KISDI
KOREA INFORMATION SOCIETY DEVELOPMENT INSTITUTE
Asian Journal of Information and Communications

An empirical study of relationship between RFID implementation critical success factors and organizational strategy

Niraj Kumar Vishvakarma*
IIT Kanpur

R.R.K. Sharma**
IIT Kanpur

Omprakash K. Gupta***
University of Houston-Downtown

Devki Nandan Bhatt****
IIT Kanpur

Abstract

Radio frequency identification (RFID) is one of the most useful technologies in the manufacturing industry. It gives benefits like real time asset tracking, increase in product visibility, and reduction in product theft and inventory level while giving a competitive advantage to an organization. To reap the full benefits of RFID implementation, it is critical to implement the RFID system successfully. There are a number of factors which are critically important for the successful implementation of an RFID project. This study establishes a framework for the relationship between RFID implementation critical success factors (ICSFs) and organizational strategy types, and empirically tests the relationship between RFID implementation critical success factors and organizational strategy types. The result shows that ICSFs which are out of organizational control similarly influence all organizational strategy types, but the impact of other ICSFs depend on organizational strategy types. We have discovered that the majority of RFID ICSFs have a higher impact on innovators and prospectors than the defenders. 80% of our hypotheses that constitute the theoretical framework are supported by empirical data collected from organizations which have implemented RFID.

Keywords: radio frequency identification (RFID), competitive advantage, implementation critical success factors, organizational strategy type.

1. Introduction

RFID is a wireless technology that uses radio waves to transmit information. The RFID system consists of three components: tag, reader and middleware. The reader queries the tag to acquire information on the identity of physical objects. This information is processed on a computer system or handheld device. It is more than just a substitute technology for the barcode system; it has a larger information storage capacity as compared to barcode, and tracks and gathers information about objects in real time. RFID does not require human intervention to capture data, which makes it superior to the barcode system. Barcode, on other hand, requires line of sight to automatically capture data (Chowdhury and Khosla, 2007).

RFID is a cutting-edge technology in the auto-ID industry and has been around for 50 years. The first use of RFID was in military applications for identifying military aircraft (Fanberg, 2004). As the potential of this

* nirajkumar.v@gmail.com
** rrks@iitk.ac.in
*** Corresponding author: guptao@uhd.edu
**** dbhatt@iitk.ac.in

technology has been proven, it has become an important tool for business as it improves performance in terms of cost, quality, efficiency, speed, and operational flexibility (Smart, 2004; So and Liu, 2006). RFID technology is currently evolving at a very high speed, and experts assert that it is likely to significantly impact businesses in the areas of operations management (Fleisch and Tellkamp, 2005; Lahiri, 2005; Wyld, Jones and Totten, 2005).

The RFID system has a number of benefits. For instance, it greatly improves the efficiency and effectiveness of supply chain by enabling organizations to track supply chain material and allow greater flexibility and control (Jabjiniak and Gilbert, 2004). To get the complete benefit of RFID implementation, this technology must be successfully implemented in an organization where organizational strategy plays a crucial role. There are a number of critical success factors which must be considered for the successful implementation of RFID system. Nagi et al. have identified eight success factors for the successful implementation of RFID in an aircraft engineering company (Ngai et al., 2007). Attaran has identified several critical success factors and barriers that influence RFID adoption or deter organizations from adopting it (Attaran, 2007).

The implementation decision is also impacted by organizational strategy types. An organization with less market orientation takes a more cautious wait-and-see approach in implementation of RFID. A lack of standards or lesser technological knowledge and concern about return on investment (ROI) (Jabjiniak and Gilbert, 2004), makes an organization implement RFID only after ROI is assumed positive.

The remainder of this paper is organized as follows. In Section 2, we review literature related to the organization's typology and try to identify the variables which define the strategy types of organizations. We also go through literature related to RFID adoption and try to identify RFID implementation critical success factors (ICSFs). In Section 3, we give some details on data collection methods and general profile of the respondent. In Section 4, we cluster the organizations into different organizational strategy types. In Section 5, we give an overview of research findings and follow this by discussions.

2. Literature review

In this section we offer a rigorous literature review on organizations' strategic typology and RFID and IT systems implementation strategy to gain an in-depth understanding of the concept.

2.1 Organization's strategy type

Organizational strategy is a pattern of decision making about an organization's future, which determines and reveals its objectives, goals, and produces the principle, plan and policies for achieving the goals. The strategy of the organization focuses on its long term directions, and matches the organization's activity with the business environment and its resources. According to Grant (1991), strategy is a match between an organization's internal strengths and external opportunities and challenges.

As the concept of strategy has a multifaceted character, different authors have given different typologies, each having a different basis of categorization. Based on the 'rate of change of products or market', Miles et. al. (1978) have classified organizational strategy types into four groups: defender, prospector, analyzer and reactors. Based on the competing values framework, Porter (1980) has divided an organization's strategy into three groups: cost leadership, differentiation and focus/niche. Miller and Roth (1994) both have grouped organizational strategy in three categories: caretakers, marketers and innovators based on product innovation. Table 1 presents organizational typology from literature review on the subject.

Table 1. Organization's typologies from literature

SN	Strategy types	On the basis of	Author
1	Prospector, defender, analyzer and reactor	Rate of change of products and market	Miles et al. (1978)
2	Cost leadership, differentiation, focus (cost, differentiation)	Competing value framework	Porter (1980)
3	Caretakers, marketers, and innovators	Product innovation	Miller and Roth (1994)
4	Mechanistic and organic structures	Decision taking ability	Burns and Stalker (1961)
5	Simple structure, machine bureaucracy, professional bureaucracy, divisionalized form and adhocracy	Organization's structure and culture	Mintzberg (1979)
6	Build, hold, harvest and divest	Market share growth and short run profit maximization	Gupta and Govindrajan (1984)
7	Exploration and exploitation	Manufacturing / service capabilities	March (1991)
8	Conservative model, entrepreneurial model	Risk taking behavior	Miller and Friesen (1982)
9	Innovators, leader, viable competitor, laggard at risk	Based market penetration	Zack (1999)
10	Blue ocean, red ocean	Strategic moves	Kim and Mauborgne (2005)

In this study, we have only selected the three most aggressive organizational strategy types: defenders, prospectors, and innovators; Defenders and prospectors are from Miles et al.'s (1978) organization's strategy types and innovators strategy is from Miller and Roth's (1994) organization's typology. The characteristics of these organizations are described using the results obtained from data analysis. The analysis results reveal that the characteristics of these organizations are much similar to those explained by Miles et al. (1978).

To classify an organization into defender, prospector and innovator groups, we have identified 14 variables from literature, 11 variables from Miller and Roth's (1994) paper and 3 from Miles et al.'s (1978) paper. All variables are given in Table 2. We call these variables strategic variables.

Table 2. Variable related to organization's strategy type

SN	Variable	Description	Author
1	STR1	The capability to compete on price.	Miller and Roth (1994)
2	STR2	The capability to make rapid design changes and/or introduce new products quickly.	
3	STR3	The capability to respond to swings in volume.	
4	STR4	The capability to offer consistent quality.	
5	STR5	The capability to provide high performance products.	
6	STR6	The capability to deliver products quickly.	
7	STR7	The capability to deliver on time (as promised).	
8	STR8	The capability to provide after sale service.	
9	STR9	The capability to advertise and promote the product.	
10	STR10	The capability to distribute the product broadly.	
11	STR11	The capability to deliver a broad product line.	
12	STR12	The strategy to aggressively innovate products.	Miles et al. (1978)
13	STR13	Increasing the market share by introducing innovation and change.	
14	STR14	Maintaining industry leadership by product/process/service offering.	

