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RESEARCH ARTICLE

Development of an Alignment Model for the Implementation of DevOps in SMEs: An Exploratory Study

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ABSTRACT An evolving set of skills that enable DevOps practice adoption in software-intensive Small and Medium Sized Enterprises (SMEs) contexts has emerged over the last decade intending to achieve a change in mentality, skillset, and toolset. This research examines an unexplored aspect of DevOps: business and IT alignment. Despite the widespread use of DevOps principles, very few research have investigated their interrelationships with existing theories. This study presents a novel perspective by including control variables such as firm size, background, and experience within the specific setting of Sri Lanka. The current body of literature extensively examines the practical elements associated with the adoption of DevOps, the development of skills, and the implementation of tools. However, there is a notable deficiency in comprehending the intersection between these fundamental DevOps principles and factors such as company size, individual backgrounds, and diverse experience levels. The primary objective of this study is to address the existing gap in knowledge by conducting a comprehensive investigation of the influence of firm size, background, and experience on the level of alignment between business and IT functions within SMEs in Sri Lanka that have adopted DevOps practices. First, 248 people participated in a survey conducted as exploratory research. The DevOps IT alignment was tested using partial least squares structural equation modelling. Moreover, it supports the creation of a reliable and credible DevOps instrument for scientific research. DevOps is promoted in SMEs to facilitate continuous information and software communication integration across IT departments. DevOps also has a beneficial effect on business-IT alignment. Greater business IT alignment is achieved via improved information exchange and continuous application integration at enterprises that foster DevOps. IT leaders must determine how to strengthen ties across departments that rely on radically different skill sets.

INDEX TERMS DevOps, alignment model, knowledge sharing, continuous integration, strategic IT alignment, strategic subunit alignment, PLS-SEM, subunit size, SME, Sri Lanka.

I. INTRODUCTION

Since the term "DevOps" was initially created in the context of information technology, especially for software product development continuous improvement, the subject has been garnering significant attention in the worldwide communities of agile and IT practitioners. Increasingly, enterprises are focusing their attention on methods that will allow their employees to realise their full potential. Additionally, the necessity of building an SME's capacity to determine what

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set of practices and principles should be embraced in the future has been elevated by the IT enterprise as a result of this change. Enterprises decide to use DevOps not just to cut down on the amount of time it takes to deploy software, but also to enhance their workers' ability to collaborate and problem-solve with one another and with customers [1]. However, these tenets must be adhered to without compromising the quality of the application [2]. The software development process may benefit from DevOps not just as a result of agile methodologies, tools, and automation, but also as a result of a culture transformation. To be more precise, it is vital to have an atmosphere that is receptive to cooperation amongst traditionally separate IT components.

Very few studies in the existing body of research investigate the linkages between DevOps and earlier theories. Plenty of research has been done on the DevOps success factor and CI/CD pipeline in Sri Lanka. For instance, Jayakody and Wijayanayake [3] conducted research that identified important success variables that might lead to the achievement of this objective. The crucial success elements are responsible for achieving ongoing, validated, substantial, and quantifiable success in IS development. The discussion of the findings aims to enhance comprehension of the elements contributing to the success of DevOps. Organisations may use these aspects to alleviate the effects of their issues.

In research conducted by Perera et al. [4], the authors examined the problems associated with adopting DevOps practices in software development teams. The three primary criteria deemed critical for the effective implementation of DevOps practices are Team factors, Stakeholder buy-in, and Complexity. Nevertheless, our investigation yielded no scholarly studies that specifically addressed the formulation of an Alignment Model for the Implementation of DevOps in SMEs, including control factors such as firm size, background, and expertise within the particular context of Sri Lanka.

In the current literature, there is a notable deficiency in comprehending the intersection between these fundamental DevOps principles and control factors like company size, individual backgrounds, and diverse levels of experience. Nevertheless, the limited research exploring the interaction between DevOps and these particular control factors necessitates a more intricate analysis. The primary objective of this study is to address the existing gap in knowledge by conducting a comprehensive investigation of the influence of firm size, background, and experience on the level of alignment between business and IT functions within SMEs in Sri Lanka that have adopted DevOps practices bridging the gaps in the previous studies.

This research significantly contributes to understanding and enhancing the implementation of DevOps practices in SMEs, with a specific focus on Sri Lanka. The study introduces novel insights by exploring the often-overlooked dimension of business and IT alignment within the DevOps framework. It pioneers the inclusion of critical control variables like firm size, background, and experience in examining the impact of DevOps on SMEs.

The research addresses the existing knowledge gap and provides a comprehensive DevOps IT alignment model tested through advanced statistical techniques. The findings reveal the positive influence of DevOps on business-IT alignment, emphasizing the importance of improved information exchange and continuous application integration. The study contributes to theory-building in the DevOps field, proposing a more holistic model that evaluates IT infrastructure and corporate structure, paving the way for future investigations and practical implementations. Despite some limitations, this research sets the stage for a deeper understanding of DevOps in SMEs and points towards avenues for refining its theoretical foundations and practical applications.

The objectives of this research are presented in the next section. A comprehensive Literature Review follows it. After that, the development of the research model and the hypotheses are shown. Next, the research methodology, data analysis, and findings are discussed in the balance of the article.

II. RESEARCH OBJECTIVE

A standardised DevOps definition has to be developed to better direct future works and facilitate the exploration of theoretical connections [5]. As a result, one of the critical objectives of evaluating the relevant literature is to explore the development of the meaning of the term "DevOps." After that, the writers are going to do a literature assessment on previous research that has been done on DevOps and its relationship to theory. Also, it is essential to understand DevOps's foundational ideas before investigating ties to theory. In a comprehensive examination of DevOps difficulties, Researchers who had conducted significant literature studies found that DevOps requires a recognised definition. Researching the benefits of using DevOps is the second goal of this project. Particular performance metrics are going to be investigated by the writers. Third, as a result, the authors propose a model of DevOps IT alignment that is more thorough and assesses not only the underlying IT infrastructure but also the corporate structure, as well as how each factor affects continuous delivery and deployment. In addition, the authors argue that this model should consider how each of these components affects the other parts.

III. LITERATURE REVIEW

This section provides a logical development of principles that contribute to forming the literary definition of DevOps. Also, DevOps often uses agile approaches to get optimal results, such as cloud computing, business adoption, and earlier writings. Cloud computing and agile software development methodologies often rely on or benefit from DevOps' assistance or complement. For businesses to remain competitive, they must provide prototypes that satisfy customers in iterative and quick cycles [6].

A. CONCEPT OF DEVOPS

The term ''DevOps'' was created by practitioners in response to conflicts between the development (Dev) and operations (Ops) departments caused by a mismatch of incentives. Operations want to maintain the systems stable and restrict the frequency of deployments, which raises the risk of outages, while development wants to bring features as quickly as feasible. Even though the term ''DevOps'' suggests that just the parties stated above are relevant, DevOps takes a system-thinking approach that encompasses all aspects of the software development life cycle (SDLC), including social and technical factors. We conceptualise these components using the capacity bundling dimensions.

