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Developing a Critical Success Factor model for DevOps

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Abstract. DevOps has presently become a mainstream software development model in the software industry. DevOps is a software engineering paradigm which is adopted and implemented by various software organizations. There is a need for a model which could guide the professionals and practitioners to achieve organizations goals and performance. To address this study objective, we have developed an initial framework for the critical success factors models which will be validated by three research questions.

Keywords: DevOps · Critical Success Factors · DevOps Success Factor Model

1 Introduction

To compete in a highly volatile market, it is necessary for an organization to release software that is both effective and has the capability to sustain in the competition [6]. For customers, it is important to have new features with efficient software delivery [4]. As the software business has matured over the years, also the requirements for speed and efficiency have changed [11]. As a response to the changing business environment, also the software development life cycles and the development processes have been evolving.

The purpose of the agile practices is to discover user requirements and develop solutions through collaboration with cross-functional teams and end users [13]. Agile practices have some limitations and create complexity while scaling agile development framework [15]. In contrast, DevOps is the combined process of ‘development’ and ‘operations’, which is used for the software development to speed up the delivery process with efficiency [18].

DevOps is a widely used development strategy that helps to minimize software development costs through implementation and adoption. The aim of DevOps is to provide continuous development and continuous delivery for the software development process [17]. DevOps allows to make collaboration with development and operations teams within the organization and provide an effective delivery process for software development.

Critical success factors are a management literature concept, which dates back to the beginning of the 1960s [5]. While there is vast literature on the critical factors and their role, they can be briefly defined as *"the few key areas of activity in which favorable results are absolutely necessary for a particular manager to reach his goals"* [3, p. 4].

2 Methods and goals

2.1 Methods

The aim of the research is to provide a deep understanding of DevOps critical success factors in software development practices. To achieve this goal, we will use four research methods in this thesis: Systematic literature review [15], Case study research [16], multivocal literature review [8] and survey methods [7]. We have chosen multiple research methods because the quantitative along with the qualitative analysis will provide an in-depth understanding of the topic at hand by answering the research questions regarding the critical success factors of DevOps project.

For the data collection process, at first we have conducted an SLR by selecting empirical papers on DevOps domain. Second, we have conducted an open ended online questionnaire survey with DevOps professionals. To get more clear idea on the topic we have conducted semi-structured interviews with same DevOps professionals who participated in survey previously. Our next step would be to design a 7-point Likert scale questionnaire to measure the constructs presented in Figure 1 and for that we will conduct an online survey to collect approximately 200 responses for our research purpose. We will also conduct a Multivocal literature review to get an overall view of DevOps success factor for organizations.

The research will conduct a thorough study based on Software companies and IT professional's practices on DevOps use. Some of the hypotheses are presented below.

2.2 Hypotheses

- H1:** Performance engineering factor for DevOps directly impacts DevOps project success.
- H2:** Integration factor for DevOps process directly impacts DevOps project success.
- H3:** Build and test automation factor directly impacts DevOps project success.
- H4:** Infrastructure factor directly impacts DevOps project success.
- H5:** DevOps as a service factor directly impacts DevOps project success.
- H6:** Intra organizational collaboration and communication factor directly impacts DevOps project success.
- H7:** Organizational hierarchy factor directly impacts DevOps project success.
- H8:** Strategic planning factor directly impacts DevOps project success.
- H9:** Team dynamics factor directly impacts DevOps project success.
- H10:** Cultural shift factor directly impacts DevOps project success.
- H11:** Team Dynamics factor moderately effects the organizational success factors of DevOps project success.
- H12:** Cultural shift factor moderately effects the organizational success factors of DevOps project success.

In this model, we suggested that technical factors and organizational factors (intra-organizational collaboration, organization hierarchy, and strategic planning) would directly impact DevOps success. The social and cultural factors (team dynamics and cultural shift) would moderate the effects of organizational factors on DevOps success. In addition, social and cultural factors might also impact DevOps success directly.