2.2 RFID technology

In this paper, the RFID ICSFs are taken from literature. We have taken most ICSFs from Ting et al. (2012) and Vishvakarma and Sharma (2015a). We have classified these ICSFs into five major dimensions: strategic, technical, managerial, operational, and others. These five dimensions are briefly discussed and followed by detailed ICSFs in Table 3.

2.2.1 Strategic dimension

Generally, the implementation decision of any information systems (IS) is taken by top level management. It is a strategy decision which requires to properly evaluate ROI, selection and partnership with RFID vendors and internal and external motivation for improving organization performance. The decision of making change in business process or operating process is highly dependent on organizational strategy types (Vishvakarma and Sharma, 2015b).

2.2.2 Managerial dimension

The successful implementation of RFID requires good project management skills, effective risk management and utilization of cross functional teams, in which management plays an important role in coordinating the whole implementation process.

2.2.3 Technical dimension

As this technology is still evolving, technological understanding is very critical for successful implementation of the RFID system. Successful implementation of this technology requires appropriate selection of hardware and software which will help in integration of RFID systems with the rest of IS systems (ERP, MRP-I, MRP-II, etc.) of the organization. The benefits from information technology (IT) architecture must match business requirements (Vishvakarma and Sharma, 2015c).

2.2.4 Operational dimension

Implementation can be easier and impactful with a clear business model and organizational plan. Another important factor in RFID implementation is to minimize customization in work processes to reduce error and to take advantage of new information systems (Holland, Light and Gibson, 1999; Roberts and Barrar, 1992; Sumner, 1999).

2.2.5 Other dimensions

Apart from the above, the organization should be sensitive to capital cost, clear performance measures, and identification of the drivers of adoption.

Table 3. RFID implementation CSFs

SN	CSFs	Author
1. Strategic dimensions		
ICSF 1	Internal and external motivation for improvement in organizational performance	Andrew, Sirkin and Butman (2006)
ICSF 2	Selection and partnership with component RFID vendors	
ICSF 3	Strengthening mutual understanding in the organization	
ICSF 4	Top management support and commitment from leadership	
2. Managerial dimensions		
ICSF 5	Good project management skill	Zailani, Fernando and Zakaria (2010) Ngai, To, Moon, Chan, Yeung and Lee (2010) Luo, Wang, Tan and Chow (2007) Lim and Koh (2009)
ICSF 6	Effective risk management skill	
ICSF 7	Effective communication skill	
ICSF 8	Staff competency and training	
ICSF 9	Utilization of cross-sectional team	
3. Technical dimensions		
ICSF 10	Selection of appropriate hardware and software	Angeles (2005) Soylemezoglu, Zawodniok, Cha, Birt and Sarangapani (2006) Huang and Tang (2008) Yue, Wu and Bai (2008) Kwok, Ting, Tsang, Lee and Cheung (2010) Reyes and Jaska (2007) Attaran (2007)
ICSF 11	Integrating RFID into existing IT architecture	
ICSF 12	Sufficient in-house technical support	
ICSF 13	Effective testing	

SN	CSFs	Author
4. Operational dimensions		
ICSF 15	Avoiding major process changes/ Limit process changes	Wang, Wang and Yang (2010) Juels, Rivest and Szydlo (2003) Weis, Sarma, Rivest and Engels (2004) Garfinkel, Juels and Pappu (2005) Shih, Lin and Lin (2005)
ICSF 15	Plan for continuous improvement of procedures	
ICSF 16	Real time data for analysis	
ICSF 17	Limitations of industries to adopt RFID technology	
ICSF 18	Privacy and security issues	
5. Other dimensions		
ICSF 19	Capital cost	Ting, Tsang and Tse (2013)
ICSF 20	Clear performance measures	
ICSF 21	Identifying "drivers" for adoption	

3. Conceptual research framework and hypothesis development

The objective of this conceptual framework is to investigate whether organization strategy affects the successful implementation of RFID. This framework is divided in two sections: in Section 3.1, we relate the competitive capabilities with organizational strategy types. In Section 3.2 we relate organizational strategy types with critical success factors of RFID implementation.

Organizations strategy is based on competitive capability of organizations given by Miller and Roth (1994). We have divided these competitive capabilities into four groups: cost leadership, flexibility, customer services, and sales and distributions. The cost leadership strategy is that in which an organization competes with its counterparts on price cutting. The capability of organizations' flexibility enables organizations to rapidly change design and quickly launch new products. Customer service capability enables the organization to fulfill customer demand with quality products, timely delivery, and after sales services. Sales and distribution capability enable the organization to cover a large market. Higher or lower importance of these capabilities defines organizations strategy types. This relationship has been already established by Miller and Roth (1994). The relationships among competitive capabilities and organizational strategy types have already been established.

The framework has categorized RFID implementation CSFs into five dimensions: strategic, managerial, technical, operational and other dimensions. The detailed description of these dimensions is given in section 2.2. Our contribution in this framework is to relate these implementation CSFs with organization strategy types; this is the novelty of this conceptual framework.

This conceptual framework investigates the effects of organizational strategy on the dimensions of RFID implementation critical success factors such as strategic, managerial, technical, operational, and other dimensions. The literature is discussed as follows.

3.1 Strategic dimensions

3.1.1 Internal and external motivation for improvement in organizational performance

Organizations will be compelled to implement RFID in order to retain a competitive edge in the industry.

RFID gives benefits in divisions like manufacturing, logistics, inventory tracking and management, material handling, safety and security, cashless payment and customer service (Chen, 2004; TIBCO, 2005). Innovators and prospectors are more market oriented than defender organizations (Miller and Roth, 1994), so competitive pressure is more critical to innovators and prospectors than to defenders.

3.1.2 Selection and partnership with component RFID vendors

Innovators and prospectors face a more dynamic business environment than defenders (Miller and Roth, 1994); they must therefore be more cautious in RFID vendor selection to meet their changing business requirements. The selection of vendors should be done by considering vendors' attitudes towards organizational partnership. At times, it may be a better strategy to develop in-house software applications suitable for business requirements.

3.1.3 Strengthening mutual understanding in the organization

Mutual understanding is important for the successful implementation of a RFID system in an organization. Mutual understanding among individuals helps develop a shared vision, and thus contributes to strategic decisions, making the process less onerous and leading to alignment between organizational capabilities and IS implementation CSFs (Reich and Benbasat, 2000).

3.1.4 Top management support and commitment from leadership

The successful implementation of information systems requires top management support, leadership commitment, and strengthening the mutual understanding of the organization (Andrew, Sirkin and Butman, 2006). The studies on information system adoption and diffusion show that top management support and commitment are critical to optimal management and use of IS in an organization (Sharma, 2007; Premkumar and Roberts, 1999; Brown and Russell, 2007; Premkumar, Ranamurthy and Crum, 1997). Top management support is a strategic decision that provides the long term vision that is critical for a successful adoption of innovation in an organization. These requirements are must for all organizations irrespective of organizational strategy type.

