Strategic and Institutional Perspectives in the Evaluation, Adoption and Early Integration of Radio Frequency Identification (RFID): An Empirical Investigation of Current and Potential Adopters

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Abstract

This study is among the first few empirical field studies that tests a proposed RFID adoption and implementation model based on strategic choice and institutional theories using survey data. We use a multi-stage model approach as suggested by Cooper and Zmud (1990) and test our proposed model by studying factors that are critical in the evaluation, adoption and integration stages of RFID. We test our model by using data from both current and potential evaluators, adopters and integrators of the technology. We find interesting similarities and differences across the three stages and also between the current and future adoption and implementation scenarios. The model has been tested by using multiple regression and binomial logistic regression techniques. Key insights have been presented and their implications have been discussed.

1. Introduction

We present a study of organizational implementation of radio frequency identification (RFID) technology testing a multi-theory model with what we believe is among the first few empirical, field data to be published in academic literature. Even with extensive writings on adoption and diffusion of innovation [20] the adoption of new and emerging technologies with unique characteristics, such as RFID, is still not well understood. Adoption of special technologies with adopter interdependencies [12] technologies that impose heavy knowledge burdens on adopters [4], and adoption of electronic data interchange (EDI) technology [3] are all instances where discussed diffusion theory generalizations could not be directly applied and new models were

subsequently developed to understand and explain adoption patterns.

In interorganizational systems (IOS) literature various models have been developed to identify adoption drivers. Most of the prior studies have used diffusion of innovation theory [20]. To investigate innovation attributes diffusion gets coupled with organizational innovativeness literature [6,18,28], which examines and explains characteristics of organizations in their adoption and diffusion decisions.

The lens of institutional theory has also been used to predict institutional pressures as drivers of IOS based interorganizational linkages [23]. However, an integrative adoption and diffusion model incorporating drivers from multiple theoretical perspectives and combining different adoption rationales with testable predictive power is still needed. In addition, external environment factors unexplored in this IOS technology context may influence the adoption and diffusion of new technologies because of their unique features and characteristics.

This study addresses an existing literature gap by building and testing an integrative model grounded in the diffusion of adoption approach coupled [5] with institutional theory to examine how companies are implementing RFID technology. RFID provides an interesting sandbox for the exploration of unknowns in the adoption literature as it is an emerging technology that may be simply used in house or, as practitioner and vendor literature suggests for benefit maximization, it can be the backbone for optimization of whole supply chains. Thus, it is a technology that possesses special features such as promoting inter-organizational linkages similar to EDI and other existing IOS, but at grander scales transcending the tight linkages and processes as seen with EDI.

This paper begins with a literature review developing the research model for predicting RFID

implementation. The next section introduces the survey methodology and empirical, field sample of managers engaged in the RFID implementation process who responded representing their organizations. The following section presents the analysis of our research model using multiple and logistic regression, and we end with a discussion of the results.

2. RFID Evaluation, Adoption, and Integration

To frame our study we begin with a brief discussion of how we understand the implementation process for RFID and then develop the theories and constructs to predict the stages of this process. Damanpour (1991) suggests innovation adoption as a process consisting of multiple stages that includes activities that lead to the decision to adopt as well as activities that facilitate putting an innovation to use and actually using it. The initiation stage has been defined by as consisting of all activities from problem perception, information gathering, attitude formation and evaluation leading to the decision to adopt. Implementation stage has been defined as all events and activities leading to modification of both the innovation and organization including initial utilization and routine use of the innovation by the adopting organization (Damanpour 1991).

Cooper and Zmud [5] present the implementation process as a six-stage model with the following stages: 1) initiation, 2) adoption, 3) adaptation, 4) acceptance, 5) routinization, and 6) infusion. This study borrows from the conceptualizations of adoption and implementation processes as suggested by Damanpour (1991) and Cooper and Zmud (1990) to examine RFID adoption and implementation.

