Journal of Business Administration and Management Sciences
July 2022 Vol. 04 Issue No. 02

HOW DO OPERATIONAL DISRUPTION AND RESILIENCY IMPACT A FIRM'S OPERATIONAL EFFICIENCY AND COMPETITIVE ADVANTAGE? PAKISTAN CASE

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ABSTRACT
Due to an uncertain business environment caused by natural and man-made operational disruptions, operational resilience is gaining importance. This is especially true for companies whose competitive advantage relies on operational efficiency. This research aims to determine if operational resilience, operational disruption, operational efficiency, and firm competitive advantage are linked. Responses were collected from 266 industry professionals. According to the study, operational resilience does not affect operational efficiency, but it does affect a firm's competitive advantage. Operational disruptions affect operational efficiency but not a company's competitive edge. This research also reveals that operational efficiency has no impact on the link between operational resilience and competitive advantage. This research will help organizations to raise their competitive edge, which is a key measure of performance. This will be done while considering operational interruption events and operational resiliency resources. This research will aid organizations to understand the importance of these variables to get a competitive advantage for their growth and survival.
Keywords: Competitive advantage, efficiency, operational resilience, Operational disruption.

1. INTRODUCTION

Even though several researchers have looked into the topic of resilience, a great deal more study is required to understand how companies may become resilient to a variety of different kinds of disruptions in the difficult environment that exists today. (Parker & Ameen, 2018). Rapidly evolving customer demands have created a world of uncertain and volatile commercial rivalry, frequent operational problems, and changing company dynamics.(Essuman et al., 2020; Hillmann & Guenther, 2021). Top management must allocate scarce resources among organizational sub-units to maximize business performance. The importance of functions like operations and marketing can affect a company's decisions and resource allocation. Weighting particular functions can also affect a company's performance. (Ahmed et al., 2014). Businesses are constantly investing to meet these challenges by developing innovative competitive strategies, additional consumer-focused services, and products, and building more robust business operations, including supply chains, to meet customer demands and reduce threat factors to gain a competitive advantage and improve business performance. (Liu, 2013; Teece et al., 2016). Even if disturbances are inevitable, there are substantial variations in how different businesses cope with them (Parker & Ameen, 2018). In the world of business, the term "resilient operations" refers to an organization's capacity to thwart disruptions, move swiftly in response to disruptions, and get back on its feet when essential functions have been disrupted. (Stolker et al., 2008). The operations of corporations are hampered by both natural and man-made disasters, which pose unavoidable hazards that businesses need to combat with sufficient vigor to ensure their continued existence (Essuman et al., 2020). A problem at any step in the business process can have a significant influence on the company's operations, particularly supply chain management. (Ali et al., 2018). Evidence shows that operational disruptions have a sudden and significant negative impact on a company's performance and operations (Essuman et al., 2020).
A fire that broke out at Phillips Semiconductor's production operation in Albuquerque, New Mexico, caused the firm to lose an estimated $400 million in income that could have been generated by its major customer, Ericsson. (Ivanov et al., 2014). Because of the devastating tsunami that struck Japan in 2011, automotive manufacturers including Nissan, Honda, and Toyota were forced to temporarily suspend their core business operations for several days, which drove up their operational costs. (Essuman et al., 2020). Disasters such as the tsunami that struck Asia in 2004, cyclones, and other natural disasters caused several natural disasters, including flash floods, droughts, and landslides (2015). In 2019, Australia was faced with a devastating fire that disrupted crucial supply chains, operations, and

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revenues, costing businesses and industries millions of dollars. Despite this, Qantas Airways' stock has plummeted to two-month low due to several flight cancellations. Australia's shops have experienced a dramatic drop in sales. (Essuman et al., 2020). According to the Business Continuity Institute, 85 percent of businesses that have supply chains that span the globe have experienced at least one disruption in their supply chain during the previous year. These kinds of disruptions can be expensive, as they can lead to decreased profits, increased downtime, delivery delays, lost customers, and damaged brands (Ivanov et al., 2014). A recent study has identified quality of infrastructure, disruptions in logistics and delivery, delays by the supplier, and interruptions of in-house/plant-like equipment and machinery as modest, but more frequent and chronic issues (Abeysekara et al., 2019). Furthermore, internal interruptions, such as problems originating at the cost of main markets loss, economic crises, technological advances, infrastructure, and product and service quality, have all had negative implications earlier and may influence the firm's potential growth and development in the future, are extremely vulnerable to business operations. All of these elements, particularly in developed countries, have a considerable impact on every economic sector (Abeysekara et al., 2019).

Customer expectations and interests are always shifting in today's competitive and diversified market, and as a consequence, the possibility of operational interruption is growing (Singh et al., 2019). Operational efficiency, reliability, and responsiveness are all important factors in a company's profitability (Hendricks & Singhal, 2005). The ability of a company's operations to resist and respond to internal and external difficulties determines its success (Abeysekara et al., 2019). According to studies firms having resilient operations, have processes in place to deal with disturbances, permitting them to attain higher operational performance results (Essuman et al., 2020). The ability of a firm to withstand supply chain interruptions is viewed as a critical organizational capability that allows it to limit the effects of disruption while remaining competitive (Baryannis et al., 2019). As a result, organizational resilience is gaining importance in operations management and other related domains (Burnard & Bhamra, 2011). Co-evolution and interactions between various organizations, as well as between organizations and their environment, will influence operational network resilience (Yao & Fabbe-Costes, 2018). A lot of organization faces short- and long-term sales and market share losses, reduced sales prices due to markdowns of excess inventories, and other supply chain issues that can all result in lower sales, and market share could prohibit the company from reaping the benefits of a stronger market. Due to that, there is a lack of product supply, as per market demand (Hendricks & Singhal, 2005). Because disruptive events have the potential to interrupt operational systems, corporate administration has to create a resilience structure of high importance (Hillmann & Guenther, 2021).

1.1 Objective of Research

The purpose of this research work is to examine the influence of operational resiliency on achieving a competitive edge in Pakistan’s manufacturing industry. In the context of the manufacturing industry of Pakistan, this article examines the correlation between competitive advantage, resilient business operations, operational efficiency, and operational disruption. How can businesses improve and maintain their competitive advantage through operational resiliency, where efficiency in operations is a mediating or intervening factor and independent variable of operational disruption? The importance of operational efficiency and resilient business operations in strengthening an organization's competitive advantage in the event of an operational disruption caused by natural or man-made events. To fill the research gap, our research questions will be: (i) what role do resilient business operations play in attaining and enhancing a firm competitive advantage? (ii) what role do operational disruptive events have in altering a firm's competitive advantage? (iii) How does operational efficiency play a role in company competitive advantage as a mediating variable?

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

This section introduces the ideas and dimensions of competitive advantage, operations disruptions, operational efficiency, and business operations resiliency components and principles.

2.1 Theoretical overview

A firm's set of distinctive assets that can be exploited to gain a competitive advantage is referred to as the resource-based view (RBV) (Sony & Aithal, 2020). Businesses could obtain a competitive advantage by using their particular resources and talents, researchers discovered late and after 20 years, the resource-based view (RBV) was renamed resource-based theory (RBT), with the premise that it had evolved into something more like an assumption than a perception (Barney et al., 2011). RBT as a result is employed in this study rather than RBV.

RBT is integrated with added viewpoints from the organization’s perspective regarding contingency to highlight the association between competitive advantage and organizational resilience, also the mediating or intervening influence of efficiency in a firm's operations. To that conclusion, we show how firm resilience components are inimitable, non-substitutable, rare, and valuable resources that refer to resources that are precious, non-substitutable, rare, and inimitable addition in the resilience of resource-based view theory (Ali et al., 2018).

