An Integrated Model of Factors Affecting Information Technology Implementation Success in Organizations

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ABSTRACT

The impact of Information Technology on individuals, organization and society is changing everything. The extent of technological revolution that the world is presently witnessing is the Information Technology has become the vehicle or major engine of the information age which has reduce the world to a global village. This new technological epoch is apparent through the intensified investment in computer-processing and data preparation appliance in the manufacturing and service industry and telecommunications infrastructure, and its widespread usage in government agencies, educational organizations, and, more recently, in the households. Owing to these technological progressions, the implementation and application of Information Technology is a significant driving force behind many socioeconomic changes. The Implementation and the subsequent use of IT is a process of interrelated steps, slipping at any of the implementation stages may actually increase inefficiency, ineffectiveness and promote a number of uncertainties. This paper tries to identify different factors which help for a successful IT implementation in organizations. Merging the factors so identified into IT implementation stages the author tries to develop a framework for successful Information technology implementation. Extensive review of literature and expert advice has been sought in developing the framework which we hope to get feedback on publication. The outcome of the study will be a model which helps organizations to understand which are the critical factors for a successful Information technology Implementation and the relation between these factors.

Keywords---- Information Technology, Implementation, Implementation Stages, Information technology Innovation, Information technology adoption and diffusion

I. INTRODUCTION

Present day most of the organizations rely heavily on Information and communication technology. Information and Communication Technology directly affects how managers decide, how they plan and what products and services are offered in the industry. Information Technology has strategic significance. In an information rich economy, a company can use information technology to reduce cost, upgrade product quality, improve customer service, or even integrate customers operations with its own operations, thus assuring repeated business[1]. Thus in an organization successful implementation of Information Technology can lead to cost reduction, quality of service delivery, improved decision making, transparency, increased efficiency, improved access to information and other technological benefits such as cheaper and efficient and access to large storage capacities within larger and more advanced computers. The Implementation and the subsequent use of IT is a process of interrelated steps, slipping at any of the implementation stages may actually increase inefficiency, ineffectiveness and promote a number of uncertainties. A new technology project typically entails a great deal of cooperation among various divisions, departments, and employees within the enterprise. The technical aspect of implementation is only one component of a chain of events between initial investment and final evaluation. During that time, a wide range of factors, both internal and external to the organizational environment, react with implementation processes and will ultimately become part of the output value of the original technology investment. In this paper the author looks at Information Technology as an innovation concept. The theories of IT innovation adaptation and diffusion were identified (Table 1). Then literature was reviewed to identify factors important for Information technology implementation (Table 2). Then the author proceeded to look at the implementation process literature (Table 3). Merging the factor research, the information technology adoption and diffusion research and the process research streams and applying a combined vision to the study of IS implementation a comprehensive
A framework of factors for a successful Information technology implementation was developed.

II. METHODOLOGY

The comprehensive framework for factors affecting Information Technology implementation success was developed through the following stages.

Stage I: The author conducted an extensive literature review of the concept of Information technology, technology implementation and factors affecting the successful Information Technology implementation. The outcome was that the innovation concept of technology and implementation was adopted to be studied and a complete database of factors affecting technology implementation and adoption was developed.

Stage II: This factor database was given for review to the subject experts to and a comprehensive list of factors which was important for the study and their shared meanings were developed.

Stage III: Further literature survey was conducted to identify relationships between the variables and assigns factors to the particular implementation stage and to investigate what impact they possess during the particular implementation stage on the IS implementation outcome.

