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# Gaining an Understanding of DevOps from its Enablers to Its Impact on Performance

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## Abstract

Despite these efforts' merit, academics have had trouble keeping up with the radical shifts in how software is created and supplied to clients. DevOps has revolutionized the way IT businesses are intended to operate as the result of years of hard effort and improvement to software delivery methods, techniques, and philosophies. Despite its widespread use and the positive effects, it has had on IT businesses' bottom lines, few people outside of the industry really understand what it is, how it operates, or if it can genuinely lead to better IT performance. This study provides a methodology that bridges the gap between these macro-level elements and the actual results of IT departments by focusing on the enabling components of DevOps, such as technological and management skills, and IT culture. Moreover, this study suggests the values of a perfect DevOps organization, which have a profound impact on IT Outcomes when they are in harmony with the firm's Delivery Approach. Information technology (IT) experts with prior DevOps experience were used to compile the survey results. In all, 176 American respondents provided their information. This alignment, in turn, has a substantial impact on IT Outcomes. This study adds not only to the growing body of literature on DevOps and software delivery, which is essential to the success of any IT firm, but also to the development of important underlying theory in these areas.

**Keywords:** DevOps, IT businesses, Deployment

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## 1. Introduction

DevOps is a new method of software delivery that has been proposed by both practitioners and academics (Erich, Amrit, and Daneva, 2014) to help organizations deploy code more quickly, more reliably, and with fewer errors. While DevOps may be just another passing IT trend, early adopters are showing otherwise, with DevOps enterprises guaranteeing much higher performance than their competitors (Ravichandran et al., 2016). DevOps Return on Investment (ROI) is argued to be hard to quantify by Ravichandran et al. (2016) since there are no universally accepted metrics for gauging the success of an organization's use of DevOps.

Despite the current buzz, many professionals and academics remain confused about what DevOps really is and how it works. DevOps is an acronym that stands for "Development Operations" (Kim, Behr, and Stafford, 2014). DevOps is a movement that emphasizes collaboration between software development and operations, two traditionally distinct areas of a company's operations. However, DevOps entails far more organizational change than simply bringing these processes (traditionally in separate departments) closer together. In other words, as will be detailed in chapter 2, DevOps will be seen as more than simply another new technique in this study since the integration of development and operations includes major changes in the way IT works, and the company should build and distribute software.

Globally this year compared to last year, by at least US$8 billion (Gartner, 2018). According to Forbes (2018), evidence shows that half of IT businesses have begun utilizing DevOps in some capacity. According to Gartner, the next several years will be crucial to DevOps' development (Barker, 2015). At long last, corporate DevOps has a designated year: 2018 (Forrester, 2017).

According to research by Ravichandran et al. (2016), businesses with strong DevOps practices may significantly boost their IT productivity in areas like code deployment and MTTR. By minimizing application downtime (when a piece of software or an application isn't working as intended and isn't bringing in money), the authors claim that DevOps can save each Fortune 1000 company up to $91 million annually. The Phoenix Project (Kim et al., 2014), a novel designed to assist businesses understand the necessity of DevOps to help IT departments develop, is one of the most significant contributions to promoting the DevOps approach.

Faster time to market, greater customer satisfaction, larger market share, more productive and satisfied employees, and the ability to compete and "win" in the marketplace are just some of the benefits the authors claim are possible thanks to DevOps. Companies are taking advantage of DevOps principles to attain IT productivity statistics unimaginable only a few years ago, all because of the rising need for quicker and better software deployment.

After implementing DevOps principles, companies like Amazon, Google, and Netflix are able to release software more than 500 times per day while maintaining high levels of stability and responsiveness to customers. When compared to a company that uses DevOps, a company that delivers software using traditional techniques does not often exceed a weekly deployment frequency. IT firms with high-performing DevOps had, on average, 60 times fewer problems and recovered from errors 168 times quicker than companies that did not utilize DevOps, according to a poll conducted by Puppet Labs in 2015 with IT professionals from various different companies. They had a 30x higher rate of deployment and a 200x shorter deployment window (Puppet Labs, 2015).