Proposition 1: The strategic dimension of RFID implementation critical success factors has a higher impact on innovator and prospector organizational strategy types than on defender organizational strategy types.

3.2 Managerial dimensions

3.2.1 Good project management skill

RFID implementation is generally a huge project that involves several stakeholders. Its implementation requires huge amount of money. The successful implementation of RFID requires streamlining stakeholders for better control on cost and execution of activities so that a project can be completed within budget and schedule (Saygin, Sarangapani and Grasman, 2007). For managing this type of huge project, organizations need to have a complete schedule and milestones before beginning implementation, so that project implementation team members always have clear roadmap of how to implement a project. The complete roadmap of the project also helps availing resources when required.

3.2.2 Effective risk management skill

Till now the standards of RFID technology have not been defined properly, so the implementation of RFID has a certain degree of risk. The RFID project team must have good risk management skills to deal with risks that arise during the implementation process (Bhattacharya, Chu and Mullen, 2008). Some contingency plan should be developed and tested in advance so that unforeseen incidents can be handled quickly and efficiently. The implementation of RFID requires a major process change, which is technology driven business process re-engineering (BPR). The success of technology driven BPR requires team effort, risk decomposition, compensation and rewards, organizational learning, top management support, and information sharing and resources (Amabile, 1997; Clark, Cavanaugh, Brown and Sambamurthy, 1997).

3.2.3 Effective communication skill

RFID project implementation requires a large workforce, where effective information transfer within the organization plays a very important role in avoiding ambiguity between people (Ngai et al., 2010). During the implementation process of RFID, a significant level of teamwork is required within the whole organization. Effective teamwork of a multi-skilled staff can tackle risk in a much better way. These managerial dimensions are critical for the successful implementation of the RFID system in all organizational strategy types.

3.2.4 Staff competency and training

As a new IS is implemented in an organization, training is required to break the employees' initial resistance. An adequate and suitable training to front-line staff will give them precise knowledge about the system. Training should cover both theoretical and practical aspects. Training is given to explain the potential benefits of system implementation and required changes (Ngai et al., 2010). All organizations must train their employees to make them understand systems functionality and usage.

3.2.5 Utilization of cross-sectional team

To implement IS, an organization requires a cross-functional team. This should consist of the best people in an organization (Bingi et al., 1999; Buckhout and Nemec, 1999; Wee, 2000; Rosario, 2000). This should have both consultants and internal staff so that internal staff can learn the skills of IS development and implementation (Sumner, 1999).

As most prospectors and innovators have decentralized organization structure, the cross-functional team must consist of internal staff from each department. The staff from different departments have different requirements. Managing such an ionized team is also a challenge. This makes the utilization of a cross-functional team more difficult for innovators and prospectors than for defenders.

Proposition 2: Managerial dimensions have an almost similar impact on innovator and prospector organizational strategy types as they have on defender organizational strategy types.

3.3 Technical dimensions

3.3.1 Selection of appropriate hardware and software

The success of RFID implementation depends on an appropriate selection of hardware and software. A suitable selection of hardware and software reduces the chances of signal collision and interference (Ngai et al.,

2010). There are various types of hardware and software available for selection, but the suitability of these hardware and software depends on application requirements. This research indicates that the suitability of hardware and software does not depend on price (Ting, Kwok, Tsang and Lee, 2011).

3.3.2 Integrating RFID into existing IT architecture

The RFID system is required to work in coordination with the ERP, MRP I, and MRP II systems of an organization to get real-time information access and usage. This requires the proper integration of the RFID system with other IS.

There are three levels of complexity involved in information system integration: artifact or product integration, system integration, and operational integration (Cowper, Emes and Smith, 2005; Hyer, 1997; Muller, 2007). In artifact integration, artificial components of the system are brought together to form IS. Most engineers think about artifact integration when they consider system integration. They consider IS integration and artifact integration to be synonymous. Most of the information systems cannot function without human intervention. In order to put system in use, human and machine need to adopt each other. In the operational integration, the artifacts system and its user are integrated into the organizational business process.

Innovators and prospectors organizations have a higher degree of process complexity than defender organizations, so the information system integration is more complex in innovators and prospectors than in defenders.

3.3.3 Sufficient in-house technical support

Implementation of the RFID system and working on RFID systems require significant in-house technical support for which an organization needs a large high skilled work force. Kim found that adoption of RFID is positively related to technical capabilities of the organization (Kim, 2008). The organizational technical capability refers to the level of IT usage and IT management in the organization (Iacovou, Benbasat and Dexter, 1995; Chwelos, Benbasat and Dexter, 2001).

3.3.4 Effective testing

A prototype test is needed to assess the performance and find out the potential problem in new process (Saygin et al., 2007). Innovators and prospectors have complex work process as compared to defenders (Vishvakarma et al., 2015b), so prototype testing is more difficult in innovators and prospectors as compared to defenders.

Proposition 3: Technical dimensions have an almost similar impact on innovator and prospector organizational strategy types as defender organizational strategy types.

3.4 Operational dimensions

3.4.1 Avoiding major process changes/ Limit process changes

Major process changes take place more often in innovator and prospector types organizations than in defender organizations (Vishvakarma et al., 2015b), which result in a frequent modifications in RFID systems too. The frequent process change makes it difficult for continuous process improvement in innovators and prospectors than for defenders.

3.4.2 Plan for continuous improvement of procedures

Generally, innovators and prospectors type of organizations follow the departmental organizational structure (Grant, 1991). so coordination among departments is much needed in these organization as compared to defenders type of organizations. This is also needed for the implementation of RFID system that has capability to provide reliable IT services to all departments simultaneously. This requires a distributed RFID system architecture in innovators and prospectors, and centralized architecture in defenders. Thus the implementation of RFID system in innovator and prospector organizations is more complex than defender organizations.

3.4.3 Real time data for analysis

Organizations that are following innovators and prospectors strategy have more customized products that lead to complex work process, whereas organizations that are following defenders strategy type having standardized products and automated work process; the tracking of objects on real time basis is easier than in the complex work process.

3.4.4 Limitations of industries to adopt RFID technology

RFID standard is yet not defined worldwide, so one type of RFID system is not applicable everywhere. As virtually there is no common frequency in all parts of the world, a common RFID system cannot be designed for all countries. Different industries also have different requirements and regulatory issues, so one RFID system cannot work for all industries.

3.4.5 Privacy and security issues

The innovator and prospector types of organizations are more innovative than defender types of organizations (Miller and Roth, 1994). Innovators and prospectors have more proprietary and innovative ideas than defenders, which leads to a high level of security risk in innovators and prospectors than defenders. The RFID is wireless technology possessing some potential security concerns during wireless transmission of data, data storage, and security of storage site (Grant, 1991). This makes innovators and prospectors more cautious during RFID system implementation.

Proposition 4: Operational dimensions have a higher impact on innovator and prospector organizational strategy types than on defender organizational strategy types.

