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# DevOps: Introducing Agility and Flexibility to BPO-IT Organisations – Service Providers’ Perspective

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**Abstract:** Competition is rife within BPO-IT service providers as outsourcing clients opt for providers’ that will add significant value to their operations. Thus, providers perceive DevOps as one way of improving the quality of clients’ services through in-house development of reliable software. Research findings indicate that DevOps involves internal reorganisation that could provide the best possible option to combine people, process and software development tools. The approach has been widely applied in software development companies purposely for continuous delivery of reliable software, and to add value to client’s services within provider’s domain. This paper presents the findings from a multi case study of DevOps implementation in BPO-IT service provider organisations. The findings suggest the inclusion of DevOps as an element of strategic IT planning to improve competitiveness by reducing costs and quality of services. The developed DevOps framework proposes a team of coordinating teams working together to improving client and providers’ performances combining IT management, software development and processing teams respectively. To illustrate the concept of the framework, a flowchart depicting a stepwise role of each team is developed, allowing for implementation of agility and flexibility into the process and continuous software delivery, reduced time of service delivery, and improved quality of services.

**Keywords:** Devops, Software, IT Management, BPO-IT

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## 1. Introduction

The combined implementation of software development and organisational operations (DevOps) has been extended to business process outsourcing (BPO) service provider organisations operating a BPO-IT organisational model. It has been boosted by its varied benefits [1]. A BPO-IT organisation is a BPO service provider that integrated IT into their organisation in order to provide IT function in-house purposely for performance improvement [2]. Simply put, the software required to process client services in a BPO organisation is developed in-house by a dedicated software development team and passed on to the operations team where client services are processed. For example, a client could outsource its entire accounting services to a service provider who is required by the contractual agreement to also provide the software required to process the service. Thus,

instead of subcontracting the development of the software to a third party or obtaining from a vendor, a dedicated software development team is established in-house solely for this purpose [3]. An outsourced accounting service could contain more than one process and BPO entails that all the processes within a service must be outsourced [4] [5] [6]. It implies that a process is a subset of a service. This includes the database to manipulate and handle customer’s transaction and profile, accounting software, payroll billing, and form processing [7]. Based on this premise, in this study, services and processes could be used interchangeably.

The entire approach identified above combines people, process and software tools to providing services to a client. However, DevOps is not either of these separately, but instead, a combination of the entire components and process

[8]. Generally, the word DevOps became popular in 2009 [9], but, within BPO, [3] is of the opinion that IT integration could provide the platform for in-house software development and operations. However, this assertion could not suggest how best these components could be combined to improve performance at both the client and service provider's domain. It could be all about innovating software development process to quickly improve performances at service provider and client's domain. DevOps span IT, business process, and thus the organisation requires management skills to achieve its objectives [10]. According to [11], to maintain a good balance between the technology and business, there must be a strong IT leadership so that an organisation's business goals could be attained. In such a scenario, the IT manager must understand the IT landscape and be able to develop an IT strategy that will synchronise the operations of IT and business process teams [12]. It implies that within DevOps, IT managerial skills are required to manage software development and the required operations to process client services.

There are divergent views toward the definition of DevOps. However, one side of the argument summarised DevOps in this way; "developers work mostly on codes, operations work mostly on system, and DevOps is a mix of these two skills [23]". The other side of the argument is of the opinion that "DevOps is not a job item, i.e. you do not hire a DevOps person, rather the spirit of DevOps speak to the trending need in the modern software development and support landscape [14]". Thus, DevOps encompasses the breakdown of artificial barriers between the "development team" and "the operational team". DevOps culture goes further to provide automation tools both at the software development and operational levels [14]. In addition, DevOps provide agility and flexibility that enhances organisation's ability to adjust its operations due to changes in client requirements [16].

Based on these premises, [8] suggested a road map as a guide towards a successful implementation of DevOps. The road map demonstrated how to address specific bottlenecks within DevOps in the following areas: software development, deployment of developed software, and critical measure of DevOps success. However, the 2014 report on DevOps suggest that organisations use key indicators, such as profitability, market share and productivity metrics to measure the impact of DevOps in their respective organisations. The report further suggests the selection of specific measurement metrics that matter to individual organisation [17]. [13] findings suggest the adoption of DevOps practices in quality assurance management as another way of improving the software quality and maximising the benefit of DevOps. In the above studies, the approach appears to be generic – no specific industry has been identified for the implementation of DevOps. Thus, this study, through exploratory research, investigates the implementation of DevOps in BPO service provider organisations operating BPO-IT organisational model. To do this, the researchers chose to investigate Indian BPO-IT

organisations providing services to onshore and offshore clients. The researcher's choice is necessitated by India's overall dominance as the number one business process-outsourcing destination [18] [19] over the years. The rest of the paper is organised as follows: Related works, Research approach, Case analysis and discussions, Conclusions and limitations.

