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Implementing value: evaluating systems frameworks and their impact on scalable systems implementations

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Abstract

Software companies need to manage integration partnerships and integration projects for complex IT systems that span across vendors and customers. Therefore, it is necessary to understand the frameworks needed to successfully implement and manage these processes. The goal of this study is to compare and evaluate the impacts of frameworks related to information technology development operations (DevOps) on the implementation phase of integrated IT projects. This case study reviewed the implementation of a novel framework for DevOps and IT system implementation for an emerging critical technology at a fintech company.

Keywords: development operations, theory of constraints, project management, critical constraint management, IT product implementation framework

Introduction

Software-producing companies must develop and distribute high-quality software at a fast pace. With this demand, organizations face challenges in understanding and managing the information technology value chain and organizational processes related to the teams that implement this software (Unger-Windeler et al., 2020). The compounding technical debt and work in progress (WIP) of these unmanaged demands cause throughput, innovation, and morale challenges (Lenarduzzia et al., 2021). Defining a framework to manage these demands, as well as governance, security, product, and project management, is critical to the organization's success (Kim et al., 2016).

This research study examines frameworks related to Development Operations (DevOps) as a possible model to address challenges in Information Systems Technology implementations for complex Information Technology (IT) projects and systems. DevOps has emerged in the Software Engineering (SE) industry over the last decade. The DevOps organizational approach prioritizes empathy and encourages greater collaboration among engineering teams involved in software delivery, to improve end-user experience, reduce development time, increase deployment rates, increase stability, optimize Mean Time to Recover, and lowering deployment and implementation costs (Amaro et al., 2022). DevOps borrows from other frameworks, such as the Theory of Constraints (TOC), and SE practices such as Lean Software Development and Agile Project Management. These philosophies, practices, and tools are focused on a continuous improvement process that improves organizational performance (Lwakatare et al., 2016; Pacheco et al., 2018).

The amount of information required to conduct business is increasing at an exponential rate. Many IT departments are finding it difficult to keep up with the demands of complex projects that require configurations and integration on systems which—despite using the same core software—have different adaptations and business rules (Kaisler et al., 2014). Organizations struggle to find scalable processes and frameworks to apply to these projects to reduce production time and increase the value stream. Many organizations have adopted multiple frameworks in attempts to address this underlying issue. Adoption of multiple frameworks can create opportunities; however, understanding the interdependencies to help determine the overlap between each process is critical to successfully reducing their complexity (Serrano et al., 2021). This research aims to close that gap by comparing and evaluating the impact of frameworks related to Development Operations (DevOps) on the implementation phase of configurations and integration of complex IT projects/systems.

This study's purpose is to evaluate system frameworks and their impact on scalable system implementations. The author will investigate whether the addition of IT development operations (DevOps) frameworks can be leveraged to deliver additional value during the implementation phase of IT projects. This research will answer the following questions:

RQ1: *Does incorporating IT DevOps frameworks positively impact scalability?*
RQ2: *Does incorporating IT DevOps frameworks positively impact the value chain for project implementations?*
RQ3: *Does incorporating IT DevOps frameworks affect project complexity?*

The outcomes of this study highlight emerging themes in information technology frameworks associated with IT system project implementations, with a focus on extending DevOps methods in software development into additional domains, taxonomies, perspectives, and challenges related to project demands. These themes were utilized to create a conceptual model to better comprehend a framework that might be scalable for IT operations and service verticals. The conceptual model features a hierarchical perspective of several key areas of inner reliability and awareness that embraces an agile adoption of best practices in implementing value for IT Projects and customers. This research is organized into a literature review, followed by a research methodology that includes a description of the procedure and data analysis.

Literature Review

Lenarduzzia et al. (2021) leverage a systematic literature review process that pulls data from 44 selected papers to understand the state of the art and the practice of Technical Debt (TD) prioritization. As a result, they created a prioritization strategies framework that addresses this debt. The authors provide insight along with outlining critical issues caused by TD and the possible activities to handle /mediate the risk involved. In addition, they created a prioritization strategies framework that addresses TD. Osterberg's master thesis (2020) outlines the need and origin of DevOps operations and community and proposes novel ideas on the impact of project management on DevOps frameworks. The cross-functional information provided in this thesis provides an excellent foundation for the impact of the project and product management systems on the DevOps processes and community.

Amaro et al. (2022) define a conceptual map of the DevOps capabilities and practices model in a multivocal literature review. The authors also suggest a novel idea on how to map these impacts on the continuous improvement practice of DevOps. The data presented in this study outlines many critical paths of DevOps with more mainstream business objectives such as culture, measurements, communication, and process. Khan et al. (2022) present a systematic approach to a literature review related to adopting DevOps culture. The challenges outlined in this study show a clear correlation between project management, communication, and DevOps principles. This article outlines many of the challenges faced by software organizations in adopting DevOps frameworks and will provide a reference point for the proposed study.