By paying attention to the following four aspects of DevOps, we may achieve this goal: (1) Technological Enablers; (2) Managerial Methodologies; (3) Organizational Culture; and (4) Delivery Approach. Specifically, it's worth noting that organizational culture has long been the subject of research inside companies and has recently attracted considerable interest in the Management Information Systems literature (for a summary, see Leidner & Kayworth 2006).

Management practices that may have an effect on IT might be influenced by culture as well. In addition to its significance in the larger field of Information Systems, culture plays a pivotal role in the DevOps literature, with nearly all authors discussing DevOps citing cultural fit as a prerequisite for successful adoption (for a review of DevOps research, see Erich et al., 2015).

Finally, I draw on the literature on IT culture and management to create a model that takes into consideration the technical and managerial aspects that facilitate DevOps adoption and how this state of DevOps reflects on the IT results assessed by the enterprise.

## 1.1. Life Cycle of Software Distribution

For quite some time, the concept of software development was fundamental to comprehending the function of IT in businesses. Over the last several years, a number of writers have been working to apply this description to what I will refer to as the software delivery life cycle. Poppendieck and Poppendieck (2003) define a software delivery lifecycle as "a series of steps or phases that provide a framework for developing and managing software throughout its entire lifecycle." First, I'll describe how software delivery differs from software development so you may better understand my explanation.

According to Davies (2018), programmers consider their work "done" when they complete their portion of the work (i.e., creating the code for the software), which implies that it may be regarded done without being live on production, without having been deployed, and without anybody really being able to use it. Even if it's deployed but doesn't function in production for whatever reason, it's still worthless," says Davies (2018). No one gives a damn that it functioned properly on your computer. For the company, this is a useless expenditure that has little chance of ever paying for itself. Once code was transferred to operations, that was considered "done" in software development.

They completed their mission. When it comes to delivering software, both engineers and businesses have similar objectives. And yet again, Davies (2018) opines, "All the value of software is in the delivery. The process of development itself is essential, but just a fraction of the whole. By zeroing down on the delivery process, engineers may improve their estimations and have more fruitful discussions with stakeholders. And by "delivery," we mean that the program is in full working order for the end customers. Only when the program is useful to the end user and generates revenue for the business can it be termed complete. As we'll see in the next sections, this disparity has been a major roadblock between Development and IT Operations, and DevOps was created to help close the gap between them. Unlike the software development process, where approaches may be used and culture is usually an afterthought, DevOps provides culture as one of the cornerstones of its functioning. DevOps acts as a paradigm because it affects the way an organization thinks and operates, the way its workers act and see their roles and duties, and the way its members interact with one another. While technical progress has Besides the technical and management aspects of DevOps, which would resemble a methodology per se, DevOps is concerned with how the system development process operates outside the methods, with how people behave anytime it is not prespecified in the methodology itself. It's about how things function inside the firm in general, whether or not they fall within the purview of a certain technique.

The bigger performance is made up of smaller events that have been meticulously planned and rehearsed. Teamwork, open lines of communication, and frequent reviews all contribute to this goal. Workers at a cutting-edge software manufacturing are always focused on the ultimate aim of making it through the present economic climate. Report by Ravichandran et al. (2016) By embracing digital transformation, businesses may better adapt their software and services to the needs of their customers. Ravichandran et al. (2016) found that 68% of customers would quit a brand entirely due to even a few seconds of delay in application load times. People who took the survey said they had a six-second tolerance for slow app loading times before abandoning the app and, typically, the provider associated with it. In addition, more than half of those surveyed said they had a three-second threshold before abandoning a slow-loading app (Ravichandran et al., 2016). It is now essential that software distribution processes be optimized.

This highlights how essential it is to accelerate and enhance application delivery via widespread adoption of the DevOps culture, methodology, and tools. Organizational embracement, in this sense, Failure to fulfil shifting consumer expectations linked to applications quality and performance frequently means losing out to more agile rivals (Ravichandran et al., 2016), hence DevOps has become a significant difference in vying for end users' attention and cash. According to the literature, this is one of DevOps' primary selling points.