## 2. Related Works

The very essence of DevOps stems from software engineering within the concepts of continuous integration and deployment where the objective is to deliver an improved software product in a lesser time and greater frequency [20]. In a typical DevOps approach for a business enterprise, [21] introduced non-functional requirements for the design and configuration of the business process architecture that would provide key components to enhance the benefits of the entire process. These components include: (1). Speed and frequency: Ability to quickly deliver new software products, troubleshooting of bugs, and improved frequency of deployment. (2). Responsiveness: Quick response to user feedback. (3). Agility and adaptability: The whole process responds quickly to changes in environment, emerging technologies, and customers' behaviour. (4) Efficiency: Improved software process execution. (5) Customizability: able to adjust the software development life cycle based on contextual needs.

Similarly, [22] investigated DevOps requirements specific to virtualised environment and software defined network technologies. The study proposes Service Provider – DevOps requirements that demonstrated how requirements engineering could influence the development and deployment of software. For its successful implementation, the study concluded by indicating four main processes that affects the process, i.e., developer support, verification process, observation, and troubleshooting processes.

DevOps implementation has been extended to cloud based applications to provide clients and practitioners a knowledge base to enhance their respective needs. One of the impediments of sourcing available knowledge for an informed decision is its complexity. To address the need for an informed decision based on the available knowledge, [23], suggested a holistic DevOps knowledge management method. Simply, the method identified a set of knowledge sources that could be accessed, and subsequently, the means to harvest the knowledge through an automated manner centred on data crawling mechanism. The study further presented how to organise, store, and utilise the knowledge using a DevOps knowledgebase predicate logic and Web Services Policy Framework.

[10] posit that one of the goals of DevOps is to speed up deployment, which invariably improves the time to delivery of service to clients. In DevOps, organisations could improve their innovation capability through the use of lean thinking – reducing waste, overhead, and concentration of valuable resources to higher-end value activities [8] [24]. This is in

line with [25] assertion that outsourcing clients have preference to BPO service providers that could demonstrate high level of innovative capability. For more understanding of DevOps implementation within organisations, the next section presents the research approach adopted by the researchers in this study.

### 3. Research Approach

This study adopted a case study approach that is qualitative and exploratory. Specifically, it provides the platform to understand the interaction between different stakeholders (IT management, software development, operations team) and how overall performance of a BPO-IT organisation is impacted. A case study approach is often used in the areas of information system and software engineering [26] [27], and as [28], highlighted, is “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”. In this study, such phenomenon includes DevOps, which is characterised by the collapse of the virtual boundary between IT management, software development, operations (service processing) and their constant interactions. In effect, as indicated earlier, this paper would development a framework that would demonstrate these interactions. [29] agreed that case study is an empirical method investigating a contemporary phenomenon in their context, but expressed it as a research strategy that would benefit more from multiple sources of evidence. As such, this study investigated multiple cases. A multiple source of evidence is to ensure that the events and processes in one well-described setting are not wholly idiosyncratic [30]. Hence a multiple case design allows the implementation of literal and theoretical replication logics [28] especially within the 7 investigated cases. In this paper, the approach aims to improve the generalisability of the findings from the 7 cases.

Interviews were conducted at research participant’s respective offices in India and the language of communication was English. In each case, two individuals within the DevOps team were interviewed. Their respective positions are Software Developer, CEO, Director, Senior IT manager, Managing Director, and any other individual within the DevOps team. Based on their positions, each contributes significantly to decision making which affects the service provider’s performances. This view is in line with [31] suggestion that information received from highly placed individuals in organisations of study is of greater value. The interviews lasted between 30 minutes to 1 hour. The data collection was done through a semi-structured interview with open-ended questions. The interviews were recorded with a digital Dictaphone and later transcribed into a Microsoft Word document. The data was imported to NVivo version 10 for coding and analysis, which were performed through the following specific steps:

(1). The transcribed word document is imported into

NVivo.

(2). Text are assigned units, nodes are generated for each question and indexed. This was followed by gathering and collecting codes for comprehensive analysis through filtered interview responses, cross case interview analysis, word frequency, text search query, and emerging categories.

(3). Interpreting codes and outcomes from stage 2. Then keywords and phrases are categorised to form themes. Stages (2) and (3) were repeated until new categories did not emerge.

The core study research questions contained in table 1 (also identified as research question-RQ) were asked to each participant, and in some cases, a follow-up question was introduced based on the participant’s response. Other relevant questions are centred on organisational context, interviewee background, processing of client services, and interactions between stakeholders. These questions were developed based on the background study of DevOps and its implementations indicated in the introduction and related work sections of this paper.

*Table 1. Core Case Study Questions.*

No	Questions
1	Can you briefly explain what DevOps means to your organisation?
2	Can you narrate briefly what happens within a process cycle?
3	What can you say are the benefits of DevOps?

