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Review

Towards adoption of business process analysis and design techniques in transitional countries: design and validation

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Abstract

Business processes are important aspect of an organization and thus their designs have become an emergent need especially in transitional countries. However, how to design and analyze the business processes that meet the customer needs still poses a challenge. In this respect, an exploratory study was conducted to investigate the extent to which business process design and analysis (BPDA) techniques were used in designing business processes in Ugandan organizations with an aim to establish the possibility of their adoption. Several challenges were identified from which possible requirements to support BPDA techniques adoption were derived. Based on these requirements, a BPDA techniques adoption framework was designed, evaluated and validated using 3 case organizations in Uganda following the design science approach. The evaluation results indicated that the framework is usable, interactive and applicable to adoption of BPDA techniques in transitional countries using Uganda as a case study.

Keywords: Business process, business process reengineering, business process design and analysis.

INTRODUCTION

A business process evolves through phases of the business process life cycle (BPLC) like design and analysis, configuration, enactment and evaluation (Weske, (2007). We however focus on the design and analysis phase because of its importance towards the design and implementation of new business processes. Business Process Design and Analysis (BPDA) is a method through which organizations define study, understand and test their business activities that enable them to function. It is comprised of two phases; analysis and design, where *analysis* enables analysts to understand how processes of a business function and interact with each other, and *design* aims at improving the way processes operate and interact (Boekhoudt et al., 2000). Through BPDA, business processes (BPs) are optimized to meet customer needs and support organizational growth through improved operational performance, integrated and automated processes, reduced cost and creation of new business opportunities (Cousins and Stewart, 2002).

BPDA leads to development of process models through the use of modeling, validation, and simulation techniques (Weske, (2007). Such techniques include but not limited to; *Integrated definition (IDEF) family* is a suite of methods for process design and analysis (Mayer et al., 1994) that include: IDEF0 (functional mode), IDEF 1(information model), IDEF2 (dynamic model), IDEF3 (Process description), IDEF4 (object – oriented) and IDEF5 (ontology description). *Petri Nets* represent dynamism within a process by use of tokens Aalst, (2004). They are used to describe, analyze, study and design various business processes (Aalst and Van Hee, 1996). Hierarchical colored Petri nets are used to simulate and analyze large systems and processes (Aalst, 2007). *Role activity diagrams (RAD)* represent business process dynamism (Bal and Cheung, 1998). RAD supports simulation and visualization of processes to cater for experimentation before process implementation (Aalst, 2007). *State-Transition Diagramming (ST)* is used to analyze and design real-

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time systems by providing information about time-related sequence of events. They are applicable in systems design (Giaglis, 2007). These techniques have been adopted and used to analyze and design BPs with a set of success factors (Jarrar et al., 2000) identified to that effect.

In transitional countries specifically Uganda, fewer organizations review their BPs and little or nothing is known about the usage of BPDA techniques. In the exploratory study conducted with three case organizations in Uganda (Kasse and Nabukenya, 2011), it was revealed that a small percentage (10%) use BPDA techniques. These organizations instead use other business analysis methods like PEST (Political, Economic, Social and Technology), SWOT (Strength, Weaknesses, Opportunities and Threats) and MOST (Mission, Objective, Strategy and Tactics) to reengineer business processes. For those that use BPDA techniques, it was observed that only 9.3% apply use cases, while 6.4% use BPMN techniques to design and analyze their business processes. On the contrary, a bigger percentage (84.4%) indicated that they were not certain of any techniques used (Kasse and Nabukenya, 2011). In the same study, we identified the challenges that impede their adoption and among them included: difficulty in use of a technique; too much time required learning how to use a technique; lack of a clear approach/plan to be followed while conducting BDPA; lack of supporting documentation; lack of organizational commitment and support; lack of collective efforts during BPDA; and failure to benchmark and research (Kasse and Nabukenya, 2011). Additionally, measures to meet these challenges were established and transformed into requirements necessary to design the adoption framework (Kasse and Nabukenya, 2011) as we will see in section 4.