3.5 Other dimensions

3.5.1 Capital cost

Generally, an RFID implementation project requires huge financial investment, so the capital cost is the major concern area during RFID system implementation for any organization. Defender organizations have a simple work process and standardized products, so they require the RFID tag with less storage capacity. Moreover, defender organizations are generally large in size and have surplus money. Therefore, they need not be concerned about the RFID tag's cost. Due to the more customized work process, the continuous process improvement in RFID system is difficult in innovator and prospector organizations than with defender organizations.

3.5.2 Clear performance measures

There are numerous observable and unobservable costs incurred during RFID system implementation, so the measurement on the return on investment is difficult to calculate.

3.5.3 Identifying "drivers" for adoption

The estimation of exact benefits extracted from RFID system implementation is also not possible, because the identification of drivers of adoption is not an easy task.

Proposition 5: Other dimensions have high impact on innovator and prospector organizational strategy types as compared to defender organizational strategy types.

Based on the literature review on organizational strategy type and RFID system implementation strategy, we develop some hypotheses given in Table 4.

Table 4. Hypotheses relating organizational strategy types with RFID ICSFs

SN	CSFs	Innovators	Prospectors	Defenders
1. Strategic dimensions				
H1	Internal and external motivation for improvement in organizational performance	H	M	L
H2	Selection and partnership with component RFID vendors	H	M	L
H3	Strengthening mutual understanding in organization	H	M	L
H4	Top management support and commitment from leadership	H	H	H
2. Managerial dimensions				
H5	Good project management skill	H	H	H
H6	Effective risk management skill	H	M	L
H7	Effective communication skill	H	H	H
H8	Staff competency and training	H	H	H
H9	Utilization of cross-sectional team	H	M	L
3. Technical dimensions				
H10	Selection of appropriate hardware and software	H	H	H
H11	Integrating RFID into existing IT architecture	H	H	H
H12	Sufficient in-house technical support	H	M	L
H13	Effective testing	H	H	H
4. Operational dimensions				
H14	Avoiding major process changes/ Limit process changes	H	M	L
H15	Plan for continuous improvement of procedures	H	M	L
H16	Real time data for analysis	H	M	L
H17	Limitations of industries to adopt RFID technology	M	M	M

SN	CSFs	Innovators	Prospectors	Defenders
H18	Privacy and security issues	L	M	H
5. Other dimensions				
H19	Capital cost	H	M	L
H20	Clear performance measures	H	H	H
H21	Identifying "drivers" for adoption	H	M	L

4. Sampling and data collection

A research questionnaire was designed and circulated online via email to a randomly selected sample of around 2,000 firms which have implemented RFID in their organizations. We have received 125 responses from different companies, in which some are small and medium enterprises, whereas others are big multinational enterprises. The response rate is 6.25%, which is very low but is satisfactory considering the length of the questionnaire and privacy issues of the organizations.

The target respondents in this survey are top managers, including general manager, vice general manager, CEO, project managers, senior RFID engineer and logistics and purchase executives. This survey was conducted from November 2014 to July 2015. First the questionnaire with cover letter was sent via email to a single respondent of each firm, so that each firm can get only one questionnaire and we get only one response from each company. We sent a reminder mail to all those firms which had not responded to the questionnaire. The reminder process was repeated twice at some interval.

In this research, we have used a five point Likert scale throughout the questionnaire. To ensure the reliability of items and data, we have used the statistical test called the Cronbach's alpha coefficient (greater than 0.70). We have performed a pilot test with 20 responses using SPSS. We have dropped some questions from the original questionnaire for a more reliable score. Finally, we have selected 14 questions which were related to organization's strategy types, having a Cronbach's alpha coefficient of 0.819 and 21 questions related to RFID implementation critical success factors, having an overall Cronbach's alpha coefficient of 0.874.

5. Methodology

In this research, we have reported 14 competitive capabilities. Out of 14 competitive capabilities, 11 were directly adopted from Miller and Roth (1994) and three were taken from Miles et al. (1978). The top level management was asked to rate these competitive capabilities on a 1-5 self-anchoring scale. These numbers represent the relative importance attributed to each capability the firm adopts to deal with customers and compete in the market place where 1= "Not at all important" and 5= "extremely important."

We use the nonhierarchical K-mean clustering method to classify an organization's strategy type based on the 14 attributes discussed above. The attributes are selected such that they represent the characteristics of an organization as proposed by Miles et al. (1978) and Miller and Roth (1994). The K-mean clustering method identifies the closest cluster center (in the form of the distance measured) for each organization, and it assigns the organization to that cluster. The assignment of an organization to a particular cluster has been done in such a way that minimizes the variance within the cluster and maximizes the inter cluster variances. We have again used descriptive statistics for each cluster to discover the internal description of each cluster.

Let $X=\{x_i\}$, $i = 1,...,n$ be the set of n d-dimensional points to be clustered into a set of K clusters, $C= \{c_k , k=1,...,K\}$. K-means clustering uses an iterative algorithm to partition the data into K clusters such that the squared error within the cluster is minimized. Let μk be the mean of cluster ck. The squared error between μk and the points in cluster ck is defined as

$$J(c_k)=\sum_{xi\in ck}(\mu k - ck)^2$$

There are K such clusters. The aim of K-means clustering is to minimize the sum of the squared error over all the clusters,

$$J(C) = \sum_{k=1}^{k}.\sum_{xi\in ck}(\mu k - ck)^2$$

5.1 Identifying strategy types

We have already fixed the number of strategy type, that is three (defenders, prospectors, and innovators) so we have applied the K-mean clustering to identify the organization's strategy types. These organization strategy types are presented in Appendix 1. The three clusters are formed on the basis of whether there is a significant distance between clusters at a significance level of 0.05 or less.

5.1.1. Cluster 1: Innovators

Organizations of this cluster are highly focused on developing competitive capabilities and are most aggressive among the three organizations strategy types. They are critically focused on technological innovation, new product development, and quickly introducing new products to the market. Moreover, high performance product, conformance quality, and on-time delivery and good after sales services are important things and are the most necessary factors to innovators. Innovators are less bothered about price as compared to most other competitive capabilities. Innovators generally place moderate emphasis on broader product line and volume flexibility.

5.1.2. Cluster 2: Prospectors

The organizations of this cluster try to optimize both capability development and cost cutting so that they can capture new market opportunities; at the same time they retain their market share from competitors. These organizations are generally focused on market-oriented capabilities such as broad product line and broad distribution channel. These organizations develop these competitive capabilities to capture the changing market requirements and swinging volume flexibility. Product performance, conformance to quality, and dependable delivery are critically vital to the prospector type of organizations. These organizations have some price consciousness as compared to innovator (Cluster 1) organizations. They put more emphasis on after sales services as compared to defender (Cluster 3) organizations.

5.1.3. Cluster 3: Defenders

The organizations of this cluster have price as the dominant competitive capability. They place a lower emphasis on the development of competitive capability and they generally prepare for a minimum standard of competition. The other important characteristics of this type of organization are conformance to quality. Our study reveals that capability of delivery and dependability are quite good for these organizations, but ability to follow delivery schedule and rapid delivery of the product are not that important. Broader product line, high

performance product and after sales services are not critically important for these organizations.

The details of competitive capability for different organization's strategy type are given in Appendix 1.

6. Data analysis

To test the robustness of equality of mean between the groups we have used Welch's ANOVA and Brown-Forsythe test. To test the equality of mean among the groups, we have used Post-Hoc analysis test.