According to Plant et al. [7], ensuring a continuous flow of information between IT development and IT operations is one of the most essential factors in achieving quicker deployments of high-quality software. The purpose of their investigation was to come up with a coherent description of DevOps by looking at 49 different papers. A definition of DevOps was proposed [8], and it was based on the most frequently cited definitions in their review of the relevant research. Concepts with less technical focus may refer to interdisciplinary cooperation or behavioural considerations. Automation and delivery, on the other hand, guarantee the accuracy and dependability of software and are related to the more technical parts of DevOps [8].

For instance, the authors discuss the process of software development, staff cooperation, quality assurance, deployment, automation, or continuous integration. Collaboration and continuous delivery are two examples of the less technical components that [8] include in their definition of DevOps, which takes a similar approach to the one described above. On the other hand, [5] include the latter principles within the terminology they use to define the term. Measurements, service development, and information exchange are some examples of where the research by [5] differs somewhat in terms of their definitions. Despite this, many of the similar features are what distinguish DevOps from other techniques. For instance, the emphasis on merging different IT components and the continuous integration of software are two of these shared dimensions [5]. Because different people use different methods of defining DevOps and current DevOps processes have evolved over time, extra effort should be made to update the definition of DevOps.

B. DEVOPS AND AGILE METHODOLOGY

At an early point in establishing DevOps, one of the most significant ideas that emerged included agile approaches. Before this transition, software development was linear at many different types of enterprises. It was necessary to strengthen assistance to cut down on release timeframes. At this stage in the development process, there were evident patterns of workload and iterative procedures, but tight adherence to sequences impeded software cycles and hampered progress. The use of agile software development life cycles has assisted in reducing the time wasted due to this analysis [9].

The previous studies proved that DevOps can deliver software to consumers at a pace that has never been seen before. It could do this via the cooperation of several teams and the continuous integration and automation of software [10]. Both Agile and DevOps emphasise reducing the time between product releases. In contrast to agile methodologies, however, DevOps differentiates itself by automating software analysis, performing frequent monitoring, and adhering to specific protocols such as infrastructure as code [11].

C. DEVOPS AND CLOUD COMPUTING

Many studies, including [12], have shown a strong correlation between the development of contemporary technology and the ideas of cloud computing and DevOps. According to [13], the key effects of cloud computing and DevOps on electronic business and application technologies are cloud computing and DevOps. The research shows that combining DevOps and business operations is crucial for automating revenue-based growth [13]. It is generally agreed that cloud computing provides an efficient environment for deploying DevOps automation and toolsets. Similarly, using DevOps principles may often improve the efficacy of cloud computing by automating and integrating in a more streamlined manner. In addition, it helps automate the process of a business collecting essential specialist knowledge, which is a significant benefit [14].

DevOps is not a substitute for the model-driven cloud management approach, even if it can be considered a competing technique. DevOps teams incorporate these non-essential components into model-driven cloud management. Although DevOps artifacts are often hosted in the cloud, they can operate independently of their deployment architecture [14]. Although agile development and cloud computing were early hallmarks of DevOps, the discipline of DevOps has now evolved into many other fields of information technology study. Recent research has focused on identifying the essential enablers required to adopt the technology effectively.

D. CONCEPT OF SMES

It was emphasised how vital SMEs are to the economy as a whole. They control more than 95% of the market throughout the world. The information technology sector is included in these SMEs. SMEs, defined by [15] as having ten or fewer employees, comprise most of Europe's software companies. According to [16], despite being the engine of the software industry, small and medium-sized software companies received very little attention in the software process improvement literature until 2007. Most of these initiatives were only carried out at the regional level [16]. Studies have shown that a software company is deemed to be small or medium-level if it has less than fifty employees working on software development [17]. Following international standards, the European

Union classifies SMEs with fewer than 20 employees or annual revenues of less than 2 million.

E. DEVOPS AND SMES

There might be a few different outcomes depending on how many individuals are employed. SMEs generate less revenue; thus, they are less likely to back ambitious projects or take chances [15]. Separating the workforce into autonomous units to deal with software quality assurance or testing may also be challenging. Conversely, there may be times when a leaner staff is preferable. As there are fewer management layers of bureaucracy to navigate in SMEs, they are more adaptable and can adjust their regulations and company culture more easily. Moreover, SMEs have fewer potential channels of communication. This allows them to respond to new situations with more agility or reach the necessary alignment models sooner.

Software companies might benefit as they work to cultivate the skills necessary to make strides in DevOps and adapt to a fluctuating market. Due to advancements in DevOps, SMEs can once again capitalise on their agile and responsive nature. This makes it possible for them to do so without being hindered by the friction we previously described.

Software development and maintenance are often seen as separate activities, which leads to miscommunication, inefficiency, and other issues. The DevOps movement [16] is an attempt to bridge this divide. While IT systems placed into production after the development phase are maintained with updates for a certain length of time and then a certain period of service time, the actual amount of time that the system is in use is often substantially longer. As a result, it becomes more difficult and riskier to manage the enterprise and more difficult to transition to a new system. In SMEs, DevOps is a cycle whose end purpose is to turn system development, enhancement, and maintenance into operations that run in permanent and continuous tandem with system operation.

Notably, the research's apparent emphasis on SMEs might indicate the prevailing patterns seen in the adoption of DevOps practices. SMEs often take the lead in embracing new practices due to their inherent adaptability and the need to compete with bigger rivals. Nevertheless, the introduction of DevOps in bigger organisations may be accomplished, as shown by several firms in diverse sectors that have effectively scaled DevOps practices to address their unique requirements and obstacles.

In the context of Sri Lanka, as shown in this study, it is seen that DevOps initiatives mostly correspond to SMEs owing to several circumstances. The agility and flexibility inherent in DevOps practises align well with the dynamic character of SMEs in Sri Lanka, enabling them to adapt to market shifts promptly. The presence of limited resources, a frequent characteristic of SMEs, makes DevOps, emphasising enhancing efficiency and automating processes, a more viable and appealing alternative. More streamlined organisational structures and a cultural predisposition towards innovation in SMEs may effectively support the necessary cultural transformation to implement DevOps practices successfully. In addition, the combination of worldwide trends and a scarcity of highly qualified individuals may result in SMEs in Sri Lanka being at the forefront of embracing DevOps practices. This adoption might give them a distinct advantage in dynamic marketplaces undergoing quick changes.

F. DEVOPS ADOPTION

In light of the growing popularity of DevOps, certain scholars have stressed the significance of effectively deploying this methodology. Before adopting it, enterprises require a more nuanced description to comprehend how it will be integrated into already established procedures and frameworks. DevOps was defined by [17] as a set of engineering process abilities made possible by cultural and technological factors. An enterprise's capabilities specify the procedures it should be able to do, while the enablers make it possible for the business to be responsive, adaptable, and productive. The researchers further dichotomise the later three enablers to assist businesses in increasing their skills throughout the adoption process.