To better understand how to support adoption of the BPDA techniques in Ugandan business organizations, it necessitated us to scrutinize the existing technology adoption models like adopter centered process oriented model (Pereira, 2002), diffusion of innovations (Rogers, 1995), theory of planned behavior (Fishbein and Ajzen, 1975), theory of reasoned action (Ajzen, 1985) and technology acceptance model (Davis et al.,1989) (see section 2).We however observed that these adoption models did not achieve much in relation to adoption of BPDA techniques. This could be attributed to the fact that the models majorly focus on adoption in general terms; without particularly addressing the specificity of issues that are pertinent and unique to transitional countries, more specifically to Uganda. Such issues are expressed in terms of factors that facilitate adoption like; financing, sensitization and awareness, change management and lack of skills (Yin et al., 2006). Notwithstanding, their application to adoption of technology in agriculture (http://www.dni.gov/nic/pdf, 2003) and software development (Umarji and Seaman, 2005) implies that their achievements are of greater significance to further our research into the possibility of BPDA techniques adoption (Xunhua et al., 2010).

Thus far, this study aimed at designing and validating the BPDA techniques adoption framework that can be used by business organizations in Uganda to adopt the techniques. The adoption framework was designed using both the identified parameters from the existing technology adoption models and the requirements derived from the exploratory study in (Yin et al., 2006). In the proceeding section we discuss why business organizations in transitional countries need to adopt the BPDA techniques while conducting business process design and analysis. This is followed by the research approach used to design the adoption framework in section 3, while section 4 presents the designed framework. In section 5 we present the validated BPDA adoption framework and finally we conclude with areas for further improvement with respect to the usage of the framework in section 6.

Why Adopt BPDA Techniques in Transitional Countries

For transitional countries, less to no evidence exists about usage of BPDA techniques to design business processes and thus, the lack of success factors to that effect. The failure to use BPDA techniques in these countries specifically Ugandan business organizations may be attributed to unawareness about their benefits (Yin et al., 2006). Nevertheless usage of BPDA techniques in the developed world has been due to a number of benefits and which transitional countries can learn from among others including:

BPDA techniques enhance and improve the modeling, validation, and simulation of process models that represent business processes (Weske, 2007). This accounts for faster and quality process models that yield quality business processes (Aalst and Van Hee, 1996). Additionally, the resultant quality and agile business processes in an enterprise (Giaglis, 2007) can enable it to have a competitive leverage over others.

Furthermore, once used, BPDA techniques give the process designers a process view from which they can visualize the entire organization without paying attention to the hierarchical nature of organizations which facilitates the breakdown of the complexities and dynamism (Bal and Cheung, 1998) that embed some business processes (Mayer, 1996) in a real time systems (Jarrar et al., 2000). This facilitates the integration of information from the different process activities, graphical expression and display of process views to support the generation and analysis of quantitative results for process implementations.

Economically, use of BPDA techniques reduces the

cost and risks associated with BPR projects and as well provide a re-useable corporate knowledge base of the efforts of the process design team (Mayer, 1996).

Other benefits are discussed in (Mayer, 1996) and these accrue to the effective, efficient and appropriate use of methods, tools and techniques such as; enabling efficient and effective knowledge capture, ensuring increased knowledge integrity, using graphical representations for clarification of communication, maintaining a common reusable repository, supporting team collaboration and maintaining an "enter once, use often" approach in data collection.

Analysis of existing technology adoption models

In the exploratory study (see (Kasse and Nabukenya, 2011), we observed that the challenges that impede the adoption of BPDA techniques in Uganda have prevented the realization for their adoption. To overcome these challenges, a review of existing technology adoption models was made that could be of relevance to supporting the design of a BPDA adoption framework that can be followed towards adoption of BPDA techniques in transitional countries specifically Uganda.

i. Theory of Reasoned Action (TRA) (Ajzen, 1985) provides a distinction between beliefs, attitude intentions and behaviors. It highlights attitudinal beliefs as the best predictors of intention to adopt. TRA assumes the adopter to act without limitations (Ajzen, 1985) yet limiting factors like time and ability affect the rate of adoption.

ii. Theory of Planned Behavior (TPB) extends TRA to overcome the limitation of uncontrolled behavior. However, TPB does not provide for ways through which to influence attitudes of the adopters (Fishbein and Ajzen, 1975). For instance, motivation programs that influence behavior towards adoption. It as well becomes inappropriate to adoption when it disregards a point in time when rejection may occur due to a sudden change in behavior.