DevOps is more than just a technique since it signifies a change in how professionals think about and handle software development and distribution. Sometimes, professionals don't put methodologies to good use because they don't apply them in their day-to-day work, but DevOps is implemented in the routine tasks of developers, analysts, and managers, with an emphasis on collaboration and a shift in perspective. Together, DevOps and method that gets your hands dirty by diving headfirst into the software delivery process (Kim et al., 2014). Based on this reasoning, a Delivery Approach will be developed.

## 2. Review of Literature

Most writers place a premium on discussing Automation within the DevOps environment (Erich et al., 2021). DevOps adoption is facilitated by process automation, according to the literature (Ravichandran et al., 2022), and by implementing DevOps, a business may automate its processes more effectively and in less time.

Having a highly automated IT department is a hallmark of every high-performing DevOps organization, and automation plays a crucial role for any business that aspires to reach that status. IT automation is the process of integrating previously separate systems and pieces of software into a coordinated whole that can perform tasks autonomously and with little human intervention.

Despite the apparent simplicity of the description, this is really rather a challenging process, particularly for larger and more sophisticated systems, and often requires the collaboration of several departments. DevOps is not the same as NoOps (i.e., doing away with IT Operations), but they do highlight the necessity of automation to provide the development team more independence and facilitate shorter iteration cycles.

When the automation process is carried out properly, it frees up IT personnel to concentrate on strategic rather than routine activities. Linthicum (2021) points out that the ease with which cloud-based apps and infrastructure can be regularly updated is largely responsible for the widespread adoption of DevOps.

The usage of cloud-based platforms with DevOps is generally synergistic, as noted by Linthicum (2020), however DevOps may be implemented successfully on non-cloud systems as well. The ROI that DevOps gives may be hastened by using cloud computing, which was designed specifically to take use of the benefits that DevOps offers.

DevOps and Cloud computing are complementary since they are both built with automation in mind (Linthicum, 2021). According to Kim et al. (2022), DevOps is the result of bringing century-old best practices in management to the IT value stream.

These technological enablers are all helpful for DevOps, and each one may be found in the IT software delivery process on its own. Kim et al.'s (2021) presentation of technological enablers has also affected and contributed to the development of the current understanding of what DevOps is. The significance of the internal technologies required for effective DevOps adoption may be better understood after we have a firm grasp on the roles played by these various aspects. However, DevOps cannot function without more than just these technological enablers.

## 3. Research and Methodology

A pilot study of the questionnaire (Straub et al., 2004) was done with experts familiar with DevOps to fine-tune all questions. This is an opportunity to test for coherence, clarity, coherence in sequence, and contextual significance. I believe this will lead to a decrease in measurement error and an increase in the study's internal validity as a whole in the long run. In September of 2018, we ran a test utilizing the crowdsourcing service Amazon Mechanical Turk.

Participants were chosen because they work in IT in the United States and have some familiarity with DevOps. There were 202 total responders, and 192 legitimate replies were received. Due to insufficient data from 9 respondents, they were eliminated. Participants were recruited from inside the United States and were chosen for their knowledge of and experience working with information technology.

They were offered $2.00 to take part in the research, the going cost for this sort of assignment on the platform. The poll had 202 responses, however we had to exclude 10. As a result, the pilot research relied on 192 correct responses. Prior to its use with IS, the questionnaire was strengthened by the fact that it has been verified by IS research

(Steelman, Hammer, Limayem, 2014). managers. Descriptive demographic information about survey respondents is provided in tables 1-10 below.

