An Investigation of a Specific System Development Methodology for Business Process Reengineering

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Abstract

System developers in South African organisations need to recognise, recommend and appreciate the use of System Development Methodologies (SDMs) (Huisman 2004). In this age of rapidly changing technological trends which South African organisations have not been spared of, system developers are constantly trying to find new ways of doing business that align with the technological advancements. In light of this, transforming the way business is done or changing business processes is usually the ultimate solution, thereby invoking Business Process Reengineering (BPR). There is therefore a strong call to employ specific SDMs for the development of Information Systems proposed for BPR (Mavetera 2012). This paper looks at specific SDMs for BPR. As of today, existent SDMs in the computing world are believed to have been designed for the development of completely new Information Systems not systems that are being improved or reengineered. The drive behind investigating specific SDMs for BPR is basically informed by past research from BPR proponents who are concerned that BPR has serious effects on the organisational business processes (Hammer and Champy 2005, Muthu, Whitman and Cheraghi 1999 and Giaglis 2009). They advocate that BPR requires a proper system development approach to be followed if it is to succeed. This theoretical investigation further looks at the extent to which SDMs accommodate the aspect of BPR in terms of BPR characteristics and success factors within their philosophy.

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Introduction

Organisational changes influence specific business processes, thereby invoking Business Process Reengineering (BPR). Influencing business processes means that it necessitates the rearranging, restructuring, reorganisation or repositioning of business processes of which IS departments play a role (Frenzel and Frenzel 2004). BPR causes Information Systems to be re-engineered in order to accommodate the changes to business processes that would have taken place. BPR introduces new ways of solving problems through IS in the business environment (Mavetera 2012). It is noted that re-engineering of IS can be complex; therefore the process requires to be managed properly (Hammer and Champy 2005, Muthu, Whitman and Cheraghi 1999 and Giaglis 2009). In light of this, some authors have suggested the use of System Development Methodologies (SDMs) to assist with managing BPR (Huisman and Iivari 2003, Huisman 2004, Avison and Fitzgerald 2006, Mavetera and Kroeze 2010).

In this paper, major categories of existing SDMs are classified, examined and compared according to their philosophical components in an attempt to satisfy the requirements of this investigation. This categorisation is useful in helping developers to make choices on appropriate or suitable SDMs when conducting BPR. In the rest of the paper, business processes are discussed first, followed by a discussion on BPR and its characteristics. A brief on the use of SDMs during BPR which attempts to find the correlation between these two follows and the paper concludes by looking at some recommendations on the importance of SDMs in assisting with BPR.

Business Processes

A business process is a collection of related structured work activities or tasks meant to produce a specific service or product or serve a specified goal of which the activities include interleaving decision points (Frenzel and Frenzel (2004). Davenport (2006) confirms that a business process is a specific ordering of work activities across time and space or a structure for action. Hammer and Champy (2005) add that this collection of activities must take one or more kinds of input and creates an output that is of value to

the customer. Davenport (2006) also purports that transformation within the business process through engineering or otherwise, must add value to the customer. Smolander *et al.* (2000) note that a business process can clearly be distinguished by such special characteristics as: Adaptability - It must be easily changeable to suit the ever changing technological needs, Order - It must consist of activities that are clearly ordered according to the workflows of the organisation , Customer - There must be a recipient of the business process outcome, usually a customer, Value-adding - The transformation taking place within the business process must add value to the recipient and the organisation, Embeddedness - A business process cannot exist in itself, it must be embedded in an organisational structure, Cross-functionality - A business process must span across several functions within and beyond the organisation (Kettinger and Grover 2005)

Chosen business processes must focus and coordinate the organisation's activities from the top downwards, towards accomplishing the organisation's mission (Kettinger and Grover 2005). Modelling business processes begins with a thoughtful understanding of the organisation's mission, analysis of the environment, and a detailed assessment of how various business units interact (Wacher 2006). Frenzel and Frenzel (2004) further explain that business processes implement the present and the future of the organisation and they are described by such critical elements as the mission, vision and competitive advantage.