#### 3.1. Case Sampling and Sample Size

The target population is BPO-IT organisations in India who are providing services to both onshore and offshore clients, and have been in operation for a minimum of 5 years. Through the association of Indian BPO organisations, those operating BPO-IT were identified and approached through email messages to participate in the study. Their contact details were obtained through their respective websites and subsequently; contacts were established with relevant individuals. In between, many email messages and calls were exchanged which resulted in 7 organisations agreeing to participate in the study. Then, a detailed letter of the study was sent to potential research participants. At the start of each interview, interviewees were presented with a consent form, which they signed respectively. In qualitative research, the criteria for selecting the sample are more important than the number of samples [33]. However, if the researcher can ascertain that the participants have the characteristics of the target population being investigated, then it is a valid method. Being wary of the pitfalls (e.g. bias) of convenient sampling, and given that, this is to an extent self-selecting, the researchers made sure that only those organisations that fulfilled the criteria indicated earlier were selected. Six of these organisations are operating BPO-IT and the seventh organisation that is not operating BPO-IT organisational model was selected as it could provide useful contrasting information in the study. In

order to maintain anonymity and clarity in this study, these cases are represented as Org1 to Org7 respectively.

Table 2 presents the profile of cases that participated this study.

**Table 2.** Profile of BPO-IT organisation operating DevOps.

Organisation	DevOps team composition	Type of services
Org1	128 Developers 8 IT Managers 230 Service processing members	Financial Analytics, Educational
Org2	350 developers 15 IT Managers 670 Service processing members	Financial, Claim, Inbound and outbound telecom
Org3	125 Developers 6 IT Managers 156 service processing members	KPO, Web Development, Media Analytics
Org4	115 Developers 2 IT Managers 78 Service processing members	Backend, e-Learning, Financial
Org5	98 Developers 1 IT Manager 56 Service processing members	Inbound and Outbound calls, Financial Analytics
Org6	80 Developers IT Manager 66 Service processing members	Financial and Backend
Org7	Not Applicable	Inbound, Outbound, Backend processes

[32] posit that the size of the sample is determined by the optimum number necessary to enable valid inferences to be made about the population. In this regard, the qualitative data must be of a manageable size for the researcher to effectively analyse [33]. The larger the sample size, the smaller the chance of a random sampling error, but since the sampling error is inversely proportional to the square root of the sample size, there is usually little to be gained from studying very large samples [34]. In a typical case study, [35] [36] suggests 1-2, 3-5, or 4-10 participants and 20-30 participants in a grounded theory; and [38] suggest 12 participants. A phenomenon only need appear once to be of value [33]. The literature suggests that in relation to sample size, a degree of saturation has been reached i.e. a bigger sample would not have added anything new. Thus, the sample size of 7 BPO organisations used in this study is valid. The next section provides participants' responses and its subsequent analysis.

### 3.2. Case Analysis and Discussion

The interviewee's responses to RQ1, RQ2, and RQ3 provide insights into the process of DevOps implementation and how organisations understand the phenomenon. These are subsequently analysed, and further discussed in order to

identify their respective contributions to the body of knowledge.

#### 3.2.1. The Concept of DevOps

In the literature, DevOps practitioners have expressed divergent views of what DevOps means to their organisation. The researchers, therefore, specifically asked research participants in their respective organisations what they understand by DevOps. Their responses could provide a common understanding of DevOps.

*RQ1: Can you briefly explain what DevOps means to your organisation?*

The motivation for this enquiry is to know how BPO-IT organisations understand DevOps. In Org2, the interviewee presented DevOps as an organisational changes where all the stakeholders (management, operation, development) are working together to provide services to their respective clients. Although BPO-IT organisations have been providing IT functions internally, a re-organisation in the business brought about by DevOps, improved interactions between different teams. Table 3 presents the themes derived from the thematic analysis of cross interview analysis of all the cases operating BPO-IT organisational model.

**Table 3.** Organisations' understanding of DevOps.

Org1	It is entirely organisational changes where there is better coordination and interaction between all our stakeholders.
Org2	As a BPO-IT company, we never called it DevOps. We work as a team because of our organisational structure. The developers, IT managers and different stakeholders working together.
Org3	Streamlining our processes through organisational changes.
Org4	Provided a strong working team relating well to each member
Org5	It is the convergence of in-house software development and business operations.
Org6	Our developers are discussing with requirement engineers, business processing teams and IT manager.
Org7	Not Applicable.

While responding to RQ1, one of the interviewees indicated as follows:

*“... it is exactly what we are doing here. We are not software development Company, but to improve our performance we are doing some jobs of IT organisation. Such as the development of the software we need to process our client services. Because of high number of clients, requirement variations, we established a software development department. We are a team comprising of developers, management, stakeholders, and those in the daily processing of client services. It is organisational process.”* (IT manager/Org6).

Interviewee's comment shows that this organisation has been developing software in-house, but only implemented DevOps to reorganise how each stakeholder contributes to the overall process of client services. Further, the researchers conducted word frequency analysis to reveal the frequently used words by the interviewees during the interview. This could provide better understanding of how organisations perceive DevOps. The cross interview, when subjected to word frequency analysis, returned the following top 8 key indicators expressed in weightage percentages: organisational (8.33%); development (5.83%); software (5.83%); changes (3.33%); teams (3.33%); DevOps (2.50%); stakeholders (2.50%), and streamlined (1.67%). The word frequency criterion was set at 100 most frequently used words with a minimum length of 4 words.