In their multivocal literature review about DevOps Relationships with Agile and Lean Deployment, Lwakatare et al. (2016) present a thematic analysis of the data collected, highlighting a lack of empirical evidence which suggests that DevOps is still in its infancy while demonstrating that many of the concepts associated with DevOps are often conflated with other frameworks that DevOps has pulled/evolved from. In a 2022 case study, Dereń et al. use the Theory of Constraints (TOC), providing an insightful view of its implementation as well as a guide to understanding the management of the identified constraints, often referred to as bottlenecks. The article also introduces Critical Chain Project Management (CCPM) as a method of the TOC framework (Dereń et al.,2022). Roy (2009) delivers a well-presented and defined view of Critical Chain Project Management CCPM) theory and practice under the TOC umbrella. Research conducted on CCPM with operation theory allows the information to be used as a backdrop to highlight how this practice has led to and continues to influence newer theories and models.

A 2014 study by Augusto & Pacheco addresses the convergences and divergences between the TOC and Six Sigma. The authors focus on the continuous improvement adoption as one of the key areas of overlap between the two practices allowing for them to easily show the effects of each along with a way to highlight the strengths and weaknesses. The conclusion of this shows that although they have different philosophies, both have been used by various industries for process improvement because, while Six Sigma requires solutions in depth, the TOC can show bottlenecks and overcome them (Augusto & Pacheco, 2014). Iden & Roar Eikebrokk (2013) conducted a systematic literature review on implementing IT Service Management (ITSM). The review provides context on the use of Critical Success Factors (CSF) and the need to engage management in the competence and training, information, and communication to staff and stakeholders, and culture when implementing ITSM. This provides a background for how the adoption of the system can be affected by service management.

A review of the Information Technology Infrastructure Library

(ITIL) framework in the light of organizational culture and adoption was conducted by Mukwasi & Seymour in 2015. Their systematic literature review provides insight into cultural contradictions embedded in the ITIL framework. This review provides a critical look at the competing values framework (CVF) and cultural contradictions that exist between an implementing organization and the ITIL-prescribed framework. (Mukwasi & Seymour, 2015) Rusman et al. (2022) provide a useful review of Control Objectives for Information and Related Technology (COBIT) and ITIL. This article focuses on the study of the impact of these frameworks on audits; however, the information compiled in the study about the overlapping areas of the body of knowledge is useful in other aspects of this author's proposed study.

Finally, Jašek et al. (2015) provide an overview of the ITIL framework and materials. The information on each key ITIL segment will help define the structure needed to review a critical service implementation cycle. The graphic that outlines the Plan Do Check Act method is well-developed and was used to assist in the case study proposed for this body of research. To provide context to the research completed in the systematic literature review, the author has elected to divide this document into sections relating to the topics of this research. This is because a single source correlating the field of research and body of knowledge in a manner that addresses the implementation and services IT value chain was not identified, which highlights the importance and timeliness of this study.

Research Methodology

The research methodology selected is a case study of a US-based FinTech company, Transact Campus. The use of a case study was selected as a method to objectively review the direct impact of the proposed novel framework's impact on the research questions. This approach's benefits allowed for the author to focus on the depth rather than the breadth of the subject and theory to be explored. (Takahashi & Luis, 2020) The case study also allowed a mixed-method approach to the research as well as a practical implementation of the development operational frameworks when applied to the challenges of implementing a complex integration to existing enterprise infrastructure in IT systems that have a mixed-host implementation. Several of the project cases examined were international institutions of higher education.

The Instrument / Survey

The instruments used in this study include interviews, surveys, flow mapping, and observations. The survey was limited to 1) Implementation Complexity - 3 items, 2) Process Scalability - 5 items, and 3) Process Value - 3 items. The survey instrument is a 5-point Likert-type scoring strategy. See Appendix A for the survey details. The 5 point scale was selected to simplify the response coding and yield a higher quality of data. (Revilla et al., 2013) The question set used in this survey was developed based on the review of development operation questions used when implementing new frameworks; however, these questions (see Appendix A) are the author's first attempt at refining a question set to evaluate the research questions. In correlation with other professionals on the framing of the questions, the author hopes to update the question set for future studies to address the limitation of limited data points. All other data were analyzed using the constant comparison method with no prior hypotheses used to identify themes and trends in the process.

Participants and procedures

All data was collected virtually. The interviews were conducted using MS Teams, and the surveys were conducted using a web-based form. Before this, the author secured IRB (Institutional Review Board) approval to use human subjects. The collected data was inspected before analyzation it to ensure data integrity and completeness. Incomplete data were removed before analysis. Participants in this study were all over the age of 18. To participate in the study, all participants were required to sign a consent form. Confidentiality and anonymity were guaranteed. The survey and interview size were limited to the organization and included fewer than 20 participants.