III. PREVIOUS STUDIES

Information Technology (IT) is concerned with technology to treat information. The acquisition, processing, storage and dissemination of vocal, pictorial, textual and numerical information by a microelectronics-based combination of computing and telecommunications are its main fields. The term in its modern sense first appeared in a 1958 article published in the Harvard Business Review, in which authors Leavitt and Whistler commented that "the new technology does not yet have a single established name. We shall call it information technology (IT)." Most of the former studies of application and adoption of Information Technology in organization looks technology as an innovation concept. The Klein and Sorra [12] article defines technology innovation as, "a technology or a practice used for the first time by members of the organization, whether or not other organizations have used it previously". So taking the innovation concept of technology, Information technology implementation can be described as "Implementation is a critical gateway between the decision to adopt innovation and the routine use of the innovation within an organization. For implementation to be a success, the application should be no longer perceived as something new, and the "targeted employees use a given innovation consistently and well" [12]. To understand what are the important steps that take place during this critical gateway, and to know what issues should be raised and resolved throughout implementation process, would allow for better control over the outcome of IS implementation, thus increasing odds of success of the innovation. The main studies in this field is categorized as follows, 1) Information technology adoption and diffusion Literature 2) Literature related to Implementation Factors 3) Implementation process literature.

a) Information technology adoption and diffusion literature – The IT innovation field is concerned with understanding the factors that facilitate or inhibit the adoption and diffusion of IT in an organization. These adopters can be individual, organizational or groups of inter related firms. This research stream produced an assortment of factors that seem to influence IS acceptance and utilization. In addition, a number of models and theories of individual acceptance have been developed. These models provide an important theoretical foundation for studying how various users, and technological and environmental influences, can predict, explain and determine the use of IS. The table below shows the theories related to IT adoption and diffusion.

<table>
<thead>
<tr>
<th>Model</th>
<th>Author</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory of Reasoned Action</td>
<td>Azjen 1975</td>
<td>Explains individual’s intention to adopt technology</td>
</tr>
<tr>
<td>Theory of Planned Behavior</td>
<td>Azjen 1975</td>
<td>Is used to predict intention and behavior of individual acceptance and usage of technology</td>
</tr>
<tr>
<td>Technology Acceptance Model</td>
<td>Davis 1989</td>
<td>Helps to predict user intention to accept IS</td>
</tr>
<tr>
<td>Motivational Model</td>
<td>Davis 1992</td>
<td>Has been used to study the nature of</td>
</tr>
</tbody>
</table>
motivation that explains user behavior towards technology

Innovation Diffusion Theory
Rogers 1995
Postulates that characteristics of adopters and innovation have an influence on the spread of innovation

Task Technology Fit Model
Goodhue 1995
Showed that success of adopting technology may be explained by compatibility of its characteristics with the characteristics of the task

b) Implementation factor Literature – factor research has identified various elements of the organizations internal and external environment factors that are likely to lead to a successful implementation. The author conducted a literature review of the factors as early as 1980’s to 2000. The end result is a fragmented summary of disparate factors. The important and most repetitive factors from the given studies and those factors which the researcher found to be important for the present study is given below.

Table 2
Comprehensive table of the factors identified

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Factor</th>
<th>Historical Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Interdepartment coordination</td>
<td>Earl and Feeley (1994), Reich and Benbasat 2000</td>
</tr>
<tr>
<td>5</td>
<td>Communication</td>
<td>Daft and Langel (19860)</td>
</tr>
<tr>
<td>6</td>
<td>User involvement</td>
<td>Hatwrick and barki (1994)</td>
</tr>
<tr>
<td>8</td>
<td>Commitment to change</td>
<td>Ginzberg (1981)</td>
</tr>
<tr>
<td>9</td>
<td>Project champion</td>
<td>Beath (1991); Somers and Nelson (2001)</td>
</tr>
<tr>
<td>10</td>
<td>Top management support and commitment</td>
<td>Ginzberg (1981); Kwon and Zmud (1987), Jarvenpaa and Ives (1991); Weill (1992); Senn (2003); Somers and Nelson (2001)</td>
</tr>
<tr>
<td>11</td>
<td>Specific plan</td>
<td>Ginzberg (1981)</td>
</tr>
<tr>
<td>12</td>
<td>Change management</td>
<td>Kwon and Zmud (1987); Ryan and Harrison (2000); Castle and Sir (2001); Kohli and Sherer (2002), Shera, Kohli, and Baron (2003)</td>
</tr>
</tbody>
</table>
External environments
Seddon, Staples, Patnayakuni, and Bowtell (1998)