According to research-based theory, firm businesses have a combination of intangible and tangible instruments that can facilitate them in acquiring a competitive edge or advantage (Barney and Clark, 2007). We categorize essential techniques, tools, and capacities that has being utilized to generate firm resilience using the RBT theory (Barney et al., 2011). The effects of resilience by implementing RBT on the resilience of the supply chain in the face of random and targeted disturbances, the findings of their study show that communication inside supply chain networks can greatly improve not only the service level of normal company operations but also the post-disruption service level (Hosseini et al., 2019). The primary notion of contingency theory is that processes efficiency and goal achievement are accomplished when a firm's resources or plans are lined up with the environment or context (Lawrence & Lorsch, 1967; Donaldson, 2001). We employ contingency theory (CT) as a result to detect potential internal and external operational disruption threats, also their impact on the output of firms. Aligning resource-based theory (RBT) with contingency theory (CT) to look at prospective threats and the capabilities, techniques, and tools needed to protect a company's success.

The RBV theory or we can say the resource-based view's incapacity to explain the production and reconstruction of capabilities and resources in response to constantly changing surroundings prompted the development of the dynamic capabilities (DC) theory. The use of DC to achieve a competitive edge is possible (Teece et al., 2009).

DC theory goes further than the idea that an organization's achievement of essential resources like rare, valuable, non-substitutable, and inimitable gives it a lasting competitive edge. Organizations with dynamic capabilities (DC) may integrate, mobilize, and restructure their capabilities and resources in response to rapidly changing circumstances. DCS or we can say dynamic capabilities are basic procedures that allow a business to rethink its resources and strategy to gain lasting advantages in competition and greater firm performance in quickly fluctuating settings. Organizational resilience aspects have a favorable impact on a company's competitive advantage, according to the dynamic capability theory.

Recovery and absorption from disruption can help organizations to achieve a competitive advantage and improve their firm performance over time. Recovery and absorption from disruption capabilities are beneficial because these strategies can help businesses to mitigate the adverse impact of interruptions (e.g., lost sales, poor delivery performance, bad reputation, and inefficiencies). An earlier study has found that major environmental elements can determine firm resilience that impacts the performance of operational outcomes (Yu et al., 2019). According to one statement, variations in conditions of disruption can offer more insight into the firm benefits in operational resilience through operational efficiency.

2.1.1 Slack Resource

According to specialists the concern of rapid changes in the environment, and slack resources of firms aid in the defense of technological structure, as we agree with many researchers who suggest that increased productivity is an indication of a slack capital increase, which is linked to firm performance (Tognazzo et al., 2016). The terrorist attacks on September 11, 2001, airlines that avoided significant levels of debt and collected the biggest financial reserves (e.g., Southwest Airlines) exceed and were able to recover previous levels of profitability without laying off employees. As a result, financial resources like as slack resources are critical. As a result, an essential part of firm resilience is slack resources. resilience (Vogus & Sutcliffe, 2007).

2.1.2 Disruption Absorption

Organizations and governments in charge of ensuring disruption absorption frequently define it more broadly, including requirements of activities to create flexibility or resilience (Hoffman & Hancock, 2017). As per New York State Commission's response to Hurricane Sandy, resilience is defined as an organization's structure's ability to recover from disruptions robustly in a redundant and sophisticated manner to limit threats (Chan & Schofer, 2016). To initiate, the data suggest that communal efforts to build flexibility or resilience play an important part in absorbing disruption which is in line with previous research (Essuman et al., 2020).

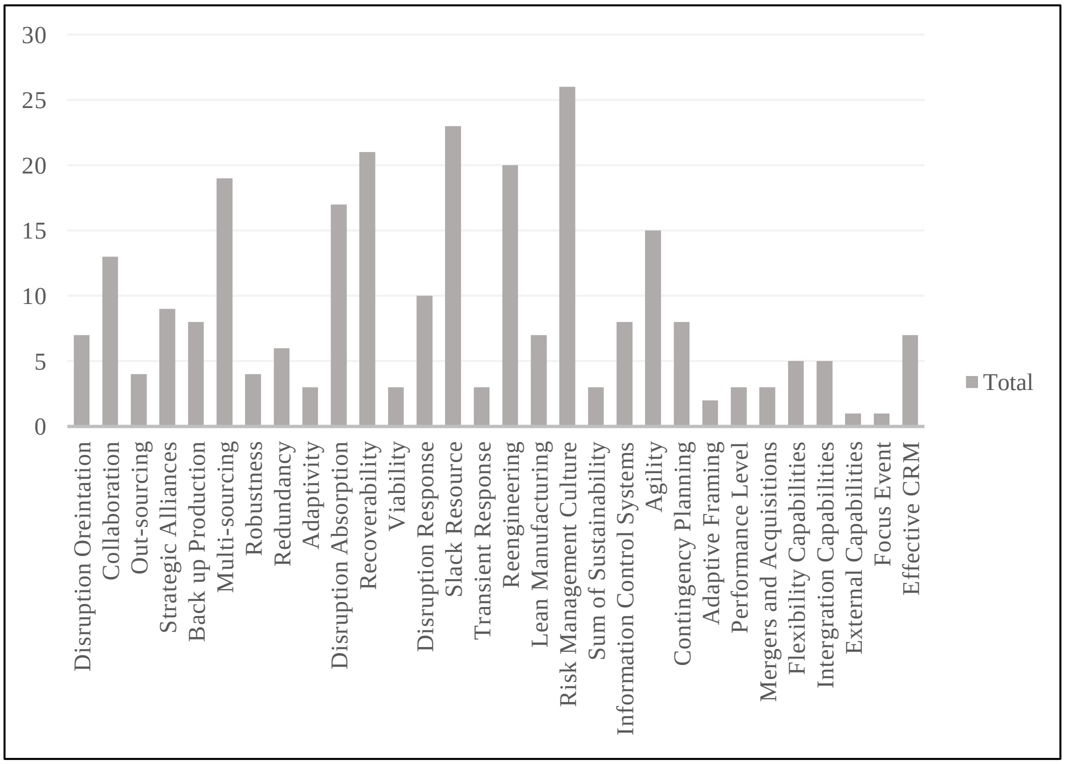
2.1.3 Recoverability

Efficiency in operations although we expect favorably connected with capabilities of recoverability, it is feasible to argue that the operational efficiency of a corporation has a strong positive association with recoverability. This anticipation is established on the notion that recoverability is mostly determined by flexibility approaches, which are less correlated with inefficiency (Essuman et al., 2020). This section is about recovering competitive performance levels once the effects of shocks or demands have been felt. The primary emphasis of recovery is disruptive events. To preserve operational resilience, businesses must seek to optimize and exploit possible advantages from opportunity events that may otherwise become dangers (Birkie et al., 2013).

2.1.4 Operational Resiliency

Resilience refers to the attributes that enable firms to anticipate and adapt rapidly to unanticipated disruptive events to avoid negative consequences (Hoffman & Hancock, 2017). Resilience is often viewed as a beneficial attribute for a firm and its members to cope with many types of challenges (Linnenluecke, 2017). It can better react to disruptions and even benefit from them because of survival, evolution, adaptability, and development, as well as forecast danger, limit the effects, and recover quickly. It can also quickly recover from unanticipated disruptions like terrorist attacks or natural disasters (Somers, 2009). After reviewing 85 impact factors publications regarding operational resiliency, we grouped some important operational resiliency frameworks to counter operational disruptions as shown in Figure 2.1. We analyzed that some resilient important frameworks or mechanisms, such as slack resource, recoverability, disruption absorption, risk management culture, reengineering, effective customer relationship management (CRM), multi-sourcing, and others are frequently mentioned and highlighted in these research papers. We use recoverability, disruption orientation, slack resource, and disruption absorption as key operational resiliency frameworks in this study to analyze the impact of these factors on operational efficiency and the competitive advantage of the firm.

