A Heuristic Approach to the Adoption and Implementation of Activity Based Costing Information Systems

Behrouz Zarei[1], Ramin Sepehri Rad[2], Fereshteh Ghapanchi[3], Amir Hossein Ghapanchi[4]
[1] Entrepreneurship Faculty, Tehran University, Tehran, Iran
[2]Faculty of Management & Economics, Tarbiat Modares University, Tehran, Iran
[3]School of Accounting, Azad University, Mobarakeh, Iran
[4]School of ICT, Griffith University, Queensland, Australia
r.sepehrirad@modares.ac.ir

Abstract: For successful implementation of Activity Based Costing (ABC) information systems, like any other Accounting Information System (AIS), there are several key points to be considered. Several researchers have studied factors influencing success in various stages of Activity Based Costing Information Systems (ABCIS) development. However, a gap in the literature concerns a lack of research for the development of a taxonomy of heuristic principles for better implementation and successful utilization of ABCISs. This paper offers a detailed analysis of ABCISs by: (i) reviewing literature studies in order to build a more exhaustive list of success factors of ABCIS. Twenty primary and twenty-two secondary success factors are identified; and (ii) running four rounds of grounded action research through interviews in a case study of a bank. Twenty-seven heuristics for the successful implementation of ABCIS are derived. Finally, the paper demonstrates the extent to which each heuristic may address each main success factor. Implications of the results for researchers and practitioners are subsequently proposed.

Keywords*:* Activity-based Costing (ABC), Activity-based Costing Information Systems (ABCIS), Accounting Information Systems (AIS), Heuristics

1 Introduction

An Accounting Information System (AIS) is a structure that a business uses to collect, store, manage, process, retrieve and report its financial data. Accounting Information Systems are generally composed of six major parts: people who are the users of the system, procedures which collect, manage and store required data, software that process the data, IT infrastructure including devices and systems which allow AIS operation and internal control which guarantee the data and information reliability (Krishman, Peters, Padman, & Kaplan, 2005) and security (Romney & Steinbart, 2009). Hall (1998) introduces AIS as a subsystem of a management information system. AISs play an important role in an organization performance (Ismail & King, 2005), especially through integrating into other information systems such as Enterprise Resource Planning (Rom & Rohde, 2007) or Just In Time systems (Nicolaou, 2002). One of the very important AISs in organizations today is Activity Based Costing Information System (ABCIS) (Chou & Tseng, 2011; Grahovac & Devedzic, 2010; Granlund, 2011; Hyvönen, Järvinen, & Pellinen, 2008; Kima & Hanb, 2003).

Mounting evidence demonstrates that a large number of the firms are encountering problems in the implementation of Activity Based Costing (ABC), and there are extreme cases of failure which have resulted in abandoning the system (Fei & Isa, 2010). Studies on ABC literature in the late 20th century have indicated a lack in paying attention to the key factors that contribute to successful implementation of ABCIS. This also includes a shortage in practical implementation frameworks that takes into account the key success factors of ABCISs (Gunasekaran & Sarhadi, 1998). The problem remains in recent years, implicated by discussions about a lack of adequate role model as a part of "ABC paradox" (Brown, Booth, & Giacobbe, 2004; Gosselin, 2006; J. Innes & Mitchell, 1995)). Although numerous studies are dedicated to the examination of the factors that influence the adoption of ABC (S. W. Anderson, Hesfordb, & Young, 2002; S. W. Anderson & Young, 1999; S. R. Anderson, 1995; Brown et al., 2004; Fei & Isa, 2010; Gosselin, 1997; Krumwiede, 1998), there is still a lack of clear guidelines for successful implementation of the system especially in developing - considering all infrastructural differences and lack of successful implementation experiences (Liua & Panb, 2007; Ríos-Manríquez, Muñoz Colomina, & Rodríguez-Vilariño Pastor, 2014).

Although numerous studies have investigated the factors influencing the success of various stages of ABCIS implementation (e.g., Anderson (2002), Anderson and Young (1999)), there is a shortage of research that puts their findings together and provide a more comprehensive list of ABCIS success factors. More importantly, the

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literature suffers from a lack of research that provides taxonomy of heuristics for better implementation of ABCISs. The objective of this study is to provide a taxonomy of heuristics which correspond with crucial factors influencing successful adoption, implementation, and deployment of ABCISs. These stages are based on ABCIS implementation stages proposed by Anderson (1995), in addition to the deployment stage. In order to reach the above-mentioned objective, this paper:

- Presents a content analysis on the selected studies in the literature to build a more exhaustive list of the ABCIS's success factors in accordance with development stages (research question 1).
- Reports on the outcome of grounded action research the outcomes of which derives effective heuristics complying with above-mentioned factors in order to successful implementation of ABCIS (research question 2).

The remainder of the paper is organized as follows. The literature review section provides some background information, discusses various ABC development stages, and reviews prior works on the success factors and heuristics contributing to the success of ABCIS implementation. The methodology section describes the research methods that have been employed in this research. The findings section presents the results of this paper, including our taxonomy of ABCIS success factors as well as 27 heuristics principles contributing to the success of ABCIS implementation (extracted through a grounded action research in a case of a bank). The discussions section discusses the results, followed by a conclusion section.

2 Literature Review

Gosselin (2006) divided the literature – concerning ABC implementation- into three categories: assessment of the impact of ABC on performance; factors that influence the decision to adopt and implement ABC; and ABC success factors (Gosselin, 2006). Given the research objectives of the study, this paper is positioned in the second group.

2.1 ABC development stages

It has been suggested that ABC can be considered as an administrative innovation, since it leads to new administrative procedures, policies, and organizational structures; whereas, technical innovations are associated with changes in products and services (Clark, Hall, & Stevens, 1999). This issue has persuaded scholars to consider ABC implementation process as an information system. Anderson (1995) used a six-stage model according to Kwon and Zmud (1987) from IS literature for the first time in an ABC case. The sequential stages are initiation, adoption, adaptation, acceptance, routinization and infusion. A critique to the Anderson's (1995) model is that it only covers stages from initiation to implementation.