Business Process Reengineering (BPR)

Mavetera (2012) defines BPR as the fundamental radical change to Information Systems based business processes, based on incremental steps where quality is of importance. BPR is considered as a pioneering attempt to change the order of work activities or the way work is performed. BPR also involves addressing issues concerning the organisational structure, the roles of business process performers, the management system and the underlying corporate culture which holds the beliefs and values that influence everyone's behaviour and expectations (Cypress 2009). Davenport (2006) adds that BPR involves examination and change of five components of the business which include: organisational strategy - the long term goals and mission that are defined by strategic management (Harrington 2006); business processes - the procedures or tasks that users, managers and IT staff

members perform (Mavetera 2004a); technology - the use of hardware and software as well as telecommunications for the purpose of storing, transforming, retrieving and transmitting data (Gant 2002); organisation - the business as an entity (Schwalbe 2010) and lastly, culture - the specific collection of values and norms that are shared by people and groups in   an organisation and that control the way they interact with each other and with stakeholders outside the organisation (Schwalbe 2010). The next section presents BPR features and success factors required in SDMs.

BPR Characteristics and Success Factors Required in SDMs
Maul and Childe (2003) noted that the differences in BPR approaches used in organisations differ according to their characteristics which include the degree of change (either radical or incremental), the scope of the exercise (either quality led or IT led) and the focus of attention (either individual process or whole process). These are discussed below:

The Degree of Change
The degree of change is composed of two approaches, namely the radical and incremental approaches.   The radical approach is also referred to as the root-to-branch radicalism as far as business process improvement is concerned (Maul and Childe 2003). Radicalism promotes early risk mitigation by breaking down the system into mini-projects and focusing on the riskier processes first (Hammer 2008). These are believed to be the roots which must be strong enough first before branches can be developed. This approach allows planning a little, designing a little, and implementing a little (Stalk 2010). Radicalism encourages all participants who are part of the process improvement to be involved earlier on. It allows the BPR process to change with each iteration; allowing corrections sooner and puts into practice lessons learned in prior iterations (Maul and Childe 2003). It focuses on the most important processes by improving subsequent process soon after the previous one is completed.

   It is noted that the incrementalist approach allows for processes to change over time rather than be improved in one huge effort (Harrington 2006). It allows processes to improve by giving enough time to the evolutionary process. It also focuses attention on stability and the belief is that only a stable foundation can support multiple additions (Maul and

Childe 2003). The incrementalist approach further allows a subset of the processes to actually run much sooner than the other processes. Interim progress is allowed to continue through the stubbing of functionality and accommodates the management of risk by exposing historical problems earlier on in the process (Stalk 2010).

The Scope of the Exercise

The scope of the exercise looks at two approaches, that is, the IT- and the quality-led approaches. IT-driven intervention views BPR as the redesign of processes to take advantage of the potential of IT (Gant 2002). This approach identifies BPR with traditional systems analysis and design and software engineering (Maul and Childe 2003). It involves developing a requirements definition, entity relationship models, normalised database, designs and eventually software solutions applying all this within existing but usually functionally-oriented organisations (Stalk 2010).

The quality led approach concentrates first on identifying the business processes, then analyses and re-engineers each process that needs improvement (Hammer 2008). Quality of the process becomes the main focus with this approach. From this perspective, IT ceases to be the focus of the analysis and design exercise and firms should delay consideration of integrated software solutions until quality BPR is complete (Maul and Childe 2003). The third and last characteristic is the focus of attention.

Focus of Attention

Like the other two characteristics discussed above, this also has two aspects, namely, the individual and the multiple views. Stalk (2010) points out that BPR intervention can vary in scope. BPR is viewed as an activity that varies from single view to multiple views. The single view involves an individual business process within a function where the idea is to improve an individual part of the business process and improvement is on a small scale (Maul and Childe 2003). The scope is usually internal, operational in outlook, low risk and addresses strategies within a particular function. The individual type of change can be regarded as mostly incremental change (Gant 2002).