The term "continuous" conjures up images of gradual, step-by-step improvements with little lag time in between each one. A team with cultural enablers is one in which members work together to achieve common goals via open dialogue, consensus-building, and developing a sense of shared purpose and identity. The third and last enabler is technical, which focuses on automating various processes. This involves automating the construction, testing, deploying, and monitoring processes.

The capability enabler serves as the focal point of the DevOps adoption strategy, and for this strategy to be effective, it requires the help of both cultural and technology enablers [17]. Another common method for defining DevOps is by considering its application as a framework for its definition, which is to use mapping studies.

As per the study, the researchers explore how these essential constructs of this study are associated with IT subunit alignment to the IT strategic alignment. DevOps can scale fast inside the information technology departments of enterprises that have the latter environmental circumstances, and it can adapt to shifting levels of profitability as well as changes in the underlying technologies that are essential to business success.

G. DEVOPS AND IT ALIGNMENT

The term "business-IT alignment" refers to the components of an enterprise that contribute to integrating an enterprise's business plans and information technology strategies to assist the enterprise in attaining specific competitive advantages [18]. Preliminary research suggests a possible connection between these models and the enterprise. This is shown by the findings of the exploratory study [19]. One of the fundamental ideas that underpins this approach is the notion of alignment, more specifically, how an enterprise matches the strategy it uses for its information systems with the strategy it uses for its business. One of the conceptual models developed in the beginning indicates that there has been a rise in the number of SEMs' performance, the efficacy of information systems, and effectiveness when business strategies and information systems are directed in the same direction [20]. The early models of strategic alignment focused primarily on four major factors that had the potential to boost efficiency. The SME strategy, information technology strategy, information technology infrastructure, and SME infrastructure were among them [21].

Academics have suggested that IT alignment has no completion date but needs ongoing adjustment to keep up with ever-present competitive factors [19]. The supplementary results show that organic enterprise structures may be useful in rapidly developing business contexts [20]. Both from a structural and a relational point of view, many of the same characteristics may be applied to DevOps. For example, DevOps emphasises the ongoing evolution of technology and collaboration across internal departments. As a result, the contingency theory calls for more research into DevOps to determine whether or not the alignment of business and information technology affects its use [21]. There isn't much research on DevOps that considers theory and employs quantitative ways to measure its value [5]. Consequently, this research aims to contribute to the growing body of empirical research by quantitatively expanding and testing a model of DevOps IT alignment.

IV. RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

One of the first models to analyse how IT and DevOps fit together into the benefits of DevOps may be considered quasi-experimental. The findings suggested that although knowledge exchange does not substantially influence departmental alignment, the Alignment of IT subunits is related to things like cross-departmental collaboration and continuous software integration [20].

The structural and relational aspects are two areas of IT alignment discussed repeatedly in this work. In addition to this, it broadens the scope of the exploratory Model for DevOps and IT Alignment by incorporating the more widely researched latent construct of business-IT alignment. Compared to the subunit alignment, which only considers the connection between development and operations, this approach considers the whole value chain. The paper argues that business-IT alignment improves when constituent parts are in sync. Alignment between components boosts productivity; thus, this is a good thing to aim towards. Hence, the researchers developed the research model shown in Fig. 1.

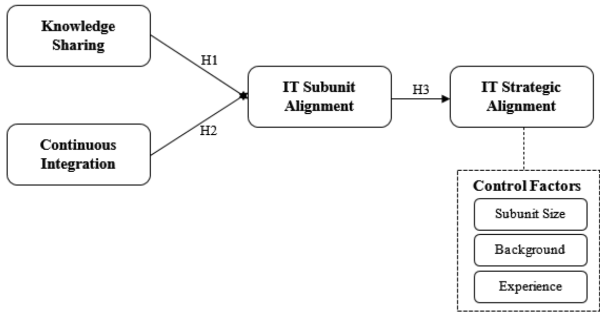

FIGURE 1. Research model.

A. KNOWLEDGE SHARING

According to the empirical results, the success of an enterprise's attempt to create alignment between its business and its information technology depends, at the very least in part, on the structural and relational aspects of that enterprise [22]. Competencies, partnerships, and a common understanding are some relational features of IT subunit alignment amongst enterprise subunits [23]. IT alignment's shared domain knowledge is an early relational trait that connects IT development and IT operations [24]. It has been shown that a common understanding and relationship across organisational units are statistically associated with IT subunit alignment at lower degrees of alignment, even though the possible effects of incorporating a DevOps perspective into some linkages with some IT alignment also have not been investigated in the same context as the literature review on alignment up to this point in our investigation. For example, it is associated with the cultural centre of power [23].

Although the DevOps core ontology is being refined, many first categorisations, also known as pillars, already exist. The exchange of information is another component in the relational alignment of IT and business [25].

In light of the results presented by [25], it has been hypothesised that information sharing throughout the strategic alignment process might assist enterprises in developing a competitive advantage. Information sharing, including implicit and explicit domain knowledge, favours alignment performance. In light of this, the research hypothesises that:

H1. Knowledge sharing has a positive impact on the alignment of the IT subunits.

B. CONTINUOUS INTEGRATION

Measurements, governance, and procedures amongst different enterprise subunits are examples of the structural components of IT subunit alignment. Alignment of subsystems in architecture is related to issues like innovative technology management and adaptability, implementing efficient standardisation across IT subunits, and having harmonious enterprise architecture. The alignment of measurements within IT subunits is associated with the exchange of metrics within disciplines in such a manner that continuous improvement may take place [23].

Automating tools and procedures for continuously deploying software to consumers is made even more difficult by the varying architectures that may be found in modern systems. Traditional approaches to software development, on the one hand, and the more agile and continuous deployment techniques essential to adapting new cloud architectures are bridged thanks to the support of DevOps [26].

Previous research has shown an association between IT alignment's structural dimension, corporate architecture's standardisation, and software development processes [23]. At the time this article was written, it was not known whether or not foundational elements like quantitative and automation related to DevOps have a direct correlation with factors of alignment.

However, according to previous research, DevOps and IT alignment may both benefit from the structural idea of continuous improvement. [21], [25]. Additionally, to reach greater degrees of business-IT alignment maturity, it is vital for both IT and business to engage in continual improvement [25]. As a result, the authors put up the following hypothesis:

H2. Continuous integration has a positive impact on the alignment of the IT subunits.

C. IT SUBUNIT ALIGNMENT

Because it occurs at a more fundamental level in the enterprise, strategic information technology subunit alignment is the foundation of strategic information systems alignment. According to the literature, there is a common misconception that all alignment leads to lower-level production [23]. Several data points show IT departments have problems that might prevent them from aligning with the business [26]. With less of a focus on external alignment, internal factors like the IT department and other departments' collaboration take centre stage. Some areas of business-IT alignment have been widened in previous models of IT subunit alignment.

For example, they have researched how to best integrate business and IT from a relational and structural perspective simultaneously. DevOps, according to this study, may improve IT alignment in terms of both its relational and structural elements by use of the procedures of continuous software integration:

H3. The alignment of the IT subunits has a positive impact on the business's strategic IT alignment.