iii. Unified theory of Acceptance and use Model (UTAUT) is used to improve predictive power of behavior of intentions to use a technology determined by performance expectance, effort expectance, and social influence and facilitating conditions (Venkatesh et al., 2003). However, the UTAUT scales that are used to analyze and interpret data tend to be confusing limiting its usage (Li and Kishore, 2006).

iv. Technology Acceptance Model (TAM) is used to predict usage of Information Systems (Davis et al.,1989) based on the users' perceived usefulness (degree to which users expect the system to be free of effort) and perceived ease of use (probability that using a system will increase user job performance). Nevertheless, TAM cannot be effectively used to adopt BPDA techniques because it only considers an individual user's perceived usefulness and perceived ease of use of a technology in discount of the effect of social organization structures where users may be a group of people doing the same activity or where a user contributes to a single activity of a process (Salovaara and Tamminen, 2007). It also disregards the aspect of sensitization and training to create awareness and acquaintance to a system before its adoption.

v. Adopter centered model bases its argument on the adopter's mental framework where the adopter is considered as a "black box" to model adoption using a sense-making approach (Miers, 2006). The model bases its argument on an individual's perception, attitude and behavior which keep varying, thus limiting its full application to adoption of BPDA techniques.

From the analysis above, we summarize that the technology adoption models are limited in terms of the fact that they ignore the need for sensitization, planning, training and performance measurement. Some models like the adopter centered model are based on individualistic perceptions and attitudes and, assume adopters to act without limitations of time, ability and financial resources.

These coupled with the challenges that impede the adoption of the BPDA techniques in Ugandan business organizations renders the technology adoption models inappropriate for direct application to adoption in transitional countries. Thus far, it became imperative to design a customized framework that can facilitate the adoption of the BPDA techniques in transitional countries using Uganda as a case study.

RESEARCH APPROACH

To design and validate the BPDA techniques adoption framework, we followed the design science (DS) research method. This is because it permits the creation of new knowledge (artifacts) and its application to the environment. DS is a "problem solving approach (http://en.wikipedia.org/wiki/BuckminsterFuller) that aims at developing constructs, models, methods, and instantiations (March and Smith, (1995) of a system for a given set of user requirements represented (Hevner, 2004). DS consists of three cycles of activities that include; the relevance cycle that inputs requirements from the environment into the research and introduces the research artifacts into environmental field for testing, the rigor cycle which provides theories and methods along with domain experience and expertise from the foundations knowledge base into the research and adds the new knowledge generated by the research to the growing knowledge base, and the design cycle which supports activity for the construction and evaluation of design artifacts (http://en.wikipedia.org/wiki/BuckminsterFuller).

For this research, in the relevance cycle we explored the different BPDA techniques used by Ugandan

business organizations and the challenges encountered during their usage (see [38] and section 4). In the rigor cycle we studied the existing adoption models, theories and frameworks to underpin the research gap from which we derived suitable parameters and requirements for transitional countries' BPDA adoption framework (see sections 2 and 4). In the design cycle we used the derived requirements to design and later validated the BPDA techniques adoption framework using three Ugandan case organizations (see section 4). The exploratory study was conducted using interviews and questionnaires with the case organizations. These organizations were purposively (Shajahan, 2007) selected to represent the different application domains and experiences of BPDA techniques usage in Uganda. They became an ideal choice for data collection due to the fact that they were observed to be the leading service providers in their respective sectors that have undergone business process reengineering in the recent times during the period when the study was conducted. The cases were from both government parastatals and the private sector i.e. the social sector, banking and revenue collection. Respondents comprised of a set of knowledgeable business and IT industry experts such as IT officers, system analysts, business analysts, IT managers, and systems administrators. Interviews were conducted to provide an understanding and motivation for the business problem that this study intended to address based on the case organizations. Below is a description of the case organizations used in the study:

Case 1: National Social Security Fund (NSSF) is a social security saving scheme mandated by the government through the NSSF Act, Cap 222 (Laws of Uganda) to provide social security services to employees in Uganda. It was established by a Parliamentary Act (1985) to provide for its membership, contributions payment to, and payment of benefits out of the Fund. It is a scheme instituted for the protection of employees against the uncertainties of social and economic life.