As RFID is still new to industry, we do not focus on the infusion stage, since press articles and interviews with practitioners indicated to us that few organizations have yet achieved infusion. Since RFID is an emerging platform technology often presented primarily for IOS applications, we recognized that the issue of adaptation would be very complex and require a separate study to ascertain how RFID is being developed, installed, and maintained. That left us with four stages to examine: initiation, adoption, acceptance, and routinization. Initiation refers to active scanning of IT solutions for organizational needs. We could see this as organizations evaluating RFID technologies. At some point they adopt a technology by committing resources after resolving any necessary evaluative issues. This is the point at which they decide to implement RFID, the adoption decision.

Once they decide to adopt RFID, there will be organizational processes into which RFID gets integrated. Acceptance refers to employees being induced to use RFID. Routinization refers to usage of RFID becoming a norm in business processes. Due to the emerging nature of RFID usage in industry, it is difficult to apply the ideas of acceptance and routinization as distinct components in our model as RFID may not be implemented in ways that employees need to directly commit to using it. The degree to which it gets integrated into business processes, on the other hand, can represent both acceptance and routinization in the context of this emerging, interorganizational platform technology's implementation process. Thus, we apply existing theory from the diffusion and adoption literature to frame or model of RFID adoption on three stages: 1) evaluation, 2) adoption decision, and 3) integration (Figure 1).

3. Why Implement RFID Technology?

Next, we turn to the question of what theories would best explain the process of implementing RFID. The majority of theory to answer this question focuses solely on the adoption stage and appears to assume that drivers will be constant throughout the implementation process by way of neglecting to explore whether different factors drive different stages of technology implementation. We begin with these theories.

As we identify factors that drive RFID technology adoption, let also keep in mind that adoption motivations may influence how the technology is subsequently *integrated* by organizations. For example, we may find that in situations where rationale for
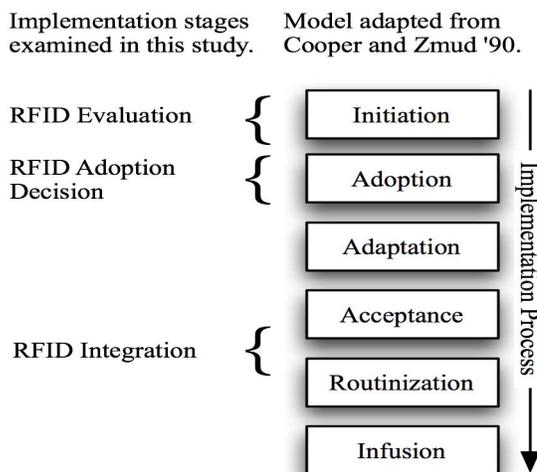
Implementation stages examined in this study. Model adapted from Cooper and Zmud '90.

RFID Evaluation { Initiation

RFID Adoption Decision { Adoption

Adaptation

Acceptance

RFID Integration { Routinization

Infusion

Implementation Process

Figure 1: RFID implementation stages

adoption is conforming to institutional environment pressures there might be a very superficial adoption to satisfy legitimacy needs (which may be reflected in low minimal levels of early integration of the technology). Similarly if the decision to adopt is motivated by desired benefits like efficiency gains to improve organizational performance we may find evidence of a significant effort undertaken to integrate the technology with existing systems within and across organizations.

Although it would seem that an organization's adoption decision is driven by well thought out internal and external assessments with a clear objective to improve performance there may be other factors such as conforming to external pressures from the organizational field to gain legitimacy, which may drive adoption [8]. This is true even more when there is technological uncertainty induced by network externalities and mutual interdependencies [12] among adopters. In the case of adoption of IOS such as EDI, a scenario similar to RFID in supply chains, pressures from dominant partners (customers/suppliers) are likely to be significant [3, 18, 23].

The rationales to adopt technology can be broadly classified under two umbrellas in organizational theory: a "rationalistic" strategic choice perspective [27] with an emphasis on improving efficiency and organizational performance and an institutional perspective [8] with emphasis on maintaining legitimacy [11, 13]. Understanding rationale invoked in adoption decisions may prove useful in explaining many superficial implementations which fail to deliver adoption benefits and lead to unexpected IT diffusion patterns. The focus of most studies and adoption models of interorganizational systems [2, 3, 10, 18] has been theories, which fall under the rationalistic perspective (strategic choice theories) such as diffusion of innovation [20] and organizational innovativeness [6] where voluntary adoption decisions are made to achieve organizational goals. Studies invoking institutional isomorphism rationale for IOS technology adoption with the exception of [23] are few and far between. We are not aware of any study that combines these two perspectives and develops hypotheses to empirically test for their differential effects on adoption and subsequent expected integration.