D. STRATEGIC IT ALIGNMENT

Technology greatly impacts any market; rigorous analysis and strategic planning are required [23]. In the existing body of research, the alignment of information systems strategy and business strategy is shown to support multiple aspects of enterprise performance, and it is a prerequisite for an enterprise's success in various outcomes [26]. Despite this, many experts believe there is no such thing as a perfectly aligned enterprise since, if such a thing existed, every business would follow the related processes. Instead, alignment is adjusting consistently to enhance business performance and competitiveness [26]. Despite these accommodations, several pillars of alignment have shown their significance.

Narrower forms of alignment, such as IT subunit alignment, classify relational alignment components as additional subcategories. These subcategories include common knowledge across business units, collaborations, and the ability to adapt. The procedures or architecture, governance, and subunit measurements are all associated with the structural components of alignment. Both of these connections were found to be significant [24]. Both constructs are supported by the most often-used definition of DevOps, which encompasses both the less technical (knowledge exchange via the cooperation of people) and more technical (continuous integration of software) elements [27].

E. SUBUNIT SIZE

The subunit size is a significant determinant in the adoption of DevOps [28]. There exists variation in the extent of DevOps adoption across SMEs. Prior studies have shown inconclusive findings about the correlation between size and the use of these technologies. One perspective is that the DevOps alignment model is more prevalent among bigger organisations due to their access to more resources [16]. Furthermore, empirical evidence suggests that only big firms can effectively implement substantial business transformations [29]. Contrarily, other research indicates that SMEs are more inclined towards innovation and exploring novel business processes than big organisations characterised by hierarchical structures [21].

However, rather than only concentrating on large-scale firms, we aim to analyse and evaluate all types of organisations comprehensively. Given the unique characteristics of small-sized firms, it becomes imperative to differentiate them from big organisations, micro-enterprises, and SMEs. Additional investigation is required to fully comprehend the variances in implementing the DevOps alignment model inside these organisations. The primary objective of this study is to provide empirical information about the impact of organisational characteristics on the adoption of DevOps practices inside SMEs.

The magnitude of an organisation can influence workers' perception of alignment. Previous research did not identify a significant impact of total company size on the outcomes, but it was considered an essential variable to include for validation purposes [30].

This research obtained data from organisations of comparable sizes; however, it is important to note that the potential for IT outsourcing might greatly impact the size of the IT subunits. Consequently, the research used measures to account for variations in subunit size while examining strategic IT alignment

F. BACKGROUND

The level of an employee's background in an organisation's culture may be inferred from their history and experience within the organisation. Hence, the duration of workers' prior experience was identified as a significant variable to be examined. Participants were requested to specify their tenure in one of the following categories: less than one year, one to three years, four to six years, or seven or more years. The examination of leaders' cultural backgrounds and their potential impact on organisational learning is a crucial undertaking. It is vital to comprehend the background of the personnel engaged in the learning practices. Additionally, an employee's background duration is a later control variable that a previous study on information systems alignment suggests evaluating [31]. Additionally, it plays a crucial role in determining the duration of an employee's tenure in the organisation.

G. EXPERIENCE

The control variable of DevOps experience quantifies the duration of an individual's engagement in a functional capacity within the DevOps domain. The presence of DevOps teams remains relatively new in several organisations, and exposure to this cultural phenomenon may impact the degree of strategic alignment between IT and the company [32].

V. METHODOLOGY

The completion of an online questionnaire measuring participants' views of the study's independent and dependent variables was used to gather data. The resulting data was analysed using PLS models in the analysis. This method was sufficient since the analysis contained dependent variables and independent variables. Structural Equation Modelling is a statistical tool that enables researchers to assess how multiple independent variables correlate to dependent variables [33]. Scholars may use knowledge regarding individual independent variables to create strong and accurate observations about the dependent variables for all population members until the relationships between independent and dependent variables have been established [34].

A. RESEARCH DESIGN

A quantitative, non-experimental correlational study design was used to assess whether knowledge sharing and continuous integration affect the alignment model; similarly, that particular alignment model correlates with the strategic alignment of information technology professionals to implement DevOps. A quantitative approach was necessary to identify the relationships between the variables. For the report, a non-experimental research approach was deemed best. The primary objective of a non-experimental architecture is to explain an actual phenomenon without altering circumstances to modify topic responses [35]. There was no attempt to control the independent variable. A correlational research method enables the researchers to predict the usefulness of one variable dependent on changes in a second variable [36].

B. POWER ANALYSIS

This study also recognised the importance of carefully considering predictive capacity while evaluating theories [37]. G*Power is a free, stand-alone power analysis software that can be used for various statistical studies [38]. To assess the sample size of this study, a power analysis was performed using G*Power software.

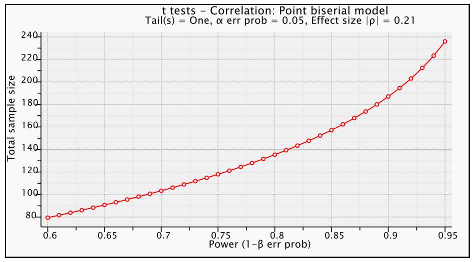

FIGURE 2. C. A. X-Y Plot for a range of values in G*Power analysis.

The sample size was calculated using the following parameters: an effect size $|\rho|$ of 0.21, an error probability (α err prob) of 0.05, a power (1-β err prob) of 0.95, and one predictor. Fig. 2 shows the X-Y Plot for a range of values in G*Power Analysis. According to the power analysis, the total sample size used for the research was 236 respondents. So, A total of 255 information technology professionals began the questionnaire, but only 248 individuals (97.25%) completed it. Completed questionnaires were analysed to ensure they were valid before including them in the study data.

C. DATA ANALYSIS

Quantitative analysis was performed on the survey results. The quantitative data processing was carried out with the IBM SPSS statistics software, Version 26, for descriptive analysis. For the data analysis, SmartPLS 4 was used for our current research, and it was the appropriate software to use for the partial least square and structural equation model. The research was initiated with VIFs for collinearity and factor loading for a reliability validity test. For the hypothesis testing, the Bootstrapping procedure of SmartPLS was employed.

VI. DATA ANALYSIS

A. DEMOGRAPHIC VARIABLES

Table 1 shows the characteristics of the information technology professionals in the sample. Based on the information, 63.3% of the respondents are male, and 36.7% are female. Based on the sample's age distribution, the study aligned with the typical age distribution of information technology professionals, as most participants (36.1%) were between 30 and 44. Also, participants provided information on their job titles.

Based on the responses, almost 76.9% of all participants worked as information systems analysts, computer scientists, information technology managers, and supervisors. The most common job title was information systems

TABLE 1. Sample's characteristics.