Data analysis

While contemplating conducting an SLR from formal literature on the specific topic of DevOps, the research included related theories and practices discovered to support DevOps processes to broaden the search to include data relevant to the framework's systematic approach. The goal of this SLR research is to map out the DevOps capabilities and practices, as well as how they relate to capabilities. An expanded variety of sources were gathered to provide order and clarity to the meanings and relationships of DevOps Practices and required Capabilities. Various keyword searches were utilized to retrieve the greatest number of studies possible. The datasets chosen are listed below.

"Theory of Constraints" AND ("Six Sigma" OR "Lean" OR "Agile") AND "DevOps",
"Critical Chain Project Management OR CCPM",
"Theory of Constraints" AND ("Six Sigma" OR "Lean" OR "Agile") AND "DevOps" AND Governance,
"DevOps" AND "technology" AND "Service" AND "implementation",
(WIP OR "Technical Debt") AND (throughput OR innovation OR morale),
"COBIT" AND "technology" AND "Service" AND "implementation",
"ITIL" AND "technology" AND "Service" AND "implementation".

The search engines used were Google Scholar Search, Sinkron, Science Direct, Springer, ACADEMIA, Research Gate, IEEE, ACM, and EBSCO. Following the completion of the search and snowballing, inclusion and exclusion criteria were used to refine the search results. The inclusion criteria for this SLR were published after 2002, full-text accessible, and reviewed by a crediting source, keywords, or authors related to the capabilities, practices, or theories surrounding DevOps. Following that, the abstracts were screened to determine their relevance to the research. Finally, the relevant papers were read, and the final study selection was reviewed. Multiple regression analysis was used to answer the research questions. The coefficients table in multiple regression analysis identifies the predictor variables that are influential in predicting the dependent variable. Before interpreting the results in the coefficients table, three tests were run: 1) the multicollinearity test, 2) the model summary/goodness of fit test, and 3) the ANOVA test.

Table 1: One-Way ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
1. Working with development decreased the lead time on integrations.	Between Groups	6.629	3	2.210	1.954	0.210
	Within Groups	7.917	7	1.131		
	Total	14.545	10			
2. Working with operations decreased the lead time on integrations.	Between Groups	2.220	3	0.740	0.550	0.664
	Within Groups	9.417	7	1.345		
	Total	11.636	10			
3. Interdependencies within the project were easier to manage with this framework.	Between Groups	2.742	3	0.914	0.629	0.619
	Within Groups	10.167	7	1.452		
	Total	12.909	10			
1. I was able to use this approach throughout the integration.	Between Groups	4.061	3	1.354	1.421	0.315
	Within Groups	6.667	7	0.952		
	Total	10.727	10			
2. When new scope changes came up, I was able to adjust quickly because I had this framework to implement.	Between Groups	2.311	3	0.770	1.221	0.371
	Within Groups	4.417	7	0.631		
	Total	6.727	10			
3. As the project progressed, I was able to identify 3. As the project progressed, I was able to identify bottlenecks.	Between Groups	1.432	3	0.477	4.455	0.047
	Within Groups	0.750	7	0.107		
	Total	2.182	10			
4. This process could be used on any sized project effectively.	Between Groups	6.970	3	2.323	1.876	0.222
	Within Groups	8.667	7	1.238		
	Total	15.636	10			
5. I was able to easily implement this process across multiple project teams successfully.	Between Groups	1.295	3	0.432	0.930	0.475
	Within Groups	3.250	7	0.464		
	Total	4.545	10			

		Sum of Squares	df	Mean Square	F	Sig.
1. I was able to identify areas in this project where I could add value because of this framework.	Between Groups	3.227	3	1.076	1.004	0.446
	Within Groups	7.500	7	1.071		
	Total	10.727	10			
2. I was able to manage multiple projects at the same time while using this framework.	Between Groups	2.750	3	0.917	1.974	0.206
	Within Groups	3.250	7	0.464		
	Total	6.000	10			
3. Having access to DevOps teams provided value to the project.	Between Groups	4.977	3	1.659	1.191	0.380
	Within Groups	9.750	7	1.393		
	Total	14.727	10			
Complexity	Between Groups	2.179	3	0.726	1.072	0.421
	Within Groups	4.744	7	0.678		
	Total	6.922	10			
Scalability	Between Groups	2.149	3	0.716	3.306	0.087
	Within Groups	1.517	7	0.217		
	Total	3.665	10			
Process	Between Groups	2.080	3	0.693	1.470	0.303
	Within Groups	3.301	7	0.472		
	Total	5.381	10			

Results

This study consists of a sample frame of twelve employees who are currently engaged in implementing IT projects with the global company. The areas of responsibility for these employees are as follows: two senior implementation consultants, two implementation consultants, two project managers, one product owner, two development engineers, and three leadership roles. This subsection represents the major players in interest and the success and product value provided through the implementation process. Several of the participants in the survey hold multiple roles or have had direct previous experience with the framework and processes being reviewed. The response rate for the survey was 100%.