Gosselin (1997) also provides an ABC implementation process with a four staged model comprising adoption, preparation, implementation, and routinization, where adoption is the stage of recognizing the change, and making the decision regarding acceptance or rejection. Krumweide (1998) represents the ABC development process with phases of initiation, adoption, analysis, acceptation, routinization, and integration. Brown et al. (2004) propose a 10-step model which is composed of 2 major stages: adoption (4 stages) and implementation (6 stages).

2.2 Factors influencing ABC implementation

Several researchers have investigated the factors impacting ABCs. For example, Fei and Isa (2010), Innes et al. (2000), and Yanren (2008) investigated factors affecting outcomes in the adoption stage of ABC. Moreover, Shields and McEwen (1996) and Gosselin (1997) have, focused on the success factors of the Furthermore, ABC implementation stage. Anderson (2002), Shields (1995), McGowan and Klammer (1997), Krumweide (1998), and Anderson and Young (1999) examined factors influencing ABC success. Anderson (1995) has classified these factors into five categories including external environment, individual characteristics, organizational factors, technological factors, and task characteristics.

Past studies on influencing variables is concentrated mainly on behavioral, organizational, and technical aspects; while studies on the role of organizational culture in ABC success has been rare (Fei and Isa (2010)). Fei and Isa (2010) further develop a four class framework of factors influencing ABC success: behavioral and organizational, technical, organizational structure and organizational culture. Moreover, Brown et al. (2004)

proposed adoption categories as follow: individual; organizational; technological; task related and environment.
There is another direction in studies representing heuristic principles and instructions applied for overcoming contextual situations in different implementation experiences (Everaert , Bruggeman, & De Creus, 2008; Glick, Blackmore, & Zelman4, 2000; Homburg, 2005; Liua & Panb, 2007; Norris, 2002; Partovi, 1991; Spedding & Sun, 1999; Von Beck & Nowak, 2000). However, a limited number of studies have presented a systematic way which organize these outspread findings and address their linkage with the contextual factors. Finally, although there are several classifications in the literature with extended number of stages, in some cases leading to a degree of overlap, there is a missing set of actions necessary for an effective utilization. Hence, this paper proposes a new step named "deployment" to Brown's two-step framework (Brown et al., 2004). Furthermore, the classification on factors resulted from content analysis has been mainly based on Brown et al. (2004) and Fei and Isa (2010). This paper explores a contingency heuristic approach using grounded action research in order to improve the outcomes of adopting ABC.

2.3 Heuristics contributing to the success of ABC development

As discussed before, ABC has a heuristic nature based on the development of an innovation logic (Clark et al., 1999; Gosselin, 2006; Homburg, 2004). In order to propose a framework to successful ABC development, a heuristic model methodology is used as Winter (1998, pp.172-3) states:

> *"A heuristic frame corresponds to a degree of problem definition that occupies an intermediate position on the continuum between a long and indiscriminate list of things that might matter at one end and a fully formulated control theoretic model of the problem at the other. Within a heuristic frame, there is room for a wide range of more specific formulations of the problem but there is also enough structure provided by the frame itself to guide and focus discussion. On the other hand, a rich variety of different heuristic frames may represent plausible approaches to a given problem."*

In the literature, there are several studies representing guidelines and heuristics for the successful implementation of ABCIS derived from different case studies (Abdallah & Li, 2008; Fei & Isa, 2010). As an example, a cross-case analysis on two UK banks identified ABC as a learning process which should help understanding of the business mechanism rather than concentrating on numerical results that do not present the sequence of causes (Norris, 2002). Staff involvement, clarity of objectives, and unity of the implementation involved in different stages of application are some other principals implied in findings of that research. Some other findings are concerned with the ***contingency*** of weather to utilize a particular program of ABC with a corresponding outcome (in terms of detail level, accuracy and etc.) or adopting a whole different solution such as Homburg (2005). Witherite and Kim (2006) recommend companies, especially financials to evaluate "significant indirect costs; complex goods and services; losses on high-volume products and profits on low-volume products; disagreement by managers over cost allocations; bid results; and age of costing system" to analyse the contingency.

Also there are separate explorations which deepen into a single technique or aspect of ABC application, analysing the results through one or more practices. ***Modelling challenges*** is a vogue subject of attention among this group of studies. Cost driver selection is one of the most important discussed among them, such as a contribution to traditional ABC named Time Driven ABC (TDABC),(Gervais, Levant, & Ducrocq, 2010). Other explorations on modelling challenges include techniques attempting to take advantage of cost driver selection opportunity in order to maximize the accuracy (Esmalifalak, Albin, & Behzadpoor, 2015; Homburg, 2004; Partovi, 1991). First brought into the literature by Spedding and Sun (1999), another advance on ABC system is the adoption of discrete event simulation. They see it proper to provide the flexibility necessary for ABC in order to get over alters in entity combinations.

As mentioned, there is lack of research on systematic approaches for utilizing heuristics for successful implementation of ABCIS. Hence this paper will draw a contingent classified framework consist of ABC development stages and related influencing factors and finally suggest heuristics to eliminate negative effect of these factors.

3 Methodology

In order to explore heuristics of development of ABCIS and to investigate their effectiveness, this paper employed two different methodologies: First, content analysis of selected papers from has been used to identify and classify factors influencing the success in each stage of ABC development as a criterion of effectiveness measurement (section 3.1). Second, grounded action research is adopted to derive heuristics for a successful implementation of ABC (section 3.2).