	Frequency	Percentage
Gender		
Men	157	63.3
Women	91	36.7
Age		
18–29	78	31.3
30–44	90	36.1
45-60	65	26.5
> 60	15	6.1
Job Title		
Chief technology officer	8	3.4
Information technology director	13	4.8
Management information systems director	17	6.8
Information systems analyst	57	23.1
Information technology manager	35	14.3
Information technology supervisor	20	8.1
Information technology solution implementor	46	18.4
Computer scientist	52	21.1
Enterprise Size (Employees)		
Under 50	216	87.1
Above 50	32	12.9
Highest Education Level		
High school	17	6.8
Diploma	62	25.2
Bachelor's degree	125	50.3
Master's degree	44	17.7
Length of Employment in Current Position		
Under 4 years	110	44.2
5 to 7 years	64	25.9
8 to 10 years	34	13.6
Over 10 years	40	16.3

analyst (n = 34, 23.1%). Participants indicated whether their enterprise employed under 50 employees; 87.1% said that they worked in an enterprise with more than 50 employees. Based on education level, more than half of the participants (n = 74, 50.3%) possessed a bachelor's degree. Participants chose from a range of choices that spanned under four years to over ten years. Most participants (44.4%) indicated they had worked in their current positions for under four years.

B. POTENTIAL COLLINEARITY

Another aspect of common-method bias that warrants examination is its association with predictors that exhibit a certain amount of variation with other variables in structural equation modelling. The problem of full collinearity is evaluated in the structural model by using variance inflation factors (VIFs) to measure the correlation between latent variables.

In the context of partial least squares structural equation modelling, examining collinearity disparities becomes imperative when formative components are included in the inner path model. In structural equation modelling, a minimum threshold of 5 or lower is needed to avoid collinearity issues [39]. However, Variance Inflation Factors (VIF) more than 2.5 (VIF>=2.5) indicates considerable collinearity [40] and needs further evaluation to ascertain if the variation influences the outcomes. A very high collinearity is above 20.

Table 2 presents the findings of the study mentioned above. The size of the subunit (CF1), the background of employees (CF2), and the level of DevOps experience (CF3) all fall below the suggested threshold for variance inflation factor (VIF).

TABLE 2. Collinearity VIFs.

CI	IA	KS	SA	CF1	CF2	CF3
1.248	1.02	1.341	1.231	1.012	1.342	1.221

Note. CI=Continuous Integration, IA=IT Subunit Alignment, KS=Knowledge Sharing, SA=IT Strategic Alignment, CF1=Control Factor 1, CF2=Control Factor 2, CF3=Control Factor 3.

C. DEVOPS PLS-SEM MODEL SPECIFICATION

Researchers who want to use partial least squares structural equation modelling should follow these three key stages, as outlined by [41] of the study (PLS-SEM). This covers the specification of the model and Bootstrapping, the reliability test assessment, and the validity test evaluation. The design of the initial path model is associated with the definition of the model. This advancement is grounded on theoretical considerations. The model constructions and the postulated constructs need to be identified in the model definition [42].

The assessment of the relevant literature and the formulation of hypotheses contributed to forming the path model, shown in Fig. 3. According to what was found in the preliminary data analysis, the measuring tool has been shown to have both validity and reliability in earlier studies. In Table 3, the latent variables are included inside the conceptual model, as below is a list of the research that backs up the things that have had prior theoretical development.

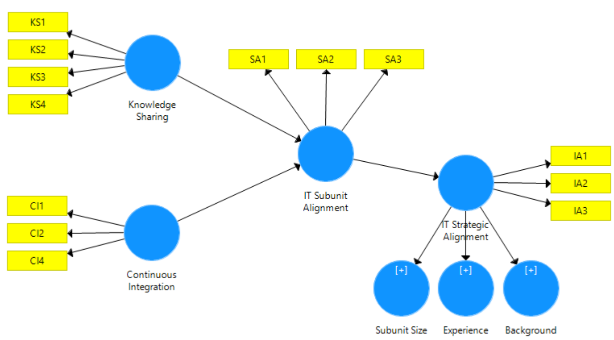

FIGURE 3. DevOps IT alignment model.

D. INDICATOR RELIABILITY

Before proceeding with structural equation modelling, the authors examined the survey question factor and cross-loadings to establish whether or not there were any internal inconsistencies before the model definition. The factors are rotated in an oblique direction throughout the analysis. When doing exploratory research, loadings that exceed the cutoff of

0.70 are acceptable [42]. Table 3 describes the factor loadings in more detail. All of the elements loaded on the hypothesised factor at levels that were higher than 0.7.

TABLE 3. Reliability analysis.

Construct	Item	Loadings	Cronbach's Alpha	CR	AVE	RHO_A
CI	CI1	0.803	0.799	0.847	0.88	0.709
	CI2	0.899				
	CI4	0.822				
IA	IA1	0.849	0.847	0.849	0.907	0.766
	IA2	0.907				
	IA3	0.868				
KS	KS1	0.865	0.887	0.888	0.922	0.746
	KS2	0.882				
	KS3	0.877				
	KS4	0.83				
SA	SA1	0.846	0.847	0.85	0.907	0.766
	SA2	0.909				
	SA3	0.869				

Note. CI=Continuous Integration, IA=IT Subunit Alignment, KS=Knowledge Sharing, SA=IT Strategic Alignment.

In conclusion, more recent research looks at multivariate assumptions. The original data set of 255 participants was reduced to 248 when missing data and extreme outliers were removed. The data set, with a few outliers, fulfilled the multivariate assumptions at the suggested levels within reasonable bounds. The factor analysis showed that the item loadings were sufficient for each postulated component.

E. CONVERGENT AND DISCRIMINANT VALIDITY

This model analysis investigates the items that make up the path model's outside border to determine the reliability and validity of those items. Given the composition of the outer model observations, various factors may play a role in determining how the measurement model is investigated [43].

The question of whether or not DevOps is connected to any preexisting fields of literature is an important one for our inquiry. This research investigates whether or not there are linkages between the relational and structural aspects of IT alignment, as well as whether or not this has any significance for the development of DevOps as a technique adopted by the industry [40].

The structural model's loadings and cross-loadings are outlined in Table 4, which may be found here. Every construct, such as knowledge sharing, continuous integration, IT subunit alignment, and strategic IT alignment models, reflects uniquely. The loadings should achieve high combined loadings while having minimal cross-loadings for the reflective indicators [43].

An additional method for determining an item's validity is to analyse the extracted average variance of each item (AVE). Additionally, researchers propose AVE values greater than 0.5 [42]. The extracted value of the average variance for continuous integration is 0.88, the value for knowledge sharing is 0.922, the value for IT subunit alignment is 0.907, and the value for IT strategic alignment is 0.907.

TABLE 4. Discriminant validity with combined loadings and cross-loadings.