Case 2: Uganda Revenue Authority (URA) is a government tax body that was set up in 1991 by the URA Statute No. 6 of 1991. The authority is a central body charged with the roles of assessing and collecting specified tax revenue, administering and enforcing laws relating to such revenue and to account for all the revenue to which those laws apply. URA is as well an advisory body to Government on matters of policy relating to all revenue.

Case 3: Barclays Bank Uganda is a global financial services provider, engaged in retail and commercial banking, credit cards, investment banking, wealth and investment management services all over the world.

These case organizations are involved in a set of business processes among which include: NSSF is involved in contributions collections, beneficiary payment, statement balance inquiry, member registration; while Barclays Bank Uganda business processes are loan management, cash management, letters of credit and guarantee, money transfers, and URA is involved in, tax payer registration, tax claims, tax assessment, payment processing, revenue collection, tax and Asyuda.

Designing of the BPDA Techniques Adoption Framework

BPDA Adoption Framework Requirements/Steps

As highlighted in section 1, the challenges from the exploratory study (see (Kasse and Nabukenya, 2011) included among others: Difficulty in use of the techniques, too much time required to learn how to use the technique(s), lack of supporting documentation, lack of organizational commitment and support, lack success factors, lack of defined procedure(s) for choosing appropriate BPDA techniques and, lack of performance measurement/indicators.

The above challenges were transformed into requirements that could be used to support adoption of BPDA techniques in business organizations in Uganda. These requirements together with identified parameters from the technology adoption models limitations (see section 2) were analyzed and used to design the BPDA techniques adoption framework. We define these requirements as a series of steps that provide guidelines on how to support/enable adoption of business process design and analysis techniques in transitional countries like Uganda. These include;

i. Need to sensitize and manage change in organizations before introduction of any new system can be used to manage changes that take place within the organization (O'Neil and Amrik, 1999) so as to enhance commitment and support. This encounters the challenge of lack of change management programs that enlighten employees about BPDA techniques and lure them into supporting the proposed changes. Change management is an approach undertaken to divert minds of individuals from their current state of thinking to a desired state. Sensitization creates awareness about existence of something that an individual might not have had knowledge about. Therefore, through sensitization and change management the adopter studies the entire BPDA process in order to understand the processes being reviewed, and the requirements needed to conduct BPDA so as to pave way for actual adoption of BPDA techniques. Success for sensitization and change management requires the adopters to work with subject matter experts who are knowledgeable about organizations' operations.

ii. Need for training (Al-Mashari and Zairi, 2000). Training would overcome the challenge of difficulty in use of techniques before their adoption. It can be conducted for techniques proposed for adoption (in our case BPDA techniques) through workshops and seminars to em-

power users improve their productivity (Trkman 2010). It creates awareness about the proposed techniques by emphasizing their usefulness and benefits, and provides documentation from the study manuals that were used as training documents.

iii. Need for planning and benchmarking is required to cater for lack of critical success factors for adoption of BPDA techniques. Benchmarking would enable organizations to learn from the experiences of developed countries (O'Neil and Amrik, 1999). Planning involves formulating programs for a definite course of action whereas benchmarking involves learning from the experiences and practices of one another. Planning is conducted to develop plans detail out procedures of how and when to conduct BPDA thereby facilitating the prioritization of adoption activities (Trkman, 2010) in view of time and resources available. Such plans would include the vision, aims, objectives and strategies for adopting BPDA techniques as well as the budgets to be used to source for funds to finance the adoption activities. Planning and benchmarking can be enhanced through conducting research and development in the area of BPDA techniques adoption. Benchmarking provides an alternative to planning by enabling the adopters to learn from experiences and success stories of other adopters.

