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Abstract

Despite continued evolution of information systems methodologies for more than three decades, the rates of software rejection and failure are still high. This paper investigates the technological environment as a major cause of such disruptions. Additionally, the paper evaluates Agile and DevOps as the remedial methodologies for managing the adverse impact of technological disruptions. The main findings affirm both Agile and DevOps as methodologies that emanated from improvements or re-engineering of earlier methodologies. Further findings discern most methodologies; including agile and DevOps; as not strategically focused but appraise DevOps as the most progressive methodology towards this respect. Rather than re-invent the wheel and come up with a new methodology, a framework that aligns DevOps for use in strategic information systems development is proposed. Besides, a more realistic definition of operations is postulated to bolster the alignment.

Adapting Agile DevOps for Strategic Information Systems Development

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Abstract: This paper highlights the impact of the technological environment on strategic IS development methodologies and additionally gives a framework for aligning Agile DevOps methodology strategically. The main findings of the research show that; future use of DevOps methodology is inevitable due to unprecedented changes in the development environment and mass adoption of automation in development, testing and monitoring of majority of the aspects of IS development. Additionally, although integrating development and operations in systems development has in the past led to development of highly acceptable systems, such systems may not be strategically aligned when projects IS are outsourced or implemented in unstructured organisations.

KEYWORDS: STRATEGIC INFORMATION SYSTEMS, AGILE, DEVOPS, SYSTEMS DEVELOPMENT METHODOLOGIES

1. INTRODUCTION

Increased virtualisation of business processes and unabated invention of top notch technologies has not only affected the way of doing business, but also, the approaches and methods of introducing new systems in businesses. Information systems development methodologies have over time shifted from transactional focussed processes initially used while developing transactional business systems, towards those that are suited for developing strategic business systems [1]. The former methodologies are described as rigid; leading to failure of many software projects [2]. Their inflexibility and alienation of customers during systems development is said to have led to a chaotic systems development process [3]. Given the radical changes in IS development methodologies in the past two decades, it is imponderable to evaluate what the future holds in this area [4].

A subsequent section of this report explores the past and the current technological developments that have, or could have, an impact on the future direction of IS development methodologies. But before then, the needs for strategic envisioning of the future of information system development methodologies are highlighted. The report wraps up with a suggestion for a strategically inclined DevOps framework that addresses the adverse impact of technology while developing strategic IS. Finally, a summary of key findings, concluding statements and recommendations for future research is presented.

2. STRATEGIC INFORMATION SYSTEMS DEVELOPMENT

The approaches adopted in developing an information system, should be aligned with the strategic goals of the organisation intending to use it [5]. Strategic goals are the business objectives that should be given the highest importance for the current and future health of the business; as pertains to meeting its shareholders goals [6].

Systems developers and project managers have over time attributed the challenges in information systems development to the strict requirements of adherence to the processes exhibited by traditional development methodologies such as: the waterfall, spiral, incremental, among others [3]. Additionally, factors that affected software projects according to the Standish software chaos report [7], insinuate a consistent trend with a discernible increase in the number of projects that failed or were rejected in the five years that preceded the report.

It is plausible to assume that, majority of the traditional information system development methodologies, perhaps overlook some important aspects of IS development process. Therefore, evaluating past and present trends that have had an impact on system development could help in strategic envisioning of IS development methodologies [5]. While some inferences may involve re-engineering the processes in existing

methodologies, others may entail their overhaul [4]. However, the approach a business decides to employ must be aligned with its strategic goal of creating a competitive advantage and cost leadership through differentiation and operational efficiency [6].

Looking at the strategic focus of organisations, there is a need for prior planning on how disruptive internal and external factors should be managed strategically. Porter suggests value chain analysis to help organisations create competitive advantage through differentiation and cost leadership achieved through innovation and operational efficiency [8]. An alternative framework is the strategic options generator by Wiseman & MacMillan [9] which advocates for the creation of competitive advantage in four ways, namely; contextualising improvement opportunities to competitive advantage, ensuring active participation by all IS professionals in systems development, synchronization of information planning with business strategy while promoting communication between various business units, and finally, making the main focus of systems development to be the improvement of competitive advantage.