3.1 Content analysis

Content analysis is a research tool that has been actively used in many fields of study for more than 50 years (Wagner, Chung, & Najdawi, 2003). This method has been developed to analyse large text-based data sets such as, essays, books and papers, to identify the frequency of keywords and phrases and to explore patterns within the data (J. L. Anderson, Jolly, & Fairhurst, 2007). In this study, the analysis was conducted through the coding procedure proposed in Zaheer and Soda (2009). There are some papers in ABC literature that have employed content analysis in their works: Anderson and Young (1999), for example, used this method to analyse interview transcripts in order to examine the "impact of contextual and process factors on the evaluation of activity-based costing systems". Additionally, Sharma and Ratnatunga (1997) analysed the content of several books to identify the role of ABC in cost accounting systems.

This study searched various keywords (including Activity Based Costing Information System, success factor, performance, positive outcomes, successful, determinants, success drivers, antecedents, etc.) on various academic databases such as, ScienceDirect, GoogleScholar and Scopus. This search retrieved several papers focusing on success factors of ABCIS implementation and related stages. Next, the authors went through each paper and extracted the stages and success factors proposed by that study. The authors then synthesized the results and made a framework (see section 4.1 and 4.2). Nvivo was used for the qualitative data analysis.

3.2 Action research

Action research has been developed to correct deficiencies of positivist science in generating knowledge for use in solving problems with which organizations face (Susman & Evered, 1978). The term "action research" introduced by Kurt Lewin (1946), but firstly used by Collier (1945), generates theories with changing the social system through the researcher acting on or in the social system. Baskerville and Pries-Heje (1999) have emphasized on the importance of this method in IS development studies. Action research which is highly collaborative (involving both practitioners and organization members), helps organizations identify problems, discover their causes, and implement appropriate changes (Zarei & Ghapanchi, 2008). Action research can also be viewed as a cyclical process with five phases: diagnosing, action planning, action taking, evaluating, and specifying learning (Susman & Evered, 1978).

3.3 Grounded theory

Grounded theory discovery process are explained in Glaser and Strauss (1967) and the more recent version in Strauss and Corbin (1990). Strauss and Corbin have stated that grounded theory needs three types of coding: **Open coding** results in naming and categorizing the main idea found in data. **Axial coding** seeks to connect categorized data identified in open coding for deeper understandings. **Selective coding** develops the theory that best fits the phenomenon by determining a story that reveals the central phenomenon under study (named "story line"). There is no necessity of conducting these procedures entirely as a sequence, each could overlap the others and iterate throughout the research project.

3.4 Grounded action research

Checkland (1981) argued that action research cannot be carried out wholly planned. Units of analysis in Grounded theory are suitable for holding data collection, analysis and theory formulation in a reciprocal relationship. This relationship harmonizes well with the action research cycle (Baskerville & Pries-Heje, 1999). Refinement of action research which involves integrating grounded theory is in two stages: First, grounded theory notation (e.g., memos and diagrams) is used to represent the theory data during the action research cycle. Second, grounded theory coding becomes the essence of the evaluating, learning, and diagnosis phases of action research (Baskerville & Pries-Heje, 1999).

Figure 1 shows the cyclical process of action research applied in this research. The context of our action research was the ABCIS in one of the major Iranian banks (banks are one of the most difficult organizations for ABC implementation (Carenys & Sales, 2008). There were two reasons for this. First, they have implications for effective use of ABC in cultural context of developing countries, which has been emphasized to be conducted as the missing part of the literature. Secondly they make the integration of guidelines more consistent to cultural factors, as a critical dimension of ABC success contingencies (Fei & Isa, 2010). Open coding, axial coding and selective coding were used to extract the heuristics for a successful implementation of ABCIS and the authors have employed action research cycle in order to examine in a real case and improve them through feedback (evaluating and specifying learning).

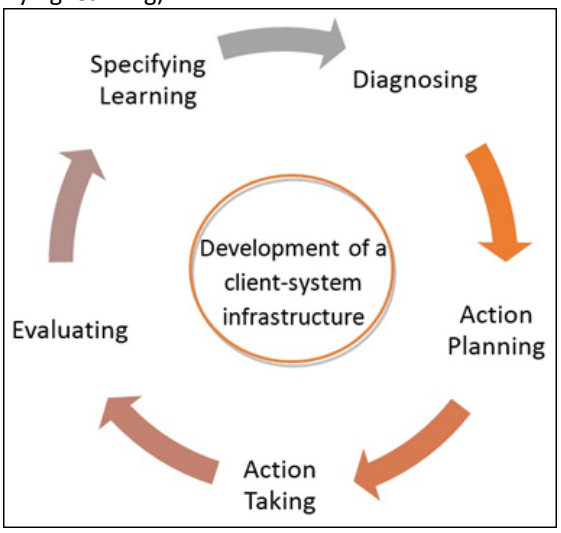

Figure 1: The cyclical process of action research (Susman & Evered, 1978)

3.5 Application of the methodology in the case

Our case study is an Iranian bank established in 1979 through the merger of 2 banks and 14 saving corporations. The main activities of this bank are related to housing and real estate. There are about 9100 staff, of which 85% are male and 15% female. This bank has 797 branches throughout the country, of which 110 branches are in the capital city. Branch rating has been considered since 1993, and has been done annually based on the performance of every branch (e.g., resources, allocations, services, etc.). So, having a detailed information of costs are vital and an ABCIS can be helpful on this issue.

To conduct the diagnosis phase, several meetings were held to identify and structure the problem (how one is able to develop an ABCIS successfully). The Interviewees were experienced accountants and financial managers (see Table 1). Based on the problem (i.e., difficulty in the successful implementation of ABCISs), preliminary data (memos) were collected and an initial round of axial and selective coding was conducted by researchers and then reviewed by experts (interviewees) in next round. Then, the story line about the problem situation was developed according to the coding.

In the next step organizational actions to improve the primary problem were identified by open coding and data (memos and transcripts) were modified by observations in the action taking step. After evaluating the results of actions by researchers and practitioners, Interviewees specified the learning by continued coding (axial, selective and even open) of both old and new data to determine if a new core category or story line would emerge from the process. Afterward, this adjusted story line became the foundation for a new diagnosis stage, leading to a further iteration of the action research cycle.

