘A VICTORY’ model through which we conceive innovation readiness in an organization, presenting the a-priori model. The data analysis provides insights into how the antecedents of innovation measure innovation readiness and potential differences between client and consultants of their views on innovation readiness.

2 ES LIFECYCLE AND POTENTIAL FOR INNOVATION

Markus and Tanis (2000) identified three phases in ES lifecycle: (i) implementation, (ii) shakedown and (iii) onwards/upwards. The adoption of the ES transformed the existing business processes, improved them to create business value and thereby introduced new behaviours to the organizational subsystems and its members (Karimi et al. 2007). Thus, this revolutionary process which caused
deeper changes in the organizational climate is considered as a radical innovation in the innovation literature (Damanpour 1988). Green et al. (1995) stated that technological uncertainty, technical inexperience, business inexperience and technology cost are four dimensions that can be used to measure the extent of radicalness. Thus, considering these dimensions implementing an ES can be considered as a radical innovation from the adopting organization’s point of view. According to Ross and Vitale (2000), after the implementation and after each major upgrade there is a dip in the performance of the organization. During this shakedown phase all the ES users learn the new system and Sumner (2000) identifies the reason for this dip in performance is the lack of expertise of using the system. Some of the challenges of this phase are; inexpertise, sudden changes in job roles, lack of user training, and software related issues (Nah et al. 2001; Niu et al. 2011). After some time the ES users get familiar with the system and attain a level of expertise. This phase is known as the onwards/upwards phase and it is a period where the organization as well as the users of the system are more stable and have reached a maturity level. In an ideal situation, the expert users will suggest new improvements and the organization will continuously improve the ES to compete with the changing environment. However, in the real business world this ideal scenario seldom occurs. The possible reason is that some organizations could believe that once the ES is in-place, there is no need (or difficult to) to make changes to it. Yet, every innovation similar to ES goes through a lifecycle. Every innovation deteriorates as the technology and the market advances and continuous improvements are required to survive in the dynamic environment. Figure 1 depicts the innovations throughout ES lifecycle.

The thick line denotes the extent of innovation throughout the ES lifecycle. As discussed earlier, when an ES is introduced it is considered as a radical change. As Damanpour (1988) stated it requires large amount of new knowledge to do a radical innovation. During the implementation, new modules are added to streamline the business processes. Organizations believe that this ultimately would lead to innovation. The challenge with ES is that even though it comprises of best practices and activities that lead to productivity gains, the level of impact of these standards dwindle with the rapidly changing technology and the customer needs. Therefore, it is important to innovate continuously throughout the ES lifecycle. The current thinking of the organizations is that ES would act as a magic wand to resolve problems related to business performance. It is true and achievable if the organizations envisage the possibility of innovation beyond the implementation time. As depicted in the diagram, throughout the ES lifecycle the innovation degrades until the next upgrade of the ES occurs. The dotted line denotes the possibility of maintaining innovative behaviour throughout the ES lifecycle. During the onwards/upwards phase the users have become experts using the system and they can suggest new improvements. These improvements can be identified as incremental innovations and this type of innovation does not require intense knowledge (Popadiuk and Choo 2006). Yet, organisations do not foresee any type of innovation beyond the ES implementation.

![Figure 1. Innovations in ES lifecycle](image-url)
3 THE A VICTORY APPROACH TO ASSESS INNOVATION READINESS

We believe the reason for organizations not expecting further innovations after ES implementation is the lack of innovation readiness of these organizations. To measure the innovation readiness we propose the A VICTORY lead approach.

The ‘A VICTORY’ model is an eight-factor model envisaged as useful for considering organizational behaviour related to the use of new knowledge or innovative practices. This model generally has been used in healthcare environment, yet, Barabba and Zaltman (1991) have applied this model in business studies to seek ways to introduce innovations to organizations (Backer 1995). The A VICTORY model is one of the well-known theories of knowledge utilization and planned change (Johnson 1989). According to Davis (1978) followings are the definitions of each factor.

**Ability** is the resource availability of an organization. Not only the financial resources but also the required human resources, training requirements, and the authority the employees need to carry out change, are considered as determinants of innovation readiness. A key challenge for the organization adopting an ES is the re-deployment and re-skilling of their current employees to the new positions and skills necessary for the new system (Sedera and Dey 2013). Furthermore, training, support staff of the helpdesk, technical upgrades requires adequate fund allocations. Another resource consideration for ES lifecycle is the preparedness for the inevitable upgrades and availability of resources for technical optimizations (Ng et al. 2002).