In table 3, the thematic analysis indicates that all but Org7 assert DevOps as an organisational structure instituted to streamline a process for the provision of quicker and improved service to clients. It could be described as “team of teams”. Whereby, software development team, IT management team, and operational team are combined to form the DevOps team. This position could further be supported by the word frequency analysis of cross case interview which indicates that the most frequently used words when presented in descending order include “organisational”, “development”, “software”, “changes”, “teams”, “DevOps”, “stakeholders”, and “streamlined”. Assembling these words could suggest that DevOps is an organisational change that streamlines the processes within the DevOps team that comprises software development and other stakeholder teams. It could suggest that when the service provider receives client's outsourced service, each team within the DevOps initiates a process that would contribute towards providing service to clients. This entire process, i.e., receiving client's services, processing and delivering a processed services form a process cycle. To understand organisation's view of a process cycle, the next section, presents the specific contributions made by each team within DevOps towards the processing and delivery of client services.

### 3.2.2. DevOps Process Cycle

In this subsection, responses from research participants to RQ2 could indicate the stepwise implementation of DevOps.

Interviewees were asked to explain every step executed in the process of DevOps implementation. In doing so, the responses could provide the platform to developing a DevOps framework.

*RQ2 Can you narrate briefly what happens within a process cycle?*

Initially, the researchers explained to the interviewees that a process cycle is all the initiated activities or processes performed within the DevOps team when client's services are received, processed and delivered back to the client. Within the DevOps culture, [10] assert that these activities or processes encompass the conceptualisation of the business concept, which include client requirements consideration and software deployment. In table 4, responses suggest that client requirements varies, but there is a common approach to the provision of services – software is developed in-house and used to process and deliver client services. The responses indicate that the quality of service delivered to clients is a product of continuous interaction of different teams that constitute DevOps. With one objective, this convergence is one of the principles of DevOps, which allow development team, and operation teams to perform in similar capacities with closely related set skills developed overtime [34]. Specifically, developers rely on requirements engineering to assemble client's requirements, and choose the best development process based on their acquired skills over the years. While, the process team quickly learns the use of the developed software and processes client services. In contrast, table 4 indicates that Org7 obtains IT functions (including software) required to process client services from a third party organisation.

**Table 4.** DevOps process cycle

Org1	Considering client's requirement, software development follows distributed versioning control approach and DevOps team members are continuously collaborating with other members until services are delivered.
Org2	We are developing the software, getting useful feedback from stakeholders, enhanced services quality are then delivered to clients.
Org3	Our CIO brings the client requirements which are discussed in-house. Then software is developed, feedback is provided, changes are made, software is delivered to Ops section.
Org4	We consider client requirements, then develop software through sectional collaboration. The software is either developed or an earlier version is modified. The operation members are trained to use the software and there is regular feedback from the operation section.
Org5	We coordinate constantly, software for processing is provided in-house, and business operation team process and deliver services.
Org6	The IT management provides our platform, software are continuously delivered for service processing.
Org7	Software is provided by a third party.

The thematic responses (table 4) derived from cross - case interview analysis are collectively expressed in Figure 1 as a DevOps framework, which comprises of three specific organisational sections. In the figure, the IT management

team provides the IT platform for the successful implementation of DevOps. The IT management is engaged in constant interaction with stakeholders, client requirements consideration, IT update and upgrade. Although each section is identified with specific functions, the figure indicates that there is constant interaction between the sub-teams that constitute the DevOps team. This continuous interaction is

depicted with two arrows in opposite direction linking each team. This means there is no barrier inhibiting the free-flow of issue-based (especially client requirements, provision of IT functions, feedback from both development and business teams, continuous delivery based on requirement variations) interaction that would find solution to a problem.

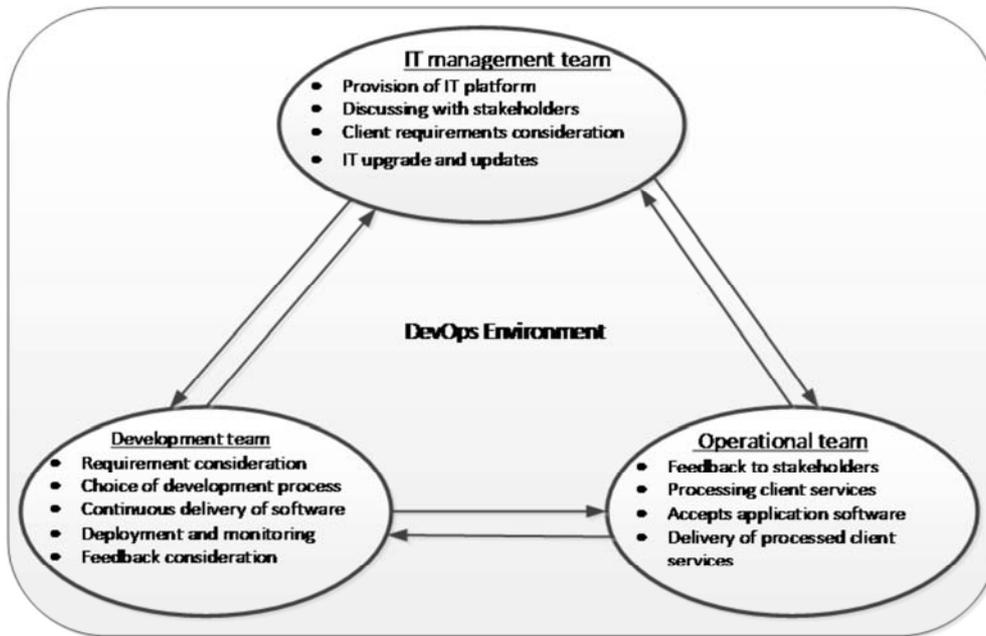


Figure 1. Organisational Framework of DevOps.