A major challenge in the successful deployment of IS development methodologies is the management discipline and its related theories; which are by nature obsolete due to their non-evolving disposition [10]; their strict implementation dissuades innovation [10]. In this regard, a close look at the traditional information systems development methodologies highlights their focus on project management as opposed to the final product [3]. This factor may have contributed to unpopularity of most of the traditional IS development methodologies [2]. For instance, the waterfall model focus is on the processes and sequences of software development leaving testing and evaluation late in the project [3]. Although this may work in small low-risk projects, managing a project using this approach may not be tenable in environments where business focus is strategic and change inevitable, and where specifications can change anytime during development [1].

Future IS development methodologies are expected to be strategically aligned and flexible enough for various environmental disruptions [1]. Agile is a front runner in this and some of its approaches have already been highly embraced by the development community for this respect [11]. However, full realisation of the benefits brought about by agile methodologies such as DevOps, can only be achieved after a paradigm shift in the management practice where managers stop being supervisors but collaborators in a flat organisational structure with shared values [12]. DevOps methodology has an ideal framework for creating such an environment. Its successful implementation in the transformation of Amazon Web Services (AWS) from an online retail shop to a tech giant, tells its story [13] .

3. THE IMPACT OF TECHNOLOGICAL ENVIRONMENT

In the automation, information and transformation eras [2], it was easier to plan for systems development in advance because the technological environment back then was stable enough to accommodate even the most rigid system development approaches and still deliver a system that met customer's expectations [2]. Expectations were also not as high as they are today, and earlier eras were characterised by systems that processed definite data [14].

The current era has brought about innovations that have led to the availability of off-the-shelf information systems designed to address almost all business IS needs [15]. A good example is the SAP enterprise resource planning (ERP) that integrates solutions for most business processes eliminating the need to develop business system from scratch [15]. Another breed of systems is a form of strategic decision support systems designed to bolster artificial and business intelligence [4]. These IS have overcome many barriers along the way and matured to trustworthy platforms [13]. A similar trend is predicted in the future where some aspects of systems development considered modern today, will be obsolete in the future. Some IS development methodologies will be prominent in the future, while others will recede [11].

The most predictable impactful technological trend is the ongoing prominence of business virtualisation enabled by ubiquitous access to resources made available by cloud computing [16]. This trend will continue to dominate most of the technological aspects in IS development [4]. This deciphers that; modern practices like pair programming popular with agile scrum methodology, will be executed virtually in the future. Furthermore, agile tools such as the Kanban board, used in the Kanban methodology, will be digitised and shared amongst virtualised teams - and so will be software testing in agile test-driven development [17]. Automation of development processes requires organisational restructuring for business process improvements. The McKinsey 7s Model shown in figure 1 below looks an ideal tool to aid such a restructuring [12].

Figure 1: McKinsey 7S Framework
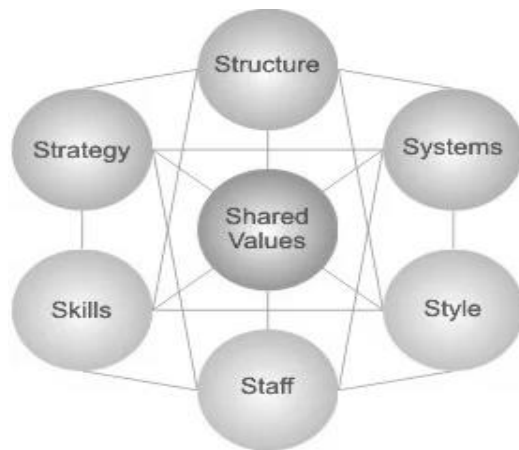
Source: [12]

With the tenets of the McKinsey 7s framework withstanding, DevOps methodology is likely to become very popular in future; largely because of its requirement for the involvement of operations and development staff in systems development [18]. The methodology is also used in managing team dynamics by ensuring IS ownership by all. This approach is overlooked by other agile practices including the popular agile scrum methodology [13]. The flexibility of DevOps methodology and its practices that are highly borrowed from the agile manifesto - will therefore continue to encourage innovation in systems development - through team collaboration and continuous delivery in the organisations that embrace it [18]. This will consequently create a competitive advantage for its proponents through operational efficiency [8]; consequenty reducing the cost of services offered . This can deter new entrants in the market reducing competition as advocated for by the Porter's five forces model [8].

