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Supply Chain Agility: Adapting to Changing Market Dynamics

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ABSTRACT:

Purpose- The function of this abstract is to analyse the link in between supply chain dexterity and also organisational adaptability in production organizations together with the results of ecological unpredictability as well as organisational ambidexterity on supply chain assimilation.

Concept, procedure, and strategy - Principle, treatment, together with method-- Five hundred and also twenty-six supervisors from Delhi/NCR's solution as well as production industries supplied the information. We made use of the architectural formula modelling (SEM) technique to use the partial the very least square (Smart PLS 3.0) device.

Findings- Research Shows a Correlation between Uncertainty in the Environment and All Three Types of Supply Chain Integrations (Internal, Customer, and Supplier). There is a strong correlation between organisational ambidexterity and supply chain integration. Research shows that supply chain linkages boost organizational flexibility and supply chain agility.

Added value/originality – The outcomes can aid determine important success elements for supply chain monitoring campaigns intending to enhance business adaptability plus dexterity in the solution as well as commercial markets.

KEYWORDS: Manufacturing companies, supply chain agility, supply chain integration, and organizational flexibility

I. INTRODUCTION

Since Oliver and Weber initially proposed the phrase "supply chain management" in 1982, the supply chain context has gone through multiple changes. Optimal use of available resources in manufacturing is typically associated with supply chains in their more conventional forms (Ellram and Cooper, 2014; Amin and Zhang, 2012; Yeoman and Santos, 2019). Lean assumptions organise a complex network of supply chain operations, according to Christopher and Towill (2001) and Birasnav and Bienstock (2019). The advent of Industry 4.0 has altered our perspective on conventional supply chain management, shaped our expectations for the workforce of the future, and tested our capacity to learn new techno-commercial skills that will allow us to extract greater value from our resources while using them more efficiently. It was not surprising that there was a dearth of previous research and literature on the topic, given the abundance of resources available and the widely varying rates of adoption and benefits realised from Industry 4.0. However, there is a difference between the services and manufacturing sectors. Studies that examine the connection between supply chain integration and improved company performance (e.g., Zhao et al., 2008; Wiengarten et al., 2019) and those that examine the function of Industry 4.0 in facilitating and enhancing supply chain integration further highlight this. Companies' agility and flexibility can be enhanced to what extent depends on the degree of integration. In what ways may businesses improve their integration through internal and external elements?

What we call today's environment is "VUCA," which stands for volatile, unpredictable, complex, and ambiguous. Maguire and Cartwright (2008) and Birasnav and Bienstock (2019) argue that resilience is about more than just a company's ability to recover from adversity; it's also about embracing change and adapting to new circumstances. One aspect of resilience is refusing to settle with the status quo, which would expose the organisation just as much to the next disaster if it went back to how it was before. Resilience, according to the transformational viewpoint (Folke, 2006; Schriber et al., 2019), is also concerned with reorganisation, regeneration, and rejuvenation. Al-Abrow et al. (2019) and Rehak (2020) are just two of many global discourses and studies that have focused on organisational resilience, a crucial topic in organisational studies. How can organisations thrive in today's uncertain and unpredictable external environments? That is the burning question on the minds of experts. One of the primary factors that determines organisational resilience is the performance of companies.



Within the context of environmental uncertainty and supply chain interactions, this study examines the many factors that influence organisational success. This study seeks to address that question by delving into the ways in which supply chain integration is driven by ambidexterity and how external environment uncertainty generates the former. What we mean when we talk about innovation and the industry in terms of the tools and capacities that companies need to be competitive and even thrive in today's volatile, uncertain, complex, and ambiguous (VUCA) environment is to examine the industry as a whole. version 4.0. Merging and synthesising technologies that blurred the boundaries between the physical, digital, and even biological domains, the first industrial revolution was marked by the transfer from manual production methods to machines with the greater use of steam power. Many people link the advent of Industry 4.0 with a slew of new technologies, such as AI, robots, the IoT, quantum computing, nanotechnology, additive manufacturing, and the Internet of Things (IoT).