The main duties of the development team include designing software architecture, requirements consideration, adoption of software development process, continuous delivery of software, and the application of feedbacks from stakeholders. Within the software architecture's perspective, DevOps presents a fascinating interplay between software design process, CASE tooling, and organisational structure [10]. Considerably, wastages are reduced and the quality of the ensuing software is improved. Other improvement factor could be from the Dev (software development) team through the choice of appropriate development process that would improve the quality of the software. In doing so, [10] suggested embedding agile framework in DevOps and classified the specific phases to include inception phase (requirement elucidation), construction phase (writing and integration of codes), and transition phase (deployment and monitoring).

On the other hand, the operation's team is concerned with accepting developed software from the development team, giving feedback with regards to fulfilment of software requirement specifications and the processing and delivery of client's services. Though each team assumes specific duties it is the collective contribution and collaboration of these teams that bring about a successful outsourcing relationship. In the absence of a team within the DevOps, the organisational structure could fall short of providing client services with an acceptable level of quality. Consequently, such service

providers are not competitive and could not be chosen by outsourcing clients because they would fail to add value to their services.

On acceptance to provide services to outsourcing client, the IT management team considers specific client requirements and the software tool required to provide the service. In the absence of application software within the organisation, respondents posit that the IT manager then approaches the software development team with requirement specification. The specification fully describes what the software will do and how it is expected to perform. After the initial discussion involving all the stakeholders (the operation team members, IT managers, and the developers), the development team develops the software and delivers it to the service processing (operation) team. The process team members are subsequently trained on the use of the new software before processing client services. Similarly, the development team receives regular feedback from stakeholders, and continuous delivery of software to meet up with varying client requirements. On the other hand, if the software is available and does not require modification after consideration of client's requirements, the IT management team frequently engages the operational team providing them with the requisite IT platform and knowledge for a successful delivery of service. Having been working in a domain, over the years, process team members gained expertise, which is crucial to processing and delivery of services. This whole

process is geared towards improving client and provider’s performances with an emphatic added value to delivered services. As one of the interviewees simply said:

“At the negotiating level, there is a tangible input from each section of Dev and Ops. I mean we are all involved. The requirements are known, we know our strength. The CIO liaison with our client. The development team provides quality software to process client services. There is a flow feedback from the ops section to the dev section. It has gone a long way to improve our performances through refinement of processing software. DevOps organisational modelling has improved the quality of services delivered to client” (Software developer/Org3)

In relation to understanding a process cycle, the researchers performed word frequency analysis on the cross-case interviews. The result shows that “software” (9.85%) is the most used word by the research participants. Other noticeable words include, services (4.55%), operation (3.795), business (3.03%), feedback (3.03%), development (2.27%), and requirement (2.27%). Thus software as part of the required IT functions evolve from in-house development process based on requirement specification and constant feedback from the operation’s team. In a BPO-IT organisational model, we draw that software is a crucial component in a DevOps environment, which the operation team requires to process and add value to client services. In order to fulfil the business agreement, the software development team relies on feedback from the operation and management teams to adjust to changes in client’s requirements.

Figure 2 is an overview of the DevOps flowchart, which is derived from the continuous interactions earlier indicated in figure 1. Figure 2 demonstrates related activities between DevOps teams in a process cycle. In outsourcing relationship, a client outsources business processes to a service provider who, in turn, delivers processed services to the client [38]. Thus, depending on client’s requirements, the IT manager directs the DevOps team to use the existing software or develop new software. In the flow chart, this is indicated by the “yes” or “no” decision. Regardless of the decision taken to provide the software, it could be quickly delivered to the operation team to process and deliver client services. [39] assert that the implementation of DevOps improves the overall performance of an organisation through continuous delivery of software. In this section, we draw on the continuous interaction between the three teams that make up DevOps. The flowchart presents two options: firstly, when the software required to process client services is available,

and secondly when the software is not available. In both instances, clients’ services should be processed and delivered in time to meet up all the contractual agreements. In summary, the DevOps team develop software with an improved quality, which translates to an improved service quality been delivered to clients. In this regard, the researchers enquired from the research participants what are the benefits of DevOps. The next section presents and discusses these benefits.