This process continued to achieve a satisfactory outcome. Thus, four rounds of action research were held in order to reach a consensus on categories and sub-categories of heuristics based on expert's opinions. Experts were satisfied with the categories and sub-categories.

4 Findings

This section presents the results of the study which answers the two primary research questions. Section 4.2 answers research question 1 by providing a taxonomy of the success factors of ABCIS implementation. Section 4.3 answers research question 2 by providing a list of heuristics contributing to the success of ABCIS implementation.

Table 1: information of interviews

Interviewee no.	Job title	Age	Years of experience in the field	Years of experience in this Bank	Number of meetings	Total minutes of interviews
1	Chief Financial Officer (CFO)	64	33	12	7	230
2	Financial Planner	55	30	8	7	270
3	Financial specialist	40	15	13	8	350
4	Financial specialist	45	18	3	8	340
5	Accountant	43	11	4	8	350
6	Accountant	51	27	16	8	325

4.1 ABC developing stages

In this paper, the authors divide the development process of ABC into three stages (Figure 2): adoption, implementation and deployment. *Adoption* is the decision making and planning process regarding quality (accuracy and detail level in cost objects as the outcomes of the system), time, and resource allocation for the project. Above these, it should be decided whether transforming into new system would be cost effective or not, and which set of application techniques and approaches would be most suited for the organizational context. The *implementation* stage includes the processes of team organizing, personnel acquainting and the implementing the new system. Because of overlapping limitations, and the necessity of extending the existing classifications, the authors have added a new phase called deployment to the stages proposed by Brown et al. (2004). *Deployment* phase is related to the process of training, routinization, using and managing the new system.

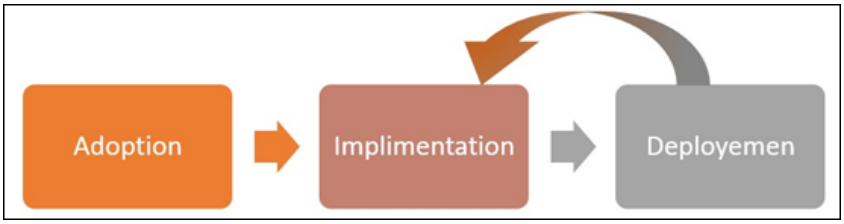

Figure 2: ABC Development stages

4.2 Success Factors of ABCIS Implementation

As a result of the content analysis of the relevant papers in the literature, the authors found 20 main success factors for ABCIS implementation. The authors then classified them into five categories: *behavioural*, *individual*, *contextual*, *technological/technical*, and *strategic*. Each of these factors is in relation with one or more application stage (i.e. adoption, implementation, deployment). The authors also found 23 factors that indirectly impact the success of ABCIS implementation (through impact a main factor), the authors called labelled them secondary factors. Sections 4.1.1 through 4.1.5 are dedicated to describe each category of success factors.

4.2.1 Behavioural Factors

Several studies have emphasized the key role of behavioural factors in ABC adoption success (Abdallah & Li, 2008; S. R. Anderson, 1995; Brown et al., 2004). Appropriate horizontal and vertical communications in the organization which require management commitment and staff motivation to participation, is one of the most vital factors within this category. There are many studies emphasizing the importance of top management support in developing an ABCIS (Liua & Panb, 2007; Norris, 2002). Management support is a generic factor that

has influenced all stages of ABCIS development and can be classified into behavioural, contextual and strategic categories. In this paper, management support is considered as a basic factor which encompasses all stages.

Another important behavioural factor which is emphasized by organizational behaviour experts is disposition to change; Anderson (1995) has mentioned such a factor and defined it as personnel's ability and desire to drive change. Disposition or resistance to change can be seemed as a result of another widely cited factor, "role involvement" (S. R. Anderson, 1995; Norris, 2002). Data distortion is another effective factor through which employees manipulate data deliberately in order to beak the project down. It could be seen as a result of resistance to change or stating dissatisfaction of organization.

There are some other items that indirectly influence the above mentioned factors. For example, "quality of informal networks" or "training" may affect both "disposition to change" and "role involvement". Some organizational structure (Gosselin, 1997; Krumwiede, 1998) factors like centralization, formalization and size also have an indirect relation with mentioned variables. It is also noticeable that some of these variables have been classified as primary factors in other categories.

There is also some research investigating the influence of ABCIS on the user's decision making process (O'Donnell & David, 2000). Finally, behavioural factors are mainly influencing implementation and deployment phases of developing an ABC system.

Table 2 introduces all secondary factors and their assigned numbers and description. As many researchers discussed the importance of distinguishing success factors in various stages of ABC implementation (S. W. Anderson & Young, 1999; Byrne, 2011; Krumwiede, 1998).

Table 2: Secondary factors

Secondary factors and assigned numbers					
1	Informal networks	**9**	Specialization	**17**	IT quality
2	Training	**10**	Autonomy	**18**	Uncertainty
3	Education	**11**	Responsibility	**19**	external communication
4	Job tenure	**12**	Complexity	**20**	Decreasing price
5	Centralization	**13**	Observability	**21**	Cosmopolitism
6	Formalization	**14**	Task uncertainty	**22**	Competition
7	Vertical differentiation	**15**	Consultants		
8	Size	**16**	Instrument		

Table 3 indicates all main factors in each category in addition to the ABC implementation stage in which the factor takes place. This table also represents the secondary variables affecting each category. Informal networks refer to human relations between employees. Training is about the level of training put into the various stages of ABC development. Centralization, formalization and vertical differentiation are structural characteristics of any organizations. Size of the corporate and task uncertainty can affect the complexity processes. Observability deals with the level of tangibility of processes of the organization. Due to the behavioural and social factors, the more specialized an organization becomes, the more difficult ABC implementation gets.

Autonomy and responsibility of personnel dealing with ABC development are prominent factors for ABC success. The status of IT infrastructures of the corporate and related instruments may also have strong effects of ABC development. Uncertainty in global markets and communicate with other competitors are some of important external factors.