II. LITERATURE REVIEW

2.1 Challenging Factors

The respondent's organization's capacity to accomplish its aims and goals may be affected by internal and external ambiguity, which collectively constitute uncertainty. According to Clampitt and Williams (2017), uncertainty spreads like a plague through an organisation, adding complexity and ambiguity wherever it goes. Modern researchers account for both internal and external sources of uncertainty when they build models and study their effects on supply chain performance, integration, and sustainable sourcing of suppliers (Wang and Song, 2017; Chang et al., 2019; Flynn et al., 2016; Chen et al., 2020). Finding a systematic approach requires taking into account both internal and external sources of uncertainty at the same time, according to Chen et al. (2020). An improved comprehension of supply chain integration and organisational uncertainty was elucidated by Chen and Paulraj (2004). According to Jia et al. (2020), when a company's capacity to manufacture its goods and services is affected by external uncertainties and volatility, it is referred to as supplier uncertainty. In this study, supplier uncertainties are caused by suppliers' inconsistent capacity to meet the standards set by Delhi NCR's manufacturing and service organisations, as well as their rate of consistency in meeting production quality standards. Both suppliers and customers' demands are frequently associated with organisational uncertainties in the supply chain (Lu et al., 2018; Birasnav and Bienstock, 2019; Selim et al., 2019). In their 2016 study, Flynn et al. proposed a new kind of dynamic capability based on the interrelationships between internal and external knowledge processes, which include supply and demand uncertainties that affect both the provider and the customer. A company's supply chain integration efforts might be hindered by uncertainties, which pose a new and formidable challenge. One of the main external factors that contributed to the rise of supply chain management was organisational uncertainty (Betts and Tadisina, 2009). Supplier uncertainty, demand uncertainty, and technological uncertainty are the three main causes of supply chain uncertainty. Notable supply chain risk and high uncertainty are both induced by epidemic outbreaks (e.g., COVID-19, SARS, Mars, etc.), which in turn disrupt both the upstream and downstream portions of the supply chain, or, put another way, interrupt SC integration. As a result, logistics (both internal and external), supply and demand, and overall SC integration are all negatively impacted by the high levels of uncertainty caused by pandemic outbreaks (Ivanov, 2020). According to this research, when there are environmental uncertainties, the supply chain benefits more from integration. Wong et al. (2011) used theories of organisational information processing and contingency to highlight the connection between supplier, customer, and internal integration in regard to uncertainty. Empirical evidence for the critical importance of supply chain practice in unpredictable business environments was provided by Rahman and Zailani (2017) and Kim and Chai (2016). They discovered that the execution of supply chain integration is greatly impacted by uncertainty. So, the following hypothesis was put out by the research:

H1a. Customer integration is positively impacted by uncertainty.

H1b. Supplier integration is positively impacted by uncertainty.

H1c. Internal integration is positively impacted by uncertainty

2.2 Being ambidextrous in the workplace

The capacity of an organisation to take advantage of both its current strengths and its potential for growth is known as organisational ambidexterity (Nazir and Pinsonneault, 2011; Venugopal et al., 2020). The capacity to sustain both exploitative and exploratory innovations for the survival and profitability of an organisation is known as organisational ambidexterity (Mom et al., 2019; Junni et al., 2013). According to Mom et al. (2019), organisational ambidexterity can be explained by the presence of two or more complementary methods that are intrinsic to the innovation stream and decision-making processes (Zimmermann et al., 2018). Organisational ambidexterity, which includes skills like coming up with novel solutions to problems, improving internal processes, and coming up with original ways to meet customers' demands, has been described by Nazir and Pinsonneault (2011) and Venugopal et al. (2020) as the result of



supply chain integration and the implementation of Industry 4.0. According to Partanen et al. (2020), ambidextrous organisations have the ability to embrace innovative ways and generate tangible and enduring value from them. In order for Delhi NCR's service and manufacturing firms to adapt to their constantly changing environment, this study suggests that organisational ambidexterity has an effect on supply chain integration (Birasnav and Bienstock, 2019). Specifically, it focuses on customer, supplier, and internal integration. As mentioned by Rai and Tang (2010), the integration capacities work together to generate a capacity for process readiness to change, which is supplied by organisational ambidexterity. In order to facilitate supply chain ambidexterity, a company can build process adaptability through integration and flexibility with the help of a structured inter-organizational system (IOS). Therefore, supply chain ambidexterity can be driven by balancing the opposing notions of integration and flexibility (Pu et al., 2018). A research model developed by Nazir and Pinsonneault (2011) demonstrated that ambidexterity enables the business process to leverage integration and reconfiguration to its advantage. So, here's what we suggest:

H2a. Customer integration is positively impacted by organisational ambidexterity

H2b. Supplier integration is positively impacted by organisational ambidexterity.

H2c. An organization's ability to integrate internally is boosted by ambidexterity.