6.1 Welch's ANOVA and Brown-Forsythe test for equality of means

The interpretation of Welch's ANOVA is the same as regular ANOVA. This test is the best approach for performing an ANOVA test where the homogeneity of variance assumption is violated, especially with unequal group sizes. In our case we have three different strategy types having different sample sizes. If Welch's ANOVA is statistically significant ($p<0.05$), it can be concluded that not all strategy type group means are equal in the population (i.e. at least one strategic type group mean is different from another strategy type group means).

The Brown-Forsythe test is similar to Welch's ANOVA test, the only difference is in calculating the denominator of the F. Instead of using mean square of error as the denominator, it adjusts the mean square using the observed variances of each group. The interpretation of the result is similar to Welch's ANOVA test. A Welch's ANOVA and Brown-Forsythe test for RFID implementation critical success factors are given in Appendix 2

The impact of ICSF1 was statistically significantly different between different organization's strategy types, Welch's $F(2, 62.66)=11.94$, $p<0.05$. Similarly the impact of ICSF2, ICSF3, ICSF4, ICSF5, ICSF8, ICSF9, ICSF10, ICSF13, ICSF13, ICSF14, ICSF15, and ICSF16 were significantly different between organizations' strategy types.

The impact of ICSF6 was not statistically significantly different between different organization strategy types, Welch's $F(2, 62.02)=1.83$, $p>0.05$. Similarly impact of ICSF7, ICSF11, ICSF17, ICSF18, ICSF19, ICSF20, and ICSF21, were also not statistically significantly different between different organization strategy types. The complete result is shown in Appendix 2.

6.2 Post-Hoc analysis to test the group-wise mean differences

Since, in this research, the three organization's strategy types have different sample sizes and the assumption of homogeneity of variances is violated, in this case the Games-Howell post-hoc test is a good measure to compare all possible combinations of group differences. It tests the statistical significance of differences between group means and provides confidence intervals for them. The output of Post-Hoc analysis is shown in Appendix 3.

For this research, we have taken 0.05 level (95% confidence interval) of significance, so we reject all the null hypotheses (group means are equal) for which $p<0.05$ and accept those for which p value is either greater than or equal to 0.05.

Welch, Brown-Forsythe, and Post-Hoc test show that there is no significant difference between the group means for ICSF6, ICSF11, ICSF17, ICSF18, ICSF19, ICSF20, and ICSF21. For these variables, p value is greater than 0.05 so we accept the null hypothesis (group means are equal).

There are two types of critical success factors for RFID adoption, namely, extrinsic and intrinsic. Extrinsic factors are those which are out of an organization's control, and intrinsic factors are those which are under the control of an organization.

Extrinsic factors like privacy and security issues, cost effective reusable tags, and initial capital expenditure

affect all organizational strategy types almost similarly. Our study reveals that there is no significant difference between the means of these extrinsic critical success factors.

There are various governmental regulations on radio frequency use for commercial, military and defense purposes. Their frequency use varies from country to country; this creates a hindrance to get a common frequency for RFID which can operate globally. As RFID is a wireless technology, it requires us to deal with various security concerns such as compromise of data during wireless transmission, storage of data, and security of the storage site. RFID is supposed to be a substitute technology for barcode. The high cost of tag creates a big hindrance in replacing the barcode, despite it having several advantages over the barcode.

The result also shows that there are a number of intrinsic implementation critical success factors which affect the strategy types of all organizations in the same way such as accurate cost benefit analysis, integration of RFID system with existing IT systems, clear performance measures, identification of drivers of adoption, and effective communication.

The various dimensions of RFID implementation CSFs are studied for different organizational strategy types. The null hypothesis is that there is no significant difference between the means of various RFID implementation CSFs for different organizations' strategy types.

$$\text{Ho: } \mu_{ICSF\,(I)} = \mu_{ICSF\,(P)} = \mu_{ICSF\,(D)}$$

$$\text{The alternate hypothesis is } H_1\text{: } \mu_{ICSF\,(I)} \neq \mu_{ICSF\,(P)} \neq \mu_{ICSF\,(D)}$$

In this research, we set some benchmarks. Any mean value which is below 3.30 is treated as "Low" critical, any mean value which is between 3.30 and 3.80 is treated as "Moderate" critical, and any mean value which is above 3.80 is treated as High. This benchmark has been taken from the intuition of authors to give more clarity to interpretation.

For ICSF1, the Post-Hoc test shows that there is a significant difference between the means $\mu_{ICSF1\,(I)}$ & $\mu_{ICSF1\,(D)}$, but not between $\mu_{ICSF1\,(I)}$ & $\mu_{ICSF1\,(P)}$ and $\mu_{ICSF1\,(P)}$ & $\mu_{ICSF1\,(D)}$. μ_{ICSF1} (I, P, D) = (4.11, 3.85, 3.26), which implies μICSF1 (I, P, D) = (High, Moderate/High, Low). The result can be interpreted as ICSF1 is highly critical for "I", moderately critical for P as per benchmark but is close to high criticality as Pot-Hoc result shows that there is no mean difference between "I" and "P", and low critical for "D".

Similarly, the impact of other ICSFs can be interpreted using Appendix 3, and the complete summery of the result is given in Table 5.

Table 5. Hypotheses testing result

SN	Implementation CSFs	Innovators	Pospectors	Defenders
Strategic dimensions				
ICSF1	Internal and external motivation for improvement in organizational performance	High	Medium/High	Low
		Supported	Supported	Supported
ICSF2	Selection and partnership with component RFID vendors	High	Medium/High	Low
		Supported	Supported	Supported
ICSF3	Strengthening mutual understanding in organization	High	Medium/High	Medium
		Supported	Supported	**Not supported**
ICSF4	Top management support and commitment from leadership	High	High	Medium
		Supported	Supported	**Not supported**

SN	Implementation CSFs	Innovators	Pospectors	Defenders
Managerial dimensions				
ICSF5	Good project management skill	High	High	High/Medium
		Supported	Supported	Supported
ICSF6	Effective risk management skill	Medium	Medium	Medium
		Not supported	Supported	**Not supported**
ICSF7	Effective communication skill	High	High/ Medium	High/ Medium
		Supported	Supported	Supported
ICSF8	Staff competency and training	High	High	High/ Medium
		Supported	Supported	Supported
ICSF9	Utilization of cross-sectional team	Medium	Medium	Low
		Not supported	Supported	Supported
Technical dimensions				
ICSF10	Selection of appropriate hardware and software	High	High	High/ Medium
		Supported	Supported	Supported
ICSF11	Integrating RFID into existing IT architecture	High	High/ Medium	High/ Medium
		Supported	Supported	Supported
ICSF12	Sufficient in-house technical support	Medium	Medium	Low/ Medium
		Supported	Supported	Supported
ICSF13	Effective testing	High	High	Moderate/High
		Supported	Supported	Supported
Operational dimensions				
ICSF14	Avoiding major process changes/ Limit process changes	Medium	Medium/ Low	Low
		Not supported	Supported	Supported
ICSF15	Plan for continuous improvement of procedures	Medium	Medium	Low
		Not supported	Supported	Supported
ICSF16	Real time data for analysis	High	Moderate/High	Moderate/Low
		Supported	Supported	Supported
ICSF17	Limitations of industries to adopt RFID technology	Medium	Medium	Medium
		Supported	Supported	Supported
ICSF18	Privacy and security issues	Medium/Low	Low	Low
		Not supported	**Not supported**	Supported
Other dimensions				
ICSF19	Capital cost	Medium	Medium	Medium/Low
		Not supported	Supported	Supported
ICSF20	Clear performance measures	High	Medium	Medium
		Supported	Supported	**Not supported**
ICSF21	Identifying “drivers” for adoption	High	Medium	Medium
		Not supported	Supported	**Not supported**