The multiple approach covers all the business processes within a function. It applies the systems view principle where the organisation's business processes are tackled in consideration of the whole organisational

strategy rather than in parts (Carter 2005). Although the process is wider in scope than individual improvement, it is still essentially operational in nature. The process involves higher risk to the organisation and can be regarded as radical change (Maul and Childe 2003). The next section will give a brief on the BPR success factors.

BPR Success Factors

Kettinger and Grover (2005), in their contribution to explaining BPR, noted that success in implementing BPR is achieved through benchmarking and the use of BPR success factors such as:

- Top management sponsorship **-** top managers are the initiators of business processes. Their strong and consistent involvement is important because they are responsible for approval and allocation of required resources like funding (Schwalbe 2010).
- Strategic alignment **-** any organisation relies on its strategic goals to survive. BPR should therefore align with organisation's strategic direction (Frenzel and Frenzel 2004). The business processes should always align with organisational strategy, in order not to divert from the mission.
- Compelling business case for change **-** the business case must contain measurable objectives, meaning that the problem at hand should be clearly understood for BPR to be a success (Frenzel and Frenzel 2004).
- Proven SDM **-** the SDM that is chosen has to be well understood with a good track record and has to meet the needs of the BPR project (Huisman and livari 2003).

Effective change management **-** this addresses cultural transformation because change is not always embraced by everyone. It should be managed accordingly so that the changed business processes are supported by every stakeholder (Frenzel and Frenzel 2004).

BPR proponents argue that the BPR success factors alone are not enough to implement successful business processes, appropriate approaches are also required, hence they the use of SDMs was recommended (Giaglis 2009).

System Development Methodologies (SDMs)

Research has shown that many South African organisations widely believe that adherence to SDMs is beneficial to Information Systems development. Some organisations claim that they do not pay much attention to the concept of SDMs (Hill 2009). Other organisations report that they are gradually adapting the use of SDMs, while others claim that they have and are using them and obtaining positive results (Huisman 2004). Apart from the claims above, it is still not very clear whether the same sentiments can be passed with regards to the use of SDMs during BPR.

For the purpose of this paper, Mavetera (2012) defines a SDM as a strategy focused and recommendable process of developing or improving an Information System or part thereof, which is based on an underlying philosophy and includes the use of tools and techniques while following prescribed processes depending on the field of practice. Thus far, research has shown that various SDMs have been developed for different purposes in IS. This study aimed to partly identify specific types of SDMs that are used for BPR. The following section discusses the use of SDMs during BPR.

SDMs Use in BPR

According to past research, BPR is a process that needs to be properly planned, designed and implemented (Giaglis 2009). It is recommended that BPR should follow a particular process and make use of particular tools and techniques (Mavetera 2012). This implies that BPR should follow some sort of SDM (Muthu *et al.* 1999). Thus far research has not shown concrete evidence that address particular SDMs that target BPR (MacArthur 2004 and Smolander *et al.* 2009). However, it may be important to note that a few of the SDMs in existence which were originally developed for purposes other than BPR have often been diverted to BPR use because of some appropriate BPR characteristics that they possess (Muthu et al. 1999).

Avison and Fitzgerald (2006) devised a framework based on certain SDMs characteristics. This framework has been referred to most of the time when SDMs are considered for use or discussed. The characteristics include: a philosophy, a model, tools, techniques, outputs, products, implementation details, programming and testing as well as the field of practice for that particular SDM. These SDMs characteristics are referred to and used

differently depending on the context of the project or study (Huisman 2004, Fitzgerald and Avison 2006 and Mavetera and Kroeze 2010).

Based on this claim a collection of SDMs was identified for evaluation. The evaluation done for this study is firstly based on one of the SDMs characteristics among the ones listed above, which is the philosophy. This evaluation was to try and establish whether SDMs have any change element underlying them that makes them recommendable for BPR. Secondly SDMs are evaluated based on the BPR characteristics discussed above as well as the extent to which they satisfy the BPR success factors.