**Value** observes the characteristics of the organization. Some of the attributes comes under value are open communication, organization culture, and administrative policies. Advent of an ES makes changes to organizational administrative policies and communicational channels. In most cases, communication channels become more formalized through ES workflow and user communications and actions become transparent (Shang and Seddon 2002). However, such policy changes in an organization are not common or continuous; those changes will also be inevitable.

**Information** can be identified as the knowledge or the idea, communication of plan of actions, and clear understanding of the goals of the organization. Davis (1978) stated that “Poor understanding of the details of the change and unsureness of what is expected has been found to be prominent but often unrecognized factors in the failure of change.” (p.657). Knowledge management (creating, retention, transfer and application) has been recognized as critical success factor for ES lifecycle-wide success (Sedera and Gable 2010), where they identified that ES stimulate knowledge management as a continuous activity and that needs to be supported by organizational strategy throughout the lifecycle.

**Circumstances and Timing** refers to the preparedness towards the changes. An example can be the growing competition in the market, and the advent of new technologies, which de creed the organizations to innovate. Especially, with the current turbulent market and economic conditions warrant organizations to have high degree of agility (Arteta and Giachetti 2004).

**Obligation** can be explained as the motivation or the felt need that makes change acceptable. Sedera and Dey (2013) highlight that ES fail in post go-live due to lack of user motivation to optimize system use. Similar arguments on the importance of motivation for innovative use have been portrayed in Burton-Jones and Straub Jr (2006), Burton-Jones and Gallivan (2007) and Li et al. (2013). They collectively argued that motivation for innovative use of a system would lead to better results. Yet, organizations considering a formal plan for continuous innovation are a minority.

**Resistance** is the associated fear or the aversion towards the change (e.g. fear of economic loss, fear of personal security). Past critical success factor and implementation studies have clearly identified that ‘resistance’ to change as a key barrier for ES success (Robey et al. 2002). Most studies, following change management models, assumed that resistance diminishes over a period of time (Waddell and Sohal 1998). Yet, the psychological literature demonstrates that unattended resistance would lead to
expression of their frustration through other means (Sheth and Stellner 1979). This has been discussed in recent literature (Sedera and Dey 2013; Sedera and Gable 2010), where users create ‘bootleg’/‘unauthorized’ systems, without using their ES (Sedera and Dey 2007).

*Yield* is the rewarding mechanisms such as incentives, new titles, and group recognition that organizations use to encourage innovation or change. Studies have demonstrated the value of incentive schemes for implementation teams to encourage on-time, on-budget ES implementations. Yet, despite it being valued as an important aspect for the health of ES lifecycle, we are unable to find any studies that reward for innovative behaviours. Eden et al. (2012) identified that, in general, studies reporting post implementation reward is minimal.

## 4 THE A-PRIORI MODEL

By applying the ‘A VICTORY’ model below, we attempt to measure the innovation readiness of the ES project lifecycle.

![A-VICTORY model](image)

*Figure 2: The a-priori model*

The a-priori model of ES innovation readiness model has eight antecedents—individually they are all conceived and measured as formative. A good formative index—one that exhausts the entire domain of the construct completely, means that the constructs should collectively represent all the relevant aspects of the variable of interest (Bagozzi and Phillips 1982; Fornell and Bookstein 1982). Therefore, its purpose, akin to the function phase of the Burton-Jones and Straub Jr (2006) approach, is to justify the a-priori salient measurement domains as per figure below (i.e. the constructs of A VICTORY) and identify appropriate measures for each dimension of readiness. The a-priori model antecedents; (i) need not co-vary, (ii) are not interchangeable, (iii) cause the core-construct as opposed to being caused by it, and (iv) may have different antecedents and consequences in potentially quite different nomological nets (Cenfetelli and Bassellier 2009; Jarvis et al. 2003; Petter et al. 2007). Moreover, use of formative constructs in this case provide a ‘specific and actionable attributes’ of a concept (Mathieson et al. 2001), which is particularly interesting from a practical viewpoint as the weight of the construct can be used to draw practical implications on the importance of specific details and therefore guide practical enforcement on the characteristics (See (Furneaux and Wade 2011)).