Strategic choice and institutional isomorphism rationales however are not mutually exclusive and may both be present simultaneously [9]. Complimentary nature of strategic and institutional rationales has been suggested through the distinction of competitive and institutional isomorphism [7, 8, 16]. This paper suggests both rationales to be prevalent in the implementation of RFID technology.

3.1. Institutional Theory Rationale

Given that we see RFID as an IOS technology at its core, a summary of the prior literature suggests IOS adoption studies have primarily been framed on two theoretical bases: 1) diffusion of innovation [8] - focusing on attributes of innovation and 2) organizational innovativeness [6, 28] - focusing on organizational characteristics. Considering that IOS are subject to network externalities, critical mass and mutual interdependence arguments have been used to explain adoption patterns [12]. Power, influence and trust [3, 21] between partner organizations based on resource dependence theory [19] have also been used to explain IOS adoption. With the exception of few studies such as viewing IOS linkage adoption from an institutional theory perspective [23], most studies have examined adoption from a strategic choice perspective with a view to increase efficiency and improve organizational performance. We believe they have excluded critical factors for understanding IOS platform technologies such as RFID.

Issues focusing on actions of other firms influencing IOS adoption are characterized as inter-organizational pressure factors. External pressure, for example, has been identified as a driver of intent to adopt in EDI studies along with sub-constructs (i.e. competitive pressure, industry pressure, enacted SC partner power and SC partner dependence) based on resource dependence arguments [3]. Socio-political factor such as exercised power of SC partners was observed with EDI to be an important adoption driver. A favorable transactional climate between SC partners on the "Cooperation-conflict continuum" is important in IOS adoption [18]. Coercive, mimetic and normative pressures have been suggested as types of institutional pressures that predict adoption of IOS based inter-organizational linkages [23]. In this study, competitive pressure, industry pressure, regulatory pressure, net exercised SC power, and favorable transactional climate have been suggested as influences, which manifest themselves through institutional pressures that drive RFID adoption. It is further suggested that organizations face coercive, mimetic and normative pressures from organizations within their SC and organizational field (i.e. regulatory bodies, industry/trade associations, successful competitors, and influences from perceived successful prominent organizations).

3.1.1. Coercive pressures. Coercive pressures are defined as formal/informal pressures, which result from organizations that the focal firm is dependent for resources [8] and is analogous to the resource

dependence argument [19]. Coercive pressures on organizations may stem from many different sources such as regulatory bodies, resource dominant organizations and parent corporations [23]. Dominant organizations within the SC and in the institutional environment could pressure dependent organizations to adopt programs, policies, and technologies that are favorable to them. With RFID technology as discussed earlier, significant benefits would be realized if the focal firm's SC partners simultaneously adopted thus allowing sharing and flowing of information across the SC. It would be likely that resource dominant organizations adopting RFID would ask their dependent partners to also adopt and it is likely that there would be pressures from regulatory bodies to become RFID compliant. Hence,

> **H1: Coercive pressures positively impact RFID adoption and integration.**

3.1.2. Mimetic pressures. Mimetic pressures result from organizations response to uncertainty [8]. In uncertain conditions, with no clear course of action unavailable, organization leaders tend to mimic/copy actions of perceived successful organizations [16]. Mimetic pressures are driven by industry bandwagon effects (following successful competitors) or driven by status (following prominent organizations) [14]. With RFID adoption, technology uncertainty may exist due to differences in firms that are strongly influenced to mimic firms considered industry leaders or competitors who are considered to have successfully adopted.

> **H2: Mimetic pressures positively impact RFID adoption and integration.**

3.1.3. Normative pressures. Normative pressures occur in relational channels among network members when norms are shared during consensus building thus potentially increasing a norm's influence [8]. Communication among SC partners and among members of professional bodies and industry trade associations concerning benefits and best practices related to innovations would result in shared beliefs and persuade organizations to adopt technologies. With RFID, a technology with network effects and dependencies, this scenario is highly likely given trade and professional association memberships and transactional climate between SC partners being important factors in norm sharing and diffusion. Hence, with RFID, favorable transactional climate between a focal firm that supports RFID adoption and its SC partners and has memberships to professional and trade associations, which sanction RFID technology use, normative RFID adoption pressures would increase.