iv. Collective adoption or rejection: collective action is required to encounter the effect of an individual selecting a technique(s) for adoption without justification. This would enable all stakeholders within the organizations to decide as a team whether to adopt or reject the proposed BPDA technique(s). However, success of this step depends upon successful completion of the previous steps, otherwise rejection would prevail

v. Measure performance: This meets the challenge of lack of performance measurement/indicators within the organisations that would be used to assess the rationale for use of BPDA techniques. Performance measurement provides checks and balances on the requirements specified for use of techniques against the expected outcomes from their usage. It is achieved through setting a standard upon which the comparison and evaluation of inputs against outcomes can be based. It therefore provides a reference point against which outcomes from the use of BPDA techniques are compared against requirements for their use thus, keeping their usage on track to prevent it from being derailed and ensure sustainable improvements (Trkman 2010).

vi. Use of BPR software tools is required to enhance the documentation capacity of some BPDA techniques by improving on the rate at which they generate and store information. This has been an impending factor to their adoption (Bal and Cheung, 1998). Integration of BPR software tools would come after successful adoption of the techniques to enhance their documentation capability in order to improve the analysis and design ability of the analysts by enhancing the creation and storage of a business process information. Therefore, Integration of BPR software tools like Yawl, Rational Rose, iGrafx, etc enhances the technique's documentation capacity to support users and provide a platform upon which performance measurement can be based.

Framework Design

The BPDA techniques adoption framework in figure 1 presents a series of steps (requirements) that provide guidelines on how to support/enable adoption of business process design and analysis techniques in Uganda. As seen in figure 1, the success of these steps lies in the initiative to explore and identify contingent factors that lead to achievement of each one of them. This means if the steps 1 to 6 are logically and hierarchically followed, they should lead to successful BPDA techniques adoption in Ugandan business organizations. Nevertheless, if objectives of a particular step are not achieved, adopters could revert to the previous step(s) to correct mistakes that might be responsible for failure of former objective(s). Once the mistakes have been corrected, the adopter can proceed to the next step.

Validation of the Framework

Validation criteria

To evaluate and validate the designed artifact (BPDA adoption framework), we used the design science research approach in order to demonstrate the utility to the prospective users using the prescribed steps in section 4. The validation followed a specific criterion that involves a set of parameters that included usability, understandability, interactivity and applicability as suggested in the design science research approach (March and Smith, 1995).

- Understandability; intended to verify whether users find the framework easy to understand when they put it to use. Understandability was determined using factors like; number and clarity of framework steps to ease interpretation and comprehension, logical flow and arrangement of steps.
- Usability: intended to assess the ease with which users can interact and work with the framework to accomplish a particular task. Usability was determined based on factors like; ease of interaction, framework learnability, clarity of language used, and efficiency, i.e. how quickly users can perform their tasks.
- Interactivity: intended to assess the ability of the framework to provide coordination between users who may be working at different stages of adoption.
- Applicability: intended to assess whether participants find the framework applicable to adoption of techniques given the challenges that exist within the organizations.

Table 1. Validation results at NSSF

Question	Yes (%)	No (%)
Framework understandability	85	15
Framework usability	80	20
Framework interactivity	90	10
Framework applicability	100	00
Av. Percentage	82	18

Table 2. Validation results at URA

Question	Yes (%)	No (%)
Framework understandability	90	10
Framework usability	85	15
Framework interactivity	78	22
Framework applicability	90	10
Av. Percentage	86	10

Table 3. Validation results at Barclays Bank

Question	Yes (%)	No (%)
Framework understandability	70	30
Framework usability	75	25
Framework interactivity	90	10
Framework applicability	90	10
Av. Percentage	81	19

Applicability was assessed bearing in mind the limiting factors of time, ability (Ajzen, 1985) and simplification of adoption process.

Every after each case' interaction with the framework, an evaluation was conducted using an in-depth structured questionnaire in order to provide further understanding and motivation for the problem we were addressing, and the possible usefulness of the framework in real-world settings.

Cases' experience with the framework

At the time we evaluated the framework, NSSF IT department was in the process of implementing an E-statement service where NSSF members would get their statements via an online system by visiting the NSSF website, login and retrieve their current balance status any time they would wish. At Barclays bank, the performance intelligence department that is in charge of innovations and works hand in hand with the IT department to assess the role IT can play in the innovations. The bank was reviewing its loan process to cut the loan period from loan application to loan delivery without compromising the collateral requirements. At URA, the IT department was in the process of implementing a new phase of E-tax that makes use of SMS to deliver tax information to clients.