## 5 DATA COLLECTION AND ANALYSIS

Our preliminary data was gathered from 82 members of the ES implementation team. It included 40 members from the implementation partner and 42 from the client organization. The organization (henceforth referred to as SCM-company to protect anonymity covered by the university ethics agreement) decided to implement SAP Financials and Controlling (SAP-FI/CO), Materials
Management (SAP-MM), Human Capital Management (SAP-HCM) and Supply Chain Management (SAP-SCM) modules in late 2013. The objectives of adoption, time phase and the scope of the implementation is consistent with recent market surveys (Kimberling 2013). In general, similar to most organizations, SCM-company thought of ES as a long-term strategic investment. Table 1 reports descriptive statistics of SCM-company. Most respondents from the client organization represent the management or senior management level.

| Details | Revenue in 2012-2013 | USD $52.6 Million | New modules considered | Sales and Distribution (2015) |
|---------|---------------------|------------------|------------------------|-----------------------------|

| Industry Sector | Implementation Approach | Phased |
|-----------------|-------------------------|--------|
| Manufacturing   |                         |        |

| Expected number of users | Level of customization | Size of implementation team |
|--------------------------|------------------------|-----------------------------|
| 71 (Phase 1) 120 (Phase 2) | Medium                 | 91 (50 client; 41 consultant) |

**Expected completion (months)**

| 7 months (Phase 1) |

*Table 1: Details of the ES implementation*

The survey items were derived through the literature review, summarized in Appendix A. The table in Appendix A consists of 28 antecedents of innovation derived through 50 studies (due to space limitations we only demonstrate 35 studies). Having derived the constructs from the original studies, we then map each construct to one of the eight constructs of the A VICTORY model. Two researchers conducted the mapping exercise, eventually arriving at 100% agreement. The review of innovation literature revealed that innovation in general is influenced by environmental, organizational and individual factors (Damanpour 1991; Kimberly and Evanisko 1981).

Using guidelines of Cook et al. (1979) and Diamantopoulos (2010) the pool of items further strengthens the derivation of an instrument for formative constructs. We employed IBM SPSS version 25 and SmartPLS 2.0 (Ringle et al. 2005) in our data analysis. Partial least squares tests (Wold 1989) is a structural equation modelling (SEM) technique that is well suited for highly complex predictive models, supports the mapping of formative observed variables and smaller sample sizes (Becker et al. 2012; Chin et al. 1988; Gefen et al. 2000; Henseler and Sarstedt 2013).

**Common Method Bias:** Sharma et al. (2009) argue against the common practice of gathering perceptual data on both the independent variable and the dependent variable from the same respondent, as it may create Common Method Variance (CMV). However, as observed in Gorla et al. (2010), CMV is more likely to exist in abstract constructs (e.g. attitude), compared to concrete measures associated with innovation. Yet, in attention to reducing CMV, items for readiness and its antecedents were not grouped under their construct headings in the survey. We also employed the Herman’s one-factor-test resulting that, not all measures leading to a single factor solution – confirming that CMV is unlikely.

**Construct Validity:** Following the guidelines of Cenfetelli and Bassellier (2009), Diamantopoulos and Siguaw (2006) and Diamantopoulos and Winklhofer (2001), we first test for multi-collinearity amongst the measures using Variance Inflation Factors (VIF). The VIF from a regression of all constructs ranged between 1.1 and 2.2, indicating that no significant multi-collinearity exists.

**Testing the Structural Model:** The test of the structural model includes, estimates of the path coefficient, which indicate the strength of the relationship between the independent and dependent variable. And also, the $R^2$ values, which represent the amount of variance explained by the independent variable/s. Together, the $R^2$ and the path coefficient (loadings and significance) indicate how well the data supports the hypothesized model (Wixom and Todd 2005). Figure 3 depicts the structural model with path coefficient ($\beta$) of innovation readiness$^2$. The $R^2$ values for the dependent variable were significant at level of 0.005 alpha. Supporting our prepositions, further validating the

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1 The rationale here is that when gathering data both IV and DV from the same respondent, spurious correlations could result (due to the common method used in data collection), which cannot be necessarily be attributed to the underlying phenomena being tested.

2 The reliability of the Enterprise Systems Readiness measures was 0.901 (at 0.005 confidence level).
readiness construct, results show the following: (i) Ability, Value, Circumstances, Timing, Obligation and Yield all are strong-significant predictors of Innovation Readiness; (ii) Our analysis does not support ‘Information’ and ‘Resistance’ as strong-significant predictors of Innovation Readiness (grey construct with dotted line). However, the significant independent variables explain at least 65% of the variance of the dependent variable (with $R^2$’s for the dependent variables exceeding 0.65). Table 2 provides results of an independent sample t-test that compare the eight antecedents of the A VICTORY model against the two main parties (client and the consultants) of ES implementation. Results of Table 1 show that client and vendor disagree with Ability, Information, Obligation, Resistance and Yield.