> **H3: Normative pressures positively impact RFID adoption and integration.**

3.2. Strategic Rationale

Strategic choice rationales for RFID implementation group into two areas explored in prior literature on IOS adoption: 1) organizational readiness and 2) factors related to perceptions about costs and benefits of an emerging technology such as RFID. We add a third grouping of environmental factors we believe particularly important to the strategy of implementing a platform IOS technology such as RFID, namely privacy concerns and standards stability.

3.2.1. Organizational readiness factors. Internal organizational characteristics and properties have been identified as organizational factors [3] influencing IOS adoption. Organizational readiness, availability of financial and technological resources (people, technology, expertise) of a firm, has been found to be a key driver of EDI adoption [10]. TM support presence, an internal champion, and organizational compatibility are some existing organization factors [18] found significant in IOS adoption. In the model put forth, TM support, IS infrastructure and capabilities and financial readiness have been proposed as attributes of organizational readiness.

Top management support(TM) has been shown to be an important IOS adoption predictor [18]. With RFID, where strategic benefit may be realized through improved partner coordination and business process reengineering, signals need to be sent within and between firms about commitment and importance of the RFID initiative. Long term strategic vision and direction from TM is critical to RFID adoption and integration in and between firms. Hence top management's encouragement and support is likely to positively impact the evaluation, adoption and integration of RFID.

> **H4: Current top management support positively impacts RFID evaluation.**
> **H5: Current top management support positively impacts RFID adoption and integration.**
> **H6: Prior top management support positively impacts RFID adoption and integration.**

The presence of a good **Information systems (IS) infrastructure** (hardware and software) coupled with good **IS capabilities** (people with expertise) can facilitate adoption [10]. This IS readiness refers to a firm possessing appropriate technology infrastructure,

people and expertise to support easy adoption. The presence of appropriate resources reduces costs and efforts in integrating RFID technology with existing systems compared to purchasing or developing new systems and training employees in new skill sets.

H7: IS infrastructure positively impacts RFID adoption and integration.

H8: IS capabilities positively impacts RFID adoption and integration.

Financial readiness refers to having enough financial resources available to pay for adopting a new technology, including new systems' learning and integration costs [3]. The presence of financial resources to cover associated RFID costs would increase the likelihood of adoption and integration.

H9: Financial readiness positively impacts RFID adoption and integration.

3.2.2. Perceived RFID factors. Technological cost and benefit factors found important in e-business contexts [30] have been suggested as perceived characteristics related to specific technologies [24]. Most past studies used innovation diffusion theory as the base for IOS adoption research. Relative advantage [8] or perceived benefits [10] have been found to be key determinants of adoption of innovations. Perceived innovation characteristics such as complexity, compatibility [25], costs and communicability [18] were identified for example as important EDI adoption predictors. Being consistently cited as important adoption factors, perceived benefits and perceived costs were technological factors selected as facilitators and inhibitors of adoption intent in this study.

Perceived benefit has consistently been found to be an important predictor of adoption intent [10]. As was with EDI technology [17], RFID technology is likely to bring both direct and indirect benefits to retailers and manufacturers. **Direct benefits** are mostly operational savings resulting from increased internal efficiency of the organization whereas indirect benefits refer to opportunities and gains resulting from RFID's impact on business processes and relationships. Some direct benefits for the retailers include improved inventory management, reduced stock-outs[1], decreased theft, and fewer scanning errors. For manufacturers some direct benefits include improved inventory management, reduced stock-outs due to increased visibility and faster, more accurate assessment of

customer requirements. These benefits are possible due to enhanced product visibility and automatic real-time tracking.