4.2.2 Individual Factors

This paper assumes individual category is composed of factors in which employees play a significant role. For example conceptual skills are mainly affected by individuals themselves, while role involvement is basically influenced by organizational culture and even management decisions. Other factors in this category are creativity and data accuracy. As Norris (2002) mentioned, people need to find new ways to use information generated by ABC system. It is obvious that creativity will affect the deployment phase. While data distortion is

not occurring by employees, data accuracy refers to disability of people to dispose of correct data unintentionally. It is mostly due to employee misunderstanding of work process or data gathering tools. Consultants can decrease these errors by experience. Data accuracy can also be because of the weakness of the data gathering instruments and required infrastructures. Again, there are some secondary variables affecting conceptual skills, creativity and data accuracy. Most important among them are job tenure, education and observability which have a positive relation to data accuracy.
Among individual factors, conceptual skills and creativity are totally related to deployment phase while lack of data accuracy could intensely make result doubtfully since it affect modelling challenges in implementation phase.

Table 3: How factors affect ABC development stages (considering secondary effects)

Categories of Influencing factors	**ABC implementation stages**			**Secondary factors****
	Adoption	**Implementation**	**Deployment**	
Behavioral	N/A	(7) Disposition to change (8) Role involvement (9) Champions (10) Data distortion	(7) Disposition to change (8) Role involvement	1,2,5,6,7,8 9,10,11,12
Individual	N/A	(11) Data accuracy	(20) conceptual skills & creativity	3,4,13,15
Contextual	(1*) Overhead dominance (2) Financial requirements (3) Services/Products diversification	(12) Stochastic nature of processes (13) Task Uncertainty	N/A	1,2,5,6,7,8 9,10,12,14 16,18,19
Technological /Technical	(4) Solution flexibility (5) IS support	(14) Critical mass (15) Training output (16) Heterogeneity (17) Detail level (18) Domain (19)Data availability	(15) Training output	1,3,4,5,6,7 8,9,10,12,13 14,15,16 17,18,19
Strategic	(6) Relevance to decision making (accuracy & usage)	N/A	N/A	14,16,17,18 19,20,21,22

* The numbers in parentheses are assigned to each main factor.
** These numbers indicate secondary factors according to table 1.

4.2.3 Strategic Factors

This category is less emphasized in the literature. The most important factor identified here, is *relevance to decision making*, generally related to organization strategies (Gupta & Galloway, 2003) and how ABC helps or improves organizational practices (Mansor, Tayles, & Pike, 2012). It could be interpreted as different ways of utilizing the results of an ABC system. ABC development could be more important and vital when an organization plans for a merger with another organization which has already adopted an ABCIS (some authors named it as cosmopolitanism (Brown et al., 2004; Kwon & Zmud, 1987) or multinational firms as Clark (1999) said). On the other hand, if an organization decides to adopt an ABC system, it has to consider its IT system quality to see whether it supports the system or must be upgraded. Another secondary variable positively affecting this category is competition (J. Innes & Mitchell, 1995) which Brown et al. (2004) have mentioned under the title "environmental factors".

In this category, there are still other indirect factors: environmental uncertainty (S. R. Anderson, 1995; Gosselin, 1997, 2006; J. Innes & Mitchell, 1995), external communication and decreasing price. Because of its

unique nature (as discussed above), it seems that strategic factors are solely related to the adoption phase of ABC implementation.

4.2.4 Technical Factors

Accurate information regarding feasibility of implementing a new information system (e.g. a new ABCIS) is very important. In ABCIS implementation it is of a great concern to allocate the overheads accurately, and also the system is expected to at least identify the areas of waste. On another hand, this should not be mistaken by expecting "real cost" information from the system.

Also, the scale of this *accuracy* and the *degree of detail* level on cost objects and the elements of the system should be derived from what is demanded for the strategies to run (Norris, 2002). Several technical factors have been identified influencing this accuracy since the early studies on ABC implementation, which were mainly conducted on technical aspects of implementation (Fei & Isa, 2010), and inasmuch the accuracy is a characteristic of the final outcome, it is in relation with challenges in every stage of development as can be inferred from the table 3.

Critical mass as the professional capacity necessary for covering different aspects of expertise is a fundamental determinant for decisions regarding the sourcing (corresponding to one of the principles) of the project, and hence the resource adequacy and managerial challenges following. In other words level of awareness about reliable abilities and knowledge of employees is in inverse relation to the potentials of possible resource wasting. Also adequate training which is under an extraordinary amount of emphasis by almost every study on the success requirements for ABC (Abdallah & Li, 2008; Fei & Isa, 2010; Liua & Panb, 2007; Norris, 2002), is a major variable both directly and indirectly (through other variables as depicted in the table) driving the quality of each application stage. Solution flexibility which is in close relation with one of the heuristics (flexibility) is the degree to which the solution can provide various information required according to initiative objectives. This essential capacity is called relevance to decision making, and is the main driver of defining of the whole project.

There are also various factors, such as organizational and contextual variables (e.g. task uncertainty, centralization, vertical difference) with impacts on discussed main elements. This includes factors such as data availability, domain, detail level, and another factor called heterogeneity which has driven serious argues, with different interpretations and definitions through the literature (Kaplan & Anderson, 2004; Noreen & Soderstrom, 1994).

4.2.5 Contextual Factors

Contextual factors are also important in different ways. They can impel the contingency of ABC adoption in an organization as Witherite and Kim (2006) mention complex goods and services and Everaert et al. (2008) point out activity complexity in its evaluation. While Schoute (2011) identified a U-shaped relationship between ABC adoption and product diversity, meaning that the firms with moderate levels of diversity in their outputs are more interested in adopting ABC systems. Financial requirements are discussed largely as a major determinant in ABC contingency (Baykasoglu & Kaplanoglu, 2008; Everaert et al., 2008; Gunasekaran & Sarhadi, 1998). Also the stochastic nature of processes has been under a great concern, especially in studies adapting simulation approach (Glick et al., 2000; Homburg, 2004; Lee & Kao, 2001; Spedding & Sun, 1999; Von Beck & Nowak, 2000).