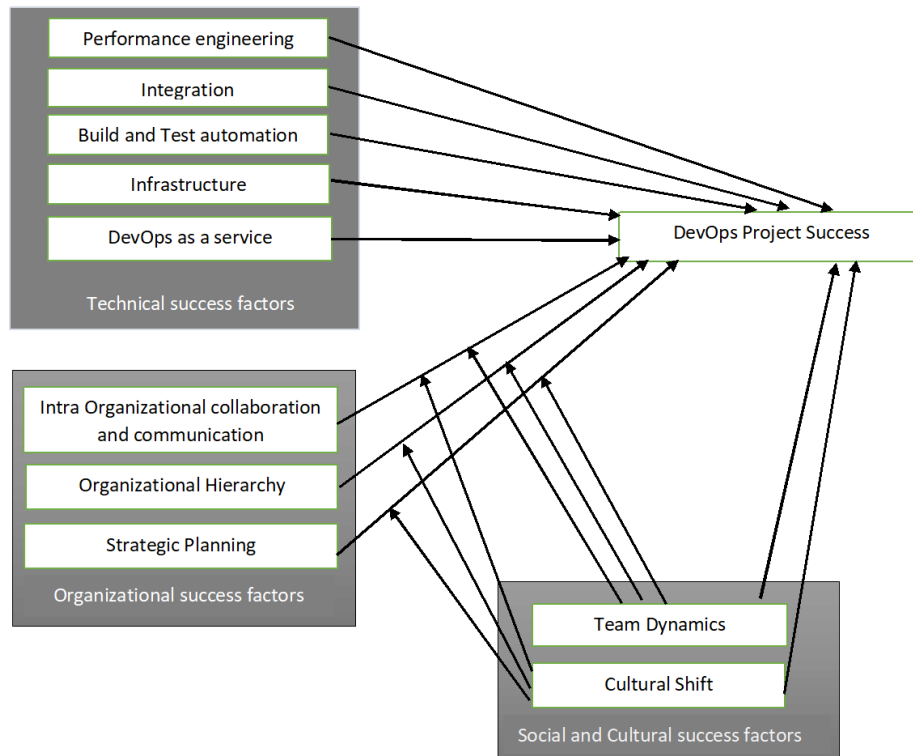


Fig. 1. DevOps critical success factor model (adapted from [2]).

2.3 Research questions

There are various critical success factors for DevOps projects, which have been discussed in prior empirical studies.

In recent years, literature review articles were published which described DevOps concept, DevOps adoption, DevOps Implementation, DevOps specific use, DevOps implementation with agile, and DevOps challenges, benefits and success factors [1, 9, 10, 12, 14]. However, we did not find any article that proposed a synthesized framework which could provide a clear, comprehensive idea about the critical success factors of DevOps projects.

To address the aim of this research topic we have one key research question (RQ). The key research question is:

RQ What are the critical success factors of DevOps projects?

To understand the key research question, we need to understand three sub-research questions. The sub-research questions are written below.

SRQ1 What are the critical success factors, as reported in the extant research literature, of DevOps projects and how do the findings differ with an MLR literature?

SRQ2 What are the critical success factors of DevOps projects as reported by the professionals?

SRQ3 What are the challenges professionals face in DevOps projects? How do they mitigate the challenges and risks?

3 Results

For the research we have three sub-research questions. The first sub-research questions is about the critical success factors reported on the extant literature and how do the findings differ with MLR literature, the second question describes about the success factors of DevOps reported by the professionals. Third question is about the challenges professionals face during DevOps practices and how they mitigate the risks for the projects.

For the first research question We are still left with the MLR literature review. We believe that after conducting the MLR literature we will get an overall view of Critical success factors of DevOps and that will address the first research question for our study. Then we will design a 7-point Likert scale questionnaire to measure the constructs presented in Figure 1 and will conduct an online survey to collect data and address our research questions. We will analyse the data with PLS (Partial least square) regression methods to find out what critical factors that impact the success of DevOps projects. Below we discuss our three papers findings.