The survey data revealed that, before the implementation of the novel framework, the perception of implementing controls that managed complexities was insufficient. Scalability processes were deemed neither effective nor ineffective in the process chain. While process value was easily identified as an area that could be leveraged for improvement, only minor improvements were made in these areas because morale was low and there was insufficient time to complete these tasks. Working with development was viewed as a neutral or negative process across all roles (Implementation Consultant, Project Management, Development, and Leadership) in many aspects of the project implementation process. Leadership and service teams (Implementation Consultant, Project Management) saw minor value in integrating development throughout the implementation timeline to be useful and improved the product's scalability.
The data sets' validity is demonstrated by Cronbach's alpha values of ($\alpha = 0.831$), ($\alpha = 0.785$), and ($\alpha = 0.829$) for the three components of Implementation Complexity, Process Scalability, and Process Value, respectively. The mean for Implementation Complexity ($M = 3.0909$; $SE = 0.25086$), Process Scalability

(*M* = 3.2364; *SE* = 0.18254), and Process Value (*M* = 3.5455; *SE* = 0.22117) show a neutral response to the survey questions; however, the data also shows that the questions asked have relevance to the case study research topics.

Perceptions after implementation show that complexity management has improved, but there is still room for growth and development. The process's scalability has improved, as has the value gained from collaboration. Working with development improved the project implementation process for all participants. Leadership and service teams found integration with development throughout the implementation timeline to be useful and improved the product's scalability. Value-added changes resulted in increased standardizations in implementation processes, allowing for a significant reduction in project timelines and throughput. The time it takes to implement a product has been reduced from 6-48 months to 3-6 months while the project throughput nearly doubled.

Table 2: Comparisons between roles for each vector group

		N	*M*	*SD*	*SE*	95% Confidence Interval for Mean		Min	Max.
						Lower Bound	Upper Bound		
1. Working with development decreased the lead time on integrations.	Implementation Consultant	4	3.75	0.500	0.250	2.95	4.55	3	4
	Project Manger	2	3.00	1.414	1.000	-9.71	15.71	2	4
	Development	2	4.50	0.707	0.500	-1.85	10.85	4	5
	Leadership	3	2.33	1.528	0.882	-1.46	6.13	1	4
	Total	11	3.36	1.206	0.364	2.55	4.17	1	5
	Model – Fixed Effects			1.063	0.321	2.61	4.12		
	Model – Random Effects				0.462	1.89	4.83		
2. Working with operations decreased the lead time on integrations.	Implementation Consultant	4	3.75	0.500	0.250	2.95	4.55	3	4
	Project Manger	2	3.00	1.414	1.000	-9.71	15.71	2	4
	Development	2	3.00	1.414	1.000	-9.71	15.71	2	4
	Leadership	3	2.67	1.528	0.882	-1.13	6.46	1	4
	Total	11	3.18	1.079	0.325	2.46	3.91	1	4
	Model – Fixed Effects			1.160	0.350	2.35	4.01		
	Model – Random Effects				.350[a]	2.07[a]	4.29[a]		
3. Interdependencies within the project were easier to manage with this framework.	Implementation Consultant	4	3.50	1.291	0.645	1.45	5.55	2	5
	Project Manger	2	3.00	0.000	0.000	3.00	3.00	3	3
	Development	2	3.50	0.707	0.500	-2.85	9.85	3	4
	Leadership	3	2.33	1.528	0.882	-1.46	6.13	1	4
	Total	11	3.09	1.136			3.85	1	5
	Model – Fixed Effects			1.205	0.363	2.23	3.95		
	Model – Random Effects				.363[a]	1.93[a]	4.25[a]		