2.3 Agility and integration of the supply chain

According to several sources (Christopher and Towill, 2001; Singh and Verma, 2018; Wang and Song, 2017), the supply chain is a network of organisations that work together in a vertical sequence or through upstream and downstream links to provide goods and services to consumers. Supply chain operations can help communication and manufacturing businesses gain a competitive edge (Liao et al., 2017). In these industries, supply chain competence is both a foundational component and a key differentiator (Newaz et al., 2020; Kumar et al., 2017). The study takes into account not just supply chain integration (SCI), but also customer integration, supplier integration, and internal integration, which is in line with previous research by Lee et al. (2007) and Kumar et al. (2017). In supply chain integration with customers, activities like sharing critical information (such as demand forecasts, inventory levels, and production plans) through a shared communication channel are part of the coordination and close alignment between a company's supply chain and its key customers (Jia et al., 2020; Kalyar et al., 2019). According to Birasnav and Bienstock (2019), when a company's supply chain management is closely aligned and coordinated with its suppliers, it is known as supply chain integration. The demand prediction, inventory level, and production plans are some of the most important pieces of information that must be transmitted through a well-established network and communication channels. When a company's internal supply chain operations are integrated, it is known as internal supply chain integration (Turkulainen et al., 2017). Moreover, internal SCI is crucial since it serves as the basis for developing supplier and customer integration (Frankel and Mollenkopf, 2015), as pointed out by Flynn et al. (2010).

In order to gain an advantage in the new environment, organisations may assess the changes happening outside their control, build alliances with stakeholders, consumers, and suppliers that benefit everyone involved, and react much faster than their competitors.

The study concluded that:

H3a. Customer integration has a favourable effect on supply chain agility based on these considerations.

H3b: Agility in the supply chain is enhanced by integrating suppliers.

H3c. Agility in the supply chain is positively impacted by internal integration.

2.4 Integration of the supply chain and organisational flexibility

An internally oriented competency, organisational flexibility is the capacity of an organisation to endure a limited number of changes without experiencing significant disruption (Shukla and Sharma, 2019). An ever-increasingly competitive marketplace can be won by skillfully utilising both stability and adaptability (Khoobiyan et al., 2017; Laser, 2020). Flexibility, as an operational capacity, encourages businesses to change (internally and across the important partners) efficiently in reaction to market externalities when there is effective supply chain integration. One of the critical factors of supply chain integration that would enable organisations to embrace revolutionary technologies, such as Industry 4.0, is adaptability, according to Gosling et al. (2010) and Dubey et al. (2019). As a result, they will be able to approach their firms in fresh ways and develop winning strategies. Most of the time, in a manufacturing system, flexibility is associated with things like equipment, processes, routes, parts, and labour (Khoobiyan et al., 2017). In order to deal with supply chain integration and external environment uncertainty, organisations must be flexible in four ways: range-number, range heterogeneity, mobility, and uniformity (Khoobiyan et al., 2017). In order to gauge production adaptability, Swafford et al. (2006) shortened the original four-dimensional model to just two. These two dimensions were then used to quantify the manufacturing and sourcing flexibility. Several studies have examined the connections between supply chain integration and the perceived organisational flexibility of customers, suppliers, and internal stakeholders (Zhang et al., 2003; Dubey et al., 2019). So, we postulated:



- H4a. Organisational flexibility is positively impacted by customer integration.
- H4b. Organisational flexibility is positively impacted by supplier integration
- H4c. It states that organisational flexibility is positively impacted by internal integration.

2.5 Foundational theories

The theoretical underpinnings of the supply chain agility model proposed by Swafford et al. (2006) and Li et al. (2008), as well as other relevant literature, were synthesised to develop this conceptual framework (Figure 1). Because of its robustness, applicability to the subject matter, and research objectives, this study's conceptual framework is built using a theoretical model that is based on Betts and Tadisina (2009) and Shamim et al. (2017). Supply chain integration is affected by uncertainties and organisational ambidexterity, which influence supply chain performance towards agility and organisational flexibility, as highlighted by the model. When discussing what drives supply chain performance, Betts and Tadisina (2009) zeroed attention on the importance of supply chain agility and adaptability.