SRQ1: What are the critical success factors, as reported on the extant research literature, of DevOps projects? Critical success factor for DevOps SLR (ICSOB2021).

DevOps fills the gap between the development and operations teams and maintains the collaboration among information technology professionals for delivering the software applications. Due to its recent emergence, there are relatively little research done, at least when compared to the other software process models, on DevOps and its successful usage. Previously, some empirical research studies have been conducted on the success factors of DevOps, but a synthesis of these findings is needed. This paper aims to find out various critical success factors of DevOps projects that have been discussed in prior research by following a systematic literature review. Based on our extensive keyword search and after applying inclusion/exclusion criteria, we have included 38 research articles in this paper. The identified critical success factors were categorized into technical, organizational, and social and cultural dimensions. Finally, this study offers a comprehensive framework depicting how the critical success factors impact or drive DevOps success.

SRQ2: What are the critical success factors of DevOps projects as reported by the professionals? Understanding DevOps critical success factors and organizational practices (IWSIB 2022).

DevOps is a combination of practices and a company culture that aims to minimize the barriers between the operation and development teams in the

organization. As its adoption and use in the industry have been growing, different kinds of research are trying to explore DevOps practices, processes and implementations in organizations. Most of the extant research conducted in the past was to investigate how DevOps worked, what impacts it made on the organizations and how the adoption of DevOps played a role in the overall success for companies. This paper presents a qualitative analysis of a dataset collected via an open-ended survey from 15 software professionals who are experienced in DevOps. The focus of the study is on reporting DevOps practices in organizations, and how they impact the success of DevOps. We discuss the DevOps professionals' point-of-view on DevOps practices and align their thoughts through a DevOps model of the critical success factors.

SRQ3: What are the perceived challenges of DevOps projects for professionals? How to mitigate the challenges and risks for DevOps? DevOps challenges in organizations: Through professional lens (ICSOB 2022).

DevOps is a set of organizational practices as well as a culture which tries to eliminate the barriers between the Devs and Ops teams, improve the collaboration and communication among teammates. DevOps is used in different organizations because it supports quicker production, stability and reliability for software development.

While the success factors of DevOps adoption have been studied in the extant literature, also the perceived challenges that a company faces during the adoption are crucial to discover. This paper explores and highlights these challenges through an open-ended survey (N=15) and in-depth interviews with DevOps professionals (N=16). According to the findings, there are various challenges while implementing DevOps in organizations. The research suggests that (i) lack of team coordination, (ii) risky change and development, (iii) team members expertise level, (iv) lack of focus or differences in development, (v) test and production environment, (vi) poorly defined functional and technical requirements, (vii) poor integration and test process, (viii) pipeline execution problems, (ix) tools integration challenges, (x) people challenges and silo-ed thinking, (xi) debugging challenges due to remote execution, (xii) feature release challenges, (xiii) integrating new standards, (xiv) challenges with clients, (xv) knowledge sharing, (xvi) responsibility distribution issues are the challenges while using DevOps. The found list of perceived challenges will help future research to suggest mitigation and risk management strategies for successful use of DevOps.

4 Conclusion

Our research focus is to understand DevOps critical success factors. To understand DevOps current state, we have conducted a systematic literature review, which has given us an overview of a current research work, findings and gaps that need to be addressed. We have designed a semi-structured questionnaire to conduct interviews with IT professionals from various companies which helped us to validate the success factors we have found in

the literature review. We have conducted interviews with DevOps professionals and got insightful information regarding DevOps operations, success factors, DevOps challenges, and risks. Next, we will develop a questionnaire for conducting an online survey with different constructs we have found from our study. Thus, we will test the hypothesis of our proposed model for DevOps success factors for (Figure 1).

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