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			N	*M*	*SD*	*SE*	95% Confidence Interval for Mean		Min	Max.
							Lower Bound	Upper Bound		
1. I was able to use this approach throughout the integration.	Implementation Consultant		4	3.50	0.577	0.289	2.58	4.42	3	4
	Project Manger		2	4.50	0.707	0.500	-1.85	10.85	4	5
	Development		2	3.50	0.707	0.500	-2.85	9.85	3	4
	Leadership		3	2.67	1.528	0.882	-1.13	6.46	1	4
	Total		11	3.45	1.036	0.312	2.76	4.15	1	5
	Model	Fixed Effects			0.976	0.294	2.76	4.15		
		Random Effects				0.357	2.32	4.59		
2. When new scope changes came up, I was able to adjust quickly because I had this framework to implement.	Implementation Consultant		4	3.25	0.500	0.250	2.45	4.05	3	4
	Project Manger		2	4.50	0.707	0.500	-1.85	10.85	4	5
	Development		2	3.50	0.707	0.500	-2.85	9.85	3	4
	Leadership		3	3.33	1.155	0.667	0.46	6.20	2	4
	Total		11	3.55	0.820	0.247	2.99	4.10	2	5
	Model	Fixed Effects			0.794	0.239	2.98	4.11		
		Random Effects				0.268	2.69	4.40		
3. As the project progressed, I was able to identify bottlenecks.	Implementation Consultant		4	3.75	0.500	0.250	2.95	4.55	3	4
	Project Manger		2	4.00	0.000	0.000	4.00	4.00	4	4
	Development		2	3.00	0.000	0.000	3.00	3.00	3	3
	Leadership		3	4.00	0.000	0.000	4.00	4.00	4	4
	Total		11	3.73	0.467	0.141	3.41	4.04	3	4
	Model	Fixed Effects			0.327	0.099	3.49	3.96		
		Random Effects				0.218	3.03	4.42		
4. This process could be used on any sized project effectively.	Implementation Consultant		4	3.00	1.414	0.707	0.75	5.25	1	4
	Project Manger		2	4.00	0.000	0.000	4.00	4.00	4	4
	Development		2	3.00	0.000	0.000	3.00	3.00	3	3
	Leadership		3	1.67	1.155	0.667	-1.20	4.54	1	3
	Total		11	2.82	1.250	0.377	1.98	3.66	1	4
	Model	Fixed Effects			1.113	0.335	2.02	3.61		
		Random Effects				0.473	1.31	4.32		
5. I was able to easily implement this process across multiple project	Implementation Consultant		4	3.75	0.957	0.479	2.23	5.27	3	5
	Project Manger		2	3.50	0.707	0.500	-2.85	9.85	3	4
	Development		2	3.00	0.000	0.000	3.00	3.00	3	3
	Leadership		3	3.00	0.000	0.000	3.00	3.00	3	3
	Total		11	3.36	0.674	0.203	2.91	3.82	3	5

teams successfully.			N	*M*	*SD*	*SE*	95% Confidence Interval for Mean		Min	Max
							Lower Bound	Upper Bound		
	Model	Fixed Effects			0.681	0.205	2.88	3.85		
		Random Effects				.205[a]	2.71[a]	4.02[a]		
1. I was able to identify areas in this project where I could add value because of this framework.	Implementation Consultant		4	3.50	1.291	0.645	1.45	5.55	2	5
	Project Manger		2	4.50	0.707	0.500	-1.85	10.85	4	5
	Development		2	3.00	0.000	0.000	3.00	3.00	3	3
	Leadership		3	3.00	1.000	0.577	0.52	5.48	2	4
	Total		11	3.45	1.036	0.312	2.76	4.15	2	5
	Model	Fixed Effects			1.035	0.312	2.72	4.19		
		Random Effects				0.313	2.46	4.45		
2. I was able to manage multiple projects at the same time while using this framework.	Implementation Consultant		4	4.25	0.957	0.479	2.73	5.77	3	5
	Project Manger		2	4.50	0.707	0.500	-1.85	10.85	4	5
	Development		2	3.00	0.000	0.000	3.00	3.00	3	3
	Leadership		3	4.00	0.000	0.000	4.00	4.00	4	4
	Total		11	4.00	0.775	0.234	3.48	4.52	3	5
	Model	Fixed Effects			0.681	0.205	3.51	4.49		
		Random Effects				0.297	3.05	4.95		
3. Having access to DevOps teams provided value to the project.	Implementation Consultant		4	4.25	0.957	0.479	2.73	5.77	3	5
	Project Manger		2	3.50	0.707	0.500	-2.85	9.85	3	4
	Development		2	2.50	0.707	0.500	-3.85	8.85	2	3
	Leadership		3	3.00	1.732	1.000	-1.30	7.30	1	4
	Total		11	3.45	1.214	0.366	2.64	4.27	1	5
	Model	Fixed Effects			1.180	0.356	2.61	4.30		
		Random Effects				0.392	2.21	4.70		
Complexity	Implementation Consultant		4	3.3325	0.47141	0.23570	2.5824	4.0826	3.00	4.00
	Project Manger		2	3.0000	0.94752	0.67000	-5.5132	11.5132	2.33	3.67
	Development		2	3.6700	0.00000	0.00000	3.6700	3.6700	3.67	3.67
	Leadership		3	2.4433	1.26081	0.72793	-0.6887	5.5754	1.00	3.33
	Total		11	3.0909	0.83202	0.25086	2.5320	3.6499	1.00	4.00
	Model	Fixed Effects			0.82321	0.24821	2.5040	3.6778		
		Random Effects				0.25802	2.2698	3.9120		