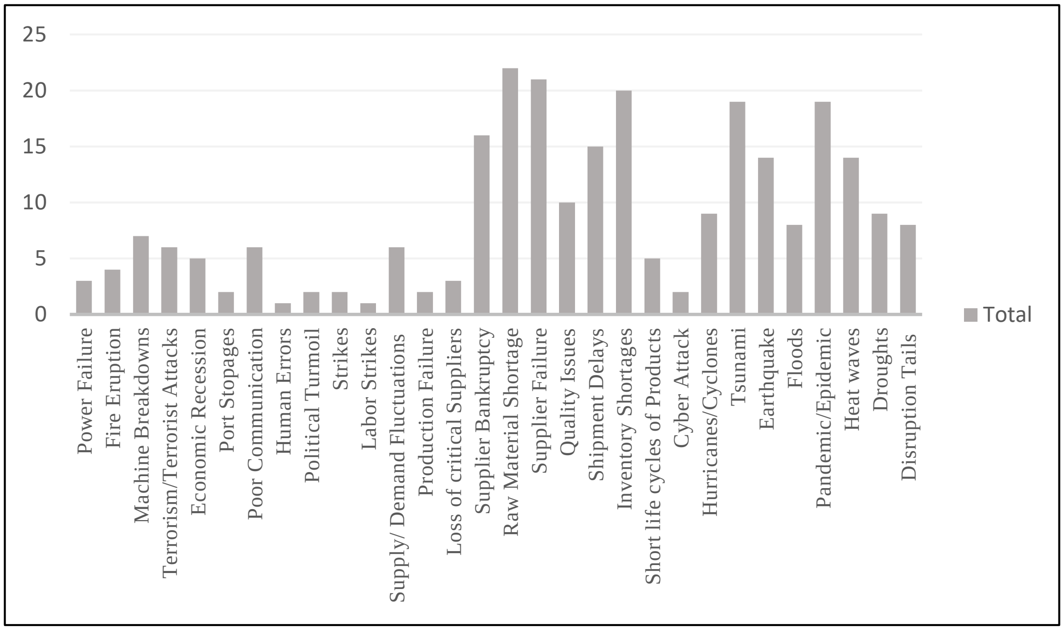
Figure 2.1: Operational Resiliency Frameworks Frequency



2.1.5 Operational Disruption

Operational disruption is defined as the frequency with which a firm's activities are disrupted by unanticipated events (Blackhurst et al., 2011). The ability of an organization to simply bounce back from a one-of-a-kind, irregular occurrence that produces vulnerability and needs a one-of-a-kind reaction has been defined as resilience (Ali et al., 2018; Somers, 2009). The capability to 'absorb' disruption or change with least disturbance, also the 'power to survive with unanticipated threats after they have appeared,' is described as resilience. In this perspective, resilience is referred to as an arrangement rather than a set of processes or actions to follow in the event of a disaster (Somers, 2009; Stolker et al., 2008). We reviewed 85 impact factors publications regarding operational disruption in which we classified natural and man-made operational disruptions. We observed that some operational disruptions, such as a shortage of raw materials, supplier failure, quality issues, supply/demand fluctuations, inventory shortages, and natural disasters such as earthquakes, floods, pandemics, and hurricanes are frequently highlighted and discussed in research papers as having a significant impact on firm business operations and performance as shown in figure 2.2.

Figure 2.2: Operational Disruptions Frequency



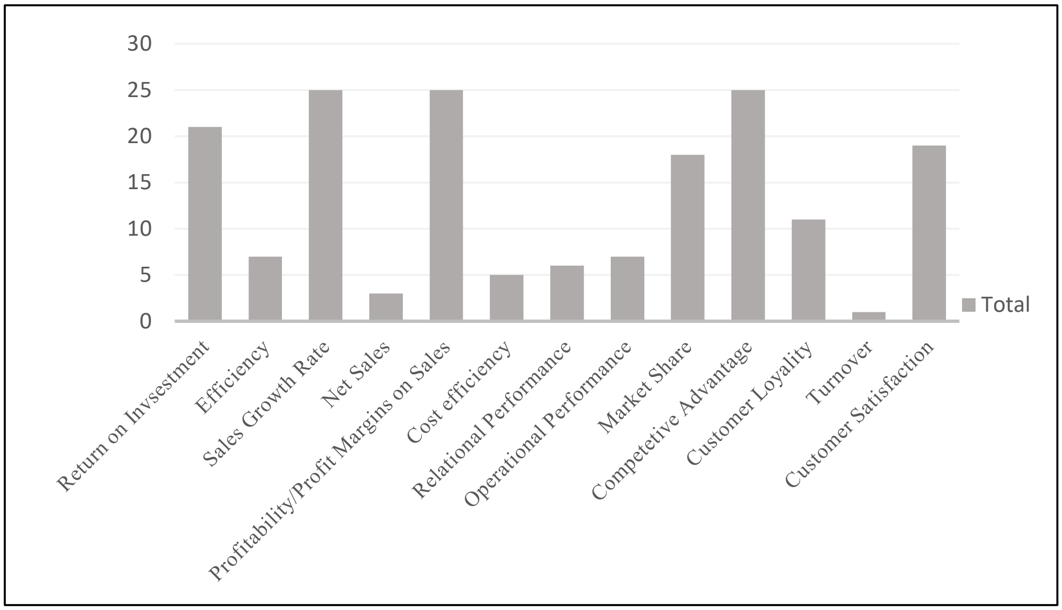
2.1.6 Operational Efficiency

When analyzing a company's profitability in proportion to its operational expenses, one can look at a statistic that is known as operational efficiency. Operational costs are taken into consideration to determine operational efficiency. When a company or investment has a positive return on its capital, the operations of that company or investment will be run more effectively. This is because the organization can generate a larger income or higher revenues while utilizing the same number of assets or utilizing fewer assets than its competitors. (Linnenluecke, 2017; Tognazzo et al., 2016). Resilience in terms of operational efficiency is put on a show when a business suffers a setback. An organization's resilience may have the reverse impact of what is intended in terms of production in a situation where there are few interruptions. As a result, the benefits of having high operational resilience in the face of minimal disruption are offset by the inefficiencies that result from having such high operational resilience (Essuman et al., 2020).

2.1.7 Competitive Advantage

A company's capacity to establish a dominant defensive position over its rivals is what is meant by the term "competitive advantage." Considered to be key indicators of a company that are used to evaluate and differentiate it from its competitors include on-time delivery, a reasonable price or cost, good quality, product differentiation, and versatility. (Abeysekara et al., 2019). A competitive advantage is a company's ability to supply customers with more value than it costs to do so. Superior value can be obtained by charging minor fees in exchange for comparable profits or by delivering extra benefits that outweigh the price rise (Ma, 2000). Only different global market strategies based on distinct expertise in quality, product, service technology or cost leadership have a chance of success. Developing a distinct competitive edge begins with achieving business excellence (Liu, 2013; Ma, 2000). After reviewing 85 operational resiliency impact factors publications regarding firm performance, we analyzed many firm performance indicators in Figure 3. We identify various indicators of business firm performance through these research papers, such as sales growth, return on investment, competitive advantage, market share, customer happiness, profitability, and others, which are commonly used in research articles. We take competitive advantage as one of the key indicators of firm performance as our study dependent variable to analyze the impact of operational disruption, resiliency, and efficiency on firm competitive advantage.