4.3 Heuristics for Successful Implementation of ABCIS

There are several studies representing guidelines and heuristics derived from challenges and experiences of different implementation cases. For example Innes and Mitchell (1991) suggest that the objectives should be clear and practical, and in line with strategies, and point out the importance of preparing adequate resources, the support and commitment should be provided by the management, and the participation and consultation of staff in different stages (Liua & Panb, 2007). Another study revealing a significant failure of ABC in China also recommends a pilot progress of initiating rather than a sudden move into a large scale involvement, an incremental feedback procedure, and defining a continual process for improving the system -concerning the accuracy (Abdallah & Li, 2008). Although concentrated on some of the major subjects of argue in the literature,

such sparse general guidelines just do not seem adequate or prepared enough to conduct a sequential process of adopting ABC, from initiating to utilization.

Heuristics derived from our grounded action research through our case study are categorized in 5 categories depicted in figure 3, namely, Contingencies of Implementation, Governance Challenges, Managerial Challenges, Modelling Challenges and Deployment Challenges (described in sections 4.2.1 to 4.2.5). Also, Tables 4 through 7 list and describe heuristics (i.e. principles) in each category.

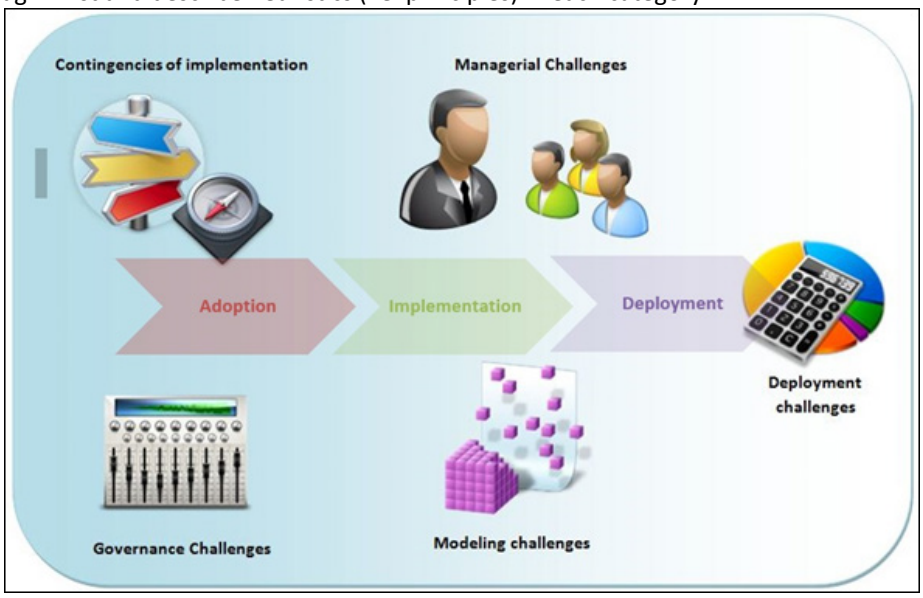

Figure 1: Categories of the heuristic principles for successful ABCIS implementation

4.3.1 Contingencies of Implementation

This category provides some heuristics about the scope and pre-requirements of the ABCIS before implementation. One of the major implications of this category is to provide a clear projection of the ABCIS capabilities and what the organization wants to do. Table 4 shows the major heuristic principles on contingencies of Implementation as a preliminary phase.

Table 4: Contingencies of implementation

Num. Name	Principle	Description
Feasibility	ABCIS development must be considered as a multilateral learning process, with all the financial, professional and managerial requirements before taking into action.	The procedure for developing an efficient ABCIS has proved to be difficult and costly; Depending on the industry context, usually there are other alternatives available.
Homogeneity	ABCIS development scope should not be considered apart from the development of an organization's information system.	It's claimed that many organizations which have tried to implement ABC in their organizations, have abandoned the attempt in the face of rising costs and employee irritation.
Cognition	ABCIS is not just an accounting tool..	ABC as the only structural resource mapping logic, not only produces general abilities like forecasting, scenario and sensitivity analysis, but also allows the user to identify and understands new aspects of the business processes.
Flexibility	ABC is a heuristic logic and open to different approaches, techniques, and can be designed for different purposes.	Management has significant alternatives in customizing the ABCIS capabilities regarding requirements and necessities.
Limitations	ABC is necessary but not sufficient for understanding strategies, and performance evaluation.	The most dangerous threats and majority of failures lies beneath misinterpretations of ABC's relevant working context.

4.3.2 Governance Challenges

Governance challenges category describes some heuristics on how organization should manage the ABC project and what considerations must have in order to lead the project successfully. Necessity of understanding of the ABCIS technically and the organization potential ability to do the project by itself are emphasized in this class. Table 5 illustrates the principles of governance challenges.

Table 5: Governance Challenges

Num. Name	Principle	Description
Recognition	Before organizing the implementation team, it's crucial to achieve an appropriate understanding of the complete process.	This is the basis of decision making about in or out-scouring (Num 2), unity and cohesion (Num 3), and professional necessities (Num 4).
Sourcing	Although outsourcing ABCIS development might be costly, but seems considerably less likely to fail.	If the organization decides not to outsource the project, it is necessary to consult a professional team.
Unity	Unity of implementation team can play a significant role in the outcome quality, and in dealing with cultural issues.	Personnel collaboration will result in a great impact on promotion and cognition through the whole organization.
Proficiency	The ABCIS development requires multi skills.	ABC is an Interdisciplinary and flexible approach which involves in finance, business process, modeling techniques, computer programming, and sometimes statistics and simulation.
Alignment	Management should consider various factors in coordinating different players.	Team cohesion could be one of the major factors affecting the project time Anderson et. al (2002).