Dedicated resources
Somers and Nelson (2001)

Commitment to change
Ginzberg (1981)

Compatibility – Task fit

Personal innovations
Agarwal and Prasad (1998)

Trialability
Rogers (1994)

Among the most prominent models that look at implementation as a process of change are Lewin, Kolb and Frohman, Kwon and Zmud, Joshi [15, 13, 14, 8]. The prominent studies in the field of MIS literature was done by Hussain & Hussain and James A.O’Brien [6, 7]. The table below shows the major implementation process stages.

**Table 3**

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Implementation Process</th>
<th>Implementation Stages</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Organizational Change Model</td>
<td>Unfreez- Change – Refreez</td>
<td>Lewin (1952),</td>
</tr>
<tr>
<td>2</td>
<td>Six Stage Model</td>
<td>Initiation – Adoption – Adaption – Acceptance – Routinization – Infusion</td>
<td>Kwon and Zmud (1987)</td>
</tr>
</tbody>
</table>

****IV. RESEARCH GAPS AND OBJECTIVES****

We have seen above the different studies relating to information technology implementation. But the historical studies have the following gaps. The technology adoption and diffusion literature has led to development of various individual acceptances of technology models. The main issue is that these models look at only the factors for individual factors. Factor research looks at individual factors in a specific environment, without exploring the relationship among the factors and how the factors can be applied to other enterprises. Implementation process research list out the stages of implementation, but lacks in clarity of the factors in each stage. Hence the objective is to combine all theses researches a develop framework for understanding and controlling the factors for successful IT implementation.

*****V. MODEL DEVELOPMENT*****

Merging the factor research, the information technology adoption and diffusion research and the process research streams and applying a combined vision to study the IS implementation permits to address broad issues that an IS implementation process might have and allows for consideration of more specific factors that are crucial throughout the course of implementation. The six-stage model of IT implementation developed by Kwon and Zmud [14] was selected to serve as a foundation because it allows to comprehensively exploring the process of IS implementation. The table below shows the six stage model.
Table 4
Six Stage Model of Implementation

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Initiation</td>
<td>A thorough analysis of organizations internal and external setting is made. Uncovers a problem or an opportunity for improvement.</td>
<td>A match is found between the IT solution and its application in the organization.</td>
</tr>
<tr>
<td>2. Adoption</td>
<td>Rational and political negotiations ensuring organizational backing for implementation of the IT application.</td>
<td>Strong Organizational backing.</td>
</tr>
<tr>
<td>3. Adaptation</td>
<td>The process and practices of the organization is reviewed and changed to match the new technology adopted.</td>
<td>Complete Business Process re-engineering.</td>
</tr>
<tr>
<td>4. Acceptance</td>
<td>The end user starts to use technology.</td>
<td>Task-technology fit is achieved.</td>
</tr>
<tr>
<td>5. Routinization</td>
<td>Usage of IT application is encouraged as a normal activity.</td>
<td>IT application is no longer perceived as something out of ordinary.</td>
</tr>
</tbody>
</table>

