Relationship between organizational factors and RFID adoption in Gas Industry central warehouses

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Abstract

This paper examined organizational factors that influence adoption of Radio Frequency Identification technology in IRAN Gas company central warehouses. RFID has the distinct advantage of collecting data at some distance from the actual product, with no direct line of sight. Such a data automation system for real-time tracking, safety monitoring and overall warehouse operation leads to real-time visibility and tracking of assets and inventory that is necessary for a warehouse. In this paper we examined organizational factors (Structural: Size and resources and Centralization and Cultural: Innovativeness) associated with the adoption of RFID in gas company warehouses.Using a survey questionnaire, data was collected from all 30 Gas company central warehouses employees .We found that organizational size do not show any relationship With RFID adoption and Centralization finantional recourses and Innovativeness are positively and significantly associated with the adoption of RFID . The implications of these and other findings are discussed.

Keywords: Organizational factors, Warehouse, RFID

1. Introduction

Using radio waves, RFID technology can automatically identify objects. With RFID tags, objects can be tracked automatically by radio readers providing greater inventory visibility and improved business and control processes [1] [2].

RFID's main ability is to capture more data automatically without human intervention, in almost real time, so it can provide a more dynamic control environment for an organization.

While RFID has been discussed in the literature as a technology that can provide several advantages: enhanced warehouse operations efficiency , better of inventory control and monitoring [3], [4], reduced labor costs [5] , inventory obsolescence material handling costs reduction [3] , quality control [6] , reductions in out-of-stock and delivery safety stock [5] uncertainty of product availability reduction [7] , to its adopters ,the RFID adoption rate is not growing as fast as expected [8] .This suggests more effort is necessary to understand the process of adoption of the technology and to identify factors affecting the RFID adoption decision [9].

Companies that used more warehousing information technologies had better performance in the areas of quality and productivity improvements and cycle time reductions than the low user group[10].

Past researches show that, organizational factors often have significant influence on the process of technology adoption [11],[12],[13],[14],[15],[16].

In this paper we study the relationships between organizational factors (size, financial resources and centralization) as structural characteristic and (organizational culture) and RFID adoption in the Gas company warehouses.

The rest of the paper is organized as follows: Section 2 introduces RFID, and the literature review of RFID adoption studies .In Section3, we present the research model and hypotheses. This is followed

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by the description of the research methods used in data collection. Section 5 the findings will be presented.

2. Literature review

2.1. RFID:

RFID is a common term for technologies and systems that use radio waves to automatically identify people or objects.

RFID typically consists of three basic components: tags (transponders), readers, and middleware [7],[17].

A tag usually containing a microchip and an antenna that are attached to or embedded in an object [18] The microchip contains identification information and may have other application data (e.g. price, cost, location, and manufacture date, etc.) [19]

A reader (also known as an interrogator) sends out a radio signal and abets the tag to broadcast the data contained on its chip. The reader then change the radio waves returned from the tag into digital data and forward them to a computer system [20],[21].

2.2 Reviews of related studies:

Earlier studies on RFID adoption have focused on a variety of factors associated in adoption process: Reference [22] study the cost factor . References [23] looked at privacy and public policy with regards to RFID.

Reference [24] investigated benefits, costs, standards, and environment; four main factors associated RFID adoption.

Reference [25] identified benefits, costs, standards, privacy, and the power of retailers as factors.

In their study to identify the factors may influence RFID adoption in South African retail organizations, Reference [26] found that the RFID adoption intention was explained by technological factors (i.e., relative advantage ,compatibility complexity ,and cost) ,organizational factors (i.e., top management attitude ,information technology expertise, organization size organizational readiness), and external factors(i.e., competitive pressure, external support, and existence of change agents.)

Reviewed prior studies, Reference [27] categorized 25 adoption factors in the technology, organizational, and environment groups. They concluded five most important factors affecting RFID adoption and diffusion in the automotive industry: compatibility, costs, complexity, performance, and top management support. Most of these factors belong to the technology characteristics group.

Based on previous literature, there are variety of factors related to technology adoption that we can categorize them into four groups: environmental, technological, inter-organizational and organizational. Each group contains different variables in different studies.

In this research we analyze organizational factors comprising four variables discussed below:

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3. Research model and hypotheses:

3.1. Organizational size:

Organizational size has an important impact on the adoption of technological adoption [28], [29], [30], [31].

In some studies a positive relationship between firm size and adoption has been concluded [31], [32], [33], [34], [35]. Because of the cost of RFID tags and other related equipments ,only large companies have the financial resources to invest in RFID [36]. In addition, greater formalization [37], greater task specialization [38], and more complex forms of communications [39] are characteristics; help larger organization adopt new technologies.