7. Conclusion

In more than 75% of implementation critical success factors, the mean score is more than 3.5 on a scale of 5. This indicates that the critical success factors which are identified from literature do represent reality. The outcome of this empirical study indicates that the extrinsic RFID implementation CSFs have an almost similar effect on all organizational strategy types. Mostly the scores for innovators on all implementation CSFs are high as compared to those of prospectors and defenders. Hence the organization which is pursuing innovator strategy finds it difficult to implement RFID systems as compared to prospector and defender strategy types. The organizations which are pursuing innovator strategy generally have complex work processes, frequently changing business requirements and making root cause changes in business processes (Chatterji and Sharma, 2009; Vishvakarma and Sharma, 2015b).

Innovators and prospectors operate in a more turbulent environment than defenders, so they have more diverse and changing business requirements than defenders. These requirements force innovators and prospectors to be more conscious in vendor selection. Innovators and prospectors have mass customized products, which require frequent process adjustment making continuous process improvement more difficult in these organizations as compared to the defender organizations. They have complex work process that makes it difficult for them to identify benefits from RFID implementation in these organizations as compared to defender organizations.

Managerial and technical considerations are highly important to successfully implement RFID systems, and the importance of these dimensions are almost similar in all organizational strategy types. RFID implementation is a huge project which requires a large budget allocation from organizations. The aim of RFID project implementation is to get positive ROI. The calculation of ROI requires consideration of different observable and non-observable costs and benefits. As the identification of these drivers is not an easy task, organizations needs to take cautious consideration on these issues.

References

Amabile, T. M. (1997). Motivating creativity in organizations: on doing what you love and loving what you do. *California Management Review, 40*(1), 39-58.

Andrew, J. P., Sirkin, H. L. and Butman, J. (2006). *Payback: Reaping the Rewards of Innovation*. Boston, MA: Harvard Business School Press.

Angeles, R. (2005). RFID technologies: supply-chain applications and implementation issues. *Information System Management, 22*(1), 51-65.

Attaran, M. (2007). RFID: an enabler of supply chain operations. *Supply Chain Management: An International Journal, 12*(4), 249-257.

Bhattacharya, M., Chu, C. H. and Mullen, T. A. (2008). A comparative analysis of RFID adoption in retail and manufacturing sectors. In *Proceedings of 2nd IEEE International Conference on RFID*, 241-249.

Bingi, P., Sharma, M. K. and Godla, J. (1999). Critical issues affecting an ERP implementation. *Information Systems Management, 16*(3), 7-14.

Brown, I. and Russell, J. (2007). Radio frequency identification technology: an exploratory study on adoption in the South African retail sector. *International Journal of Information Management, 27*(4), 250-265.

Buckhout, S., Frey, E. and Nemec, J. (1999). Making ERP succeed: turning fear into promise. *IEEE Engineering Management Review, 27*(3), 116-123.

Burns, T. and Stalker, G. M. (1961). *The Management of Innovation*. London: Tavistock Publications.

Chatterji, D. and Sharma, R. R. K. (2009). Important differences in management control systems, cultural dimensions and management practices of innovators, prospectors and defenders. In *Proceedings of 3rd European Conference on Entrepreneurship and Innovation*, 71-82.

Chen, Y.H. (2004). Getting ready for RFID. *OR/MS Today, 31*(3), 30-35.

Chowdhury, B. and Khosla, R. (2007). RFID-based real-time hospital patient management system. In *Proceedings of the 6th IEEE/ACIS International Conference on Computer and Information Science, and International Workshop on e-Activity* 2007, 363-368.

Chwelos, P., Benbasat, I. and Dexter, A. S. (2001). Empirical test of an electronic data interchange adoption model. *Information Systems Research, 12*(3), 304-321.

Clark, C. E., Cavanaugh, N. C., Brown, C. V. and Sambamurthy, V. (1997). Building change-readiness capabilities in the IS organization: insights from the Bell Atlantic experience. *MIS Quarterly, 21*(4), 425-454..

Cowper, D., Emes, M. and Smith, A. (2005). ... is he in heaven or in hell that illusive systems integrator-who's looking after your systems integration. INCOSE Publication Database(https://www.incose.org/ipub/).

Fanberg, H. (2004). The RFID revolution - healthcare is ready to embrace the new technologies. *Marketing Health Services, Fall*, 43-44.

Fleisch, E. and Tellkamp, C. (2005). Inventory inaccuracy and supply chain performance: a simulation study of a retail supply chain. *International Journal of Production Economics, 95*(3), 373-385.

Garfinkel, S. L., Juels, A. and Pappu, R. (2005). RFID privacy: an overview of problems and proposed solutions. *IEEE Security and Privacy Magazine, 3*(3), 34-43.

Grant, R. M. (1991). The resource based theory of competitive advantage. *California Management Review, 33*(3), 114-135.

Gupta, A. and Govindrajan, V. (1984). Business unit strategy, managerial characteristics and business unit effectiveness at strategy implementation. *Academy of Management Journal, 27*(1), 25-41.

Holland, P., Light, B. and Gibson, N. (1999). A critical success factors model for enterprise resource planning implementation. In *Proceedings of the 7th European Conference on Information Systems*, 273-287.

Huang, K. and Tang, S. (2008). RFID applications strategy and deployment in bike renting system. In *Proceedings of 10th International Conference Advanced Communication Technology*, 660-663.

Hyer, S. A. (1997). An effective approach to system integration: a comprehensive checklist. INCOSE Publication Database.

Iacovou, C. L., Benbasat, I. and Dexter, A. S. (1995). Electronic data interchange and small organization adoption and impact of technology. *MIS Quarterly, 19*(4), 465-485.

Jabjiniak, B. and Gilbert, G. (2004). RFID warrants a strategic approach. *Business Integration Journal, 12*, 29-31.

Juels, A., Rivest, R. L. and Szydlo, M. (2003). The blocker tag: selective blocking of RFID tags for consumer privacy. In *Proceedings of the 10th ACM conference on Computer and Communications Security*, 103-111.

Kim, S. H. (2008). An empirical study of factors influencing organizational intention to use RFID technology and the moderating effect of presence of champions. *Journal of Business Research, 23*(3), 139-171.

Kim, W. C. and Mauborgne, R. (2005). *Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant*. Boston: Harvard Business School Press.

Kwok, S. K., Ting, J. S. L., Tsang, A.H.C. Lee, W.B. and Cheung, B. C. F. (2010). Design and development of a mobile EPC-RFID based self-validation system(MESS) for product authentication. *Computers Industry, 61*(7), 624-635.

Lahiri, S. (2005). *RFID Sourcebook*. Upper Saddle River, NJ: IBM Press.

