

Implementation of Risk Management in South African Manufacturing Firms

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Abstract

The manufacturing sector has become one of the competitive industries. The demands of a competitive business environment require business firms to be able to respond well to uncertainties. The study aimed to identify the risks and the risk management strategies in the South African manufacturing environment. The study used survey questionnaire to collect quantitative and qualitative data required to answer the research questions. The collected data was analysed through grouping of themes, proportional analysis and descriptive statistics. The research results indicated that risks experienced in manufacturing firms are strategic risks, operational risks, financial risks and hazardous risks. The study found that the risk management strategies employed by the majority of the firms are precautionary risk management strategies and risk informed strategies, where with precautionary risk strategy, mitigation measures are taken even though the causes and the effects of the suspected risks are not fully proven and with risk informed strategies the organization's risk appetite, risk culture and risk governance are taken into consideration when addressing risks. The research further found that manufacturing firms are more familiar with risk management tools like FMEA, risk matrix approach and brainstorming.

Keywords

Risk, Risk management, Manufacturing, Risk management strategies, Risk assessment

1. Introduction

The manufacturing industry contributes to the global economy, it serves as an engine for economic growth, social development and political advancement for many developing countries (Adeniran, Agbaje & Adeosun, 2019; Gabriel, 2019; Zhao & Tang, 2018). The industry also brings forth prospects of capital accumulation (Gabriel, 2019). Other sectors such as service; construction; mining and agriculture also play a big role in the Gross Domestic Products (GDP) growth and customarily require infrastructure provided by the manufacturing industry. Within the manufacturing sector, industries that highly contribute to the growth of Gross Domestic Products include electrical machinery and equipment; metal products, food, beverages, tobacco and chemicals (Zhao and Tang, 2018).

The manufacturing sector is a competitive industry, businesses across the globe chase profit and customers demand value at a lower cost. South African manufacturing industry is facing a challenge to compete with other manufacturing firms globally due to operational risks associated with a high cost of raw materials, labour, and electricity (Bhorat and Rooney, 2017). Some enterprises do not have resources to endure systems like globalisation, legislation, new technology, market expansion and open trade barriers which contribute to high competition in doing business (Ferreira de Araújo Lima, Crema and Verbano, 2020a). Local products cost fortunes as compared to imported goods, this results in a high influx of cheap goods from other countries, thus affecting sales and production volumes in manufacturing. The demands of the highly competitive business environment require efficient risk management. It is important for manufacturing firms to know the industry risks and have the ability to respond to uncertainties and unforeseen circumstances. Good risk management is a good competitive advantage as it sets the company ahead of the rest of the market and it create opportunities for potential grow the business.

1.1 Objectives

According to Krüger, Dickason and Meyer (2020), enterprises encounter numerous risks that could be associated with employees, management, business reputation, operations and regulations. Failure to manage risks could lead to a big loss for the organization and even result to the end doing business (Mishra, Rolland, Satpathy & Moore, 2019). Various industries including banks, insurance, manufacturing and others continue to consider risk management as an important element of managing and making decisions in business (De Oliveira, Marins, Roch & Salomon, 2017). The objectives of this study were to determine:

- I. The risks in the South African manufacturing environment.
- II. The risk management strategies employed in South African manufacturing.

2. Literature Review

2.1 Risks in the Manufacturing Industry

Literature defines the term "risk" in a variety of ways. In principle, risk can be both a threat and an opportunity, of which an opportunity is a positive divergence from the planned key performance indicator (Klöber-Koch, Braunreuther and Braunreuther 2017), this is supported by Fang (2016) that risk is a social-economic phenomenon with two or more possible outcomes due to uncertainties. However, the positive component is overlooked in this paper, only negative effects are considered. According to Sifumba, Mothibi, Ezeonwuka, Qeke & Matsoso, (2017:387), risk is a “probability of loss and the magnitude of that loss is detriment”. Aven (2016) defines risk qualitatively as a probability of an unfavourable occurrence; potential for the realization of unwanted, bad effects of an event; the exposure to an unclear proposition and the repercussions of an action associated uncertainty. Risk can also be quantified by multiplying the likelihood of occurrence by the amount of harm they cause when they occur (Klöber-Koch, et al., 2017). One of the performance indicators widely used to measure risk is Key Risk Indicator (KRI), this indicator monitors a specific risk, and it provides a forward direction and information regarding the risk that may or may not exist, as well as a warning system for future actions (Tupa, Simota & Steiner, 2017).