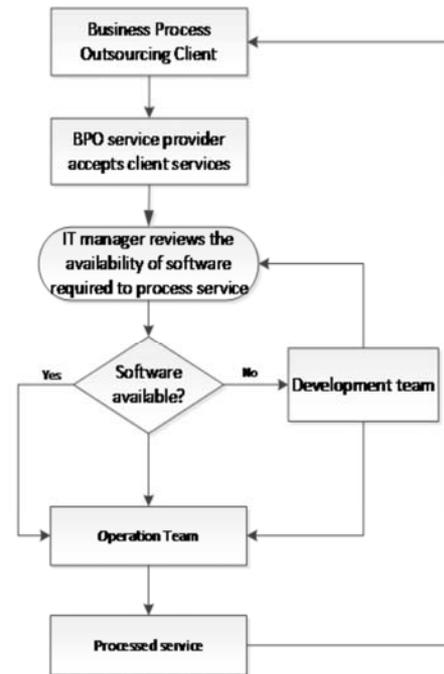


Figure 2. DevOps flowchart.

### 4. Benefits of DevOps

Although the literature has shown a risen interest from organisations towards the emergence and implementation of DevOps, the researchers asked RQ3 so that respondents could indicate what are the benefits and how they are derived.

RQ3: What can you say are the benefits of DevOps?

To understand the exact benefits expressed by each organisation, a cross-case interview analysis for RQ3 was performed and coded as a node named RQ3. Subsequently, a child node named “BenefitsDevOps” was further coded from RQ3, which is reduced to themes and presented in table 5.

Table 5. Benefits of DevOps.

Org1	Continuously delivering quality software, services delivered within a short time, reduced cost, very competitive, SLA are fulfilled quickly
Org2	Improved client’s satisfaction, reduced cost of providing services, software with improved quality, less downtime, performance improvement, competitive
Org3	Competitiveness, reduced cost of providing services
Org4	Solved the problem of variability in client requirement, reduced time fulfilling SLA, quality of services improved, competitive, quality software
Org5	Costs of providing service reduced, competitive, high level of satisfaction
Org6	Continuous delivery of software based on client requirements, increased software quality, cost is competitive
Org7	We are not thinking of DevOps now.

All the BPO-IT organisations affirmed that their level of competitiveness and overall performance improved over the time through the reorganisation brought by DevOps. This could be facilitated by the interactions among the DevOps participating teams. While Org7 indicated that, with a small number of clients, the organisation could not afford the level of IT infrastructural investment that would bring about total implementation of DevOps. It implies that organisations intending to implement DevOps would have the financial strength to invest in infrastructure and quality human resources. As one of the respondents said:

*“We are not thinking of DevOps now. First we have to upgrade our IT infrastructure, invest in human resources, and then reorganise how we deliver services. This is a small organisation that depends of clients for software tool to process their services. DevOps could present opportunities but we are not there now”* (CEO/Org7).

BPO is a competitive sector and outsourcing clients choose service providers with capabilities that add value to their services [41]. The adoption of DevOps as an internal process increases the provider's strength to deliver services to several clients simultaneous, especially, the ability to comprehend the varying client requirements. Similarly, continuous delivery as a key characteristic of DevOps enhances the rate at which services are delivered to clients by large organisations [41]. To add credence to these benefits, two of the research participants added as follows:

*“..... ours is a large organisation with large number of clients. Requirements are not the same. We successfully manage these requirements and quickly provide services simultaneously to clients at a reduced cost. The DevOps team is continuously delivering quality software based on daily client requirements. I can now tell you that we are very competitive in this sector.”* (Org5/IT manager)

*“... as such we needed to improve client's satisfaction. And in DevOps we reduced the cost of providing services, have software with improved quality level, and most especially we have less downtime. ....is great performance improvement and SLAs are completed in short time”* (Org1/CIO).

To understand the weightage of each benefit mentioned by respective participants, a word frequency analysis was performed on the child node “BenefitDevOps”. It returned the following top 7 weightages in the order of significance: quality (7.34%), services (7.34%), software (6.42%), competitive (5.50%), reduced (4.59%), improvement (3.67%), satisfaction (2.75%). These findings could suggest that the implementation of DevOps brought about improved quality of software and services delivered to clients. In the same way, organisations are more competitive because of costs of processing services are reduced, there is no downtime and services are delivered quickly. Generally, there is improvement in all their outsourcing relationships because of client's satisfaction and quicker fulfilment of SLA.

## 5. Conclusions and Limitations

Besides detailing the DevOps implementation within a BPO-IT organisation, the study developed a DevOps framework. The framework could be adopted by BPO-IT organisations, with intent to increase their competitiveness through the provision of quality services. The derived DevOps framework is a “team” of “collaborating teams” that receive client services, considers the requirement specification before developing the application software to process client services and its subsequent processing and delivery by the operation team. DevOps provide the platform to develop software with an improved quality that is translated to the quality of services delivered to clients. This is in line with researcher's assertion [2] [42] that the quality of a service primarily depends of the quality of software used in processing it. In a BPO-IT organisation, findings suggest that DevOps is reorganisation of already established teams that are involved in the provision of service to clients. Already, a BPO-IT organisation has a model of in-house provision of IT functions such as software, but DevOps provides the best possible way to coordinate and combine the teams in order to maximise its benefits. In effect, the reorganised structure improves client and provider's performances.