Lim, S. and Koh, C. (2009). RFID implementation strategy: perceived risks and organizational fits. *Industrial Management & Data Systems, 109*(8), 1017-1036.

Luo, Z., Wang, E. C., Tan, C. and Chow, K. K. (2007). Apply Model Integration in RFID Technology Adoption Analysis. In *2007 IEEE International Conference on Automation and Logistics*, 2931-2935.

March, R. J. (1991). Exploration and exploitation in organizational learning. *Organization Science, 2*(1), 71-87.

Miles, R. E., Snow, C. C., Meyer, A. D., Henry, J. and Coleman, J. (1978). Organizational strategy, structure, and process. *The Academy of Management Review, 3*(3), 546-562.

Miller, D. and Friesen, P. (1982). A longitudinal study of the corporate life cycle. *Management Science, 30*(10), 1161-1183.

Miller, J. G. and Roth, A. V. (1994). A taxonomy of manufacturing strategies. *Management Science, 40*(3), 285-304.

Mintzberg, H. (1979). *The Structuring of Organizations: A Synthesis of the Research*. Englewood Cliffs, NJ: Prentice-Hall.

Muller, G. (2007). Coping with system integration challenges in large complex environment. INCOSE Publication Database.

Ngai, E. W. T., To, C. K. M., Moon, K. K. L., Chan, L. K., Yeung, R. K. W. and Lee, M. C. M. (2007). RFID systems implementation: a comprehensive framework and a case study. *International Journal of Production Research, 48*(9), 2583-2612.

Ngai, E. W. T., To, C. K., Moon, K. K., Chan, L. K., Yeung, P. K. and Lee, M. C. (2010). RFID systems implementation: a comprehensive framework and a case study. *International Journal of Production Research,48*(9), 2583-2612.

Porter, M. E. (1980). *Competitive Strategy*. New York, Free Press.

Premkumar, G. and Roberts, N. (1999). Adoption of new information technologies in rural small business. *Omega, 27*(4), 467-484.

Premkumar, G., Ranamurthy, K. and Crum, M. (1997). Determinants of EDI adoption in the transportation industry. *European Journal of Information Systems, 6*(2), 107-121.

Reich, B. H. and Benbasat, I. (2000). Factors that influence the social dimension of alignment between business and information technology objectives. *MIS Quarterly, 24*(1), 81-113.

Reyes, P. M. and Jaska, P. (2007). Is RFID right for your organization or application?. *Management Research News, 30*(8), 570-580.

Roberts, H. J. and Barrar, P. R. N. (1992). MRPII implementation: key factors for success. *Computer Integrated Manufacturing Systems, 5*(1), 31-38.

Rosario, J. G. (2000). On the leading edge: critical success factors in ERP implementation projects. *BusinessWorld,* May, 27-32

Saygin, C., Sarangapani, J. and Grasman, S. E. (2007). A systems approach to viable RFID implementation in the supply chain. In Jung, H., Chen, F. F. and Jeong, B.(Eds.) *Trends in Supply Chain Design and Management: Technologies and Methodologies*. Springer Science & Business Media. 3-27.

Sharma, A. (2007). Strategic, institutional and radicalness factors in the evaluation, adoption and early integration of RFID: an empirical investigation of current and future adopters. Ph. D. Dissertation, Emory University.

Shih, D.-H., Lin, C.-Y. and Lin, B. (2005). RFID tags: privacy and security aspects. *International Journal of Mobile Communications, 3*(3), 214-230.

Smart, L. J. (2004). Making sense of RFID. *Library Journal, 129*, 4-11.

So, S. C. and Liu, J. J. (2006). Securing RFID application: issues, methods and controls. *Telecommunication and Network Security, 15*(4), 43-50.

Soylemezoglu, A., Zawodniok, M. J., Cha, K., Hall, D., Birt, J. and Sarangapani, J. (2006). A testbed architecture for auto-ID technologies. *Assembly Automation, 26*(2), 127-136.

Sumner, M. (1999). Critical success factors in enterprise wide information management systems projects. In *Proceedings of the Americas Conference on Information Systems (AMCIS)*, 232-4.

TIBCO (2005). *Implementing RFID for Rapid ROI and Long-term Success*. Palo Alto, CA: TIBCO.

Ting, S. L., Kwok, S. K., Tsang, A. H. C. and Lee, W. B. (2011). Critical elements and lessons learnt from the implementation of an RFID-enabled healthcare management system in a medical organization. *Journal of Medical Systems, 35*(4), 657-669.

Ting, S. L., Tsang, A. H. and Tse, Y. K (2013). A framework for the implementation of RFID systems. *International Journal of Engineering Business Management, 5*, 9.

Ting, S. L., Wang, L. X. and Ip, W. H. (2012). A study on RFID adoption for vehicle tracking in container terminal. *Journal of Industrial Engineering and Management,5*(1), 22.

Vishvakarma, N. K. and Sharma, R. R. K. (2015a). RFID implementation critical success factors and RFID adoption strategies: a theoretical framework. *International Journal of Business Strategy,15*(1), 12-20.

Vishvakarma, N. K. and Sharma, R. R. K. (2015b). Relating organizational strategy, culture and control systems with implantation strategy of business process re-engineering(BPR). *Journal of Academy of Business and Economics, 15*(1), 18-29.

_____(2015c). Relating "Internet of Things" (IoT) architectures to strategy types of organizations: a conceptual framework. *Journal of International Management Studies, 15*(1), 25-32.

Wang, Y. M., Wang, Y. S. and Yang, Y. F. (2010). Understanding the determinants of RFID adoption in the manufacturing industry. *Technological Forecasting and Social Change,77*(5), 803-815.

Wee, S. (2000). Juggling toward ERP success: keep key success factors high. *ERP News*. Retrieved from http://www.erpnews.com/erpnews/erp904/02get.html

Weis, S. A., Sarma, S. E., Rivest, R. L. and Engels, D. W. (2004). Security and privacy aspects of low-cost radio frequency identification systems. In *Proceedings of Security in Pervasive Computing*, 201-212.

Wyld, D. C., Jones, M. A. and Totten, J. W. (2005). Where is my suitcase? RFID and airline customer service. *Marketing Intelligence & Planning, 23*(4), 382-394.

Yue, D., Wu, X. and Bai, J. (2008). RFID application framework for pharmaceutical supply chain. In *Service Operations and Logistics, and Informatics, 2008. IEEE/SOLI 2008. IEEE International Conference on* (Vol. 1, pp.1125-1130). IEEE..

Zack, M. H. (1999). Developing a knowledge strategy. *California Management Review, 41*(3), 125-145.

Zailani, S., Fernando, Y. and Zakaria, H. (2010). Determinants of RFID adoption among logistics service providers in Malaysia: a discriminant analysis. *International Journal of Logistics Systems and Management, 7*(3), 345-367.