The philosophy of an SDM is a principle or set of principles that underlie the SDM. It is sometimes argued that all SDMs are a based on a common philosophy to improve the world of information systems development (Fitzgerald and Avison 2006). A philosophy covers aspects on paradigms, objectives, domains and target applications (Mavetera and Kroeze 2010). Table 1 below thus uses these aspects of a SDM philosophy to evaluate their suitability for BPR.

Table 1: SDMs evaluation based on philosophy components

SDM	Philosophy			
	Paradigm	Objective	Domain	Target
Process Oriented SDMs STRADIS YSM	Science	For the development of strategic Information Systems	Specific for problem solving	General purpose, any size of system
	Science	Specific for the development of new Information Systems	Specific for problem solving	Large organisations
Blended SDMs IE SSADM	Science	Specific for the development of new Information Systems	Planning, organisational and strategy type	large organisations

	Science	Specific for the development of any Information Systems	Specific for problem solving	Large organisations
Object Oriented SDMs RUP OOA	Science	Specific for the development of agile Information Systems	Specific for problem solving	Any organisation
	Science	Necessary for change development in cases of problems or need	Specific for problem solving	General purpose/ Large organisations
Rapid Development SDMs XP DSDM	Science	Specific for the development of new Information Systems	Specific for problem solving	Small/ Medium organisations
	Science	For organisational/ general problem solving	Specific for problem solving	Large/ Small organisations
People Oriented SDMs ETHICS KADS	Systems	Concerned with the process of change for Information Systems	Specific for problem solving	Large organisations
	Systems	Specific for the development of new Information Systems	Mainly for expert systems	Small/ Medium organisations
Organisational oriented SDMs	Systems	Concerned with the process of change	Mainly for large and complex	Large organisations

SSM PRINCE		Information Systems	problems	
	Systems	Information Systems and elsewhere	Specific problem solving	Large/ Small organisations

The evaluation in Table 1 shows that the SDMs selected have at least one element that qualifies them to be recommendable for BPR. It is also evident that all the SDMs evaluated possess one recommendable BPR characteristic in common which is IT-led since they are all for the development of IS. However, these SDMs seem to lack adequate emphasis on one or more of the crucial BPR characteristics thereby disqualifying them to be specific SDMs for BPR. It may therefore be safe at this particular stage to assume that there is no specific SDM for BPR purposes and therefore suggest that future research may need to consider developing some.

Evaluation of SDMs Based on BPR Characteristics and Success Factors

In Table 2 below, an overall evaluation of SDMs was done in order to identify their strong and weak points based on the BPR characteristics and success factors. A key is also presented with the table to explain the symbols that are used. In the key **'S'** means that the SDM strongly supports the BPR success factor in line with it, 'M' represents moderate support, 'W', means there is weak support and **'N'** means support is non-existent. The evaluation in Table 2 also shows the strongest BPR characteristic that defines a SDM. A section of recommendations is also added in the last column of Table 2 below in an attempt to recommend possible SDMs for BPR based on the BPR characteristics and success factors.

In the last column the study recommends probable SDMs for BPR purposes. An improvement can also be made to these mentioned SDMs by enhancing them with the missing characteristics and success factors as discussed for them to qualify as specific for BPR.

Table 2: Evaluation of SDMs based on BPR characteristics and success factors

SDM	BPR Success Factors				BBR Strong Characteristics	Recommendations of SDM for BPR
	Strategic Alignment	Top Management involvement	Compelling Business Case for Change	Effective Change Management		
STRADIS	S	S	N	N	Radical, IT-led	M
YSM	M	W	N	N	Quality-led, IT-led	N
IE	M	S	N	N	Radical, IT-led	W
SSADM	S	W	M	W	Incremental, IT-led	M
RUP	N	N	N	M	Incremental, IT-led	W
OOA	N	N	W	W	Quality-led, IT-led	W
XP	N	N	W	N	Incremental, IT-led	W
DSDM	W	W	W	W	Quality-led, IT-led	W
ETHICS	M	M	S	S	Incremental, IT-led	M
KADS	W	N	M	N	Quality-led, IT-led	W
SSM	S	M	N	N	Incremental, IT-led	M
PRINCE	N	N	N	N	Quality-led, IT-led	W