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			N	*M*	*SD*	*SE*	95% Confidence Interval for Mean		Min	Max
							Lower Bound	Upper Bound		
Scalability	Implementation Consultant		4	3.250	0.3785	0.18930	2.6476	3.8524	3.0	3.8
	Project Manger		2	4.100	0.1414	0.10000	2.8294	5.3706	4.0	4.2
	Development		2	2.800	0.2828	0.20000	0.2588	5.3412	2.6	3.0
	Leadership		3	2.933	0.7023	0.40552	1.1885	4.6781	2.2	3.6
	Total		11	3.236	0.6054	0.18254	2.8296	3.6431	2.2	4.2
	Model	Fixed Effects			0.4654	0.14035	2.9045	3.5682		
		Random Effects				0.26607	2.3896	4.0831		
Process	Implementation Consultant		4	3.750	0.8770	0.43854	2.3544	5.1456	3.00	5.00
	Project Manger		2	4.165	0.2333	0.16500	2.0685	6.2615	4.00	4.33
	Development		2	2.835	0.2333	0.16500	0.7385	4.9315	2.67	3.00
	Leadership		3	3.333	0.6650	0.38394	1.6814	4.9853	2.67	4.00
	Total		11	3.545	0.7335	0.22117	3.0527	4.0382	2.67	5.00
	Model	Fixed Effects			0.6867	0.20706	3.0558	4.0351		
		Random Effects				0.25599	2.7308	4.3601		

The results of the survey and the throughput analysis of research question one show that the application of this novel framework positively impacts scalability on all levels and roles of the organization. In addition, this framework was found to be scalable in terms of project size as well as process and product throughput. When the author examines the result set through the lens of research question two, it becomes apparent that the framework provided a positive impact on the value chain of the organization and its customers throughout the project implementation lifecycle. Project complexity about project management, as referenced in research question three, shows a minor increase in the project management workflow; however, it reduces the complexities faced by the implementation teams, development teams, and leadership teams about deployment and reporting for successful implementation and development break-fix.

Discussion

The research data collected on evolving frameworks associated with IT system project implementations provide a clear path for the implementation of this framework. The DevOps community continues to focus on agile culture, understanding the feedback loop, applying tools such as the Do-Act-Check methodology, and managing the critical paths defined by the TOC. The current body of research is limited to the deployment or implementation of development projects contained in an organization's operational infrastructure and provides limited guidance on implementing the frameworks in projects that expand into the organization’s customer’s infrastructure. However, the combination of the frameworks and principles outlined with other IT governance and business models allowed the author to develop a framework that was able to span organizational verticals and inter-organizational dependencies.

Framework

- Evaluate the organizational value demands from the leadership

- Evaluate and map the technical debt related to the product and processes for implementation
- Address the culture and IT governance issue (Unplanned Work)
- Isolate the critical chains and highlight the constraints (Principles of Flow) (Planned Work)
- Organize the workflow to leverage the optimal value stream of each constraint (Single Piece Flow)
- Develop and implement documentation on current tasks, processes, procedures, and policies related to the constraints (Improvement of Daily Work) (Change Work)
- Diversify the constraints (Locality and Simplicity)
- Implement clear communication channels between Services and Development (Principles of Feedback)
- Address technical debt
- Review process changes and restart the framework (Principles of Continuous Learning)

Case Review

In initial conversations with the leadership teams and project management teams, the author notes that the concepts related to WIP and value streams when applied to implementation tasks had not yet been evaluated. The company's strategy and forecasting had previously focused on financial and personnel time constraints. The overarching goal and value proposition for the company was to reduce time on task to increase the successful completion of implementation projects to book as revenue for the organization. The primary reason for conducting this research with Transact Campus was the expansion and growth of emerging technology in a global market across diverse and complex customer organizational infrastructure and policies. In this case study the author focused on an emerging value stream for the company that is playing a critical role and the direction and evolution of its software and services. The implementation projects under review span across multiple third-party vendor connections along with fundamental shifts related to the primary companies underlying infrastructure and processes in the software.

To fully evaluate the research questions proposed in this study, it was necessary to audit the current process in place and the frameworks used for the implementation of this product line. In this review, the author found a substantial lack of controls around constraints, a continuously revolving project team, limited processes surrounding development integration with the services provided during implementation, a lack of direction about the resource time, priority when assessing conflicting implementation timelines, and a knowledge gap between teams about product functionality and contractual obligations. In addition, the backlog on technical debt due to changing priorities and scope creep was noted to have a direct impact on the culture and morale of the implementation teams. However, the author did find that the leadership and project teams had identified these issues and were in the beginning stages of information gathering to assess and address them.