Appendix 1: Mean of strategic variables for different strategy type

	STR1	STR2	STR3	STR4	STR5	STR6	STR7	STR8	STR9	STR10	STR11	STR12	STR13	STR14
I	3.29	4.41	3.97	4.68	4.65	4.27	4.54	4.32	3.78	3.94	3.92	4.57	4.36	4.14
P	3.71	3.71	3.22	4.76	4.57	3.70	4.34	4.41	3.35	3.00	2.63	3.93	4.22	4.34
D	3.27	3.19	3.08	3.85	3.62	2.92	3.85	3.65	2.62	2.96	2.69	3.00	2.69	3.23
T	3.41	3.83	3.45	4.50	4.36	3.71	4.29	4.19	3.32	3.32	3.11	3.92	3.89	3.99

Appendix 2: A Welch's ANOVA and Brown-Forsythe test

Robust Tests of Equality of Means								
		Statistic	df1	df2	Sig.	I	P	D
ICSF1	Welch	11.94	2	62.662	0	4.11	3.85	3.25
	Brown-Forsythe	11.674	2	95.761	0			
ICSF2	Welch	7.353	2	58.91	0.001	4.22	3.93	3.23
	Brown-Forsythe	7.819	2	79.065	0.001			
ICSF3	Welch	5.842	2	62.692	0.005	4	3.83	3.35
	Brown-Forsythe	5.639	2	95.758	0.005			
ICSF4	Welch	4.177	2	61.984	0.02	4.24	4.24	3.69
	Brown-Forsythe	4.202	2	93.179	0.018			
ICSF5	Welch	3.716	2	60.462	0.03	4.3	4.14	3.81
	Brown-Forsythe	3.663	2	87.177	0.03			
ICSF6	Welch	1.836	2	62.029	0.168	3.97	3.85	3.62
	Brown-Forsythe	1.687	2	93.423	0.191			
ICSF7	Welch	2.59	2	59.919	0.083	4.16	3.95	3.73
	Brown-Forsythe	2.376	2	85.487	0.099			
ICSF8	Welch	7.551	2	64.97	0.001	4.11	4.2	3.62
	Brown-Forsythe	6.171	2	99.007	0.003			
ICSF9	Welch	4.605	2	59.844	0.014	3.73	3.51	3.04
	Brown-Forsythe	4.756	2	83.8	0.011			
ICSF10	Welch	5.828	2	59.847	0.005	4.43	4.32	3.73
	Brown-Forsythe	6.404	2	83.666	0.003			
ICSF11	Welch	1.818	2	63.288	0.171	4.32	3.98	3.94
	Brown-Forsythe	1.803	2	97.326	0.17			
ICSF12	Welch	3.916	2	62.975	0.025	3.92	3.61	3.38
	Brown-Forsythe	3.653	2	96.41	0.03			

ICSF13	Welch	3.774	2	61.491	0.028	4.24	4.12	3.75
	Brown-Forsythe	3.497	2	91.823	0.034			
ICSF14	Welch	4.172	2	63.656	0.02	3.59	3.22	3.04
	Brown-Forsythe	4.219	2	98.205	0.017			
ICSF15	Welch	3.641	2	61.063	0.032	3.7	3.56	3.19
	Brown-Forsythe	3.797	2	90.368	0.026			
ICSF16	Welch	4.228	2	59.402	0.019	3.95	3.63	3.24
	Brown-Forsythe	4.189	2	81.646	0.019			
ICSF17	Welch	0.953	2	62.857	0.391	3.59	3.32	3.32
	Brown-Forsythe	0.959	2	96.156	0.387			
ICSF18	Welch	1.088	2	61.044	0.343	2.59	2.28	2.31
	Brown-Forsythe	1.155	2	91.213	0.32			
ICSF19	Welch	1.863	2	59.916	0.164	3.65	3.63	3.29
	Brown-Forsythe	2.069	2	84.028	0.133			
ICSF20	Welch	0.707	2	62.442	0.497	3.86	3.68	3.62
	Brown-Forsythe	0.819	2	92.963	0.444			
ICSF21	Welch	0.726	2	66.177	0.487	3.76	3.61	3.52
	Brown-Forsythe	0.698	2	96.117	0.5			

Appendix 3: Post-Hoc Analysis results for the constructs on the organization structure dimension.

	Dependent Variable	(I) Cluster Name	(J) Cluster Name	Mean Difference (I-J)	Std. Error	Sig.
Strategic Dimensions	ICSF1	Innovator	Prospector	.254	.159	.281
			Defender	.849*	.179	.000
		Prospector	Defender	.595*	.175	.004
	ICSF2	Innovator	Prospector	.289	.218	.419
			Defender	.985*	.246	.001
		Prospector	Defender	.696*	.241	.018
	ICSF3	Innovator	Prospector	.171	.177	.630
			Defender	.654*	.200	.006
		Prospector	Defender	.483	.196	.052
	ICSF4	Innovator	Prospector	-.002	.191	1.000
			Defender	.551*	.216	.043
		Prospector	Defender	.553*	.212	.037

Managerial Dimensions	ICSF5	Innovator	Prospector	.158	.160	.616
			Defender	.490*	.181	.029
		Prospector	Defender	.331	.177	.180
	ICSF6	Innovator	Prospector	.119	.175	.793
			Defender	.358	.198	.200
		Prospector	Defender	.238	.194	.472
	ICSF7	Innovator	Prospector	.215	.175	.475
			Defender	.431	.198	.098
		Prospector	Defender	.217	.194	.538
	ICSF8	Innovator	Prospector	-.087	.160	.862
			Defender	.493*	.180	.027
		Prospector	Defender	.580*	.177	.006
	ICSF9	Innovator	Prospector	.218	.197	.547
			Defender	.691*	.223	.010
		Prospector	Defender	.474	.218	.100
Technical Dimensions	ICSF10	Innovator	Prospector	.115	.179	.813
			Defender	.702*	.202	.003
		Prospector	Defender	.586*	.198	.015
	ICSF11	Innovator	Prospector	.349	.214	.271
			Defender	.381	.242	.294
		Prospector	Defender	.032	.237	.991
	ICSF12	Innovator	Prospector	.309	.181	.239
			Defender	.534*	.205	.037
		Prospector	Defender	.225	.201	.535
	ICSF13	Innovator	Prospector	.121	.170	.776
			Defender	.492*	.192	.042
		Prospector	Defender	.371	.188	.149
Operational Dimensions	ICSF14	Innovator	Prospector	.375	.182	.124
			Defender	.556*	.205	.029
		Prospector	Defender	.181	.201	.668
	ICSF15	Innovator	Prospector	.142	.166	.694
			Defender	.510*	.187	.027
		Prospector	Defender	.369	.183	.137
	ICSF16	Innovator	Prospector	.312	.213	.347
			Defender	.708*	.241	.016

		Prospector	Defender	.397	.236	.248
	ICSF17	Innovator	Prospector	.278	.223	.463
			Defender	.273	.251	.557
		Prospector	Defender	-.005	.246	1.000
	ICSF18	Innovator	Prospector	.313	.220	.369
			Defender	.287	.249	.516
		Prospector	Defender	-.026	.244	.994
	ICSF19	Innovator	Prospector	.015	.170	.996
			Defender	.359	.192	.181
		Prospector	Defender	.344	.188	.194
	ICSF20	Innovator	Prospector	.173	.182	.635
			Defender	.241	.205	.503
		Prospector	Defender	.068	.201	.945
	ICSF21	Innovator	Prospector	.142	.193	.763
			Defender	.242	.218	.543
		Prospector	Defender	.099	.214	.898
		* The mean difference is significant at the 0.05 level.				