Impact of DevOps on Project Management Methodologies - An Empirical Study

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Abstract - **DevOps practice & Project Management methodologies are crucial for faster reach to the market in IT Industry. The term "DevOps" advocates a collaborative working between Development and IT Operations, leading to the faster reach to market of planned work while simultaneously increasing the quality, reliability, stability, resilience, and security across the project life cycle. Project management methodology aims to maximize the efficiency of resources and time. It is a set of guiding principles and processes for managing a project and get the desired project outcome. This paper aims to understand the impact of DevOps on project management methodologies if any with reference to managing and implementing DevOps Projects. For this purpose, data were collected through the questionnaire as a data collection tool from IT Managers and DevOps Engineers. Data were analyzed with SPSS software ver. 24. Sign binomial test was performed to test the hypothesis and identify the changes if any in Project Management Methodologies with respect to DevOps projects. Finally, suggestions to Project Managers for managing DevOps projects are suggested**

keywords - DevOps, Project Management, Methodologies, DevOps Practices, Impact

I. INTRODUCTION

Project management is the initiating planning, organizing and managing the resource efforts to accomplish a successful project. Project management is that the application of knowledge, skills, tools, and techniques to project activities to satisfy the project scope. A project is temporary therein it's a defined beginning and end in time, so defined scope and resources. Project management includes creating a project plan, which involves defining and agreeing the project key goals and plan how project goals will be achieved, identifying tasks and quantifying the resources needed, and determining cost budgets and timelines for project completion. It also includes managing the implementation of the project plan, along with operating governance to ensure that there is correct information on 'performance' relative to the plan, and the mechanisms to implement corrective actions wherever necessary. Today companies are undergoing digital transformation This means companies needs to adapt these changes and get aligned to Agile and DevOps practices.

Agile is one of the most recognizable project management methodologies in digital transformation age and is best suited to projects that are iterative and incremental. It's a kind of process where demands and solutions evolve through the collaborative effort of self-organizing and cross-functional teams and their customers. Agile & DevOps go complimentary to each other and in recent years have become critical part of business operation. The DevOps during the life cycle of the software helps in reducing number of steps to brink software to the market. The focus is on faster reach to the marked along with Swift User feedback.

DevOps boosts Organizations agility and is all about making the business successful by delivering MVP (Minimal Viable Product) to the customer faster and in a reliable way. DevOps fundamentally changes How IT managers approach the project by moving away from traditional monolithic multi months and multi years project initiatives and adapt to greater speed and agility in delivering MVP's.

DevOps requires development, testing, build, release management and operation teams to follow best practices in their areas and technology. The project teams as required need to be introduced to system thinking, Continuous Integration & Build, Continuous Delivery, Continuous Monitoring, Continuous Deployment, DevOps Consulting Skills, DevOps Operating Model Awareness, Infrastructure Provisioning Skills, DevOps Enabled agile Practices, Ample Feedback Loops, Collaborative Development, Lean & Agile Development, Create Real Time Visibility, test automation tools, application release automation tools, application performance monitoring tools, Platform as service (PaaS) tools, Infrastructure as a service(IaaS) tools and Software as a service (SAAS) tools

II. PROJECT MANAGEMENT METHODOLOGIES

There are many methodologies to settle on from, each with their own set of rules, principles, processes, and practices. Which methodology is the right fit depends entirely on the kind of project you may undertake. the purpose of choosing a project management methodology is to maximize the efficiency of resources and time. One thing to stay in mind is that while there are variety of methodologies to settle on from, there's no such thing because the 'right' methodology. Meaning, there won't be the

one methodology that's perfect to use for each single project. Projects vary in scope and requirements, which suggests the correct methodology to implement will vary

Agile. One among the more recognizable project management methodologies, Agile is best suited to projects that are iterative and incremental. It's a kind of process where requirements and solutions evolve through the collaborative effort of self-organizing agile teams. Originally created for software development, it absolutely was established as a response to the inadequacies of the Waterfall method (the processes of which didn't meet the demand of the highly competitive and constant movement of the software industry.

Agile project management came into practice from the values and principles of the Agile Manifesto. A declaration cemented in 2001 by 13 industry leaders, its purpose is to uncover better ways of developing software by providing a transparent and measurable structure that fosters iterative development, team collaboration, and recognition.

Scrum is comprised of five core values comprising of commitment, courage, focus, openness, and respect. Its goal is to develop, deliver Minimum Viable products through collaboration, accountability, and iterative progress

Kanban is another popular Agile framework that, kind of like Scrum, focuses on early releases with collaborative and self-managing teams. Kanban that was developed on the assembly line of Toyota factories within the 1940s, it's very visual method that aims to deliver top quality results by painting an image of the workflow process in order that bottlenecks is identified timely within the development process

The lean methodology aims at maximizing customer value by minimizing waste. It aims to form more value for the customer by using fewer resources. Stemmed from the Japanese manufacturing industry, its values suppose that 'as waste is eliminated, quality improves while the assembly time and price are reduced.'