Table 1. Pre-survey Participants Age

| Age | |
|---|---|
| 18-24 | 14 |
| 25-34 | 83 |
| 35-44 | 52 |
| 45-54 | 23 |
| 55-64 | 15 |
| 65-74 | 2 |
| 75 or older | 3 |
| Total | 192 |

Table 2. Gender of People Who Completed a Pre-Survey

| Gender | |
|---|---|
| Female | 60 |
| Male | 128 |
| Prefer not to inform | 4 |
| Total | 192 |

Table 3. Educational Background of Pre-Survey Respondents

| Education | |
|---|---|
| High school degree or equivalent (e.g. GED) | 7 |
| Bachelor's degree (e.g., BA, BS) | 102 |
| Associate degree (e.g., AA, AS) | 18 |
| Professional degree (e.g., MD, DDS) | 22 |
| Master's degree (e.g., MA, MS, MEd) | 42 |
| Ph.D. | 1 |
| Total | 192 |

Table 4. Jobs Held by Respondents Prior to the Survey

| Job | |
|---|---|
| Programmer | 63 |
| Analyst | 60 |
| CIO | 1 |
| Director | 13 |
| Manager | 41 |
| Other | 14 |
| Total | 192 |

Table 5. Time in Company for Pre-Survey Respondents

| Years in the Current Company | |
|---|---|
| 0-3 | 64 |
| 4-7 | 69 |
| 8-11 | 18 |
| 12-15 | 20 |
| 16+ | 21 |
| Total | 192 |

Table 6. Pre-survey Employees' Average Lengths of Service in Their Current Roles

| Years in Position | |
|---|---|
| 0-3 | 119 |
| 4-7 | 54 |
| 8-11 | 16 |
| 12-15 | 2 |
| 16+ | 1 |
| Total | 192 |

Table 7. Pre-survey Respondent Industry Experience (in Years)

| Company Time in the Market | |
|---|---|
| Less than one year | 2 |
| 1-3 years | 3 |
| 4-9 years | 23 |
| 10-27 years | 66 |
| More than 27 years | 98 |
| Total | 192 |

Table 8. Company Sector of Pre-Survey Respondents

| Company's Sector | |
|---|---|
| IT | 112 |
| Other | 80 |
| Total | 192 |

Table 9. Organizational Level Considered by Pre-Survey Participants

| Organizational Level | |
|---|---|
| Entire organization | 138 |
| My subsidiary | 40 |
| My subunit | 14 |
| Total | 192 |

Table 10. Pre-survey Participants Market Dynamism for their Company's sector

| Market Dynamism | |
|---|---|
| Strongly Disagree | 0 |
| Disagree | 9 |
| Somewhat Disagree | 13 |
| Neither Agree or Disagree | 14 |
| Somewhat Agree | 51 |
| Agree | 80 |
| Strongly Agree | 25 |
| Total | 192 |

The main purpose of a pretest is not to analyze the demographics of the sample, but doing so is vital for validating the tool since the respondents share many features with the target population. Following initial sample characterization, Exploratory Factor Analysis (EFA) was carried out using the IBM SPSS statistical software. The results of calculating the Cronbach's Alpha coefficient are shown in Table 10.

## 3.1 Data Analysis

While 190 people participated in the poll, only 176 were considered valid. Participants were IT experts who have some experience with DevOps. The tables below provide the completed descriptive statistics for the sample. Tables 11–21 provide descriptive information about Final Survey respondents.

Table 11. Age of Completed Survey Participants

| Age | |
|---|---|
| 18-24 | 8 |
| 25-34 | 67 |
| 35-44 | 45 |
| 45-54 | 40 |
| 55-64 | 14 |
| 65-74 | 1 |
| 75 or older | 1 |
| Total | 176 |

Ages of participants are shown in Table 11. The majority of attendees are above the age of 35, indicating that they hold positions of authority within their respective companies.

Table 12. Final Survey Participants Gender

| Gender | |
|---|---|
| Female | 75 |
| Male | 101 |
| Prefer not to inform | 0 |
| Total | 176 |

Gender is broken out in Table 12. The model was not affected by this control variable.

Table 13. Final Survey Respondents' Levels of Education

| Education | |
|---|---|
| High school degree or equivalent (e.g., GED) | 5 |
| Bachelor's degree (e.g., BA, BS) | 84 |
| Associate degree (e.g., AA, AS) | 18 |
| Professional degree (e.g., MD, DDS, DVM) | 22 |
| Master's degree (e.g., MA, MS, MEd) | 47 |
| Ph.D. | 0 |
| Total | 176 |

Level of Education is shown in Table 13. Nearly half (47%) and over ninety-five percent (95%) of the sample had at least a bachelor's degree.