a. Stage 1 – Initiation
The first variable in this stage is Path dependencies. Weil’s [20] conversion model talks about Path dependencies, it means that technology decisions are not made solely in response to the current business environment. Today’s decisions are affected by past technology decisions, which may either limit or increase the range of current choices. The author feels that every organization should assess where they stand before embarking any new Information technology. Second important variable is Organizational climate. Organizational climate can be defined through organizational politics, Institutional leadership, confidence of employees with their management, the reward systems, and organization size and goals [18]. There are no organizations that would possess identical organizational environments, simply because they would have different people working for them. In fact resistance to new technology can be attributed to internal political issues and the power associated with them [16,17]. If the organization’s context, such as social or political culture, is not compatible with the design features of the new technology; it will be difficult to gain end user support. Thus, a deeper understanding of an organization’s climate would aid in shaping the right implementation plan and creating a conducive environment for implementation. Once the organizational characteristics are understood an investigation to the user characteristics or work group characteristics will help to plan implementation which best suit the work group. The work group characteristics are taken from the work of [18,14]. Which can be seen as, collaboration among workers it was shown that if groups are collaborative in the way they interact, it is easier to encourage innovative behavior among them [18], job tenure [18], computer literacy level of the workers [14]. Reviewing what exposure to various technologies the users had in the past, and how confident they are in their computer capabilities, can help define what additional computing support or computer training should be provided [23]. Also, knowing the users’ attitude toward computers and innovations can give an extra key to successful implementation as it would help to recognize how users will feel about the new system [19,23]. Careful consideration of the current job characteristics [18] or as [14] name it characteristics of the task that include the level of autonomy, control over work quality, and responsibility for the outcome, would give better guidance toward what job changes may occur due to the new IS implementation, and would help managers to prepare users for changes as well as anticipate possible source of resistance later in the implementation [18]. In summary, during the initiation stage, an organization identifies an opportunity for change and evaluates specific IS solution to engage in. However no commitment from either potential users or the IS department is made during initiation stage.

b. Stage 2 - Adoption
To increase the odds of successful implementation, it is crucial to gain early support from key participants including potential IS users and their management. Research suggests that user involvement and management support increases user IS acceptance [16,17,24,25]. Baronas and Louis [24] noted that implementation of a new system is likely to represent a threat to user’s perceptions of how much control they have over their work. They propose that developers and those who implement the system should involve users in the implementation process. The strength of participation-satisfaction relationship was investigated by [26] looking at the effects of four contingency factors - task complexity, system complexity, user influence, and user developer communication. It was concluded that the more the task is
unstructured or ambiguous, and the more complex the system, the more essential the user’s participation is in user satisfaction and consequently to system success [26]. Therefore, placing user involvement and user participation into the adoption phase of the implementation model helps in establishing strategies that would first seize user involvement and then transform it into active user participation throughout implementation process, thus ensure full backing for implementation from those who might potentially resist the project.

User participation does not happen on its own; management plays a critical role in facilitating and influencing user’s participation in the implementation [27]. Previous studies have recognized management support as one of the key reoccurring factors affecting system success [5,8,14,20]. Management that can ensure sufficient resources to the implementation effort, that is willing to accept risks, and that acts as a change agent to create more conducting environment through encouraging and promoting IS use, is associated with greater system success. Another concern is commitment to the change. An organization where its members are unwilling to accommodate to the change is unlikely to have a successful implementation [5]. Both commitment to the project and commitment to the change require attention from management and users. Commitment to change can be obtained by proper communication and inter-departmental coordination of the need for new system adoption and its impact on the task of the workers. If proper communication is not maintained it will lead to two factors, uncertainty – where information is not available and equivocality – an ambiguous situation that is subjected to multiple interpretations. They say that this can be avoided through face to face meetings or any optimal form of communication. The allocation of sufficient resources has been cited as affecting IS success [28]. Whether a particular project has enough resources or not is a direct result of how committed and supportive management and the organization are, and therefore an allowance needs to be made for this stage as well. Types of resources that are common to support implementation effort are personnel, equipment, time, money and implementer’s skills. Upper management is responsible to assure that properly skilled personnel are available to work on the project for the necessary time periods. They also state that key task such as project management should be held by qualified in-house members and not consultants [18]. It is at this stage that the management should see the skill level of its employees and a decision to appoint external consultants should be taken.