Waterfall one of the more traditional project management methodologies, Waterfall a linear, sequential design approach where progress flows downwards in one direction—like a waterfall. Originating within the manufacturing and construction industries, The methodology was first introduced in a writing written in 1970 by Winston W. Royce (although the term 'Waterfall' wasn't used), and emphasizes that you're only ready to move onto the following phase of development once this phase has been completed

Six Sigma is project management methodology first introduced at Motorola in 1986. It aims to enhance quality by reducing the amount of errors in a very process by identifying what's not working and so removing it from the method. It uses quality management methods, which are mostly empirical and statistical, yet because the expertise of individuals who are specialists in these methods.

III. LITERATURE REVIEW

PMI PMBOK, (2008), Project management body of knowledge is a recognized standard for project management profession. The book introduces key concepts in project management field. PMBOK provides a common vocabulary within the project management profession for discussing and applying in project management.

Obeidat, Mohammad Abdul Qadir, (2016), shows that Project Management Information's systems (PMIS) has become strategic resource for project managers in managing project optimally. The study reveals a positive correlation between use of PMIS and project performance during project execution.

Christopher Cullen, (2011), The study highlights project management effectiveness tool that measures the effectiveness of software project management. The focus is to gain effectiveness in project management practices by implementing quantitative measurements.

Gene Kim, Kevin Behr, George Spafford, (2013), The Phoenix Project's subtitle is "A Novel About IT, DevOps, and Helping Your Business Win." . This book is a manual for helping IT managers change the way employees think about the way they plan, schedule and complete work. Practical approaches to creating change, like Kanban and continuous delivery and are illustrated through relatable use cases.

Sriram Narayan (2016), This book explains management of Agile based development. The book provides insight for IT manager to move from Systems of records and adapt in system of engagement and required organizational changes to deliver in agile way. Conclusion is having Agile IT Organization design in place and model related practices and promote collaboration and integrations among process, methods and tools.

The Open Group IT4IT Forum Agile Work Group (2016), This document describes the application of the IT4IT Reference Architecture to the area of Agile Development using techniques such as DevOps and Kanban. This document explains how to apply the IT4IT Reference Architecture, an Open Group Standard, to various different scenarios related to managing the business of IT.

Rayome, Alison DeNisco (2017), The study highlight challenges in DevOps implementation and address how to overcome them. Some of the key challenges highlighted in the study are related to company culture, test automation, and legacy infrastructure.

Duma, Yevhenx (2018), the study reveals 10 DevOps skills required to work in DevOps , Some of key skills that has been given focus are strong communication and collaboration skills, Coding , automatic testing & software Security skills.

Choudhuri, Niladri (2019) The Upskilling 2020 report from DevOps Institute highlights process skills and knowledge as main important skills for DevOps. Governance, Risk and Compliance (GRC) skills have gained focus recently. The study reports Collaboration and cooperation as one of the top skills required in DevOps.

Brownlee Dana, (2019) , The study offers about the project management trends on the horizon and focus on the areas where project managers needs to have broader skills and technically aligned with trending technologies.

Donnelly, Caroline (2017), This article explains how to build a developer and operations collaboration (DevOps) culture. Tips mentioned include the head-on address to legacy technology problems and technical debt, the avoiding of being stuck in fire fighting cycle, and the need to stop the break-fix-style cycle. Conclusion is to promote collaboration among development and operations team and promote DevOps mindset.

Sanjeev Sharma, Bernie Coyne, (2015), This book "DevOps for Dummies" explains a business-centric approach to DevOps. Objective is to implement DevOps essential for all organizations that must be agile and lean enough to respond rapidly to changes such as customer demands, market conditions, competitive pressures, or regulatory requirements.

Muslihat Dinnie, (2018), The scope of this study was to understand popular Project management methodologies and get insights about project characteristics associated with each type of project methodology.

Cohan , Esther, (2019). The study gives overview about different types of project management methodologies.

S.W. Ambler, (2011), The journal focused on "Disciplined Agile Delivery." Elements such as release, and deployment should be integral parts of agile vision and daily activities. Conclusion is to focus on Disciplined agile delivery, collaborative DevOps and have DevOps enabled agile delivery model.

IV. OBJECTIVES

- To Understand Changes in project management methodologies with respect to managing DevOps projects.
- To offer suggestions for implementing DevOps practice to improve overall project outcome.

V. HYPOTHESIS

Hypotheses (H0): There are significant changes in project management methodologies with respect to Managing DevOps projects.