This study argues that organisational ambidexterity and environmental uncertainty impact supply chain integration, which in turn stimulates supply chain agility and flexibility, by utilising the models of Betts and Tadisina (2009), Swafford et al. (2006), Li et al. (2008), and Shamim et al. (2017). Since not all structures will stay within a company's control threshold, we have kept "uncertainty" as a key construct in our model. Evidence from studies by Betts and Tadisina (2009) and Shamim et al. (2017) indicates that there is a positive link between uncertainty and supply chain integration. This suggests that when external uncertainties increase, supply chain integration also improves. This study identifies organisational ambidexterity as an inventive capability, suggesting that ambidextrous businesses are more likely to embrace and implement new technology, such those provided by Industry 4.0. The outcome is improved supply chain performance as a consequence of tighter integration throughout the supply chain. Presented here as dependent structures are supply chain agility and organisational flexibility. According to the research, supply chain integration is positively affected by the independent variables ambidexterity and uncertainty.

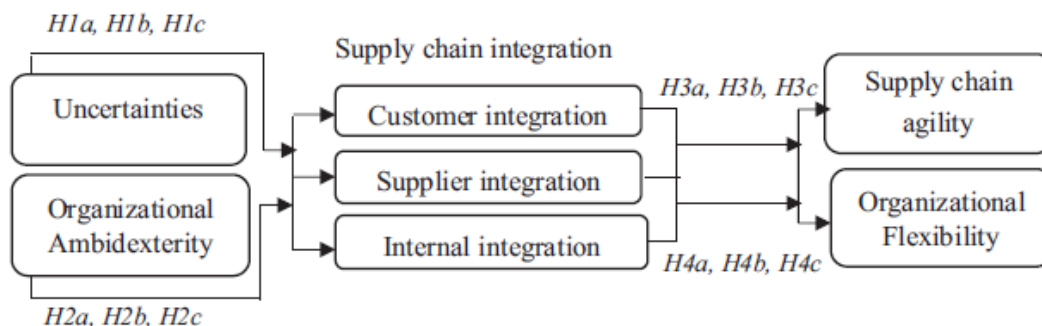


Figure 1. Conceptual model

III. RESEARCH METHODOLOGY

3.1 Collecting data

From August to October 2019, managers in Delhi NCR’s manufacturing and service industries participated in a purposive sampling exercise that yielded quantitative data for the study. In qualitative research, purposeful sampling is a common method for finding and selecting people with extensive knowledge or experience with the phenomena under study (Cresswell and Clark, 2011; Palinkas et al., 2015) while making the most of limited resources. Email, online survey platforms, social media, and physical distribution methods are some of the ways that participants' data is collected through purposive sampling. Starting with a database of email addresses of influential people in the sector and other relevant respondents, the digital survey forms were sent to the intended recipients. To further expand the scope of this questionnaire, the web-based and online survey platform, Google Forms, was employed. In order to reach the people who were supposed to fill out the Google Forms, the researchers used social media apps like WhatsApp. Since this study was primarily concerned with professionals, they also used LinkedIn. The target population was approached personally and given hard copies of the surveys through various professional networking channels, including seminars, conferences, and meetings. Because of its simplicity and reliability in decreasing the ambiguity of the outcomes, the researchers of this study chose this strategy.



Because participants had to meet certain requirements to have their opinions heard in the study, it only included those aged 18 and higher. Managers from Delhi NCR's manufacturing and service sectors participated, all operating at the entry-level of their respective hierarchies. The 1,000 manufacturing industries included in the database were: construction and building materials; agriculture; information and communication technology; technology and digital; wholesale and retail; automobiles; public administration; tourism; transportation and logistics; oil and gas; and banking and finance. The respondents were selected using a purposive sampling method. In order to get the go-ahead for data collecting, we approached the relevant company executives. Our distribution of questionnaires to company managers followed our acquisition of data collection authorization. The survey and plain-language explanation of the project took about twenty-five minutes to finish. Participants were informed that their involvement in this research was entirely optional, and their confidentiality was assured. To encourage people to take part in our study, we did not offer them any kind of financial reward. A total of 740 out of 1,000 questionnaires (74% response rate) were returned after distribution. Since several company management are currently attending a business meeting, it is possible that some survey takers will be unable to complete and submit their surveys. A usable response rate of 52.6% was achieved when 526 out of 740 questionnaires returned were sufficiently filled out for data analysis.