Figure 2.3: Firm Performance Indicators



2.2 Impact of resilient operations on competitive advantage and operational efficiency

H_{1a}: Operational resiliency has a positive and significant impact on competitive advantage

H_{Ib}: Operational resiliency has a positive and significant impact on operational efficiency

2.3 Impact of operational disruption on competitive advantage and operational efficiency

H_{2a}: Operational disruption has a negative and significant impact on competitive advantage

H_{2b}: Operational disruption has a negative and significant impact on operational efficiency

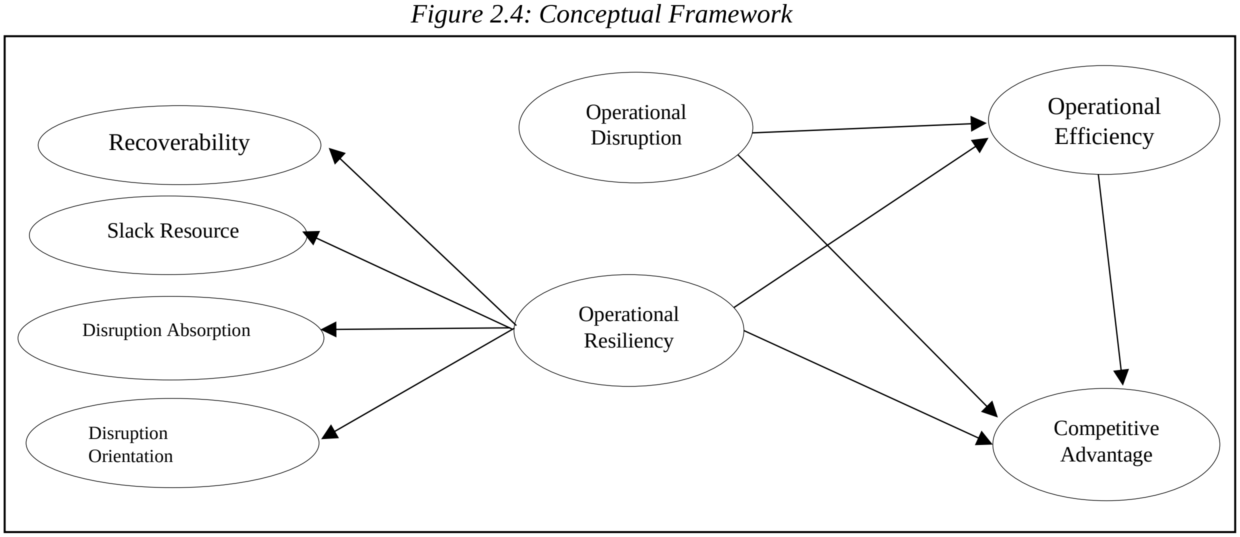
2.4 Mediating or Intervening role of operational efficiency

H_3: Operational efficiency significantly intervene/mediates the impact of operational resiliency on competitive advantage

2.5 Conceptual Framework

We developed a conceptual framework that consists of an independent variable for operational interruption as well as a second independent variable for operational resiliency. Because it incorporates four first-order constructs—recoverability, slack resource, disruption absorption, and disruption orientation—it is also what we refer to as our higher or second-order construct. All these first-order constructs are founded on the theories that were presented earlier. We use operational efficiency as a mediating variable in our research, and competitive advantage serves as our research dependent variable.

Figure 2.4: Conceptual Framework



3. METHODOLOGY:

This is a quantitative study, which is grounded on the positivist paradigm (Alharahsheh & Pius, 2020) Positivism is based on natural scientists' philosophical approach, which derives generalizations from observable reality in society (Scotland 2012; Saunders, Lewis, and Thornhill 2007). Quantitative research methods investigate phenomena and their interactions using numbers and everything that can be measured systematically (Paul D.Leedy, 2018). This research is casual and explanatory. Explanatory research aims to provide an explanation for a condition or problem under investigation, without requiring a causal relationship, as well as to explain patterns relating to the phenomenon under investigation. This research could have a flexible or fixed design (Colin Robson, 2002)**.** Explanatory research examines the relationship between phenomenon variables in an attempt to establish causal linkages between them (Saunders, 2007).

The deductive approach was used when we test the theory and develop a hypothesis, the research philosophy is a very essential element while conducting the research. The deductive approach is more aligned with positivist philosophy This study adopted the deductive method as hypotheses were developed and tested by using AMOS (Saunders et al., 2007). The SEM can be broken down into its parts, which are, respectively, a measurement model and a structural model. Each of these models represents a distinct aspect of the analyzed system (Keith, 2014) The structural model investigates the causal relationship between latent variables and their observable or measured counterparts, whereas the measured model examines the association between latent variables and their underlying observed or measured variables (Bryne, 2012) The structural equation model combines factor analysis with regression analysis (Hox and Bechger, 1998) The use of SEM makes it simple to evaluate numerous regression equations at the same time (Lomax and Schumacker, 2012) The structural equation model (SEM) is used to model the relationship among variables (Judea Peal, 2021) The structural equation model (SEM) can be used to evaluate a variety of theoretical models that propose how constructs are defined by a set of variables and how these constructs are interconnected. (Lomax and Schumacker, 2012) Once the theory-based model has been thoroughly established, the measurement technique for the construct is determined. After the data have been collected, SEM software is used to conduct an analysis that generates overall model fit indices and parameter estimates. (Bryne,2012) In this research non-probabilistic sampling was used because the sampling framework was unknown (Pace, 2021), and purposive sampling was used (Sivakumar et al. 2017). In the process of carrying out research, purposeful samples are also employed in a very widespread manner. The characteristics of a sample are said to have been defined for a purpose that is relevant to the study if the sample is considered to be of the purposive type.(Andrade, 2021) therefore, 266 samples were taken from the manufacturing industry.

3.1 Measures

Operational resilience is a second-order construct made up of four first-order components that are our study's independent variable: disruption absorption (three items), slack resource (four items), recoverability (four items), and disruption orientation (eight items) (Essuman et al., 2020). Operational efficiency (four items) and operational disruption (five items) are the second and third independent variables in our study, respectively (Essuman et al., 2020). Competitive advantage is our dependent variable (six items) derived (Abeysekara et al., 2019). Questionnaire of the survey comprised a total of forty-one items, including seven demographic questions and thirty-four construct-related questions.

4. RESULTS AND FINDINGS

The information was gathered between July 2nd and July 28th, 2021. There were 266 available responses out of 551 surveys submitted during this period, representing a response rate of 52 percent. Male respondents made up 91 percent of the total, while female respondents made up only 9%. 48 percent of respondents were between the ages of 20 and 30, while 42 percent were between the ages of 30 and 40. Graduates made up 44% of the respondents, while postgraduates made up 49%. Middle management accounts for 45 percent of responses, while senior management accounts for 19 percent. Production is represented by 27% of respondents, the supply chain is represented by 19% of respondents, and sales and marketing are represented by 21% of respondents. 37% of respondents have 3-5 years of working experience, while 29 percent have no work experience. Following are the graphs showing percentages of different groups. The analysis technique is maximum likelihood estimation, and structural equation modeling (SEM) utilizing AMOS is used. In operational resiliency research, SEM is preferable to regression analysis since it not only checks the measurement model at the same time - the relationship between each (latent) operational resiliency dimension and each item used to measure it – as well as the relationships between each latent variable, including dependent factors like a competitive advantage.

4.1 Descriptive Statistics

Regression analysis is frequently impossible if the data does not follow a normal distribution. The descriptive analysis is performed to assess whether the collected data is univariate normal. If the skewness and kurtosis ranges are between

-3 and +3, the data is considered normally distributed (Joseph F. Hair et al., 2019). Table 4.1 summarizes the findings of a study of standard deviation, variance, and mean in a descriptive statistical study.