Although counterarguments exist that smaller organizations have more flexibility due to fewer levels of bureaucracy, thus increasing their ability to adopt technology more quickly [40] , few empirical results have shown that smaller firms tend to be more innovative [41].

In this study, organizational size is defined as work force size (number of employees) [28] ,[42] and the number of items categorized in each warehouse.

We expect that organization size will have a positive influence on RFID adoption:

H1: There is a positive relationship between size of organization in terms of number of employees and number of items in each warehouse and RFID adoption.

3.2. Financial resources:

Financial resources of an organization are another predictors of innovation [43] ,[44].

Financial resources facilitate the adoption of technology and provide organizations with the capacity to accept risk inherent in investing in new technology [45].

The measure we used in this study is the budget allocated for new technology acquisition.

H2: There is a positive relationship between the amount of financial resources and RFID adoption.

3.3 Centralization:

Centralization has been defined as the degree that power is distributed among all the positions within an organization [43] , [46].

It consists of two dimensions :[46] , [43].

1)Participation in decision making which shows how much members of the organization, participate in organizational decisions [43] , and 2) Authority hierarchy which refers to" the amount of autonomy employees have in relation to deferring to superiors when making decisions about day to day tasks" [47].

Reference [48] suggested that centralization is negatively associated with organizational adoption. This is empirically supported by prior studies [49] , [50] , [28] , [51] , [52] , [45].

A reason for this relationship is that in a centralized structure, top management is not aware of operational- level problems and con not suggests relevant innovations to meet their needs. Another reason is that the more power is concentrated at the top by a few strong leaders, the more new ideas and innovations are restricted [53].

However, some researchers found a positive relationship between centralization and technology adoption [54].They found that centralized decision making would facilitate faster and more efficient adoption because lower level management resistance would not impede top management support. Evidence has also supported that decentralized organizations are more likely to adopt technological innovations.

In this study we ask the respondents to state how much they are interfered to every day decision making and how much their boss intervene to their tasks.

Based on these arguments and previous findings, the following hypothesis is proposed in this research:

H3: There is a negative relationship between the degree of centralization of the organization and adoption of RFID.

3.4. Organizational Culture:

There are over 54 definitions of organizational culture in literature [55].“A system of shared norms and behaviors that are learned by members of the organization and shape their way of doing” (p. 313). Reference [56] defined organizational culture as “a set of emotional conditions, views of the past and standards of behavior belonging collectively to an organization (p. 43).

Organizational culture can explain why some organizations adopt new technology quicker than their competitors [57].

We ask the respondents about management’s attitude towards innovations and new ideas and also respondent willingness to search and seek innovations [44].

H4: There is a positive relationship between innovative organizational culture and adoption of RFID.

4. Research design:

The propositions in last Section formed the basis for carrying out the investigation. This study is an applicable-descriptive research. We use questionnaire which developed by adopting measures from several sources [44] , [43] , [58] ,[59] , [28].

A5-point Likert scale was used for each item, anchored by Strongly Agree at one end to Strongly Disagree at the other. The target population for this study was Gas company central warehouses employees in all the states in IRAN. Due to resource constraints, we chose a sample, using random sampling and mail the questioners to 145 respondents.120 questioner were returned and used for our analysis.

4.1. Reliability:

Cronbach's Coefficient Alpha in a small sample size was 0/93 which means the questioner has a high degree of reliability.

5. Data analysis:

Using SPSS software, we specify Correlation Coefficient between RFID Adoption and other factors (organizational size, centralization, financial resources, and innovative culture) as follow:

Table 4-1: results of analyzed data:

	sample size	Correlation Coefficient	Statistic	P-value	α	result
RFID Adoption-organizational size	120	-0.069	0.75	0.452	0.05	there is no relation between RFID Adoption-organizational size
RFID Adoption - centralization	120	0.461	5.64	0/000	0.05	there is a positive relationship between RFID Adoption-organizational size
RFID Adoption – financial resources	120	0.208	2.31	0.023	0.05	there is a positive relationship between RFID Adoption-organizational size
RFID Adoption – innovative culture	120	0.599	8.13	0.000	0.05	there is a positive relationship between RFID Adoption-organizational size

5. Conclusion

As mentioned in the table, the results are as followed:

Organizational size does not have impact on RFID adoption. All other structural variables (finantional resources, centralization) and also innovative culture of the organization have a positive relationship with RFID adoption. So the propositions number 2 and 4 (financial resources and innovative culture) are proved and the other 2 hypothesis (size and centralization) rejected.

These findings can guide the decision makers. It shows that consideration of innovativeness and allocating financial recourses to new technology can speed up the rate of adoption. Because Gas Company is governmental in Iran, centralization is unavoidable. In such situations, decision makers should concern financial resources and innovative culture more.

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