Some **indirect benefits** for retailers might include higher customer satisfaction from fewer stock-outs and faster service at purchase or return time and improved consumer purchase insight patterns. Manufacturers may benefit indirectly through improved consumer insight, greater understanding of value-chain problem areas, and improved efficiencies, and reduced costs resulting from reengineering of business processes. Some indirect benefits can be derived through manufacturer-retailer collaboration efforts and may become a new basis for competitive advantage for both. Hence, based on diffusion of innovation theory [8], perceived relative advantage/perceived benefit (both direct and indirect) is likely to be a key predictor of intent to adopt and integrate RFID.

H10: Perceived direct benefits positively impacts RFID adoption and integration.

H11: Perceived indirect benefits positively impacts RFID adoption and integration.

Perceived costs, when high, lead to lower intent to adopt [21]. The less expensive the innovation, the more likely it will be adopted [8], but innovation costs relative to innovation benefits are more meaningful. Although cost is a significant inhibitor of innovation adoption, its links to diffusion are not clear. Some researchers argue once an adoption investment is made, higher costs may motivate firms to more actively diffuse it within, thus diluting its costs [29]. With RFID, the costs of RFID tags, integrating RFID with information and resource management systems, purchasing new hardware and software, reengineering business processes and replacing existing infrastructure may be inhibitors of adoption. On the other hand, due to the high costs, we see a differential effect on the evaluation stage, making it more likely, so that organizations can better reduce their risks in implementing RFID.

H12: Perceived costs negatively impacts RFID adoption and integration.

H13: Perceived costs positively impacts RFID evaluation.

3.2.3. External Environmental Factors. Factors external to a firm but influencing a firm's functioning and decision-making (i.e. governmental influences, technology standards development, legal environment, consumer readiness, stakeholders' privacy concerns, technological breakthroughs) have been characterized as environmental factors. Some of these factors such as competitive and industry pressure have been classified under the environment context [24], where

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[1] Hardgrave, B., Waller, M. and Miller, R., 2005, "Does RFID Reduce Out of Stocks? A Preliminary Analysis," White Paper, Information Technology Research Institute, Sam M. Walton College of Business, University of Arkansas

as interorganizational factors [3] also address some of these influences. However, in this paper due to the ubiquitous and radical nature of RFID external environment factors such as standard convergence (data, software/hardware and legal standards), perceived stakeholder privacy and perceived consumer readiness are viewed as important environmental influences on a firm's RFID adoption decision.

Standard convergence is defined as the degree of consistency of standards between the partner organizations within an industry (vertical) and across industries (horizontal). With RFID adoption, it is important to achieve interoperability between SC partners and to move towards open standards for leveraging cross industry benefits. It is proposed that higher perceived standard convergence would be favorable for adoption as it would result in more transactions using RFID within and across industries, thus greater benefits at possibly lower costs. Hence

> **H14: Perceived standards convergence positively impacts RFID adoption and integration.**

Perceived privacy is the extent to which individuals and organizations believe they have control over information about them being communicated to others. This definition derives from the definition of "Privacy" as being the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others [26]. In context of RFID, due to its pervasive nature, it is suggested that beliefs of privacy of consumers and/or organizations would foster its adoption while lack of would inhibit.

> **H15: Perceived privacy positively impacts RFID adoption and integration.**

3.3. Adoption Rationales Compared

The factors and implementation process examined in this paper is summarized in our research model (Figure 2). As discussed earlier, organizations adopt new technologies with different underlying rationales (i.e. strategic choice and institutional). The research model proposed in this study suggests both strategic and institutional rationales exist simultaneously during the adoption and integration decisions even though their relative strengths may differ. Based on the findings of Teo et al. [23] it is suggested that in the adoption of RFID technology institutional pressures from organizations would be a stronger driver for adoption than strategic considerations.

Since integration requires substantial commitment of resources (effort, time, money), greater integration would be more likely when adoption is voluntary,

keeping in mind performance and efficiency benefits, than when it is a response to pressures from organizations. Hence, for expected integration of RFID both internally and externally, it is suggested that strategic rather than institutional rationale would be stronger predictors.