Table 4.1: Reliability Analysis and Descriptive Statistics

Constructs	Mean	SD	Skewness	Kurtosis	Cronbach Alpha
Operational Disruption (OD)	12.1	4.1	-.11	-0.43	0.80
Slack Resource (SR)	13.8	3.0	-.07	0.27	0.74
Disruption Absorption (DA)	9.8	2.1	-.13	-0.51	0.63
Recoverability (RE)	14.7	3.1	-.23	-0.37	0.82
Operational Efficiency (OE)	12.3	3.2	.31	0.12	0.71
Competitive Advantage (CA)	21.2	3.9	-.63	0.18	0.88
Disruption Orientation (DO)	35.6	5.9	-.32	-0.42	0.86

4.2 Constructs Reliability

Internal consistency and closely related items incorrectly scattered data are assessed using Cronbach's alpha value. The data is considered accurate if the alpha value is greater than 0.7. Table 4.1 shows that except for one construct, the construct reliability (Cronbach's alpha values) in our study is more than 0.7, indicating good internal reliability (Henseler et al., 2015). The Cronbach's alpha value for the disruption absorption construct is slightly less than 0.7, which is adequate. The construct of competitive advantage, which we adopt as the study's dependent variable, has a Cronbach's alpha of 0.89.

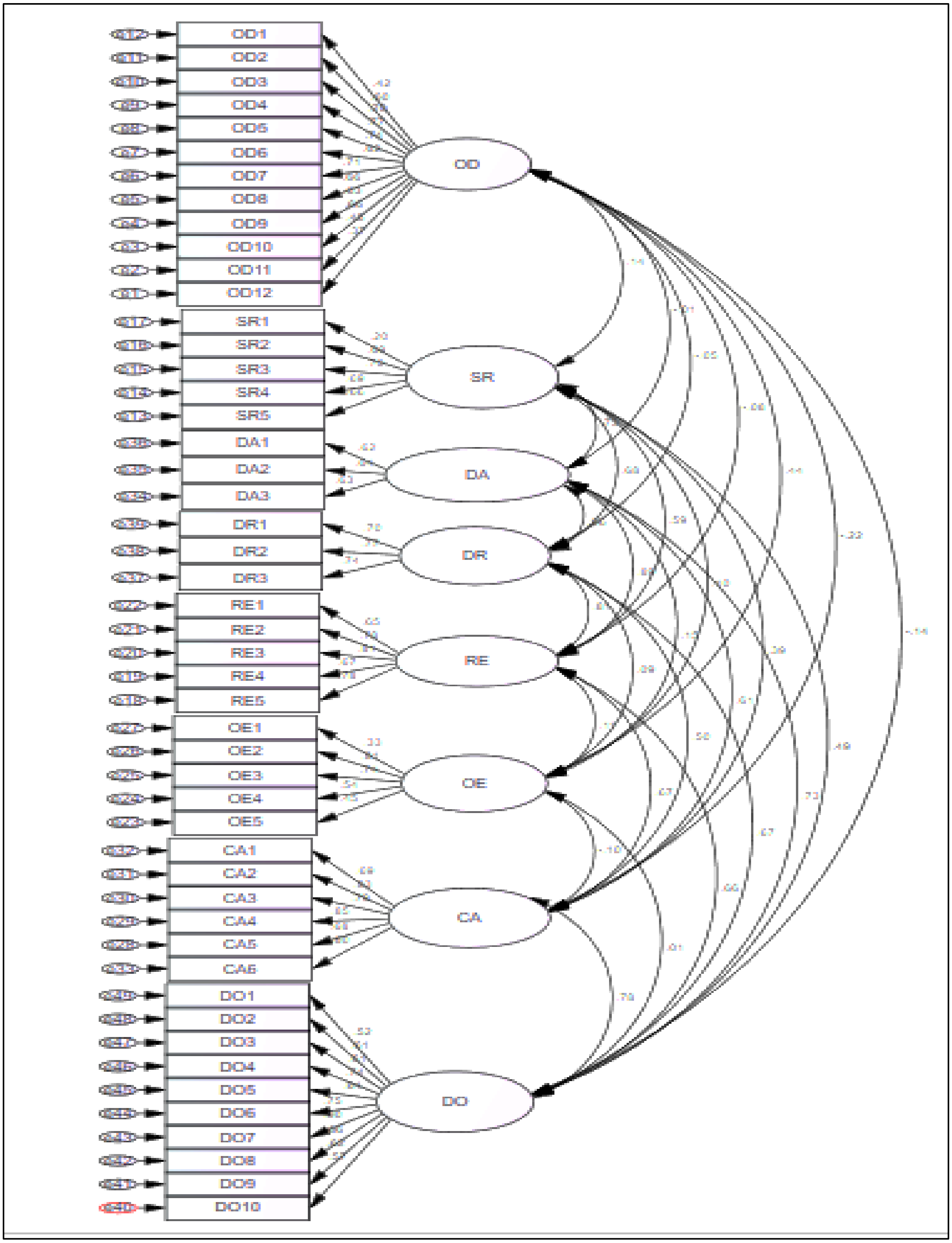
4.3 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis was used to investigate the relationships among indicator variables and constructs (latent variables). Table 4.3 results show that except for operational efficiency (KMO=0.68) and disruption absorption (KMO=0.66), the link among indicators (construct items) and constructs are substantial in almost all the cases, with KMO values more than 0.7 being significant. This is lower than the industry average of 0.7, but it's still respectable. For all constructs, the total variance explained is greater than 50% in Table 4.3, showing a significant and positive relationship between indicator variables and constructs (Joseph F Hair, 2021).

Table 4.3: Confirmatory Factor Analysis (CFA)

Constructs	Total Items	KMO & Bartlett's Test	Approx. Chi-Square	Total Variance Explained (TVE)
Operational Disruption (OD)	5	0.83	424.47	59.77 %
Slack Resource (SR)	4	0.79	264.41	58.95 %
Disruption Absorption (DA)	3	0.62	117.03	58.98 %
Recoverability (RE)	4	0.83	413.10	69.20 %
Operational Efficiency (OE)	4	0.65	241.37	56.53 %
Competitive Advantage (CA)	6	0.87	867.11	67.54 %
Disruption Orientation (DO)	8	0.85	716.28	63.47 %

Table 4.2: Measurement Model



4.4 Analysis of Covariance

Table 4.4 shows the covariance between the dependent variable competitive advantage and independent variable operational disruption is -0.107, showing that there is a significant link between these two variables, exhibiting negative covariance. There is no significant link between operational efficiency and operational disruption. The computed correlation between operational efficiency and operational interruption is 0.308, which is satisfactory. The correlation between operational interruption and operational efficiency is 0.308, showing a strong significant and positive relation between these variables. Except for operational efficiency and disruption orientation, which are both non-significant and negative, the association between second/higher-order elements of resilient operations (recoverability, slack resource, etc.) is positive but not significant.

Competitive advantage has a positive and significant covariance with the higher/second-order construct of resilient operations (recoverability, slack resource, disruption absorption, and disruption orientation variables). The negative statistical correlation between competitive advantage (dependent variable) and operational efficiency (mediating variable) is negligible. First-order constructs such as recoverability, slack resource, disruption absorption as well as disruption orientation variables, have significant and positive covariance.

