

An exploration study to detect important factors influencing on development of RFID in after sales services

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ABSTRACT

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Radio-frequency identification (RFID) is the wireless use of electromagnetic fields to transfer necessary information, for the purposes of automatically identifying and tracking tags attached to various objects. This paper presents a survey to study the role of different factors influencing on RFID implementation in after sales services in auto industry. The study designs a questionnaire and distributes it among 20 managers who work for after sales services in auto industry located in city of Tehran, Iran. Cronbach alpha has been calculated as 0.74, which is well above the minimum acceptable level. Using the existing literature as well as a survey with experts, the study has detected four important factors including management, technical, economic and environmental factors. We also weight all factors and sub-factors using Shannon entropy method.

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1. Introduction

Radio-frequency identification (RFID) is the wireless use of electromagnetic fields to transfer necessary information, for the purposes of automatically identifying and tracking tags attached to various objects. Konsynski and Smith (2003) summarized the ways in which firms and academics were thinking about RFID technologies and stimulated strategic thinking about their possible implications. There are literally various studies on the effects of RFID implementation for business development. Fosso Wamba et al. (2008) presented application of RFID for business to business development in retail industry. They concluded that RFID implementation could improve supply chain management. Attaran (2007) introduced RFID as an enabler of supply chain management. Janz et al. (2005) discussed different successful implementation of RFID for health care industry. Li et al. (2005) discussed different applications of mobile RFID for health care purposes.

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2. The proposed study

This paper presents a survey to study the role of different factors influencing on RFID implementation in after sales services. The study designs a questionnaire and distributes it among 20 managers who work for after sales services in auto industry located in city of Tehran, Iran.

2.1 Shannon entropy and objective weights

Shannon (2001) proposed the entropy concept, which is a measure of uncertainty in information formulated in terms of probability theory. The entropy concept is well suited for measuring the relative contrast intensities of criteria to demonstrate the average intrinsic information transmitted to the decision maker (Zeleny, 1982).

2.2 Entropy weighting method

The entropy weighting method (Zeleny, 1982) can effectively measure the average essence of data quantity, and the larger the entropy value, the lower the information express quantity (Zeleny, 1982, Feng & Chen, 1992). The steps of the algorithm can be summarized as follows:

Step 1. Let x_{ij} , $i = 1, 2, \dots, m$; $j = 1, 2, \dots, n$, be the superiority rating of the i^{th} alternative under j^{th} criterion above the alternative level. Then we can define

$$X = [x_{ij}]_{m \times n} \quad i = 1, \dots, m, j = 1, \dots, n \quad (1)$$

and we call X as decision matrix.

Step 2. Form normal decision matrix $R = [r_{ij}]_{m \times n}$, where

$$\forall i, j, r_{ij} = \frac{x_{ij}}{\sum_{i=1}^m x_{ij}} \quad (2)$$

Step 3. Calculation of concentration index for per criteria's data as follows,

$$E_j = -\frac{1}{\ln(m)} \sum_{i=1}^m r_{ij} \ln(r_{ij}), j = 1, \dots, n \quad (3)$$

In Eq. (3), lower value for E_j implies less concentration of data C_j criteria and more dispersal of its data.

Step 4. Determination the amount of per criteria's Dispersal

The amount of per criteria's Dispersal calculated as follows,

$$d_j = 1 - E_j \quad j = 1, \dots, n \quad (4)$$

Step 5. Calculation the weight of criteria:

The weights of criteria calculated are as follows:

$$W_j = \frac{d_j}{\sum_{j=1}^n d_j} \quad j = 1, \dots, n \quad (5)$$

Therefore, we have, $0 \leq w_j \leq 1, j = 1, \dots, n$.