> **H16: Institutional rationales are stronger predictors than strategic choice rationales in RFID adoption.**
> **H17: Strategic choice rationales have a stronger impact on RFID integration than institutional rationales.**

4. Research Methodology

Data Collection

In this study, we seek to investigate the factors that support the evaluation, adoption and integration of RFID technology or seek to answer the question: why do organizations adopt RFID technology and also identify how presence of particular drivers for an organization would relate to RFID evaluation, adoption and integration decisions and the subsequent degree of expected integration of the technology. To accomplish the above-mentioned goals and to develop a better understanding of the adoption process, we conducted a survey of RFID program managers and senior executives that have been associated with the RFID initiative within their organizations.
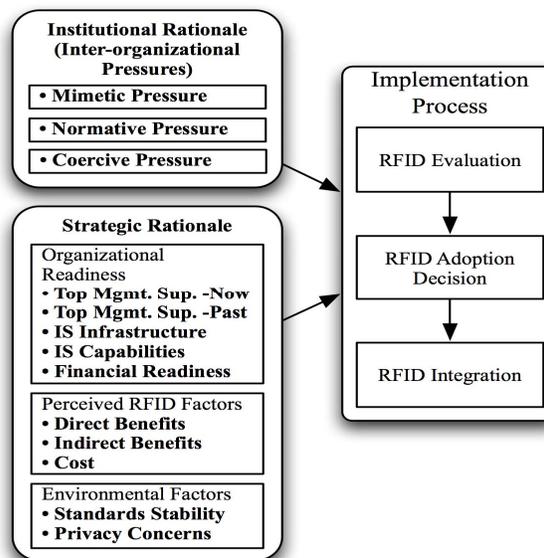

Figure 2: Research Model

The survey instrument was developed iteratively using questions from prior literature and insights gained from semi-structured interviews conducted in the exploratory phase of this study. The instrument was pilot tested over three rounds and respondents were also asked for feedback on the survey. The survey instrument was reviewed by PhD students and Faculty for clarity and validation. Each iteration led to an improved instrument that was finally used for our data collection.

The final round of data collection began in the month of April 2007 using an online survey. RFID program managers and senior executives within organizations that had shown interest in RFID in business press or were potential adopters of the technology were sent a request to participate in the survey with an online link. This was followed by final round of data collection using paper-based survey of current and potential adopters of the technology at an industry association conference. Data collection ended in mid-may after which the data from both sources (online and paper based) was combined and utilized for analysis.

Data Analysis

The survey led to a total of 123 responses including both the online and paper based versions. These included about 22 responses from RFID vendors and consultants that were removed from our analysis, as we were pre-dominantly interested in the current or potential end-users of RFID. There were 73 self reported end users and 28 respondents that were included as likely end users based on their organization's profile. As the respondents were key decision makers on RFID within their respective organization their responses were used as representative of the organization's response to RFID.

The 101 responses of likely and self-reported end users were utilized for the data analysis to test our evaluation, adoption and integration model. The model was tested for the current and future RFID evaluation, adoption and integration scenarios using binomial logistic regression and multiple regression techniques respectively.

Table 1. Results from Multiple Regression for future RFID Adoption Scenario					
	Future Evaluation Intent	**Future Adoption Intent**	**Future Integration Intent**	**Degree of Expected Internal Integration**	**Degree of Expected External Integration**
Significant Variables	TMSC, 0.43* PC, 0.21*	TMSC, 0.28* TMSP, -0.23* ISINF, 0.56*	ISINF, 60* CP, 0.39*	ISCAP, -0.06* NP, 0.17* MP, -0.15*	ISCAP, 0.07* NP, 0.15*
N	33	48	60	85	83
R-square	0.66	0.56	0.57	0.26	0.30
adj. R-Square	0.42	0.40	0.45	0.12	0.17
Power	0.98	1.0	1.0	0.92	0.96
Predictors	13	13	13	13	13
*Significance at alpha=0.05					

Table 2. Results from Binomial Logistic Regression for Current RFID Adoption Scenario			
	Current Evaluation	**Current Adoption**	**Current Integration**
Variables Significant	None ISCAP, 0.18**†	TMSC, 0.27** CP, 0.37**	TMSC, 0.22** Std, 0.15**†
N	93	92	92
Chi square	83.51	122.74	111.61
Chi Sq/DF	1.05	1.57	1.43
Predictors	13	13	13
** P < 0.05 †When only self reported end user sample is used.			