As much as it’s important for businesses to take on risks that they can handle, but time to time the enterprises are forced to take risky decisions to remain afloat (Krüger, Dickason and Meyer, 2020). The manner in which risk is understood and characterized has a significant impact on how the risk is analysed, thus it can have a big implication on the overall risk management. Literature divides the risks encountered by firms into four categories, namely: strategic risk, operational risk, financial risk and hazard risk (Mishra *et al.*, 2019).

- i. Strategic risks: Strategic risks are risks that could have an impact on achieving the strategic objectives of the organization, this can be short-term, medium-term or long-term goals.
- ii. Operational risks: Operational risks are risks affecting operational management strategy, this type of risk stems from the enterprise functions and processes.
- iii. Financial risks: Financial risks are risks due to the market behaviour, exchange rates, and product costing and company liquidity.
- iv. Hazard risk: Hazardous risks are risks due to natural disasters and political influence. The occurrence of such risks are outside the business control.

Table 1 below provides a summary of the risks identified in the manufacturing industry. The first and the second columns present the main risk categories and the examples of each risk factor respectively, and the third column gives the source of information. Risks identified under strategic, financial and hazardous risks are mostly macro environmental factors and the identified operational risks are internal micro environmental factors.

Table 1. Risks identified in the manufacturing sector

Risks Identified		Reference
Strategic Risks	<ul style="list-style-type: none"> • Changes in customer demands • Customer and supplier relations • Budget overruns • Product market alignment • Offensive marketing and advertisement 	<ul style="list-style-type: none"> • Ferreira de Araújo Lima et al. (2020) • Mishra et al. (2019) • Kádárová & Durkáčová (2012)

Risks Identified		Reference
	<ul style="list-style-type: none"> • Ethics violation • Product design and development • Mergers and industry consolidators • Inadequate management oversight 	
Operational Risks	<ul style="list-style-type: none"> • Raw materials risks • People risks • Process risks • Technological risks • Other risks 	<ul style="list-style-type: none"> • Krüger et al. (2020) • Tupa et al. (2017) • Naudé & Chiweshe (2017) • Klöber-Koch et al. (2017) • Sumbal et al. (2020) • Marodin & Saurin (2015)
Financial Risks	<ul style="list-style-type: none"> • Fluctuation of interest rates • Changes in currency and exchange rates • Economic recession • Revenue management • High commodity prices 	<ul style="list-style-type: none"> • Mishra et al. (2019) • Kádárová & Durkáčová (2017) • Naudé & Chiweshe (2017)
Hazard Risks	<ul style="list-style-type: none"> • Compliance to the law and legislations • Health and safety risks • Pollution • Natural disasters • Disease and pandemics • Unfavourable weather conditions 	<ul style="list-style-type: none"> • Mishra et al. (2019) • Kádárová & Durkáčová (2012)

2.2 Risk Management Strategies

Risk management is the process of managing risk in a particular system. It is a systematic approach that involves identifying, assessing and understanding potential risks and while evaluating the current control measures in place, if the controls are not enough to manage the risk to an acceptable level, then actions are taken to bring down the risk level and possibly mitigate the risk (Tupa, et al., 2017). Risk management assist businesses to manage risks, achieve profits and improve safety and business reputation (Aven, 2016). Research has shown that those who adopt risk management strategies are more likely to grow and survive the uncertainties (Naude and Chiweshe, 2017). Risk management strategies can be classified into three categories as illustrated in Figure 1 below. The categories include risk informed strategies, discursive strategies and precautionary strategies. The implementation of these three strategies can be mutually inclusive, which means an organization can choose to implement two strategies simultaneously.

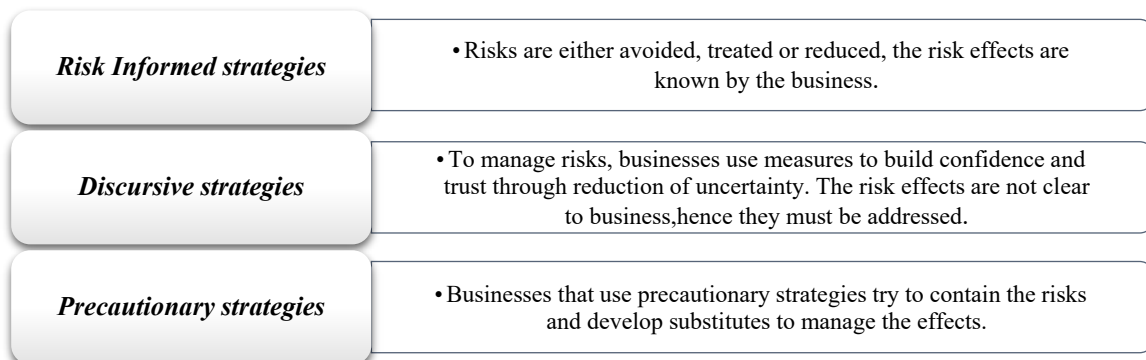


Figure 1. Three risk management strategies (Aven, 2016)