Hypotheses (H1): There are no significant changes in project management methodologies with respect to Managing DevOps projects.

VI. RESEARCH METHODOLOGY

Type of research was descriptive, and nature of research was quantitative. Structured questionnaire was used for data collection. IT Managers were requested to tell whether there is the change required in project management methodologies with reference to managing DevOps Projects. Non-probability Quota sampling technique was used to select the sample for collecting primary data. The source of information and targeted segment for this study was Managers DevOps projects and DevOps engineers working on DevOps implementation.

The study included 117 respondents for each IT Managers and DevOps engineers and were requested to provide information. however, 13 questionnaires were rejected due to incomplete data therefore 104 is the sample size that was taken into consideration.

VII. DETERMINATION OF SAMPLE SIZE

Sample size was determined using sample size determination by mean method.

Variables in study were measured using a 5-point measurement scale, hence the mean method was adopted.

Formula

$$N = \frac{z^2 * s^2}{e^2}$$

Where, 'z' is the standard score associated with confidence level (90% in the current case). Hence standard scores equals to 1.645 (borrowed from normal table)

'S' is the variability in the data set, computed as a ratio of range / 6. Range is equal to 5-1 = 4 (the difference between minimum and maximum value in the 5point scale). 6 refers to ±3 standard deviation values on the X axis of the standard normal curve, which takes in all the data set in study.

Hence S = 4/6 = 0.66

E is the tolerable error = 10% (in the current study).

$$\text{Sample size n} = \frac{1.645^2 * 0.66^2}{0.1^2} = 117$$

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Final sample size = 104

VIII. HYPOTHESIS TESTING

Hypotheses (H0): There are significant changes in project management methodologies with respect to Managing DevOps projects.

Hypotheses (H1): There are no significant changes in project management methodologies with respect to Managing DevOps projects.

Statistical test: sign binomial test

Variables and measurement

Managers were requested to tell whether there is the change required in project management methodologies with reference to managing DevOps Projects.

(1= Yes, 2 = No)

Test proportion: Test proportion was taken as 0.5. Since more than 50% of favorable responses to a particular category suggest greater approval for this category.

Hence P = 0.5

H_0: $P \leq 0.5$ (proportion of responses indicating "There are significant changes in project management methodologies with respect to Managing DevOps Projects" is less than or equal to 50%)

$H_{1\text{-}1}$: $P > 0.5$ (proportion of responses indicating "…There are no significant changes in project management methodologies with respect to Managing DevOps projects" is more than 50%)

Level of significance: $\alpha = 0.05$

Binomial Test						
		Category	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)
Is there change required in project management methodologies in reference to managing DevOps projects.	Group 1	No	100	.96	.50	.000
	Group 2	Yes	4	.04		
	Total		104	1.00		

Conclusion.

Since the observed proportion (number of managers saying No)   0.96 and Test proportion is .5, P < 0.05 (.000) the null hypothesis is rejected. Hence   the proportion of mangers saying there is no changes required in project management methodologies in reference to managing DevOps Projects is significantly more than 50% Hence the hypothesis "There are no changes in project management methodologies with respect to Managing DevOps Projects" is proved.

IX. SUGGESTIONS

   DevOps transformation are happening at great pace. DevOps mindset help combine their strong leadership acumen and skill with relevant knowledge, empowering them to innovate across product and project life cycle. With changing business priorities, technology advancement and DevOps best practices. IT managers are expected to achieve more with less. Increasing emphasis is being placed upon the necessity for the technical professional to develop competencies in "DevOps skills. "Importantly, Project Management skills and DevOps skills are crucial for faster reach to the market. Though there are no changes in project management methodologies, but technology quotient of the project managers is often continually improved with changing technologies.   Suggestion for applying DevOps practices in project management for better project outcome are as follows

- IT project managers should develop their technology quotient. this will enable IT Project Managers to make correct decisions in choosing the right technology which otherwise can have disastrous effects on projects outcome and costing.

- IT Managers should Develop skills in Agile project management and apply agile methodologies in managing DevOps deliveries. They should be trained on tools used for Agile Project Management so that can use that tool effectively from Agile Project Management perspective.
- Project managers should be trained on project management ALM (All life cycle management tools) for effective collaboration across the project lifecycle
- IT Managers should incorporate data analysis in the project management process. IT Managers should stay up to date on new tools and new cloud service offering. Technologies like Artificial Intelligences should be implemented to generate   predictive analytics and real time project updates. Predictive analytics capabilities should be exploited for manage risks more proactively and effectively.
- IT Project Managers need to develop efficacy in Cloud. The Project managers needs acquire Cloud skills. They need not to be specialized in cloud computing service but should be to be aware about the value adds provided by these services so that right fit of services are procured to address the specific project needs.

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