5. Results

The summary of multiple regression results for potential evaluators, potential adopters and potential integrators is presented in Table 1. The summary of logistic regression results for current evaluators, current adopters and current integrators is presented in Table 2. The summary of hypotheses results is presented in Table 3. Figure 3 presents summary of model results for both current and future scenarios.

7

6. Discussion of Results and Conclusion

Evaluation

We begin our discussion of the results for pre-adoption evaluation of RFID by considering those who have not yet evaluated the technology but might do so in the future.

Table 3. Summary of Hypotheses Results

Hypothesis	Variable	Factor	Model Stage	Support Current	Support Future
H1a	Coercive Pressures	Institutional	Adoption	Yes	No
H1b	Coercive Pressures	Institutional	Integration	No	Yes
H2a	Mimetic Pressures	Institutional	Adoption	No	No
H2b	Mimetic Pressures	Institutional	Integration	No	No
H3a	Normative Pressures	Institutional	Adoption	No	No
H3b	Normative Pressures	Institutional	Integration	No	No
H4	Current TM Support	Strategic	Evaluation	Yes	Yes
H5a	Current TM Support	Strategic	Adoption	No	Yes
H5b	Current TM Support	Strategic	Integration	No	No
H6a	Prior TM Support	Strategic	Adoption	No	Yes
H6b	Prior TM Support	Strategic	Integration	No	No
H7a	IS Infrastructure	Strategic	Adoption	No	Yes
H7b	IS Infrastructure	Strategic	Integration	No	Yes
H8a	IS Capabilities	Strategic	Adoption	No	No
H8b	IS Capabilities	Strategic	Integration	No	No
H9a	Financial Readiness	Strategic	Adoption	No	No
H9b	Financial Readiness	Strategic	Integration	No	No
H10a	Perceived Direct Benefits	Strategic	Adoption	No	No
H10b	Perceived Direct Benefits	Strategic	Integration	No	No
H11a	Perceived Indirect Benefits	Strategic	Adoption	No	No
H11b	Perceived Indirect Benefits	Strategic	Integration	No	No
H12a	Perceived Costs	Strategic	Adoption	No	No
H12b	Perceived Costs	Strategic	Integration	No	No
H13	Perceived Costs	Strategic	Evaluation	No	Yes
H14a	Perceived Standard Convergence	Strategic	Adoption	No	No
H14b	Perceived Standard Convergence	Strategic	Integration	Yes	No
H15a	Perceived Privacy	Strategic	Adoption	No	No
H15b	Perceived Privacy	Strategic	Integration	No	No
H16	Institutional> Strategic		Adoption	Yes	No
H17	Strategic> Institutional		Integration	Yes	No

Figure 3. Model Results Summary
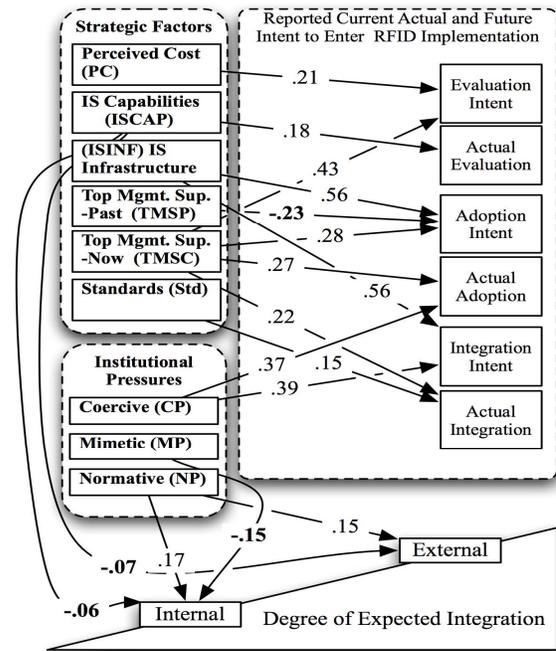
From the results presented in Tables 1, 2 & 3 we find perceived costs and current top Management support to be positively related to the intent to evaluate the technology. Hence hypotheses H4 and H13 have been supported. This means organizations where the top management encourages to look at a new technology or those organizations that consider the new technology to be costly and hence risky are more likely to evaluate it rather than those which are driven by institutional pressures or where the benefits are self evident.