Table 14. Jobs Held by Final Survey Respondents

| Job | |
|---|---|
| Programmer | 15 |
| Analyst | 25 |
| CIO | 6 |
| Director | 35 |
| Manager | 89 |
| Other | 6 |
| Total | 176 |

Each employment in the sample is listed in Table 14. According to what was discussed earlier in the theoretical portion of this study, the understanding of organizational culture would be more accurately reflected if the respondents held management or executive positions in the firm. There is considerable generalizability to the decision-making process of IT organizations in regards to their method to providing software since 74% of the participants in this sample are at a management level (CIO, Director, or Manager). This is strong evidence for the reliability of the sample.

Table 15. Years in the Company, by Pre-Survey Participant

| Years in the Current Company | |
|---|---|
| 0-3 | 65 |
| 4-7 | 44 |
| 8-11 | 30 |
| 12-15 | 25 |
| 16+ | 12 |
| Total | 176 |

Table 16. Pre-survey Employees' Average Lengths of Service in Their Current Roles

| Years in Position | |
|---|---|
| 0-3 | 80 |
| 4-7 | 53 |
| 8-11 | 22 |
| 12-15 | 12 |
| 16+ | 9 |
| Total | 176 |

Table 17. Final Survey Participants' company Sector

| Company's Sector | |
|---|---|
| IT | 135 |
| Other | 41 |
| Total | 176 |

Table 18. Company Size Among Respondents in the Full Survey

| Company Size | |
|---|---|
| Up to 19 employees | 7 |
| 20 to 99 employees | 21 |
| 100 to 499 employees | 41 |
| More than 500 employees | 107 |
| Total | 176 |

Table 19. Market Experience of Final Survey Respondent Companies

| Company Time in the Market | |
|---|---|
| Less than one year | 13 |
| 1-3 years | 6 |
| 4-9 years | 23 |
| 10-27 years | 55 |
| More than 27 years | 79 |
| Total | 176 |

Tables 15-19 illustrate the profile of the respondents and hence aid in defining the features of the sample. There is nothing particularly noteworthy about them, with the exception of table 16, which reveals the growth of DevOps in non-IT-centric businesses.

Table 22. Descriptive Statistics and Correlations

| Factors | Mean | SD | Cronbach's α | C. Rel. | AVE | *1. Tech.* | *2. Man.* | *3. Cult.* | *4. Del.* | *5. Alig.* | *6. IT Out.* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *1. Technology* | 5.49 | 1.51 | 0.89 | 0.91 | 0.55 | **0.744**[a] | | | | | |
| *2. Management* | 5.17 | 1.49 | 0.88 | 0.90 | 0.54 | 0.62 | **0.733** | | | | |
| *3. Culture* | 5.16 | 1.53 | 0.93 | 0.94 | 0.63 | 0.58 | 0.68 | **0.794** | | | |
| *4. Delivery* | 5.24 | 1.46 | 0.92 | 0.93 | 0.58 | 0.55 | 0.65 | 0.72 | **0.76** | | |
| *5. Alignment* | 4.89 | 1.58 | 0.92 | 0.94 | 0.76 | 0.47 | 0.62 | 0.68 | 0.74 | **0.871** | |
| *6. IT Outcomes* | 4.89 | 1.57 | 0.90 | 0.92 | 0.61 | 0.50 | 0.65 | 0.72 | 0.72 | 0.71 | **0.781** |

Table 20. Final Survey Participants' Organizational Level considered

| Organizational Level | |
|---|---|
| Entire organization | 130 |
| My subsidiary | 40 |
| My subunit | 6 |
| Total | 176 |

The IT industry often views DevOps as an enterprise-wide phenomena. However, some businesses include dedicated DevOps teams as part of their infrastructure. Participants were asked if they were thinking about their DevOps analysis in terms of the whole corporation or their own department while responding to this question. Since DevOps will be executed consistently throughout a huge firm, this is of paramount importance. Table 20 reveals that more than 73% of respondents were thinking about the whole company when they filled out the survey, indicating that DevOps is a broad cultural shift.