With the cooperation of the individuals in the company across the teams outlined in the results section, the author was able to review existing processes and timeline documentation around this product implementation and development cycle. With this information, the author was able to develop documentation around critical chains and processes needed inside of a standard implementation for the core functionality of the product while leaving room for additional use cases/third-party integrations required for each customer’s unique environment. This in turn allowed for critical constraints to be identified and the scope of work to be defined for the project. After reviewing the current documentation and developing a more precise and transparent assessment of the process and product from development through implementation, the author—in conference with the project managers—identified constraints in timing, personnel, and customer management. By applying Kanban boards around the constraints and documenting the processes, procedures, and policies needed to complete tasks at each constraint, a framework was implemented to address the backlogs of work.

The implementation of this framework improved project timelines and resource consumption related to the implementation of this product line. Alignment with development during projects that adopted this framework allowed for the implementation team to provide shortened feedback loops to address product issues, customer concerns, and vendor relations to escalations. The sprint times required for the development and implementation of new functionality around critical services needed for international deployments were highlighted and accelerated due to this process change. This framework implementation achieved a more streamlined project plan with appropriate gates, critical milestones, and resource consumption times. Consequently, the implementation of these new project plans had a direct impact on work in progress and throughput for the value chains related to the project and product. Transact Campus was able to adjust their forecasting goals for the implementation of this product by double within its yearly projections as the time it takes to implement a product has been reduced from 6-48 months to 3-6 months.

Conclusion

The research provided and conducted in this study provides a clear and repeatable process to incorporate information technology development operations frameworks into project implementations. The framework leveraged tools that have been shown to improve project and process scalability, as well as the value chain associated with project implementations of complex IT systems across diverse infrastructures with reliance on third-party applications and vendors. The framework was applied successfully to enterprise systems that have a mixed environment or a closed environment in relation to on-premises and cloud hosting. The initial implementation and development around the constraints identified can add complexity to an organization whose governance processes, procedures, and policies are fixed and do not align with agile IT frameworks. The complexities faced in defining and revising the project plans for implementation using this framework are limited to the initial template creation and process alignment. While this research study provides information on the limitations of these frameworks, it is reliant on working with an organization that is open and transparent with its organizational resources to focus on critical processes and value chain improvement.

This case study is constrained by its focus on a singular product line and a restricted group of participants who are subject matter experts in their product line as well as its development, implementation, and financial impacts on this organization. Suggestions for future research include expanding the pool of projects to multiple product lines and expanding the participant pool to include individuals with less subject matter expertise to see if similar results are still achieved. The author hopes that the systematic approach presented in this case study can be used as a framework to apply development operations tools and frameworks to implementation projects outside of Transact Campus, furthering the body of knowledge related to information technology development operations. The information outlined in the paper address the research question by showing that the implementation of this novel framework based on Development operation frameworks has a direct positive impact on the value chain, scalability, and complexity of implementation for IT systems.

References

Amaro, R., Pereira, R., & Mira da Silva, M. (2022). Capabilities and Practices in DevOps: A Multivocal Literature Review. *IEEE TRANSACTIONS ON SOFTWARE ENGINEERING*, 1-20. https://doi.org/10.1109/TSE.2022.3166626

Augusto, D., & Pacheco, J. (2014). THEORY OF CONSTRAINTS AND SIX SIGMA: INVESTIGATING DIFFERENCES AND SIMILARITIES FOR CONTINUOUS

IMPROVEMENT. *INDEPENDENT JOURNAL OF MANAGEMENT & PRODUCTION (IJM&P), 5*(2), 331-343. https://doi.org/10.14807/ijmp.v5i2.150

Dereń, A., Januszko-Szakiel, A., & Korycińska, P. (2022). Infobrokering Project Management in Line With the Theory of Constraints – a Case Study. *Zagadnienia Informacji Naukowej - Studia Informacyjne, 58*(2), 64-80. https://doi.org/http://dx.doi.org/10.36702/zin.729

Iden, J., & Roar Eikebrokk, T. (2013). Implementing IT Service Management: A systematic literature review. *International Journal of Information Management, 33*(3), 512-523. https://doi.org/https://doi.org/10.1016/j.ijinfomgt.2013.01.004

Jašek, R., Králík, L., & Nožička, J.. (2015). ITIL® - General Overview. *AIP Conference Proceedings 1648, 550021* . AIP Publishing. https://doi.org/10.1063/1.4912776

Kaisler, Stephen, Armour, F., & Espinosa, J. A. (2014). Introduction to Big Data: Challenges, Opportunities and Realities. *Hawaii International Conference on System Science*, 728. https://doi.org/10.1109/HICSS.2014.97