Item	CI	IA	KS	SA
CI1	0.803	0.318	0.338	0.318
CI2	0.899	0.532	0.499	0.533
CI4	0.822	0.414	0.303	0.414
IA1	0.41	0.849	0.48	0.846
IA2	0.499	0.907	0.579	0.909
IA3	0.447	0.868	0.538	0.869
KS1	0.382	0.519	0.865	0.519
KS2	0.412	0.535	0.882	0.535
KS3	0.394	0.548	0.877	0.548
KS4	0.42	0.502	0.83	0.503
SA1	0.41	0.849	0.48	0.846
SA2	0.499	0.907	0.579	0.909
SA3	0.447	0.868	0.538	0.869

Note. CI=Continuous Integration, IA=IT Subunit Alignment, KS=Knowledge Sharing, SA=IT Strategic Alignment.

TABLE 5. Discriminant validity with the fornell-larcker criterion.

Variable	CI	IA	KS	SA
CI	0.842			
IA	0.517	0.875		
KS	0.465	0.609	0.864	
SA	0.518	0.92	0.609	0.875

Note. CI=Continuous Integration, IA=IT Subunit Alignment, KS=Knowledge Sharing, SA=IT Strategic Alignment.

Consequently, the findings suggest that each item has enough validity concerning the stated purpose for which it is being used in an evaluation [42]. The examination of the reliability and validity test model has now come to a close. The researchers then evaluate the structural bootstrapping path model after completing these evaluations.

TABLE 6. Discriminant validity with the heterotrait-monotrait ratio.

Variable	CI	IA	KS	SA
CI				
IA	0.606			
KS	0.536	0.702		
SA	0.606	0.981	0.702	

Note. CI=Continuous Integration, IA=IT Subunit Alignment, KS=Knowledge Sharing, SA=IT Strategic Alignment.

Researchers advise that the loadings in Tables 5 and 6 should be equal to or larger than 0.5 to ensure the discriminant validity of the measuring instrument.

F. STRUCTURAL MODEL EVALUATION

According to the path coefficients and p-values associated with each of the supposed connections in the path model, each relationship is statistically significant to some degree. The range of values for a path coefficient between −1.0 and 1.0 is considered acceptable, and the strength of the relationship between the two variables is indicated by a coefficient value [42].

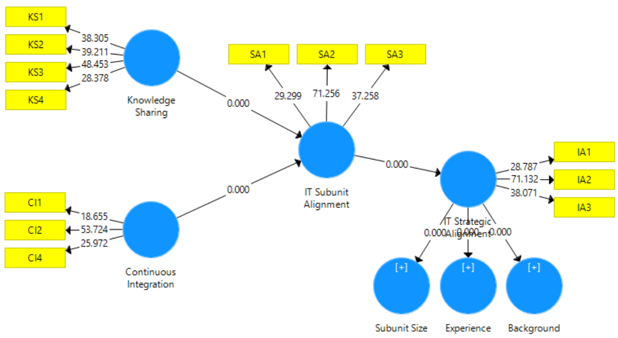

FIGURE 4. Bootstrapping model.

Effect size is a quantitative measure of the effect's influence and often adheres to the above authors' criteria. Effect size values more than 0.02 are considered low, values greater than 0.15 are considered intermediate, and effect size values greater than 0.35 are considered high [42], [43].

G. HYPOTHESIS RESULTS

The outcomes of the structural model evaluation reveal that the model has a sufficient descriptive level and explanatory power. The path model's hypothesised connections support heavy statistical analysis despite the fact that the control variables are meaningfully connected to IT alignment.

The results of testing the hypothesis are shown in Table 7. The ongoing integration of software code and the exchange of information have positively impacted the degree of IT subunit alignment.

The internal model of a PLS analysis tests the hypothesised relationships between independent factors and dependent variables. Path coefficients (β), effect sizes (f^2), coefficient (R^2), and cross-validated redundancy (Q^2) are recommended as a minimum for internal model testing in PLS-SEM by scholars [33]. The PLS-SEM findings are shown in Fig. 4.

TABLE 7. Direct relationship for hypothesis testing.

Relationship		Std Beta	Std Error	T-Value	P-Values	Results
H1	KS -> SA	0.47	0.069	6.798	0.00**	Supported
H2	CI -> SA	0.299	0.055	5.446	0.00**	Supported
H3	SA -> IA	0.92	0.03	20.61	0.00**	Supported

Note. CI=Continuous Integration, IA=IT Subunit Alignment, KS=Knowledge Sharing, SA=IT Strategic Alignment

There is a link between the exogenous and endogenous variables and a relationship between the path coefficients and those related pathways. In the path model, P-values lower than 0.001 are denoted by a pair of asterisks close to the route coefficients. It is possible to do coefficient determinations subunit alignment, and IT strategic alignment is a hidden factor within the scope of IT.

VII. FINDINGS AND DISCUSSIONS

A. RESEARCH FINDINGS

There is a positive relationship between knowledge sharing of software and IT subunit alignment in enterprises that use DevOps, although the t-value is high ($\beta = 0.47$, $p < 0.001$, $t = 6.798$). Hence, Hypothesis 1 was accepted. Continuous integration has also been shown to have a significant connection with IT subunit alignment, although one that is linked with the highest t-value ($\beta = 0.299$, $p < 0.001$, $t = 5.446$), making Hypothesis 2 acceptable. In conclusion, the alignment of IT subunits has a substantial bearing on the strategic alignment of information technology ($\beta = 0.92$, $p < 0.001$, $t = 20.61$). In this instance, the magnitude of the impact is considerable, and hypothesis 3 was accepted.

The authors' conclusions are in line with those of several previously conducted investigations. First, to make headway toward one of the primary goals of this study, which is to discover linkages with earlier theories, a trustworthy definition of DevOps is required [5]. As more and more academics come to a consensus on and more often reference a standard definition of DevOps, future research must investigate the ontology represented by its higher-level notions. This might result in insightful mapping studies that include pertinent ideas.

Second, although this study adds to the findings of previous research that indicates that the implementation of DevOps in major enterprises in the United States resulted in greater subunit alignment [21], it is recommended that more research be conducted to incorporate this outcome [42]. Continuous integration has been widely recognised as a beneficial indicator of the success of information technology operations. Its designation as a competency, which [15] refers to as a cornerstone of DevOps, may offer a metric for identifying high-performing IT departments and teams. This finding is noteworthy because more technical measurements of IT success, including Information technology infrastructure, are often less important indicators of business and IT alignment [23]. Knowledge exchange across IT subunits with significantly diverse technical skill sets and aims is an essential metric of strategic alignment between business and IT. This may be less surprising, but its significance should not be underestimated. Like [23], it examined the alignment of software developers and testers.

Third, this study's most important finding is that adopting DevOps approaches improves alignment at the sub-unit level, which fosters better strategic alignment between the business and IT. This is a significant result for several reasons. Sub-unit alignment among software engineers and inside enterprises where DevOps is applied has been shown to have a favourable effect [43]. However, no previous research has examined the extent to which business and IT goals are aligned.

Fourth, the findings shed light on the fact that there are correlations between DevOps and strategic IT alignment that are statistically significant. Additionally, it offers new opportunities for academics to investigate the fundamental ideas that boost IT performance and the competitive benefits that are supported when business and IT are aligned.