One more factor that was shown to have a positive effect on the implementation success and thus included in the model is project champion presence. A champion is an individual in the organization that has a previous experience with the technology; possesses a great level of confidence in the new system and its potential benefits; and is enthusiastic about the technology and change it represents [2]. The champion can be an opinion leader and change agent that inspires others to adopt innovation and accept the change.

c. Stage 3 - Adaptation

The emphasis of this stage is on preparing the organization and its users for the use of the new system. This is a time when management commitment to the project, users’ involvement and user participation established during the adoption phase, needs to be effectively utilized. To do so, the implementation project should be carefully planned. This stage looks at the following important variables: extent of project definition and planning [5] and project uncertainty [5] and implementation team composition [24].

In identifying issues in the IS implementation, Ginsberg [5] demonstrated that the extent of project definition and planning are factors that should be viewed as a placing demand on both management and users. Having a project plan will decrease project uncertainty by assessing organizational needs, system fit into work practices, training requirements, evaluation criteria and specifying the roles of project team members. “The more thorough the planning effort, the less likely are unforeseen circumstances which could endanger the project” [5]. To carry out the implementation plan, an implementation team should be comprised of members with the right skill-sets and knowledge-sets within the interpersonal, computer systems, and organizational areas [24] The skills and experience of the implementation team as well as ability to build strong relationship between the user and the provider of the new IS represents a significant factor in the success of failure of an implementation effort [24] and thus needs to be added to the model.

With every new technological adaptation there is a period of adjustment and change of a new system within a given organizational setting. The more compatible the innovation with the existing values, past experience, and needs of adopters, the more likely it is to be adopted [14,29,30]. Moore and Benbasat [30] confirmed compatibility to be a good predictor of usage behavior. Cooper and Zmud [3] concluded that compatibility is a factor affecting adoption. However, when we look at the adaptation stage, the users start to learn about new technology characteristics and functionalities, they will gain a better understanding of how compatible the technology is with their tasks and workflow content during this stage.

An study [31] suggests that personal innovativeness positively moderates the relationship between the perception of compatibility and the decision to adopt an innovation. More innovative individuals may develop stronger intention to use the innovation at the same level of perceived complexity and congruence with work style as a less innovative individual. Thus knowing the level of users’ personal innovativeness management
can create a different support structure to motivate those who are less innovative, and utilize those who are more enthusiastic about innovation—as champions for instance. Studies also focused on the role of institutional structure in successful implementations [32]. The main observation made is that the institutional context—key aspects of which are workflow patterns, work procedures, routines, reward systems, control and coordination mechanisms—affects the end users’ ability and motivation to successfully adopt and use IS innovations. The organizational structure needs to be shaped in ways that facilitate an appropriate use of technology to accomplish work. The actions that can be undertaken to ensure successful implementations are: instituting new structures, new performance control systems, new coordination mechanisms, and changes to performance goals [32].

Another factor that plays an important role in new system implementation is user training and education about new system [14]. Careful planning and implementation of a training program may facilitate acceptance of the system by users. Training influences system usage by building confidence in the new system use, thus increasing users’ satisfaction. While preparing for implementation users need to understand why the particular IS is being introduced and how the project will affect them both during and after its implementation. Without such knowledge, ignorance and uncertainty will lead to: project resistance, a lack of participation and eventual disassociation from the IS. Another factor that is important to consider is whether the user will have a chance to experiment with the new system before committing to its use. Traillability has been generally considered positively related to innovation [29]. Having an option for trying out the new system offline for a period of time can give the potential user an opportunity to become familiar and proficient with it without worrying that it may cause downtimes at work. In summary, the center of adaptation stage is the process of mutual adaptation of technology and organization environment. During this phase the existing institutional context is revised; IS innovation functions and features are evaluated in terms of fit for a particular setting; new systems and support mechanism are established to promote long-term acceptance and usage of the technology; and training programs are designed to satisfy the needs of different groups are carried out. Strong management support and user participation are critical at this stage.