Khan, M. S., Khan, A. W., Khan, F., Khan, M. A., & Whangbo, T. K. (2022). Critical Challenges to Adopt DevOps Culture in Software Organizations: A Systematic Review. *IEEE Access, 10*, 14339-14349. https://doi.org/10.1109/ACCESS.2022.3145970

Lenarduzzia, V., Beskerb, T., Taibic, D., Martinid, A., & Arcelli Fontanae, F. (2021). A systematic literature review on Technical Debt prioritization: Strategies, processes, factors, and tools. *Journal of Systems and Software, 171*, 1-16. https://doi.org/https://doi.org/10.1016/j.jss.2020.110827

Lwakatare, L. E., Kuvaja, P., & Oivo, M. (2016). Relationship of DevOps to Agile, Lean and Continuous Deployment A Multivocal Literature Review Study. *Product-Focused Software Process Improvement* (pp. 399–415). Trondheim, Norway: Springer International Publishing. https://doi.org/10.1007/978-3-319-49094-6 27

Lwakatare, L. E., Kuvaja, P., & Oivo, M. (2016). Relationship of DevOps to Agile, Lean and Continuous Deployment A Multivocal Literature Review Study. *Product-Focused Software Process Improvement* (pp. 399–415). Trondheim, Norway,: Springer International Publishing. https://doi.org/10.1007/978-3-319-49094-6 27

Mukwasi, C. M., & Seymour, L. F. (2015). Towards understanding organisational culture contradictions between organisations and the Information Technology Infrastructure Library (ITIL) framework: A review of the literature. *African Conference on Information Systems & Technology (ACIST)*, (pp. 1-11). Accra, Ghana: Ghana Institute of Management and Public Administration (GIMPA),

Österberg, G. (2020). A Systematic Literature Review on DevOps and its Definitions, Adoptions, Benefits and Challenges. Åbo Akademi University Department of Information Technologies.

Pacheco, D., Pergher, I., Valle Antunes Júnior, J. A., & Luís Roehe Vaccaro, G. (2018). Exploring the integration between Lean and the Theory of Constraints in Operations Management. *International Journal of Lean Six Sigma*. https://doi.org/https://doi.org/10.1108/IJLSS-08-2017-0095

Revilla, M. A., Saris, W. E., & Krosnick, J. A. (2013). Choosing the Number of Categories in Agree–Disagree Scales. *Sociological Methods & Research*, *43*(1), 73-97. https://doi.org/https://doi.org/10.1177/0049124113509605

Roy, S. (2009). Critical Chain Project Management Theory and Practice. *Critical Chain Project Management Theory and Practice.*

Rusman, A., Nadlifatin, R., & S. A. (2022). Analysis Factors Affect Information System Audit Using COBIT and ITIL Framework. *Jurnal dan Penelitian Teknik Informatika, 7*(3), 799-810. https://doi.org/https://doi.org/10.33395/sinkron.v7i3.11476

Serrano, J., Faustino, J., Adriano, D., Pereira, R., & Mira da Silva, M. (2021). An IT Service Management Literature Review: Challenges, Benefits, Opportunities and Implementation Practices. *MDPI Information, 12*(111), 1-23. https://doi.org/https://doi.org/10.3390/info12030111

Takahashi, A. R., & Luis, A. (2020). Case study research: opening up research opportunities. *RAUSPManagement Journal., 55*(1). https://doi.org/https://doi.org/10.1108/RAUSP-05-2019-0109

Unger-Windeler, C., K. J.-C., Reuscher, T., & Schneider, K. (2020). Are Product Owners communicators? A multi-method research approach to provide a more comprehensive picture of Product Owners in practice. *Software; Evolution and Process, 33*(1), 1-23. https://doi.org/10.1002/smr.2311

Appendix A

Please identify your role in the organization: ______________________________

Scale: 5 = strongly agree, 4 =agree, 3 = neither agree nor disagree, 2 = disagree, 1 = strongly disagree.

Implementation Complexity	Score
1. Working with development decreased the lead time on integrations.	
2. Working with operations decreased the lead time on integrations.	
3. Interdependencies within the project were easier to manage with this framework.	
Process Scalability	
1. I was able to use this approach throughout the integration.	
2. When new scope changes came up, I was able to adjust quickly because I had this framework to implement.	
3. As the project progressed, I was able to identify bottlenecks.	
4. This process could be used on any sized project effectively.	
5. I was able to easily implement this process across multiple project teams successfully.	
Process Value	
1. I was able to identify areas in this project where I could add value because of this framework.	
2. I was able to manage multiple projects at the same time while using this framework.	
3. Having access to DevOps teams provided value to the project.	