![Figure 3: Results of the PLS analysis](image)

|   | A     | V     | I     | C     | T     | O     | R     | Y     |
|---|-------|-------|-------|-------|-------|-------|-------|-------|
|   | Sig / t-value* | Sig / t-value* | Sig / t-value* | Sig / t-value* | Sig / t-value* | Sig / t-value* | Sig / t-value* | Sig / t-value* |
| Client Vs. Consultant | 0.02 / -2.41 | 0.71 / 0.86 | 0.01 / -3.35 | 0.65 / .69 | 0.66 / 0.69 | 0.01 / -2.86 | 0.01 / -3.35 | 0.03 / -1.89 |

* significant at 0.05

Table 2: Independent sample t-test results

6 DISCUSSION

The objective of this research-in-progress paper was to test a model for organizational readiness for ES lifecycle-wide innovation. We employed the A VICTORY model of innovation readiness of Davis (1978) to ascertain client readiness for lifecycle-wide innovation through ES. Data was collected from both client and consultant. We found that Information and Resistance do not contribute to ES innovation readiness. The remaining A VICTORY model constructs explained 65% of the variance of organizational innovation readiness. The Information construct is not significant. From the outset, it would seem that “knowledge” is important to the organization for innovation. Yet, as suggested in Figure 1, the organizational learning requirements are less in relation to incremental innovation – thus making the “Information” construct less relevant for innovation readiness. Secondly, the “resistance” construct also shown as non-significant. We argue that ‘Resistance’ is somewhat contradicting to the notions of innovation. In general, especially with the implementation team as the respondent sample, it is unlikely that resistance is recognized as a barrier for innovation readiness. Though the initial findings are heartening, further research is underway to extend generalizability. Through our conceptualization, the model provides a clear outline of factors important for ES innovation for practitioners, and could facilitate a new track of research on continuous ES innovation. Amongst its limitations, the single site data collection prohibits extensive generalizability.
| Model Factor | Antecedent | Resistance | Obligation | Timing | Circumstances | Information | Value | Ability | Structure | Functional Differences | Resource Utilization |
|--------------|------------|------------|------------|--------|---------------|-------------|-------|---------|------------|-----------------------|---------------------|
| HR Practices | (Menzel 1960) | x          |           |        |               |             |       |         |            |                      |                     |
| Managers’ Education | (Fey and Birkinshaw 2005) | x          |           |        |               |             |       |         |            |                      |                     |
| Project Complexity | (Gumusluoğlu et al. 2009) | x          |           |        |               |             |       |         |            |                      |                     |
| Knowledge Sharing | (Stock et al. 2013) | x          |           |        |               |             |       |         |            |                      |                     |
| Organization Structure | (Damanpour et al. 2012) | x          |           |        |               |             |       |         |            |                      |                     |
| Organization Culture | (Damanpour 1991) | x          |           |        |               |             |       |         |            |                      |                     |
| Technical Knowledge | (Kessler et al. 1996) | x          |           |        |               |             |       |         |            |                      |                     |
| Environmental Dimensions | (Shane et al. 1995) | x          |           |        |               |             |       |         |            |                      |                     |
| Environmental Competency | (Damanpour et al. 2012) | x          |           |        |               |             |       |         |            |                      |                     |
| Environmental Obligation | (Jansen et al. 2006) | x          |           |        |               |             |       |         |            |                      |                     |
| Ability | (Drazin et al. 1996) | x          |           |        |               |             |       |         |            |                      |                     |
| Project Size | (Troilo et al. 2014) | x          |           |        |               |             |       |         |            |                      |                     |
| Project Team | (Somech et al. 2013) | x          |           |        |               |             |       |         |            |                      |                     |
| Project Integration | (Janssen et al. 2006) | x          |           |        |               |             |       |         |            |                      |                     |
| Leadership | (Fey et al. 2005) | x          |           |        |               |             |       |         |            |                      |                     |
| Project Team | (Fey et al. 2005) | x          |           |        |               |             |       |         |            |                      |                     |
| Project Team | (Kuester et al. 2013) | x          |           |        |               |             |       |         |            |                      |                     |
| Project Team | (Berends et al. 2013) | x          |           |        |               |             |       |         |            |                      |                     |
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