During the demonstration of and interaction with the framework, the participants had a new experience of approaching the design and analysis of business processes. At the start of the demonstration, participants expressed a strange feeling about the framework as they were used to the old way of approach that lacked a clear plan of how the process will be conducted. This was overcome by explaining and stressing the benefits of BPDA techniques and the role that the framework plays towards the adoption of those techniques.

VALIDATION RESULTS

After their interaction with the BPDA techniques adoption framework, the participants assessed it using a questionnaire that was distributed and below are the results as presented in tables 1-3.

Table 4. Combined validation results

Question	Mean	Std. Deviation
Framework understandability	1.0556	.23570
Framework usability	1.1667	.38348
Framework interactivity	1.1111	.32338
Framework applicability	1.1111	.32338

The results in tables 1-3 indicate the responses from individual organizations that were used to evaluate the framework. We can note that regarding framework understandability, respondents indicated high scores of 80%, 85% and 75% at NSSF, URA and Barclays bank respectively. This could mean that respondents found the framework steps clear and logically structured to ease interpretation and understanding. Additionally, the framework usability parameter scored higher with 85%, 90% and 70% at NSSF, URA and Barclays bank respectively. This could have been due to the fact that respondents could work with the framework to accomplish an activity in a much less cycle time as compared to working without it. Furthermore, the framework was found to be highly interactive with scores of 90%, 78% and 90% at NSSF, URA and Barclays bank respectively. This could have been due to the iterative and coordinated steps that could be easily followed towards adoption. Regarding the framework applicability to specific issues in developing countries, high scores of 100%, 90% and 90% at NSSF, URA and Barclays bank respectively were realized. This was justified by the fact that factors that tend to limit adoption like time and funding were put into consideration by the framework thereby making it applicable to adoption of BPDA techniques in Uganda.

The high scores from the individual organizations validation gave us a platform to conduct a combined evaluation to enable us to generalize our conclusions.

Using results in table 4, findings revealed that the framework was highly understandable (Standard deviation = 0.23570) because there was clarity of framework steps complemented by logical flow and arrangement of steps. Results also indicated that BPDAAF attested to a high usability standard (Standard deviation = 0.38348) due to the fact that participants were able to work with the framework with ease and in less time to accomplish a task. Moreover the BPDAAF proved to be interactive (Standard deviation = 0.32338), due to the coordinated steps that are iterative to enable the adopter to move back and forth to ensure achievement of objectives from each step. Lastly, participants found the framework averagely applicable (Standard deviation = 0.32338) to adoption of BPDA techniques. This could be attributed to the framework putting into consideration limiting factors like time and finances that must be catered for before adoption takes place.

Thus far using the validation results with respect to the BPDAAF understandability, usability, interactivity and applicability, we can generally conclude that the designed BPDAAF can be used to aid Ugandan organizations to adopt BPDA techniques as it provided the participants with clear guidelines that could be followed to support adoption.

CONCLUSION AND FUTURE WORK

Compromising the quality of business processes is detrimental to an organization's success. The effects of such are expressed in terms of customer dissatisfaction, loss of customer loyalty and profitability. Quality and agility of business processes is achieved through the use of methods, models, tools and techniques that simplify the design and analysis of such processes (Aalst 2007). This research highlighted the fact that Ugandan organizations do not use BPDA techniques due to lack of knowledge about their existence, lack of institutional support and skills necessary to use the techniques (Benbasat and Zmud 2003). among others. The challenges were overcome by designing a framework with a set of guidelines that facilitate the adoption of BPDA techniques. Among these included; the need to sensitize and manage change, need to plan and benchmark, need to train, and performance measurement. From the validation and evaluation results, we conclude that the BPDAAF is indeed understandable, usable, interactive and applicable based on its ability to facilitate adoption of BPDA techniques by Ugandan business organizations.