4.3.3 Managerial Challenges

Managerial challenges category provides principles which can be helpful for the top management of the organization to facilitate the implementation of ABCIS through decreasing personnel resistance against change and also improving participation atmosphere in the organization. One of the most critical cited issues in implementing new systems is management commitment which is the key driver of this category. Participation, learning and support are the most important subjects in table 6, which shows the managerial challenges heuristics.

Table 6: Managerial Challenges

Num. Name	Principle	Description
Collective learning	Education and communication are vital.	Quality of the outcome of ABCIS development depends on a creative and collective learning process.
Upside-down receptivity	Management commitment is vital dealing with cultural and communicational issues. (see Intakhan, 2014)	The receptivity spirit should be motivated upside down.
Systematic learning procedure	As well as the operational processes, systematic learning activities should be planned.	Open discussions and visual simulation has great impact on improving the mental models.
Participation	Personnel collaboration can make a great impact on managerial challenges (from subjective point of view).	As much as personnel participate and cooperate in ABCIS development, the outcome would be better fit. On the contrary if they are not motivated enough, negative reactions are likely to infect the project.

4.3.4 Modelling Challenges

This category discusses technical heuristics to maximize the accuracy of the outcomes of the ABCIS according to the aim and dedicated budget and other resources of the project. These principles are related to the various stages of designing and modelling ABCIS. Table 7 indicates heuristics principles of modelling challenges category.

Table 7: Modelling challenges

Num. Name	Principle	Description
Process mapping	Mapping the processes should be done in required detail level regarding to objectives of the ABCIS.	According to ABCIS requirements the project team might focus on major processes of each department instead of detail mapping the activities.
Data gathering considerations	Subjective data gathered from employees must be checked with different sources.	Some critical data such as appropriate set of cost drivers, probably process paths, must be gathered through observation and/or interviews.
Cost drivers	Increase the accuracy of results choosing multiple cost drivers.	In traditional ABC, cost of an activity was driven by just one cost driver. In the real world, however, activities are often driven by more than one cost driver.
The role of organization theories	Reviewing organization & management theories help defining an appropriate driver, especially resource consumption drivers.	Define proper drivers for ambiguous concepts paying attention to theories. (such as organization's complexity)
Using Operational Research methods	Utilize multi-criteria decision making methods when defining drivers. .	Techniques such as AHP, TOPSIS, and VIKOR… must be used when there's no other choice due to lack of time, budget, tools or information (Sepehrirad, Azar, & Sadeghi, 2012).
Using Statistical & Engineering Economics concepts	To calculate cost of some services, we need to consider future values or costs.	Regressions and Engineering Economics methods might be necessary. For example to calculate services in bank industry one may have to calculate present value of loans which will repay in next years.
Time-driven ABC	Considering time as driver.	TDABC reduces the time and cost of projects but needs exact time study.
Simulation	Simulation can handle probability in processes and sensitivity analysis.	Integration of ABC & simulation through activity is described in Spedding and Sun (1999). There is also some application in service industry such as (Glick et al., 2000; Zarei, 2002) and also in production such as (Von Beck & Nowak, 2000).

4.3.5 Deployment Challenges

Deployment challenges specifically refer to final stage of ABCIS implementation which is mainly focused on other usages of the new system. One of these principles hints at probable economical and behavioural disadvantages. Table 8 discusses heuristic principles of this category.

Table 8: Deployment Challenges

Num. Name	Principle	Description
Creativity	ABCIS encompasses vast potential which can be achieved through innovative, and open collaborative surveys.	ABCIS presents cost behavior of activities, processes, plans or strategies.
Guidelines	The outcomes of an ABCIS are applicable variously.	ABCIS is a strategic decision aiding tool that can be used in many fields: eliminating of non-value added activities (Agha, qedra, Kurd, & Mohanna, 2010), calculation of the cost of new products, etc.
Side Effects	Lack of knowledge, communication, or adoption issues in ABCIS development might lead to various problems.	- Many of these side effects identified in literature.
Accuracy	ABCIS must be considered as a financial tool not an accounting one.	Accuracy could be managed by defining the cost drivers due to the ABCIS purposes.
Budgeting	ABCIS results are input data for budgeting.	Activity Based Budgeting could be developed based on an ABCIS system (Liu & Pan, 2007; Moustafa, 2005).

5 Discussions

Information technologies have made numerous progress (Merati et al., 2010; Ghapanchi and Aurum, 2011a; Ghapanchi et al., 2012a; Ghanbarzadeh et al., 2014; Ghapanchi et al., 2012b; Ghapanchi and Aurum, 2012a; Ghapanchi et al., 2014; Ghapanchi, 2013a). Several research have been conducted on various areas of IT including IT user acceptance (Vichitvanichphong et al., 2013; Najaftorkaman et al., 2013; Ghapanchi et al., 2011; Ghapanchi, 2013; Najaftorkaman, 2014; Tavana et al., 2015; Amrollahi et al., 2013; Ghapanchi, 2015; Kosman et al., 2013; Ghapanchi et al., 2008; Ghapanchi and Aurum, 2011b; Ghapanchi and Aurum, 2012b).
Through content analysis of the literature and conducting grounded action research, this paper has identified 20 primary success factors for ABCIS implementation and also has proposed 27 heuristic principles contributing to the success of ABCIS implementation. Table 9 illustrates the extent to which each heuristic may contribute to each success factor. A focus group consisting of experts (Table 1) have identify identified the relationship between principles and factors. Each rate has been assigned through consensus after discussion among the group. In the table below, 'L' means low effect, 'M' medium and 'H' means high effect. For example means paying attention to principle 1 will lead to considering financial requirements, solution flexibility and IS-support (in medium, high and medium levels respectively), which are mentioned as factors needed for successful implementation of ABCIS.