DISCUSSIONS This research focuses on numerous fundamental building components that are essential to the further investigation of DevOps. It is heartening to see that research is continuing to increase in this area of study because of the continuing success of DevOps deployments in businesses [44]. The qualitative findings suggest that businesses are optimistic about their experiences using DevOps to demand quicker app delivery times of better quality. However, researchers indicate that empirical study should continue to test whether or not DevOps is truly accomplishing what it promises using quantitative methodologies. This work must continue since it is important. The focus of this work is on this particular structural component. This is accomplished by considering, as possible foundations for this technique, elements established via previous research and largely rely on software development theory.

This research further supports executive choices to employ DevOps teams, especially in fast-changing enterprises. The software development lifecycle can be shortened, but not to the extent that DevOps can. Large enterprises profited from a larger number of models in an enterprise, while more study is needed to examine variances of these models. This was the case regardless of whether or not there was a correlation between the alignment and performance.

Using the quantitative PLS-SEM approach, the findings demonstrate that certain IT managers in IT enterprises implementing DevOps enjoy stronger IT strategic alignment at the subunit level. Continuous software integration and sharing knowledge are two aspects of the DevOps methodology that assist businesses in improving the alignment of their business plan and information technology enterprise's strategy at both the ground and executive levels. Fostering a DevOps culture is helpful because it helps enterprises achieve IT strategy alignment. Different indicators of enterprise success may be traced back to the degree to which IT strategies are aligned.

VIII. CONCLUSION AND FUTURE DIRECTION

In conclusion, the DevOps IT alignment model requires further development. There are chances to close the gap between DevOps's culture of cross-departmental knowledge sharing and IT infrastructure automation. Similarly, deploying code requires better advances in tools and emerging technologies. According to the research of several scholars, the most difficult obstacle to overcome is when attempting to adopt these models in an enterprise. As a consequence of this, the authors suggest a model of DevOps IT alignment that is more comprehensive and evaluates not just the underlying IT infrastructure but also the corporate structure, as well as how each of these elements affects continuous delivery and deployment.

This research illustrates a connection between DevOps characteristics and IT strategic alignment; few studies participate in theory building within this practice field. This study is one of the few. Therefore, the authors suggest more investigation into the DevOps methodology's underpinnings using this theory and other similar techniques. Structural Equation Modelling becomes more useful as developing and evaluating theories becomes more complex. This is because it simultaneously addresses convergent and discriminant use validity conceptually associated with the structural model. The authors of this research addressed more detailed quantitative validity testing in the study's phase devoted to the first data analysis.

Even though the approach used in this research attempts to address potential problems with the study's internal validity, it still has many limitations. For example, Control variables such as employees' background, DevOps experience levels, and the subunit size of the enterprise's relational IT departments are all embedded inside the endogenous latent variable of IT alignment. However, there is a need for a more robust theoretical framework to find more related control variables that can be included in the future. The model does expand beyond the relevant literature to include IT managers in various countries to address the issue of the generalizability of the results. However, the sample is limited to a few provinces in Sri Lanka that may have been using DevOps for longer than other enterprises. Therefore, more research is required to resolve internal and external validity issues.

REFERENCES

[1] F. M. A. Erich, C. Amrit, and M. Daneva, "A qualitative study of DevOps usage in practice," *J. Softw., Evol. Process*, vol. 29, no. 6, p. e1885, Jun. 2017.
[2] A. Kumar, M. Nadeem, and M. Shameem, "Assessing the maturity of DevOps practices in software industry: An empirical study of HELENA2 dataset," in *Proc. Int. Conf. Eval. Assessment Softw. Eng.*, Jun. 2022, pp. 428–432.
[3] J. A. V. M. K. Jayakody and W. M. J. I. Wijayanayake, "Critical success factors for DevOps adoption in information systems development," *Int. J. Inf. Syst. Project Manage.*, vol. 11, no. 3, pp. 60–82, Oct. 2023.
[4] P. Perera, M. Bandara, and I. Perera, "Evaluating the impact of DevOps practice in sri Lankan software development organizations," in *Proc. 16th Int. Conf. Adv. ICT Emerg. Regions (ICTer)*, Sep. 2016, pp. 281–287.
[5] R. Jabbari, N. Bin Ali, K. Petersen, and B. Tanveer, "What is DevOps? A systematic mapping study on definitions and practices," in *Proc. Scientific Workshop XP*, May 2016, pp. 1–11.
[6] C. Barna, H. Khazaei, M. Fokaefs, and M. Litoiu, "Delivering elastic containerized cloud applications to enable DevOps," in *Proc. IEEE/ACM 12th Int. Symp. Softw. Eng. Adapt. Self-Managing Syst. (SEAMS)*, May 2017, pp. 65–75.
[7] O. H. Plant, J. van Hillegersberg, and A. Aldea, "Design and validation of a capability measurement instrument for DevOps teams," in *Proc. ICASD*. Cham, Switzerland: Springer, 2022, pp. 151–167.
[8] M. Shahin, A. R. Nasab, and M. Ali Babar, "A qualitative study of architectural design issues in DevOps," *J. Softw., Evol. Process*, vol. 35, no. 5, p. 2379, Sep. 2021.
[9] J. Roche, "Adopting DevOps practices in quality assurance: Merging the art and science of software development," *Queue*, vol. 11, no. 9, pp. 20–27, Sep. 2013.
[10] M. Rowse and J. Cohen, "A survey of DevOps in the south African software context," in *Proc. Annu. Hawaii Int. Conf. Syst. Sci.*, Jan. 2021, p. 6785.
[11] O. H. Plant, J. van Hillegersberg, and A. Aldea, "Rethinking IT governance: Designing a framework for mitigating risk and fostering internal control in a DevOps environment," *Int. J. Accounting Inf. Syst.*, vol. 9, no. 10, p. 0560, Apr. 2022.