4. IMPROVEMENT AND RE-ENGINEERING OF EXISTING METHODOLOGIES

Both agile and DevOps methodologies are improvements of older methodologies [3]. For instance, the agile scrum methodology is an improvement of the spiral model whose major limitations were 1) the length of spirals (iterations) which were too long; that is, they took several months and sometimes years to accomplish and 2) over planning in the initial stages that led to a complex system in each spiral. The agile scrum methodology came in and modified these spirals to short sprints [17].

On the other hand, DevOps came in to close gaping gaps of non-involvement of operations staff in systems development and limited automation in agile practices [13]. Failure to address these gaps had over time contributed to rejection of many systems even with the improvements brought about by the agile methodology [7].

Figure 1.2, the major reasons why projects IS were challenged in the period 2010-2014 [7]

Project Challenge Factors	% of Responses
1. Lack of user input	12.8%
2. Incomplete Requirements and Specifications	12.3%
3. Changing requirements and Specifications	11.8%
4. Lack of executive support	7.5%
5. Technology incompetence	7.0%
6. Lack of resources	6.4%

Table 1.2 above shows that; the first four reasons why projects IS were rejected had to do with the customer and the users of the system. The report associates these gaps to traditional IS development methodologies and to some extent agile practices [7]. These gaps have since been addressed by DevOps requirement of integrating customer, developers and support staff – including systems users in the development process for continuous delivery [19]. Moreover, table 1.2 highlights changing requirements and specifications as significant contributors to the rejection of IS systems. These factors are strategic in nature and requires a strategically aligned methodology because they may pose challenges to the development and operations teams. Furthermore, strategic decisions are entrusted to the top management.

5. THE STRATEGIC ALIGNMENT OF AGILE DEVOPS METHODOLOGY

Almost all software development methodologies are not strategically aligned [18]. Their focus is on providing a framework that allows for a seamless development process - that leads to achievement of user requirements through integration of quality control mechanisms in systems development processes [20]. It is however not conclusively correct to assume that their implementation is not always strategically aligned [21]. Moreover, the frameworks presented by various scholars can be misleading to organisations with limited expertise in strategic management. The table below uses

Porters five forces model [8] to highlight important tenets of strategic management missed by various agile methodologies.

Table 1.3, Application of Porter's five forces in some of the agile methodologies

Method ology	Competitive forces within an industry			
	Customers	Suppl iers	New Entrants	Substitutes
DevOps	✓	✗	✗	✗
Scrum	✓	✗	✗	✗
XP	✓	✗	✗	✗
Kanban	✓	✗	✗	✗
FDD	✓	✗	✗	✗

Key: ✓ - Considered ✗ - Not Considered

As shown in table 1.3 above, although information systems are developed to help businesses achieve their strategic goals, most methodologies do not factor in how the goals are addressed in the development process. That is why traditional methodologies may still be in use in some organisations. In environments encumbered with disruptive technologies, requirements may change immediately a project begins.

To add to the great foundations of Agile DevOps methodology, figure 1.3 below illustrates how the methodology should be integrated in the strategic management process. While it is true that any other methodology falls in the same place, DevOps has the most advanced tenets to build up on.

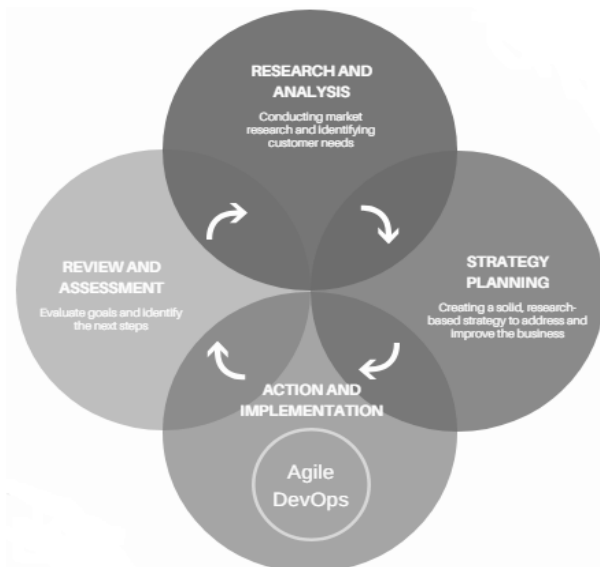**Figure 1.3, The Strategic Alignment of Agile DevOps methodology**