Table 9: The impacts of heuristics on influencing factors

Heuristics		Number of Factors Influencing (according to Table 2)																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
implementation Contingencies	1		M		H	M															
	2					H															
	3		L				H												M		M
	4	L	M	L	H	M												H		M	
	5						H												M		
Governance Challenges	6		H		M		M			H								H	H		
	7		H					H	M	L					H	H					M
	8							H	M	M	M	L								L	
	9			H	M	M	L						M			H	L	M			
	10		M				M							M				H			
Managerial Challenges	11							M	M	M	H	H				H					M
	12							M	M	H	M				M	L					
	13							M	M	M	M					H					H
	14							H	H	H	H										
Modeling challenges	15		M		M	H	M								M			H		M	
	16										H	H		H							
	17												H							M	
	18													H						M	
	19												L	M				M		H	
	20												M	M				M	L	H	
	21		L		M	L	L					M		H				H			M
	22			H	M	M							H					M			
Deployment Challenges	23																				H
	24						H		H	H								M	M		
	25																				
	26		M		M		M	M	H	H					L	L					L
	27		M		L		H											M	M		

Success factors in this study are used as a criterion to measure the effectiveness of the heuristic principles (tables 4-8). In order to prioritize the principles, more influential heuristic has received a higher priority. The low influence are assumed to be equal to 1, medium influence are considered equal to 2 and high affect are considered equal to 3. In this way the effectiveness of each principle is countable. The results have revealed that **sourcing**, **collective learning**, **process mapping** and **accuracy** (number 7, 11, 15 & 26 respectively) are the most important heuristics having major roles in successful ABCIS implementation. **Recognition** and **proficiency** (number 6 and 9) are also significant whit a minor distance. These heuristics (except accuracy) could be

recognized as fundamental necessities to start an ABCIS project. The analysis also shows that governance and managerial challenges contains the more effective heuristics. This indicates that paying attention to proposed heuristics in early stages of ABC development is important.

5.1 Implications for practitioners

This section clarifies how organizations can use the results of this paper. According to this study, the most important phase of ABCIS development is its first stage (i.e. adoption). At this stage management must identify ABCIS capabilities and the organization's needs and then make realistic expectations of the new system. At this stage management must decide if ABCIS is proper for the organization or not, and if there is appropriate infrastructure in order to develop ABCIS or not. Another important issue to consider at this stage is top management support. Decision makers should make a long-term commitment to the ABCIS project.

In order to achieve each success factor (for example at adoption stage), the authors have recognized some heuristic principles (as mentioned before Table 8 indicates how each heuristic affect the success factors). For example, category of contingencies of implementation makes managers to have a clear understanding of the ABCIS features, its pre-requirements and even its disadvantages. While contingencies of implementation give insights about ABCIS, category of governance challenges provides some advice about determining the organization's needs.

The second stage of ABCIS development is implementation. At this stage, organization is engaged with managerial and technical problems because of the operational nature of implementation. Organization faces some behavioural and individual problems which may have a cultural nature because of dealing with personnel. Managerial challenges provide insights about these issues. Paying attention to collaboration and learning is highly recommended as a means of overcoming stated problems.

Implementation stage involves technical factors in ABCIS development. ABC as an accounting technique involves several points to be considered in order to provide successful outputs. There are some considerations and many alternatives mentioned in modelling challenges heuristics to achieve reliable outcomes. For example, two mentioned contextual factors: stochastic nature of processes and task uncertainty can be eliminated by utilizing simulation. Using multiple cost drivers and management science techniques are also other recommendations to increase reliability of results.

The third stage of ABCIS development is deployment phase. At this phase, the new system is utilized and outcomes provide feedback to modify the system. Disposition to change and training are the most important factors affecting deployment stage. As these factors are behavioural and individual, related principles are almost mentioned in governance and managerial challenges.

The key important elements in deployment challenges heuristics are about other usages of ABCIS which mostly can be obtained creatively. Due to the activity based nature of ABCIS, this system can provide greater information than cost accounting. This information can be used for BPR, value engineering, operational budgeting, etc.

In all, this study has sought to provide insights for practitioners who are about to develop an ABCIS through hinting potential factors which can lead to success/failure of developing new system and more importantly, presenting heuristic principles in order to overcome the potential challenges of ABCIS development (through frequently paying attention to them).

5.2 Future Studies

Heuristics introduced in this paper are based upon an experience of implementing ABC in a state bank in Iran. There also could be more heuristics need to be extracted from other experts in the bank industries all around the world to challenge and complete these heuristics and even from similar experiences in other industries. So, it is expected that future studies focus on other fields (present paper could be used as a guide).

The methodology of this study was mostly qualitative; but quantitative methods like statistical analysis could also be applied (For example in order to identify the relationship between heuristics and influencing factors). The impacts of heuristics on influencing factors presented on table 8 are generally based on expert's opinion; researchers can investigate these effects using actual data and case studies.

While this paper aimed at extracting the heuristics, a possible extension to this work could be a study which prioritize these factors.

6 Conclusion

Based on a case study of a bank as well as the insights from the literature, this paper provides a relatively comprehensive list of the success factors of ABCIS, and also offers a set of effective heuristic rules (also called principles) for better development of ABCIS. In this paper, the authors discussed ABC development through three phases of adoption, implementation and deployment. The factors affecting the success of ABCIS implementation at each stage are also discussed and categorized (resulted from a content analysis of the relevant literature) as behavioural, individual, contextual, technological and strategic. This paper also focused on developing heuristics principles based on a grounded action research. The authors introduced 27 principles; each of them can contribute to a number of success factors and of course in different stages of development. These principles are categorized into five classes including: contingencies of implementation which is mostly in relation with adoption stage; governance, managerial, modelling and deployment challenges.

Finally, effectiveness of principles would have measured complying with primary success factors. The most important results of this study reveals that **governance** and **managerial** challenges contains the more effective heuristics. Successful implementation of ABCIS is highly depended to proper management of behavioural issues and conflicts rather than technical ones in the project.

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