Further, the study suggests that investment in IT infrastructure and human resources could be a prerequisite for the implementation of DevOps. As indicated earlier, Org7 is a small organisation and lack the financial strength to invest in IT infrastructure that could lay the foundation for a successful implementation of DevOps. However, implementing DevOps reduces the cost of processing client services, thereby improving the competitiveness of the outsourcing client and the service provider. Thus, IT managers involved in DevOps could consider cost reduction and competitiveness as part of their core benefits in strategic planning. Org4 indicated DevOps as a solution to varying client requirements, which are also changing even when the service is being processed. Other benefit includes continuous delivery of software, which reduces the time of processing and delivery of client services.

Additionally, the flexible and agile characteristics of DevOps specifically addressed two key issues:

- a. When large BPO-IT organisations with hundreds of clients present varying requirements.
- b. In the midst of processing client's services, changes in requirements are requested.

In both instances, these issues are solved through flexibility and agility features of DevOps. Client's expected values are added to the service and delivered in time.

The scope of this study is limited to identifying the organisational changes and considers the software development process adopted by development team as beyond its scope. Further research could be carried out on this area to understand the software development method that

could provide software with an acceptable level of quality. Similarly, the claims in this study have been confined to an exploratory study, which could have produced a generalisable claim with more data. Although the number of cases fulfilled the minimum number suggested by researchers [35] [36], larger number of cases with wider scope of study would have been preferred for this study.

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## References

- [1] Gottesheim, W. (2015, February). Challenges, Benefits and Best Practices of Performance Focused DevOps. In *Proceedings of the 4th International Workshop on Large-Scale Testing* (pp. 3-3). ACM.
- [2] Ikerionwu, C., Foley, R. and Gray, E. (2014). Improving software quality in the service process industry using agility with software reusable components as software product line: An empirical study of Indian service providers. *International Journal of Advances in Engineering and Technology*, 7(3), 701-711.
- [3] Singh, S. (2012). IT-BPO combined model shows cracks yet HCL, Infosys and other IT majors believe that's the way to go corporate trends. *The Economic Times (Online)*, Available at: <http://search.proquest.com/docview/921642709?accountid=15977>. [Retrieved on 22<sup>nd</sup> March, 2015].
- [4] Rai, A., Keil, M., Hornyak, R., and Wüllenweber, K. (2012). Hybrid relational-contractual governance for business process outsourcing. *Journal of Management Information Systems*, 29(2), 213-256.
- [5] Fullick, A. (2012). Business Impact Analysis (BIA). Available at: <http://stoneroad.wordpress.com/2010/12/02/business-impact-analysis-bia-there%E2%80%99s-a-difference-between-a-service-and-a-process/>. [Retrieved 11<sup>th</sup> November, 2015].
- [6] Scheer, A. W., and Nüttgens, M. (2000). *ARIS architecture and reference models for business process management* (pp. 376-389). Springer Berlin Heidelberg.
- [7] Kremic, T., Tukul, O. and Rom, W. (2006). Outsourcing decision support: a survey of benefits, risks, and decision factors. *Supply Chain Management: An international Journal*, 11(6), 467-482.
- [8] Sharma, S. and Coyne, B. (2015). *DevOps for Dummies 2nd Edition e-book*. 2nd IBM Limited ed. Hoboken, NJ 07030-5774: John Wiley & Sons, Inc.
- [9] Debois, P. (2009). Agile 2008 Toronto. Just Enough Documented Information. <http://www.jedi.be/presentations/agile-infrastructure-agile-2008.pdf> Retrieved 12 March 2015.
- [10] Bass, L., Weber, I., and Zhu, L. (2015). *DevOps: A Software Architect's Perspective*. Addison-Wesley Professional.
- [11] Gartner. (2011). The IT Services Scenario: The future of IT services. Available at: [http://www.gartner.com/it/content/1894800/1894815/february\\_28\\_it\\_svc\\_scenario\\_erocco.pdf?userId=58159340](http://www.gartner.com/it/content/1894800/1894815/february_28_it_svc_scenario_erocco.pdf?userId=58159340). [Retrieved, December 17, 2015]
- [12] Ghodeswar, B. and Vaidyanathan, J. (2008). Business process outsourcing: an approach to gain access to world-class capabilities. *Business Process Management Journal*, 14(1), 23-38.
- [13] Roche, J. (2013). Adopting DevOps practices in quality assurance. *Communications of the ACM*, 56(11), 38-43.
- [14] Mueller, E. (2015). What is a DevOp. [Blog] *TheAgileAdmin.com*. Available at: <http://theagileadmin.com/2010/10/08/whats-a-devop/> [Accessed 20 December. 2015].
- [15] Wochna, J. (2015). *Get Mapped: Using Value Stream Mapping to Create a DevOps Adoption Roadmap*. [online] UrbanCode. Available at: <http://developer.ibm.com/urbancode/docs/get-mapped-using-value-stream-mapping-to-create-a-devops-adoption-roadmap/> [Accessed 20<sup>th</sup> November. 2015].
- [16] Bang, S. K., Chung, S., Choh, Y., and Dupuis, M. (2013, October). A grounded theory analysis of modern web applications: knowledge, skills, and abilities for DevOps. In *Proceedings of the 2nd annual conference on Research in information technology* (pp. 61-62). ACM.
- [17] Puppetlabs.com 2014 State of DevOps Report. (2015). [online] Available at: <https://puppetlabs.com/sites/default/files/2014-state-of-devops-report.pdf> [Accessed 24 Aug. 2015]
- [18] Javalgi, R. R. G., Benoy Joseph, W., Granot, E., and Gross, A. C. (2013). Strategies for sustaining the edge in offshore outsourcing of services: the case of India. *Journal of Business & Industrial Marketing*, 28(6), 475-486.
- [19] Lacity, M. C., Willcocks, L. P., and Rottman, J. W. (2008). Global outsourcing of back office services: lessons, trends, and enduring challenges. *Strategic Outsourcing: An International Journal*, 1(1), 13-34.
- [20] Olsson, H. H., and Bosch, J. (2014). Post-deployment data collection in software-intensive embedded products. In *Continuous Software Engineering* (pp. 143-154). Springer International Publishing.
- [21] Babar, Z., Lapouchnian, A., and Yu, E. (2015). Modeling DevOps Deployment Choices Using Process Architecture Design Dimensions. In *The Practice of Enterprise Modeling* (pp. 322-337). Springer International Publishing.
- [22] Kim, J., Meirosu, C., Papafili, I., Steinert, R., Sharma, S., Westphal, F. and Manzalini, A. (2015, May). Service provider DevOps for large scale modern network services. In *Integrated Network Management (IM), 2015 IFIP/IEEE International Symposium on* (pp. 1391-1397). IEEE
- [23] Ghanam, Y., Ferreira, J. and Maurer, F. (2012). Emerging issues and challenges in cloud computing- A hybrid approach. *Journal of Software Engineering and Applications*, 5(11), 923-937. doi:10.4236/jsea.2012.531107
- [24] Santos, J., Wysk, R. and Torres, J. M. (2014). *Improving production with lean thinking*. John Wiley & Sons.
- [25] Saxena, K. and Bharadwaj, S. (2009). Managing business processes through outsourcing: a strategic partnering perspective. *Business Process Management Journal*, 15(5), 687-715.
- [26] Höst M. and Runeson, P. (2007). Checklists for software engineering case study research. *First international symposium on empirical software engineering*, (pp. 479-481).