2.2.1 Important Process Steps for Risk management

The process of risk management consist of four elements; risk identification, risk assessment, risk response and risk control (Tupa, Simota and Steiner, 2017), see Figure 2. Klöber-Koch, et al. (2017) put an emphasis on risk prioritisation after assessing, they reckon that this step will ensure that the most threatening factors are highlighted and given a priority. All employees including line workers, supervisors, managers and executives must work together to effectively manage risk (Ferreira de Araújo-Lima, Crema & Verbano, 2020).

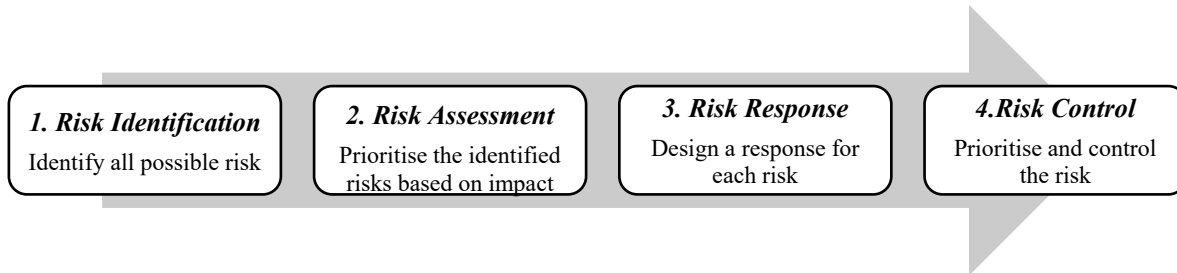


Figure 2. Risk Management Process (Naude and Chiweshe, 2017)

3. Risk Assessment Methods

The second process step in risk management is risk analysis also known as risk assessment as presented above in Figure 2. After identifying all the potential risks, it is important to know their risk level and their impact. The methods of risk assessment can be classified into two groups, quantitative and qualitative. The tools used for both methods are presented in Table 2. The quantitative tools are based on numerical results, calculating the probability, occurrence and the impact while the qualitative tools are based on experience and group discussions.

Table 2. Risk Assessment tools (Ferreira de Araújo Lima et al., 2020)

<i>Risk Assessment tools</i>	
<i>Quantitative</i>	<i>Qualitative</i>
Decision tree analysis	Brainstorming
Expected value	Delphi Techniques
Failure Mode Effect Analysis (FMEA)	Expert Judgement
Fault Tree Analysis (FTA)	Facilitated Risk Assessment Process
Monte Carlo simulation	Interviews
Risk Matrix Approach	Risk Register
Sensitivity Analysis	SWOT Analysis
	Risk Categorization
	Scenario Analysis

4. Data Collection

The study used survey questionnaire to collect both quantitative and qualitative data to identify and understand the risks and risk management strategies in manufacturing environment. The questionnaire was distributed to the participants using two electronic channels, email and LinkedIn. The process followed for data collection is summarised in Figure 3, starting from identifying the data collection methodology suited for the study. Quantitative questions were closed ended questions, using the Likert scale to rate as the responses, while the qualitative questions were open-ended questions, giving the respondents an opportunity to give details on their responses.