Key
S – Strong   M – Moderate
W – Weak   N – Non-existent

Recommendations

This section presents the recommendations to the study informed from the findings presented in the sections above. Development is more comfortable where developers believe in following a prescribed way of doing things (Mavetera and Kroeze 2010). This should be done for both new developments and for BPR. Table 2 above combines the discussions on BPR and SDMs in an attempt to find a recommendable SDM for BPR purposes.

Recommendation 1

Some issues to be considered when developing SDMs for BPR include the following:

- Stakeholder cooperation - the coming together and agreeing of the individuals involved with the business processes in combination with an energised BPR team and management is required apply their techniques to carry everyone on board

- Philosophy or the underlying assumptions – the philosophy of the SDM should strongly address the aspect of change and should be well defined and understood by all stakeholders affected and should define the scope of the BPR project and achievable objectives should be derived.
- Capture the softer side of development – the SDM should consider important aspects such as change management and other important aspects such as cultural and personality diversity, cultural mindset, attitudes as well as customer relations management.

Recommendation 2

SDMs for BPR, like any other development methodologies, should be divided into model stages as suggested below:

- **Stage 1 - Envision:** the organisation reviews their existing strategy and businesses processes and identify areas for improvement as well as technological opportunities.
- **Stage 2 - Diagnosis:** involves the creation of appropriate documentation for business processes in terms of process attributes like activities, resources, communication, roles, Information Systems and costs.
- **Stage 3 - Redesign:** business processes are then redesigned through alternatives devised from brainstorming and creativity techniques.
- **Stage 4- Reconstruction:** to assist stakeholder with change management that ensures smooth migration to the new business processes, responsibilities and roles.
- **Stage 5- Evaluation:** the new processes are monitored to determine if both organisational and Information Systems strategies were met and establish whether quality requirements were met and retrain workers on what BPR actually is.

Recommendation 3: Devising A BPR Framework from Several SDMs

The characteristics of BPR projects differ with each organisation because the business processes are different, yet existent SDMs make no distinction among BPR projects. Giaglis (2009) contributes that BPR is a multi-

dimensional tool in that it accommodates the use of several SDMs to examine processes from a holistic perspective with regards to the organisation. Instead of adapting or devising a single SDM for BPR, which will probably address specific situations only, different SDMs may be used for different BPR projects. Organisations can develop a framework based on a collection of various stages of existent SDMs that are relevant to their unique settings and then add other stages of their own provided they strictly consider the BPR characteristics discussed above. The problem with this approach however is that there is no guideline as to how adaptation decisions can be made or whether there are any controls over the changes and how well the adapted SDMs frameworks would work.

Conclusion

The success or failure of BPR lies in the good practices and measures applied into the process, more specifically the SDMs that are used to accomplish the project (Venkatraman 2009). This paper looked at specific SDMs for BPR. This was done by reviewing literature from past research on accommodation of BPR success factors and characteristics in existent SDMs. The results indicated that vagueness still remains as to the existence and use of particular SDMs for BPR.

This research is a first step in understanding the nature of SDMs in use for BPR and the extent to which they accommodate specific BPR characteristics and success factors needed for them to qualify as specific for BPR. The problem of addressing business processes in SDMs while implementing BPR, seem to be rather basic but quite difficult to address in practice.

Clemons (2000) and Mavetera (2004b) contribute that more research needs to be done on organisational regulations, attitudes, policies, and practices which may be an impediment to BPR efforts. Hammer and Champy (2005) emphasise that further contributions may be needed to the development of SDMs with a focus on BPR. The use of specific SDMs in BPR is widely touted but non-existent, therefore findings on the relationship between BPR and SDMs still remains a path to be explored.

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