Table 4.4: Covariance Analysis

Path			Estimate	S.E.	C.R.	P
Operation Disruption	←→	Disruption Absorption	-.016	.042	-.377	.706
Operation Disruption	←→	Recoverability	-.042	.043	-.967	.333
Operation Disruption	←→	Operational Efficiency	.308	.061	4.968	***
Operation Disruption	←→	Competitive Advantage	-.107	.041	-2.703	.008
Operation Disruption	←→	Disruption Orientation	-.048	.032	-1.503	.134
Slack Resource	←→	Disruption Absorption	.267	.046	5.927	***
Slack Resource	←→	Recoverability	.277	.047	6.124	***
Slack Resource	←→	Operational Efficiency	.022	.043	.506	.614
Slack Resource	←→	Competitive Advantage	.163	.036	4.578	***
Slack Resource	←→	Disruption Orientation	.158	.033	4.901	***
Recoverability	←→	Disruption Absorption	.361	.053	6.921	***
Operational Efficiency	←→	Disruption Absorption	.051	.043	1.171	.242
Competitive Advantage	←→	Disruption Absorption	.223	.041	5.602	***
Disruption Absorption	←→	Disruption Orientation	.218	.039	5.693	***
Recoverability	←→	Operational Efficiency	.018	.046	.413	.681
Recoverability	←→	Competitive Advantage	.308	.047	6.786	***
Recoverability	←→	Disruption Orientation	.242	.041	6.097	***
Operational Efficiency	←→	Competitive Advantage	-.074	.042	-1.812	.071
Operational Efficiency	←→	Disruption Orientation	-.003	.032	-.113	.908
Competitive Advantage	←→	Disruption Orientation	.243	.038	6.217	***

4.5 Construct Validity

The validity of constructs must be confirmed when they are employed in research because of the diversity that can occur due to demographic and cultural characteristics. Adapting the constructs employed in this study to the Pakistani population could change the results. As a result, to assure the study's consistency, it was required to verify the validity of the respondents' data. Convergent and discriminant validity are two methods used to examine the validity of a construct (Fornell & Larcker, 1981). The constructs used in this investigation were all adopted (Essuman et al., 2020).

4.5.1 Convergent Validity

To pass the convergent validity test, the AVE (average variance explained) must be more than 0.40. Because all of the AVE values in this study are larger than 0.4, the data complies with the convergent validity criterion (Joe F Hair et al., 2018)The data from the respondents in this study meets the criteria for convergent validity as shown in Table 4.5.

Table 4.5: Convergent Validity

Constructs	Average Variance Explained (AVE)
Operational Disruption (OD)	0.47
Slack Resource (SR)	0.45
Disruption Absorption (DA)	0.57
Recoverability (RE)	0.43
Operational Efficiency (OE)	0.63
Competitive Advantage (CA)	0.40
Disruption Orientation (DO)	0.43

4.5.2 Discriminant Validity

The discriminant validity test is used to determine the uniqueness of the associated variables. The discriminant validity test determines whether or not the variables are distinct (Joseph F Hair, 2021). The square root of the total variance explained, which must be greater than the value of each pair of correlations, is calculated as part of the discriminant validity test process (Joseph F Hair, 2021). As shown in Table 4, the data from the respondents in this study meets the criteria for discriminant validity.

Table 4.6: Discriminant Validity

Constructs	No. of Indicators	Square Root of AVE
Operational Disruption (OD)	5	0.69
Slack Resource (SR)	4	0.68
Disruption Absorption (DA)	4	0.76
Recoverability (RE)	4	0.65
Operational Efficiency (OE)	6	0.77
Competitive Advantage (CA)	3	0.64
Disruption Orientation (DO)	8	0.66

4.6 Confirmatory Factor Analysis (CFA) for Model Fitness

Confirmatory factor analysis in Table 4.7 is used in this study to investigate the model fitness of the constructs (CFA). After scale refinement, operational resiliency, disruptive event, and operational efficiency exceeded acceptable levels of the major fit indices, with the comparative fit index (CFI) exceeding the 0.9 critical thresholds (Service et al., 1998). The value of CMIN/DF should be less than 5, hence this model's CMIN/DF is 1.1671, which is less than 5, suggesting that the model is acceptable. The goodness of fit is also measured by the IFI and TLI values, which should all be more than 0.9 in this model. However, the model is fit and significant because all three values are greater than 0.9 (Service et al., 1998). The PCFI and PNFI should both be more than 0.7 and the findings show that they are significant, showing that the model is valid. This model's RMSEA and RMR or SRMR badness of fit should be less than 0.8, which they are, showing that it's significant (Service et al., 1998).

Table 4.7: Confirmatory Factor Analysis (CFA)

CMIN/DF	CFI	TLI	PGFI	RMR	GFI	AGFI	PNFI	PCFI	RMSEA
1.671	0.909	0.900	0.713	0.057	0.839	0.810	0.725	0.820	0.052

4.7 Regression Analysis

Regression weights ate showing the effect and relationship between mediation and independent variables. The results reveal that operational resiliency has no significant impact on operational efficiency as the p-value is greater than 0.05. Whereas the impact of operational disruption on operational efficiency is significant as the p-value is less than 0.05, moreover, when operational resiliency increases by one-unit, operational efficiency increases by 0.442 units, which is significant. Because P-value is less than 0.05. The impact of the second-order construct on its first-order variables is substantial. The results show that operational resiliency has a substantial impact on attaining the competitive advantage, an increase in operational resiliency by one unit increases the competitive advantage by 1.123 units, and the p-value is also less than 0.05. The impact of operational disruption and operational efficiency as independent and mediating variables on competitive advantage is not significant because P is greater than 0.05. Increasing one unit of operational disruption affects operational efficiency by -0.083 and -0.098, respectively.

Figure 4.8: Conceptual Framework with Regression Weights

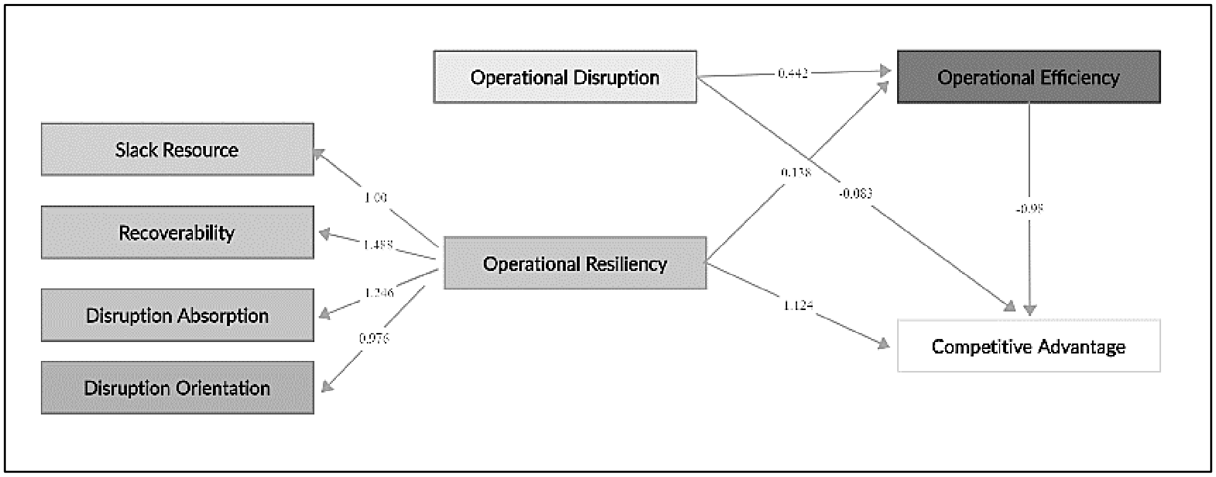


Table 4.9: Regression-Weights

Path			Estimate	S.E.	C.R.	P
Operational Efficiency	←→	Operational Resilience	.138	.143	.978	.328
Operational Efficiency	←→	Operational Disruption	.442	.080	5.530	***
Slack Resource	←→	Operational Resilience	1.000			
Disruption Absorption	←→	Operational Resilience	1.246	.191	6.507	***
Recoverability	←→	Operational Resilience	1.488	.201	7.377	***
Disruption Orientation	←→	Operational Resilience	.976	.157	6.257	***
Competitive Advantage	←→	Operational Resilience	1.124	.167	6.676	***
Competitive Advantage	←→	Operational Disruption	-.083	.047	-1.701	.088
Competitive Advantage	←→	Operational Efficiency	-.098	.051	-1.928	.053