Table 21. Final Survey Participants Market Dynamism for their Company's sector

| Market Dynamism | |
|---|---|
| Strongly Disagree | 0 |
| Disagree | 5 |
| Somewhat Disagree | 7 |
| Neither Agree nor Disagree | 8 |
| Somewhat Agree | 16 |
| Agree | 80 |
| Strongly Agree | 60 |
| Total | 176 |

A control question, shown in Table 21, was designed to find out whether the participants thought the market they were operating in was a dynamic one. There just aren't enough responses to warrant a group comparison of very dynamic/low dynamic market groups to test for a difference in outcomes. The fact that this is even a question demonstrates that current IT firms see the market as very volatile, implying that they must be nimble in order to survive. Table 22 shows the factors' descriptive statistics.

An Elements that are not on the diagonal (in italics) represent inter-construct correlations, whereas the square roots of the average variance extracted (AVE) are on the diagonal determined the reliability of the constructions, as well as their validity. All of the dependability indices calculated using Cronbach's Alpha (table 22) scored higher than the suggested minimum of 0.7 (Nunally and Bernstein, 1994). In order to determine whether or not the variables were discriminatory, principal component factor analysis with direct Varimax rotation in SPSS version 25 was used. The remaining metrics for the model's reliability and validity are shown in Table 22.

## 3.2 Limitations of Study

This study has a few caveats that should be taken into account for future studies. First, the study relied on information provided by a small number of self-reporting participants working in each company's IT department (mostly IT managers, but also some analysts). In my opinion, the informants knew enough about the company and the Software Delivery Process, but everyone has their limits depending on the environment into which they are placed.

Some Factors, such Culture, exist in an organizational environment and are difficult to capture, and although it is possible and sometimes desirable to use the person as a proxy to understand Culture, this is not always the case. The reliability of the measures of certain important factors in this research may improve if more people participate, whether they are in upper management or not. Second, as I utilized cross-sectional data to assess the effect of Delivery Approach on IT Outcomes by mediating the relationship with ideal DevOps, it would be beneficial to do longitudinal study on the effects of DevOps over the long run. Such investigation may provide light on the lagging effect of DevOps on IT efficiency. Due to study limitations and the fact that most organizations have just lately decided to publicly use DevOps, this was not feasible. Third, there are several flaws in the methods used in this research. However, investigating such organizational phenomena is difficult in any approach. There is a problem in the field of cultural studies.

I would also miss the additional knowledge gained from investigating a large number of different organizations rather than just the few allowed by the case study approach, which is useful when studying, say, an organization's cultural factor. The study's limited international applicability is also due to the fact that it was done in only one country: the United States. This enabled the researcher

to ignore other forms of culture, such as national culture, that could have a role in the adoption of DevOps. There is no need for national culture to have a role in the adoption of DevOps; nonetheless, companies with power-centric cultures (Weill & Ross, 2004) may experience greater friction as a result of embracing DevOps's open and transparent tenets.

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## 4. Conclusion

Although DevOps has gained increasing interest in the business world, it remains an understudied topic in the field of information systems. Few empirical studies have been conducted on DevOps, and those that have fallen short in their attempt to address organizational concerns. Furthermore, there has not been much IS study of the Software Delivery process that accounts for emerging trends in the industry. In order to better understand the new software delivery philosophy known as DevOps, this study's primary goal was to consolidate and relate existing knowledge about the Software Delivery Process, IT culture, and IT organizational capabilities (i.e., technological and managerial factors).

Because DevOps is supported by three distinct factors technology, management, and culture to offer a nomological model to evaluate the impact that its adoption has on IT's quantifiable Outcomes. In addition, I elaborate on the IT department's efficiency may be boosted by bringing it closer to the ideal DevOps and the Delivery Approach Factor. According to the results of this study, the DevOps mindset has to be taken into consideration while releasing software. Organizations that seek to improve their IT delivery efficiency might take advantage of the institutionalized environment provided by DevOps. The study theoretically proposes and experimentally confirms a nomological model that connects DevOps to its facilitators and results, providing businesses with a more complete picture of how DevOps affects them.

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