3.2 Objectives

The research tool utilised in this study was a questionnaire that participants filled out on their own time. It was based on measurements and scales that had already been validated and modified according to the study's topic. A seven-point Likert scale was utilised for all items in this study. The scale ranged from -3 to +3, with each value representing the respondent's level of agreement with each question. Choose -3 to show how unsatisfied the respondent is with the statement or question posted to them, and choose +3 to show how satisfied they are with the same statement or question. Stronger relationships were observed using seven-point scales, according to Lewis and Erdinç (2017). We utilised Bahasa Malay-translated scales because we were already using them to assess variables with English-language origins. A bilingual subject expert and two sets of questionnaires were utilised. The final research instrument took respondent opinions and feedback into account during its design. Six professionals reviewed the instruments and provided feedback on confusing questions. Both the English and Bahasa Malay versions were fine-tuned somewhat. As part of the standard operating process for administering surveys, we informed participants that their answers would remain anonymous and that there was no right or wrong way to answer the questions.

The 15 components that make up the supply chain integration construct were modified from those of Flynn et al. (2010) and arranged into three broad groups. When companies in a survey work to integrate their supply chains, it's because they want to make sure that all of their stakeholders are working towards the same aims and objectives. In order to facilitate rating the level of integration or information sharing between their organisations, respondents were asked to classify their stakeholders into three groups: key customers (coded as "SCC"), key suppliers (coded as "SCS"), and internal (coded as "SCI"). A seven-point Likert scale, with -3 representing "not at all integrated" and +3 representing "very integrated," is to be used by respondents to document their responses to these questions.

After modifying eight elements from Swafford et al. (2006) and Betts and Tadisina (2009), the concept of supply chain agility was evolved. How fast the respondent's company's supply chain adapts in response to changes in the business environment is called supply chain agility. We asked respondents to rate the pace with which their company's supply chain agility (labelled as "SCA") was affected by the deployment of Industry 4.0 technologies. On a seven-point Likert scale, from -3 (very slow) to +3 (very fast), they marked their responses to these questions.

IV. RESULTS

4.1 Profile of the population

Males made up 48.9% of the sample and females 51.1% out of 526 usable samples. What this means is that there is a minor bias towards females on the scale. Nearly half of those who took the survey have some background in the oil and gas sector. Next on the list at 17.8% are banking and finance, followed by 17.2% for construction and building supplies. About three quarters of the respondents work in the oil and gas, banking, or construction and building materials industries. The next largest group is the agricultural sector, accounting for 5.6% of the total. Then there are the following industries: 3.3% in information and communication technology, 3.3% in wholesale and retail, 2.8% in the automotive sector, 2.2% in government and public administration, 2.2% in power and utilities, 1.1% in property and real estate, 0.6% in tourism, and 0.6% in This study's goal of collecting survey responses from industry leaders is encouraged by the fact that 73.3% of respondents hold senior management positions such as vice president, general



manager, or head of department within their respective companies. In their respective companies, 14.4% were in top management, 7.2% were in middle management, and 5.0% were in junior management.

4.2 Measurement model

Constructs	Characteristics	%	Constructs	Characteristics	%	
Gender	Male	48.90	Industry	Oil and gas	43.30	
	Female	51.10		Finance and banking	17.80	
Position	Top management	14.40		Construction and building materials	17.20	
	Senior management	73.30		Agricultural	5.60	
	Middle management	7.2		ICT, technology and digital	3.30	
Department	Junior management	5.0		Wholesale and retail	3.30	
	Procurement and purchasing	31.10		Automotive	2.80	
	General management	26.10		Government and public administration	2.20	
	Business development and sales	13.90		Power and utilities	2.20	
	Marketing	13.90		Property and real estate	1.10	
	Research, analysis and strategy	4.40		Tourism	0.60	
	Operations and logistics	2.80		Transportation and logistics	0.60	
	Audit risk and compliance	1.70		No. of Employees	1-49	3.3
	Human resources	1.10			50-99	3.3
	ICT	1.10	100-499		8.9	
	PR, media and communication	1.10	500-999		20.0	
	Accounting and finance	0.60	1000-4999		35.0	
	Others	2.20	Above 5000		29.4	
Purchase responsibility	Influencer	27.8	Average duration with key suppliers		Less than 1 year	1.1
	Purchaser/buyer	36.7		1-4 years	11.7	
	Decision-maker	28.3		4-7 years	22.2	
	End user	7.2		7-10 years	29.4	
Average no. of projects with key suppliers	1-4	17.8		Above 10 years	35.6	
	4-7	15.6				
	7-10	27.8				
	Above 10	38.9				

V. DISCUSSION

One of the study's contributions is an examination of environmental uncertainty, which includes both internal and external factors that can affect a company's capacity to manufacture its goods and provide its services. Customers, suppliers, and internal integration are all parts of the supply chain, and the results show that uncertainty has a huge effect on all three. This finding lends credence to the claims made by Wong et al. (2011), who noted that environmental



uncertainty significantly impacts the interrelationships of the three constituent parts of supply chain integration—internal integration, supplier integration, and customer integration.