4.8 Total Indirect (mediated) Effect and Direct (unmediated)

The total effect of operational resiliency on operational efficiency (direct and indirect) is 0.138. When operational resiliency improves by one, operational efficiency increases by 0.138 of resilient operations operational efficiency due to both direct (unmediated) and indirect (mediated) effects (Kline, 2015). The total effect of operational disruption (direct and indirect) on operational efficiency is 0.442. When operational disturbance increases by one-unit, operational efficiency increases by 0.442 units due to both direct (unmediated) and indirect (mediated) effects of operational disruption on operational efficiency. Operational resiliency has a total direct and indirect effect on the competitive advantage of 1.108. Because operational resiliency has both direct (unmediated) and indirect (mediated) effects on competitive advantage, increasing operational resiliency by one result in a 1.108 gain in competitive advantage. The total impact of operational disruption (direct and indirect) on competitive advantage is -0.126. That is, while operational disruption rises by one-unit, competitive advantage falls by 0.126 units. This is because operational disruption has both direct (unmediated) and indirect (mediated) competitive advantage consequences. The total effect of operational efficiency (direct and indirect) on competitive advantage is -0.098. Because operational efficiency has both direct (unmediated) and indirect (mediated) effects on competitive advantage, a one-unit increase in operational efficiency decreases competitive advantage by 0.098 units.

Figure 4.10: Structural model

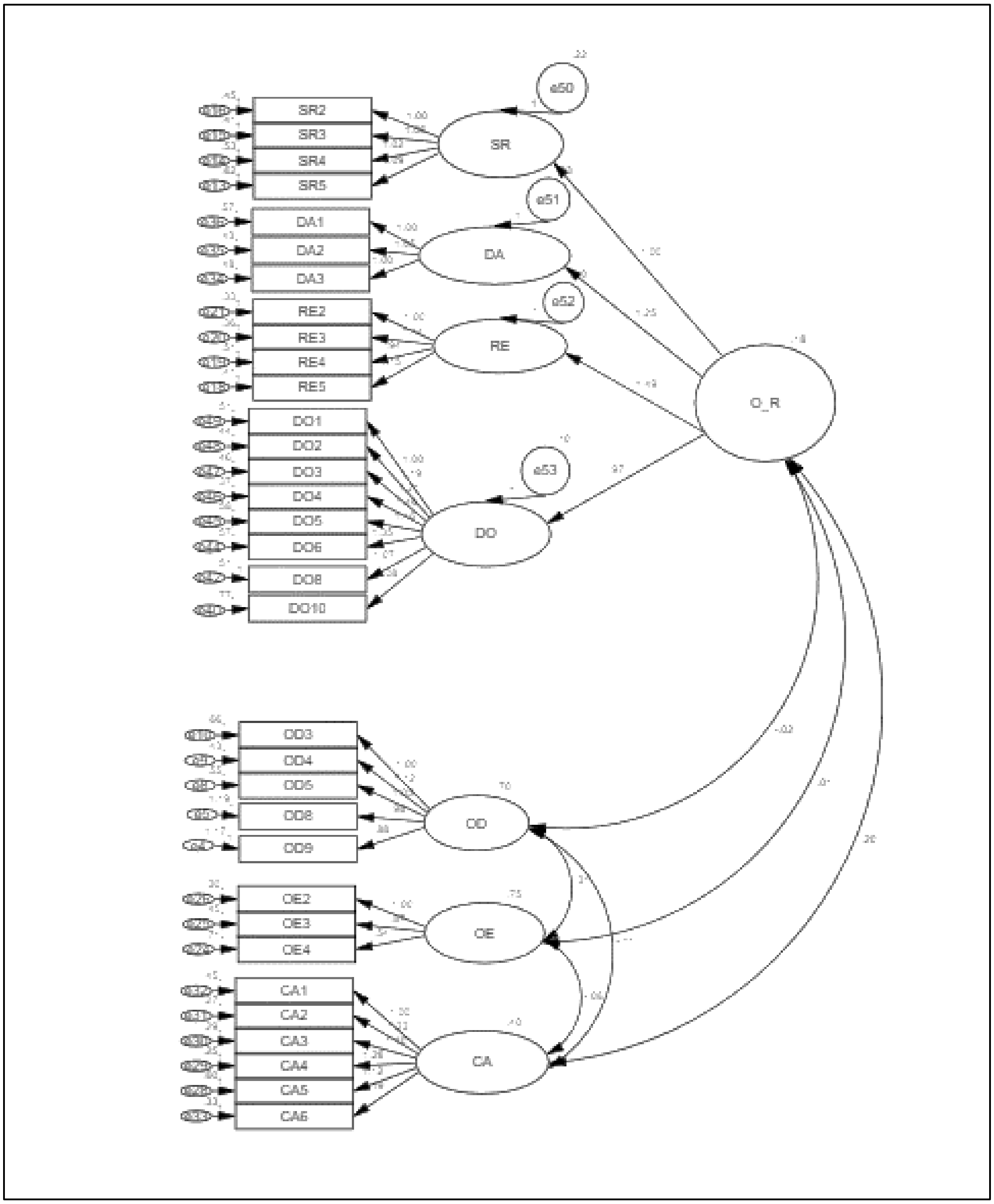


Table 4.11: Total Effects

	Operational Resilience	Operational Disruption	Operational Efficiency	Disruption Orientation	Disruption Absorption	Competitive Advantage	Recoverability	Slack Resource
Operational Efficiency	.138	.442	.000	.000	.000	.000	.000	.000
Disruption Orientation	.976	.000	.000	.000	.000	.000	.000	.000
Disruption Absorption	1.248	.000	.000	.000	.000	.000	000	.000
Competitive Advantage	1.108	-.126	-.098	.000	.000	.000	.000	.000
Recoverability	1.488	.000	.000	.000	.000	.000	.000	.000
Slack Resource	1.000	.000	.000	.000	.000	.000	.000	.000

4.10 Direct-Effects (unmediated)

Operational resilience has a direct (unmediated) effect on the operational efficiency of 0.138. That is because operational resiliency has a direct (unmediated) influence on operational efficiency, when operational resiliency increases by one, operational efficiency increases by 0.138. Operational disruption has a direct (unmediated) effect on the operational efficiency of 0.442. That is, when operational disruption increases by one, operational efficiency increases by 0.442 because operational disruption has a direct (unmediated) influence on operational efficiency.
Operational resiliency has a direct (unmediated) effect on the competitive advantage of 1.124. That is because operational resiliency has a direct (unmediated) influence on competitive advantage, when operational resiliency increases by one, competitive advantage increases by 1.124. Operational disruption has a direct (unmediated) effect on the competitive advantage of -0.083. Each increase in operational disruption diminishes competitive advantage by 0.083 units due to the direct (unmediated) effect of operational disruption on competitive advantage. Operational efficiency has a direct (unmediated) effect on the competitive advantage of -0.098. Because operational efficiency has a direct (unmediated) influence on competitive advantage, increasing operational efficiency by one reduces competitive advantage by 0.098 units.