Notwithstanding, based on the outcome of the research study and in order to generalize our conclusions, we recommend complimenting it with a number of activities. First, an assessment of the contribution of external parties towards the adoption process; particularly, the need to restudy the effect of external stakeholders like suppliers and IT manufacturers, the role they can play and how they can be integrated in the adoption framework since IT adoption research helps them to better handle the development, application, and management of information systems (O'Neill and Amrik 1999). Secondly, there is need to perform an empirical study on the usage of the framework with the three Ugandan cases and more business organizations to determine if it indeed enables transitional countries

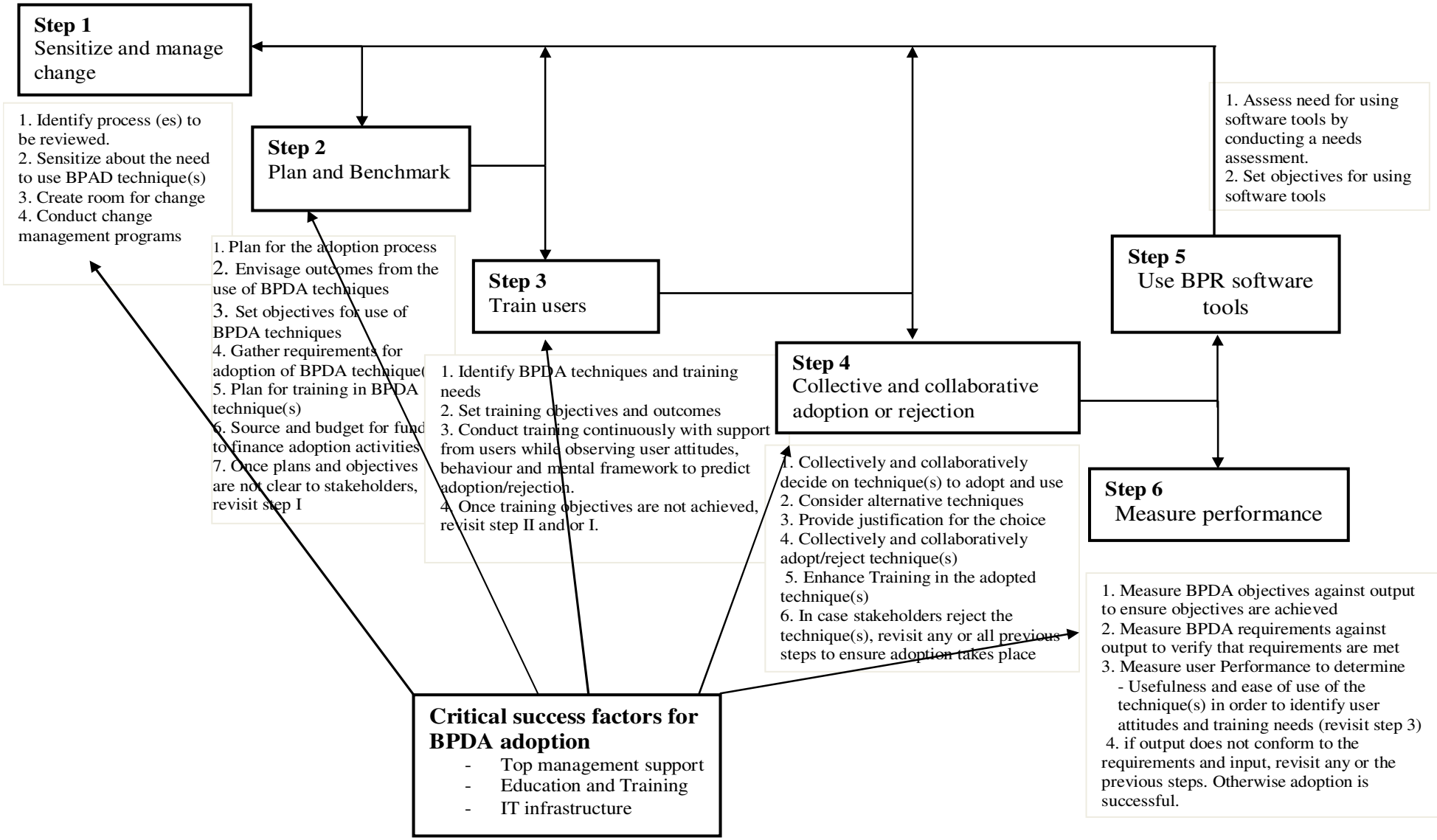

Figure 1. *BPDA adoption framework (BPDAAF)*

to adopt the business process analysis and design techniques in their business processes.

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