Both the demand from customers and the supply from suppliers are often connected to external environmental risks in the supply chain (Prater et al., 2001). All three factors corroborate this idea and expand it by including the buyer and seller in the uncertainty around supply and demand. Uncertainties, according to Eisenhardt and Martin (2000), provide a positive picture of the outside forces influencing a business's attempts to integrate its supply chain. In order to meet the demands of their target market, the products or services are fresh and original. Thus, the importance of supply chain integration is highlighted in this study, as customer, supplier, and internal behaviours are most profound when uncertainties are present.

Hypo	Relationship	Beta (β)	SD	t-value	Comments
H1a	Uncertainties (UNC) → Customer integration (SCC)	0.391	0.057	6.864**	Supported
H1b	Uncertainties (UNC) → Supplier integration (SCS)	0.212	0.097	2.184*	Supported
H1c	Uncertainties (UNC) → Internal Integration (SSI)	0.386	0.061	6.331**	Supported
H2a	Organizational ambidexterity (OA) → Customer integration (SCC)	0.303	0.068	4.429**	Supported
H2b	Organizational ambidexterity (OA) → Supplier integration (SCS)	0.083	0.115	0.722	Not Supported
H2c	Organizational ambidexterity (OA) → Internal Integration (SSI)	0.150	0.084	1.785*	Supported
H3a	Customer integration (SCC) → Supply chain agility (SCA)	0.284	0.089	3.200**	Supported
H3b	Supplier integration (SCS) → Supply chain agility (SCA)	-0.009	0.125	0.070	Not supported
H3c	Internal integration (SSI) → Supply chain agility (SCA)	0.093	0.078	1.190	Not supported
H4a	Customer integration (SCC) → Organizational flexibility (SCF)	0.250	0.069	3.643**	Supported
H4b	Supplier integration (SCS) → Organizational flexibility (SCF)	0.145	0.074	1.944*	Supported
H4c	Internal integration (SSI) → Organizational flexibility (SCF)	0.145	0.079	1.831*	Supported

Note(s): Uncertainties (UNC), Organizational ambidexterity (OA), Customer integration (SCC), Supplier integration (SCS), Internal integration (SSI), Supply chain agility (SCA), Organizational flexibility (SCF), t-value ≥ 2.32 considers significant level at 0.01 and t-value ≥ 1.64 considers significant level at 0.05

Table 4.
Hypothesis testing

VI. CONCLUSION

Due to the brief duration of data collection, the study had various limitations. Given that this study's participants are all prominent figures in the relevant industries, it will be difficult to collect a representative sample from such a small time frame. In light of this, the researcher recommends that future studies think about extending the lead time and broadening the area of questionnaire participation. The researcher was only able to conduct the study at one moment in time because of time and resource limitations, hence it used a cross-sectional research design. This researcher would like to propose that future studies think about using a longitudinal research design, since this would give stronger evidence of the measurement tools' validity. The current study attracted a large number of oil and gas industry leaders due to the researcher's extensive professional network, which introduced an inherent bias in favour of the industry's perspective in the results. Changing to a longitudinal study should give the researchers greater leeway to plan and execute the study efficiently, as well as more resources to collect samples from a wider range of industries, reducing the likelihood of any bias in the results. Quantitative analysis is the exclusive emphasis of this study. All analyses, findings, and conclusions are based on statistical means. The researcher has concluded that future studies would benefit from using qualitative analysis in order to produce more thorough and reliable results that are representative of the study population. For example, as this study aims to collect advice from industry leaders, data from qualitative interviews would be quite helpful and provide strong validation to the survey results.

The purpose of this research is to determine the effect of adopting new technology on the performance of business entities across a range of sizes, including start-ups, small-medium enterprises, mid-to-large companies, conglomerates, government-linked companies, and multinationals. Researched here are just businesses that have embraced modern tech to a certain extent, and how those businesses feel about the benefits they've reaped as a result. This study's author



suggests that, rather than focusing on innovators and early adopters of new technology, future studies should examine pre-adoption to identify the reasons why organisations are hesitant to join the bandwagon. Researchers may utilise this study's results to delve more into the topic of business entities' adoption rates of new technologies, how these adoption rates affect their operations, and how these adoption rates shape the values and drivers of new firms.

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