Table 4.12: Direct-Effects

	Operational Resilience	Operational Disruption	Operational Efficiency	Disruption Orientation	Disruption Absorption	Competitive Advantage	Recoverability	Slack Resource
Operational Efficiency	.138	.442	.000	.000	.000	.000	.000	.000
Disruption Orientation	.976	.000	.000	.000	.000	.000	.000	.000
Disruption Absorption	1.248	.000	.000	.000	.000	.000	.000	.000
Competitive Advantage	1.124	-.083	-.098	.000	.000	.000	.000	.000
Recoverability	1.488	.000	.000	.000	.000	.000	.000	.000
Slack Resource	1.000	.000	.000	.000	.000	.000	.000	.000

4.11 Indirect or Mediated-Effects

The indirect or mediated impact of operational efficiency on competitive advantage is -0.014. Because operational efficiency has an indirect (mediated) effect on competitive advantage, increasing operational efficiency by one reduces competitive advantage by 0.014 units. The effect of operational disruption on competitive advantage is -0.042. Because of the indirect effect of operational disruption on competitive advantage, every one unit increase in operational disruption reduces competitive advantage by 0.044 units.

Table 4.13: Indirect-Effects

	Operational Resilience	Operational Disruption	Operational Efficiency	Disruption Orientation	Disruption Absorption	Competitive Advantage	Recoverability	Slack Resource
Operational Efficiency	.000	.000	.000	.000	.000	.000	.000	.000
Disruption Orientation	.000	.000	.000	.000	.000	.000	.000	.000
Disruption Absorption	.000	.000	.000	.000	.000	.000	.000	.000
Competitive Advantage	-.014	-.044`	000	.000	.000	.000	.000	.000
Recoverability	.000	.000	.000	.000	.000	.000	.000	.000
Slack Resource	.000	.000	.000	.000	.000	.000	.000	.000

Hypothesis 1a To put it another way, the more resilient a business is, the more competitive it is likely to be. In this situation, we accept our alternative hypothesis that operational resiliency has a large impact on a firm competitive advantage, thus we enhance our operational resiliency by one unit. It has been found that operational resiliency has a substantial impact on establishing a competitive advantage in the marketplace.

Hypothesis 1b According to this concept, the degree to which a corporation can maintain its operations throughout time has a considerable influence on the efficiency of those operations. However, the findings of the experiments reveal that operational resiliency does not have a substantial impact on operational efficiency. This is because the value of the P-value is larger than 0.05., which is statistically insignificant, leading us to infer that our alternative hypothesis is not valid.

Hypothesis 2a This hypothesis says operational disturbance hinders competitive advantage. We can't accept our alternative hypothesis since operational disruption's influence on competitive advantage is also not significant. P is more than 0.05, and competitive advantage reduces by only -0.083 units for every unit of operational disruption.

Hypothesis 2b According to this hypothesis, there is a considerable and positive impact that operational disturbance has on the overall efficiency of the operation. We are going to go ahead and accept our alternative hypothesis because the value of P is lower than 0.05. The influence of operational disruption on operational efficiency is large and favorable. This is because an increase of one unit in operational resiliency increases 0.442 units in operational efficiency, which is a significant amount.

Hypothesis 3 According to this hypothesis, operational efficiency boosts competitive advantage by mitigating the effects of operational resiliency and disruption. The p-value for operational efficiency as a mediating variable with operational disruption and operational resiliency on competitive advantage is over 0.05, meaning the impact is not significant. A one-unit increase in operational disruption and operational resiliency reduces operational efficiency by -0.098 units.

5. DISCUSSION

Resiliency in operations, according to this hypothesis, has a significant impact on competitive advantage. The results show that operational resiliency has a significant impact on gaining competitive advantage, which endorses the results of a previous study (Abeysekara et al., 2019) with increasing operational resiliency by 1 unit increases competitive advantage by 1.124 units, indicating that operational resiliency has a very significant impact on firm competitive advantage, so we accept our alternative hypothesis in this case. A firm resilient in operations, according to this hypothesis, has a significant impact on operational efficiency, But the test results reveal that operational resiliency has no meaningful impact on operational efficiency because the value p-value is more than 0.05, which confirms the results of a previous study (Essuman et al., 2020). So, we reject our alternative hypothesis because while operational resiliency increases by one-unit, operational efficiency only increases by 0.138 units, which is statistically insignificant. Operational disruption, according to this hypothesis, has a negative and significant impact on competitive advantage. We can't accept our alternative hypothesis since the impact of operational disruption on competitive advantage is also not significant, as the p-value is more than 0.05, and competitive advantage drops by only -0.083 units when operational disruption increases by 1 unit, which isn't significant. Operational disruption, according to this hypothesis, has a significant and positive impact on operational efficiency. As the value of P is less than 0.05, so we accept our alternative hypothesis. The impact of operational disruption on operational efficiency is significant and positive, as when operational resiliency increases by one-unit, operational efficiency increases by 0.442 units, which is significant. Operational efficiency, according to this hypothesis, has a positive impact on competitive advantage by mediating the effects of operational resiliency and operational disruption. The impact of operational efficiency as a mediating variable with operational disruption and operational resiliency on competitive advantage is not significant because the p-value is greater than 0.05. Increasing one unit of operational disruption and operational resiliency decreases operational efficiency by -0.098 units, this is statistically insignificant.

6. CONCLUSION

According to the theoretical perspective we discussed earlier in which operational resiliency and operational efficiency both play a vital role in enhancing firm performance taking competitive advantage as a key performance indicator of business organizations. But different events of man-made and natural operational disruption impact negatively on gaining competitive advantage and ultimately firm performance declines as described by theory. Also, operational resiliency has a significant and positive impact on operational efficiency, but operational disruption didn't have any role in increasing operational efficiency according to the theory. From the literature we discussed earlier after reviewing 85 impact factors research publications, we analyze that operational resiliency enhances firm competitive advantage same as in theoretical perspective and operational disruption reduces firm competitive advantage. Operational efficiency didn't have any major role in enhancing a firm competitive advantage according to the literature reviewed. Operational resiliency and disruption also play a significant and non-significant role in increasing firm operational efficiency respectively in the light of the literature reviewed.

From the results analysis of our study based on data taken from 266 respondents through a structured questionnaire from the manufacturing industry of Pakistan, it is observed that a firm's resilient business operations have a significant impact on the firm competitive advantage while the impact of operational disruption and operational efficiency as independent and mediating variables respectively on competitive advantage is not significant. So, we can conclude that resilient business operations play an important role in enhancing and improving a firm competitive advantage as the impact or effect of resilient business operations has a significant effect on competitive advantage. Resilient operations for firms have gained much importance to be competitive in the market due to the uncertain business environment nowadays. Firms and organizations must consider their business operations resiliency in events of natural and man-made operational disruption as an important factor for enhancing and improving their competitive advantage in today's world of complex environments for business than ever before. This study also shows the non-significant impact of operational disruption events on competitive advantage. Operational disruptions also have no significant impact on mediating variable operational efficiency. Operational efficiency as mediating variable plays no significant role in gaining a competitive advantage. So, firms can take resilient operations as a key factor to improve and enhance a firm’s competitive advantage. According to this research, operational disruption and operational efficiency do not play an important role in gaining a competitive advantage.

7. RESEARCH LIMITATIONS AND FUTURE IMPLICATIONS

The limitation of the research work is that it's only for the manufacturing industry of Pakistan. Respondents are only from the manufacturing industry and are not included in the service industry. Also, this study can proceed further to find the relationship and impact of resilient business operations on the overall firm's performance including revenues, profits, quality, and customer satisfaction. Several other factors can be concluded in firm performance as return on investment, sales growth rate, net sales, profit margins on sales, cost efficiency, market share, customer loyalty, turnover, and operational performance. Also, for operational resiliency, we can take other factors like strategic alliance, multi-sourcing, process reengineering, lean manufacturing, agility, contingency planning, integration capabilities, mergers and acquisitions, and risk management culture. Other operational disruptions as economic recession, production failure, supply/demand fluctuations, supplier failure, shipment delays, inventory shortages, machine breakdowns, and labor strikes. We can find relationships between above mentions factors of operational resiliency, operational disruption, and firm performance.

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