[12] M. Airaj, "Enable cloud DevOps approach for industry and higher education," *Concurrency Comput., Pract. Exper.*, vol. 29, no. 5, p. 3927, Mar. 2017.
[13] M. S. Khan, A. W. Khan, F. Khan, M. A. Khan, and T. K. Whangbo, "Critical challenges to adopt DevOps culture in software organizations: A systematic review," *IEEE Access*, vol. 10, pp. 14339–14349, 2022.
[14] J. Wettinger, V. Andrikopoulos, and F. Leymann, "Automated capturing and systematic usage of DevOps knowledge for cloud applications," in *Proc. IEEE Int. Conf. Cloud Eng.*, Mar. 2015, pp. 60–65.
[15] S. N. Samsudeen, S. Thelijjagoda, and M. B. F. Sanjeetha, "Social media adoption: Small and medium-sized enterprises' perspective in Sri Lanka," *J. Asian Finance, Econ. Bus.*, vol. 8, no. 1, pp. 759–766, 2021.
[16] W. Hasselbring, S. Henning, B. Latte, A. Möbius, T. Richter, S. Schalk, and M. Wojcieszak, "Industrial DevOps," in *Proc. IEEE Int. Conf. Softw. Archit. Companion (ICSA-C)*, Mar. 2019, pp. 123–126.
[17] M. B. Sanjeetha, S. N. Samsudeen, and R. K. Kariapper, "Small and medium-sized entrepreneurs' behavioural intention to use accounting information systems in eastern province of Sri Lanka," *Solid State Technol.*, vol. 63, no. 6, pp. 17260–17272, Dec. 2020.
[18] J. Smeds, K. Nybom, and I. Porres, "DevOps: A definition and perceived adoption impediments," in *Proc. ICAD*. Cham, Switzerland: Springer, May 2015, pp. 166–177.
[19] N. Noorani, A. Zamani, M. Alenezi, M. Shameem, and P. Singh, "Factor prioritization for effectively implementing DevOps in software development organizations: A SWOT-AHP approach," *Axioms*, vol. 11, no. 10, p. 498, Sep. 2022.
[20] M. A. Akbar, S. Rafi, A. A. Alsanad, S. F. Qadri, A. Alsanad, and A. Alothaim, "Toward successful DevOps: A decision-making framework," *IEEE Access*, vol. 10, pp. 51343–51362, 2022.
[21] N. Azad, "Understanding DevOps critical success factors and enterprise practices," in *Proc. IEEE/ACM IWSiB*, May 2022, pp. 83–90.
[22] A. Kumar, M. Nadeem, and M. Shameem, "Assessment of DevOps maturity in software development organisations: A practitioner's perspective," in *Proc. ICEASE*, Jun. 2023, pp. 438–443.
[23] R. McAdam, K. Miller, and C. McSorley, "Towards a contingency theory perspective of quality management in enabling strategic alignment," *Int. J. Prod. Econ.*, vol. 207, pp. 195–209, Jan. 2019.
[24] M. Hart, "IT software development and IT operations strategic alignment: An Agile DevOps model," ProQuest LLC, 2017.
[25] R. N. Rajapakse, M. Zahedi, and M. A. Babar, "An empirical analysis of practitioners' perspectives on security tool integration into DevOps," in *Proc. 15th ACM / IEEE Int. Symp. Empirical Softw. Eng. Meas. (ESEM)*, Oct. 2021, pp. 1–12.
[26] C. Onita and J. Dhaliwal, "Alignment within the corporate IT unit: An analysis of software testing and development," *Eur. J. Inf. Syst.*, vol. 20, no. 1, pp. 48–68, Jan. 2011.
[27] J. Iden, B. Tessem, and T. Paivarinta, "IS development/IT operations alignment in system development projects: A multi-method research," *Int. J. Bus. Inf. Syst.*, vol. 11, no. 3, pp. 343–359, 2012.
[28] V. Gupta, P. K. Kapur, and D. Kumar, "Modeling and measuring attributes influencing DevOps implementation in an enterprise using structural equation modeling," *Inf. Softw. Technol.*, vol. 92, pp. 75–91, Dec. 2017.
[29] T. Mariyanti and N. Septiani, "The effect of commitment to managerial performance intervening variable at the national Baznas of Riau province," *Aptisi Trans. Technopreneurship*, vol. 5, no. 2, pp. 135–141, Jul. 2022.
[30] A. Hermawan and L. P. Manik, "The effect of DevOps implementation on teamwork quality in software development," *J. Inf. Syst. Eng. Bus. Intell.*, vol. 7, no. 1, p. 84, Apr. 2021.
[31] P. E. Spector, "Mastering the use of control variables: The hierarchical iterative control (HIC) approach," *J. Bus. Psychol.*, vol. 36, no. 5, pp. 737–750, Oct. 2021.
[32] L. I. Soksophay and S. Duang-Ek-Anong, "Determinants of intention to use DevOps in Cambodia's technology industry," *AU-GSB e-J.*, vol. 14, no. 2, pp. 27–39, Dec. 2021.
[33] J. Luftman and R. Kempaiah, "An update on business-IT alignment: 'A line' has been drawn," *MIS Quart. Executive*, vol. 6, no. 3, pp. 165–177, Sep. 2007.
[34] J. Wettinger, U. Breitenbücher, O. Kopp, and F. Leymann, "Streamlining DevOps automation for cloud applications using TOSCA as standardized metamodel," *Future Gener. Comput. Syst.*, vol. 56, pp. 317–332, Mar. 2016.
[35] Y. Liu, Y. Zhang, and J. Wang, "Mesocrystals as a class of multifunctional materials," *CrystEngComm*, vol. 16, no. 27, pp. 5948–5967, 2014.
[36] P. Ajibade, "Technology acceptance model limitations and criticisms: Exploring the practical applications and use in technology-related studies, mixed-method, and qualitative researches," *Library Philosophy Pract.*, vol. 9, pp. 1–14, Jul. 2018.
[37] F. Faul, E. Erdfelder, A. Buchner, and A.-G. Lang, "Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses," *Behav. Res. Methods*, vol. 41, no. 4, pp. 1149–1160, Nov. 2009.
[38] S. Mayr, E. Erdfelder, A. Buchner, and F. Faul, "A short tutorial of GPower," *Tuts. Quant. Methods Psychol.*, vol. 3, no. 2, pp. 51–59, Sep. 2007.
[39] S. Coleman, R. Göb, G. Manco, A. Pievatolo, X. Tort-Martorell, and M. S. Reis, "How can SMEs benefit from big data? Challenges and a path forward," *Qual. Rel. Eng. Int.*, vol. 32, no. 6, pp. 2151–2164, Oct. 2016.
[40] A. Field, *Discovering Statistics Using IBM SPSS Statistics*. Thousand Oaks, CA, USA: SAGE, 2013.
[41] G. Radhakrishnan, "Non-experimental research designs: Amenable to nursing contexts," *Asian J. Nursing Educ. Res.*, vol. 3, pp. 25–28, Mar. 2013.
[42] J. Henseler, T. K. Dijkstra, M. Sarstedt, C. M. Ringle, A. Diamantopoulos, D. W. Straub, D. J. Ketchen, J. F. Hair, G. T. M. Hult, and R. J. Calantone, "Common beliefs and reality about PLS: Comments on Rönkkö and Evermann," *Enterprise Res. Methods*, vol. 17, no. 2, pp. 182–209, Apr. 2014.
[43] M. Sarstedt, C. M. Ringle, D. Smith, R. Reams, and J. F. Hair, "Partial least squares structural equation modeling (PLS-SEM): A useful tool for family business researchers," *J. Family Bus. Strategy*, vol. 5, no. 1, pp. 105–115, Mar. 2014.
[44] N. Kock and P. Hadaya, "Minimum sample size estimation in PLS-SEM: The inverse square root and gamma-exponential methods," *Inf. Syst. J.*, vol. 28, no. 1, pp. 227–261, Jan. 2018.

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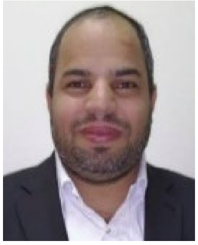

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