- [27] Themistocleous, M., Irani, Z. and Love, P. E. (2004). Evaluating the integration of supply chain information systems: A case study. *European Journal of Operational Research*, 149 (2), 393-405.
- [28] Yin, R. K. (2011). *Case study research: Design and methods* (4th ed.). London: Sage Publishing.
- [29] Robson, C. (2002). *Real World Research* (2nd ed.). Blackwell Publishing. Malden.
- [30] Furco, A. (2003). Issues of definition and program diversity in the study of service-learning. *Studying service-learning: Innovations in education research methodology*, 13-33.
- [31] Oza, N. (2006). An empirical evaluation of client-vendor relationships in Indian software outsourcing companies (Doctoral dissertation, School of Computer Science, Faculty of Engineering and Information Sciences, *University of Hertfordshire*).
- [32] Hulley, S. B., Cummings, S. R., Browner, W. S., Grady, D. G., & Newman, T. B. (2013). *Designing clinical research*. Lippincott Williams & Wilkins.
- [33] Wilmot, A. (2005). Designing sampling strategies for qualitative social research: With particular reference to the office for national statistics qualitative respondent register. *Survey methodology bulletin-office for national statistics*, 56, 53.
- [34] Vul, E., Goodman, N., Griffiths, T. L. and Tenenbaum, J. B. (2014). One and done? Optimal decisions from very few samples. *Cognitive science*, 38(4), 599-637.
- [35] Creswell, J. W. (2002). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River, NJ: Pearson Education.
- [36] Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). Thousand Oaks, CA: Sage.
- [37] Guest, G., MacQueen, K. and Namey, E. (2011). *Applied thematic analysis*. Los Angeles. Sage Publications.
- [38] Lacity, M. C., and Willcocks, L. P. (2012). *Advanced outsourcing practice: Rethinking ito, bpo and cloud services*. Palgrave Macmillan
- [39] Fitzgerald, B. and Stol, K. J. (2014, June). Continuous software engineering and beyond: trends and challenges. In *Proceedings of the 1st International Workshop on Rapid Continuous Software Engineering* (pp. 1-9). ACM.
- [40] Feeny, D., Lacity, M. and Willcocks, L. P. (2012). Taking the measure of outsourcing providers. *MIT Sloan management review*, 46(3).
- [41] Humble, J., and Molesky, J. (2011). Why enterprises must adopt devops to enable continuous delivery. *Cutter IT Journal*, 24(8), p. 6.
- [42] Lahiri, S., Kedia, B. L. and Mukherjee, D. (2012). The impact of management capability on the resource-performance linkage: Examining indian outsourcing providers. *Journal of World Business*, 47(1), 145-155.