An important aspect about evaluation of RFID that emerges from the study of those who have already evaluated the technology suggests that having the necessary skills and capabilities to evaluate, adopt and implement a new technology is critical in determining whether actual evaluation of the technology takes place or not.

Adoption

As is evident from the results in Tables 1, 2 & 3 Current Top management support, presence of IS infrastructure for supporting tracking and scanning are positively related to RFID adoption intent for the future while the top management support in the past for adoption of other technologies is negatively related to RFID adoption intent. The role of Top management support and IS infrastructure has been highlighted in prior literature and its confirmation in the case of an IOS platform technology such RFID denotes the importance of conditions that exist within the organization to drive its adoption. The negative relationship with past Top management support in the past may be either due to support for a competing technology in the past or due to change in the management's perspective in case of RFID. None of the institutional variables were found to be important in the organization's intent to adopt in the future. What is even more significant is that neither perceived benefits nor perceived costs, standards or privacy seem to matter enough to determine future adoption intent. That however may also mean that benefits might indirectly relate to adoption intent if the reason for top management's support for the new technology is pre-dominantly strategic and not institutional.

However, same is not true when we look at current adopters or those organizations that have already adopted RFID. There is an interesting disconnect that we find between what has driven actual current adopters and what drives potential future adopters. Institutional pressures i.e. coercive pressures have primarily driven the current adopters as might be expected with the ongoing mandates and to some extent support from the top management, which again might be due to a perception of future benefits, unless there is some other institutional mechanism such as normative or mimetic influence at work.

From the assessment of the current and future scenarios we find support for both rationales are at work in determining the adoption of RFID. While external coercive institutional pressures are stronger drivers of current adoption when compared to internally driven strategic rationale, the strategic rationale supports future adoption intent with no influence of institutional factors. This may either mean a change in adoption context of RFID or that those that have not already adopted RFID but might do so in future are driven by internal reasons and hence don't anticipate or experience significant institutional pressures to adopt.

Integration

When we discuss about adoption of RFID it is also critical to also know how the adoption might result in eventual integration and use of the technology within and across organizations. To differentiate between a "superficial or minimal adoption" which might result is very limited use of the technology we studied the impact of strategic and institutional factors in relation to the decision to integrate the technology and the actual degree of expected integration in the future. Based on our results in Tables 1, 2 & 3 and summary on Figure 3 we find that IS infrastructure and coercive pressures are likely to drive the decision to integrate the technology in the future while support from top management support and perceptions of standard stability have driven the current adopters to go beyond adoption to the integration stage. This however is distinct from the degree of expected integration in the future for both current and potential adopters. For extensive external integration with partners across the supply chain and internally within the business processes we find normative pressures to positively influence the extent of integration while IS capabilities seem to be negatively related to both external and internal integration. This result is contrary to our expectations, as we would expect those with better capabilities to eventually integrate more. The only argument that we could make in favor of this relationship is that having strong existing capabilities might allow organizations to leverage more from current technologies such as bar codes and hence may not require them to integrate extensively. Also mimetic pressures or blindly copying others without thinking through the implications of adopting RFID might result in low or minimal integration of RFID, as the

adopter may be clueless on how to leverage it for maximum benefit.

This study is among the first few empirical field studies that we are aware of on the adoption and implementation of RFID. We use a multi theory and multi method approach and also compare between current and future scenarios for each of the different stages in RFID adoption and implementation. We include factors from multiple theoretical perspectives with different underlying rationales for adoption and integration. We also tested for the effect of perceived standards convergence and perceived privacy variables as these variables seemed relevant for RFID adoption and integration from initial data gathering and to the best of our knowledge have not been tested in a prior IOS study. We find that different factors become significant in different stages of adoption and implementation. There are also significant differences between the factors in predicting current and future scenarios. Both strategic and institutional factors are critical in understanding the RFID phases of adoption and implementation and attention needs to be given to both rationales for a better and more complete understanding of why an emerging platform technology such as RFID is evaluated, adopted and how it is eventually integrated and used. We believe our study is useful and furthers this understanding by presenting a critical overview of RFID technology at various stages and for both the current and future scenarios.

6. References

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