d. Stage 4 - Acceptance

Goodhue [33] studied user evaluation of the IS through applying the task technology fit construct as a measure of IS success. He argued that users give evaluations based not only on inherent system characteristics, but also on the extent to which that system meets their task needs and their individual abilities. The value of technology appears to differ depending on the tasks of the user; users view their systems as tools that assist or hinder them in the performance of their tasks [33]. The more closely the system meets users’ needs and abilities, the higher the performance level users can reach. Seddon [34] defined “the degree to which the stakeholder believes that using particular system has enhanced his or her job performance, or his or her group’s or organization’s performance” as a Perceived Usefulness [34]. He developed the Perceived Usefulness concept when extending McLean and DeLone (1992) IS Success model, which uses the Individual Impact category as a measure of realized benefits from system use. Seddon [34] model concluded that Perceived Usefulness affects User Satisfaction, which influences expectations about future benefits, thereby influencing IS use. To evaluate the level user satisfaction with the new IS, System Quality and Information Quality are the most studied dimension in the IS research along which users evaluate IS [34]. Moore and Benbasat [30] defined ease of use as a degree to which potential adopters view usage of target technology to be relatively free of effort. They found it to be a significant predictor of innovation adoption. The more the system was perceived as relatively difficult to understand and use, the less the probability that it would be used. The most extensively studied attributes of Information Quality are content, accuracy and format, error less, flexibility, access, security, integration. Implementation of the new technology affects business functions and influences users directly. Due to changes in the job content and uncertainty of the new system target, users may become resistance to an implemented change. Markus [16] explained resistance to the IS implementation as a power distribution misfit of IS that can lead to different power and resource allocations. Copper and Zmud [3] also suggested that organizational resistance and lack of technology understanding had more explanatory power of inhibiting new system infusion within its work environment then the task technology fit. Research on individual acceptance of information technology found facilitating conditions to be a direct determinant of usage behavior. The facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system [35].

e. Stage 5 - Routinization

The fifth stage in Kwonz and Lewin model is routinization. At this stage the usage of IT application is encouraged as a normal activity. The organizations governance systems are adjusted to account for the IT application, the IT application is no longer perceived as something out of ordinary. Not many literature is available for this stage of IT implementation. When we go through the MIS literature the important variable at this stage is documentation. James O’Brien [7] describes documentation as recording and finalizing of detailed system specifications, including usage manual for end users and IS personnel’s, authority structure, and procedures and policies for the use of the new system in
the organization. The next variable is maintenance. This can be defined as the monitoring, evaluating and modifying of operational business systems to make desirable necessary improvements. The last variable is the termination of contract. According to Hussain & Hussain[6] it means confirming new behaviors patterns and completing transfer of responsibility to users.

f. Stage 6 - Infusion

This stage is seen as the outcome stage of a successful information technology implementation. Increased organizational effectiveness is obtained by using IT application. Successful implementation of IT can lead to cost reduction, quality of service delivery, improved decision making, transparency, increased efficiency, improved access to information and other technological benefits such as cheaper and efficient and access to large storage capacities within larger and more advanced computers. The author feels that the outcome of the IT implementation can be evaluated using two variables Cost and Time

The figure given below depicts the comprehensive model developed from the above literature.

VI. CONCLUSION

In this paper, based on review of the literature and interaction with large number of experts, the author have developed a model to study the factors affecting success of information technology implementation in organizations. This model will help researchers to understand information technology implementation success. It will also pave way to design of tools to measure likelihood of success and to diagnose areas where improvements and risk management is necessary in IT implementation projects. The first level variables under each head are only discussed in this paper, which is a part of the ongoing doctoral work. Second level factors under the first level and items to be used for measurement of factors and sub factors need to be worked out. The model so developed also needs to be tested and validated. However publication at this stage will help other researchers to branch off in different directions of research from this basic model. It will also help the researcher to have a discussion initiated so that the model is enriched.

REFERENCES