3. The results

The proposed study of this paper uses the existing literature as well as brain storming with some experts has derived some important factors summarized in Table 1 as follows,

Table 1
The summary of factors on the effect of RFID for business development in auto industry

Item	Attribute	Sub-factor	DM/Literature
1	Management	The relationship of executive managers with top management	Decision maker
2		Reasonable expectation from RFID	Decision maker
3		Coordination of team with levels of management team	Zeleny, 1982
4		Credibility of executable team	Decision maker
5		The rate involvement of all employees	Decision maker
6		Management of customers' information	Gibbs & Kraemer, 2004
7		Management interest in RFID development	Decision maker
8	Economic	Financial affordability for paying RFID investment	Gibbs & Kraemer, 2004
9		Financial support on behalf of managing director	Gibbs & Kraemer, 2004
10		Necessary budget allocation	Decision maker
11		Cost reduction in operations	Decision maker
12		Feasibility study for RFID implementation	Ozturk & Palakurthi, 2010
13	Technical	Existence of necessary technical knowledge	Shin – Yuan Hung , 2010
14		Business knowledge	Yu Min Wang , 2010
15		Technical skills	Decision maker
16		Technical supervision	Brown & Russell, 2007
17		Using technical supportive experts on RFID	Decision maker
18		Having appropriate technical knowledge	Decision maker
19		Compatibility of the system with infrastructure	Shih et al., 2008
20		Availability of supportive teams	Decision maker
21	Maturity of RFID technique in after sales services	Brown & Russell, 2007	
22	Environmental	Organizational culture	Decision maker
23		Existing infrastructures	Zhang et al., 2007
24		Coordination of RFID with organizational strategy	Shih et al., 2008
25		Compatibility of RFID system with previous technology	Decision maker
26		Maturity of organization on coping with RFID	Decision maker
27		Risk identification and assessment	Decision maker
28		Success in previous projects	Decision maker
29		Rules, regulations and standards	Gibbs & Kraemer, 2004; Zhang et al ,2007

As we can observe from the results of Table 1, there are 29 items associated with the proposed study of this paper. We have further discussed the items and managed to reduce the number of items, accordingly. In addition, Table 2 shows details of our rankings for sub-factors.

Table 2
The summary of ranking for sub-factors

Rank	Sub-criteria	Criteria	W_j	E_j	D_j
1	Coordination of RFID with organizational strategy	Environmental	0.0508	-2.61716	3.617158
2	Budget	Economic	0.0507	-2.60785	3.607848
	Willing for execution	Management			
3	Organizational culture	Environmental	0.0506	-2.6046	3.604602
4	Technological maturity	Technical	0.0505	-2.59845	3.598451
	Financial support	Economic			
5	Technological agreement	Environmental	0.0502	-2.58189	3.581892
	Financial affordability	Economic			
6	Risk assessment	Environmental	0.05	-2.57111	3.571114
	Compatibility with standards	Environmental			
	Management relationships	Management			
7	Guarantee	Technical	0.0499	-2.56745	3.567446
	Economic fusibility	Economic			
8	Expert consultant	Technical	0.0498	-2.56502	3.565019
	Economic value	Economic			
9	Coordination	Management	0.0495	-2.54996	3.549959
10	Involvement	Management	0.0494	-2.54262	3.542616
11	Coordination	Technical	0.0492	-2.52993	3.529932
	Maintenance knowledge	Technical			
12	Reputation	Management	0.0491	-2.52724	3.527242

4. Discussion and conclusion

The implementation of Entropy weighting method for four major attributes of management, economic, technical and environmental yields 0.2487, 0.2511, 0.2486 and 0.2516, respectively. As we can observe from the results of Table 2, Coordination of RFID with organizational strategy as an environmental factor is number one priority followed by the availability of necessary budget as well as management team's willingness on execution of such project. Organizational culture is the third important factor, which plays essential role for the development of RFID in after sales services. In addition, technological maturity and financial affordability are other important factors, which could help for the RFID development. In terms of environmental factors, having a good risk assessment and compatibility with existing standards are another important factors for the proposed study of this paper while building a good relationship with customers is another important management factor. The results of our survey are somewhat consistent with the results of Ozturk and Palakurthi (2010), Brown and Russell (2007) and Shih et al. (2008).

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