Figure 1.3 is a framework that ensures that there is continuous feedback from the research and strategic planning units of an organisation on new and emerging technologies so that the development and operations team focus is on continuous delivery of quality IS. In the long run, customer requirements are met, and a sustainable competitive advantage is attained for the organisation.

After the plan, develop/test, deploy and operate cycle (see figure 1.4), the system is reviewed to evaluate if it meets the strategic goals of the organisation. This may require additional steps that may need additional research and analysis for system improvement and continuous creation of a sustainable competitive advantage. This process is repeated in the whole lifecycle of the information system.

Figure 1.4, adapting Agile DevOps for Strategic alignment
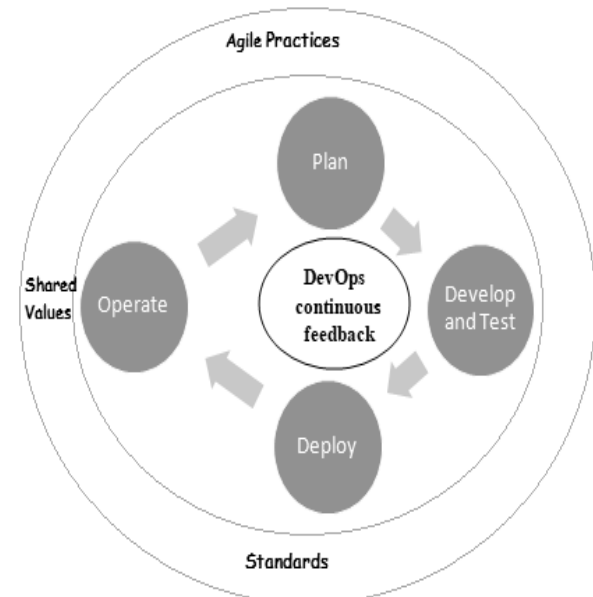
From figure 1.4 above, in addition to agile practices and systems development standards, shared values have been included in the development environment. It is in this section where human resource management, financial management and supply chain management functions of the project are coordinated for a smooth development environment. This helps in a seamless coordination of factors simultaneous with the project such as: staffing requirements, leadership, skill improvement and work structure among others.

1.5 CONCLUSIONS

Strategic information systems development methodologies should be aligned with the strategic business goals if they are to remain relevant to the organisation. Using the Standish Group 2014 software chaos reports as a case study, it was observed that, despite the continued evolution of information systems methodologies for more than two decades, the rates of software rejections and failures rates are still high. To address these gaps, a framework for aligning Agile DevOps IS development methodology with the strategic goals of an organisation is proposed and the areas for the improvement of the methodology highlighted and discussed.

The paper also highlights and discusses the technological environment as the major cause of disruptions during IS development while emphasising that technological disruptions will continue even in the future. Since, most of the methodologies in use today have resulted from improvements or reengineering of earlier methodologies, it is prudent to adapt the methodologies that have come to fruition rather than re-invent the wheel and come up with new ones. This however does not mean that new innovations that could lead to efficient software project management should be discouraged.

Lastly, irrespective of the improvements of DevOps methodology as discussed in this paper and evidences of the methodology success in past projects, it is worth highlighting that; factors that compel continued use of other methodologies; be it agile, waterfall, spiral, incremental or any other, will still promote their use where such methodologies are the best choices and where the cultural changes advocated for by the DevOps methodology may not be welcomed in organisations. In such cases, the methodology of choice should be aligned with the strategic goals of the organisation that contributes towards the competitive advantage created by the system.

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