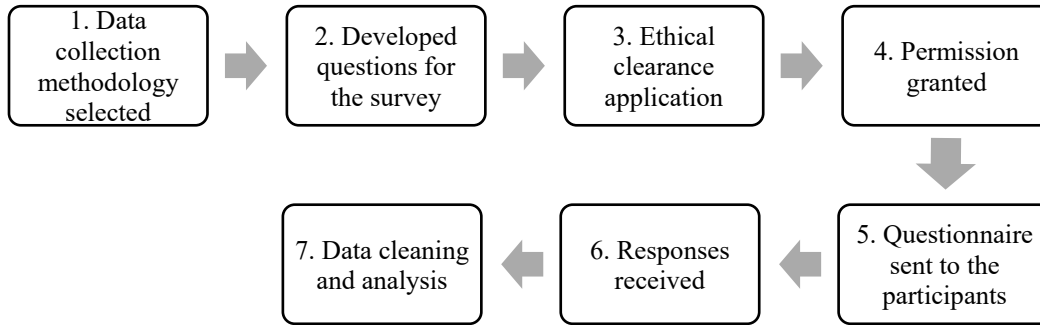


Figure 3. Data collection process followed

5. Results and Discussion

5.1 Respondent Profile

The majority of the respondents belonged to organizations that employed more than 200 employees (58%), followed by those who belonged to firms with 101 to 200 employees (17%), then 0 to 50 employees (15%) and lastly those who belonged to firms that employed 51 to 100 employees (10%). A representation of 46% were engineers who showed a majority of interest in the survey, followed by production managers at 21%, then technicians with the representation of 15%. Senior managers and managing directors had a representation of 6% each, then executive managers, specialists and accountants with a representation of 2% each. It was important to get a representation of all the stakeholders who influence the risk management of the organization.

5.2 Results

Every business in the manufacturing industry has certain risks that they are exposed to from time to time and if those risks are not well managed, they can affect the growth of the business negatively. The companies with 0 to 50 people and 101 to 200 people reported to experience operational risks more than strategic, financial and hazardous risks. The respondents who belonged to companies with 51 to 100 people reported to experience strategic risks more, while respondents who belonged to companies with above 200 employees reported to experience both strategic risks (47%) and operational risks (47%) often, full results of risks that prevent firms from achieving business goals are shown in Figure 4.

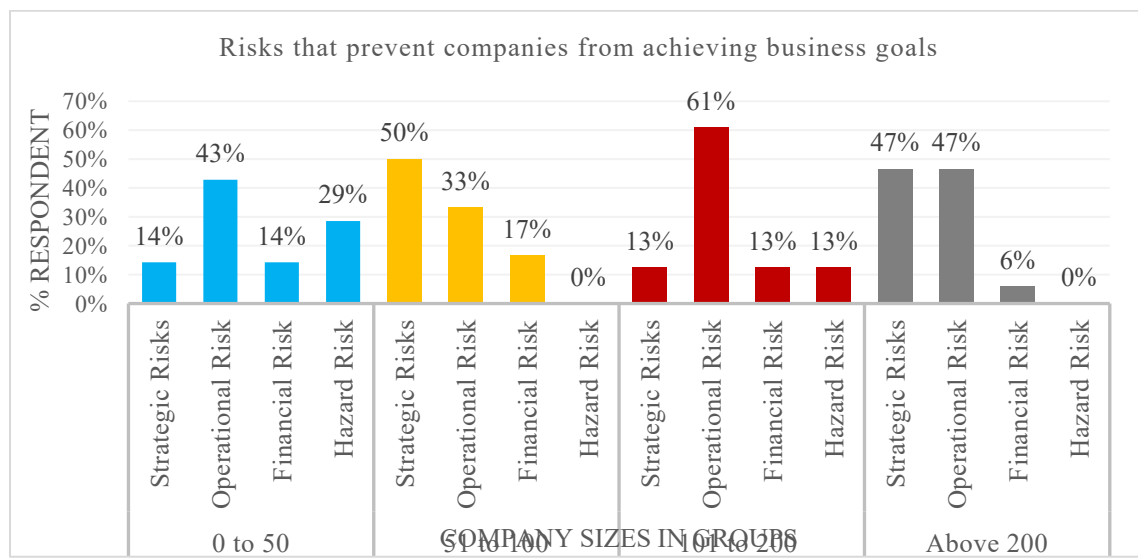


Figure 4. Risks that prevent companies from achieving business goals based on company size

Respondents were given six strategic risks to rate often their organizations experience strategic risks on a scale of never; rarely; sometimes; often and always, the representation of responses is presented in Figure 5. Although the results in Figure 5 indicate that the majority of the manufacturing firms are not affected by the changes in customer demands, supplier relation risks, budget overruns and other strategic risks, according to a report published by Statistics South Africa in March 2022, there was a decline in manufacturing production early 2020 when covid-19 pandemic was declared. The total index value in May 2020 was 45,4 from averaging at 90 for more than a year(Statistics South Africa, 2022).

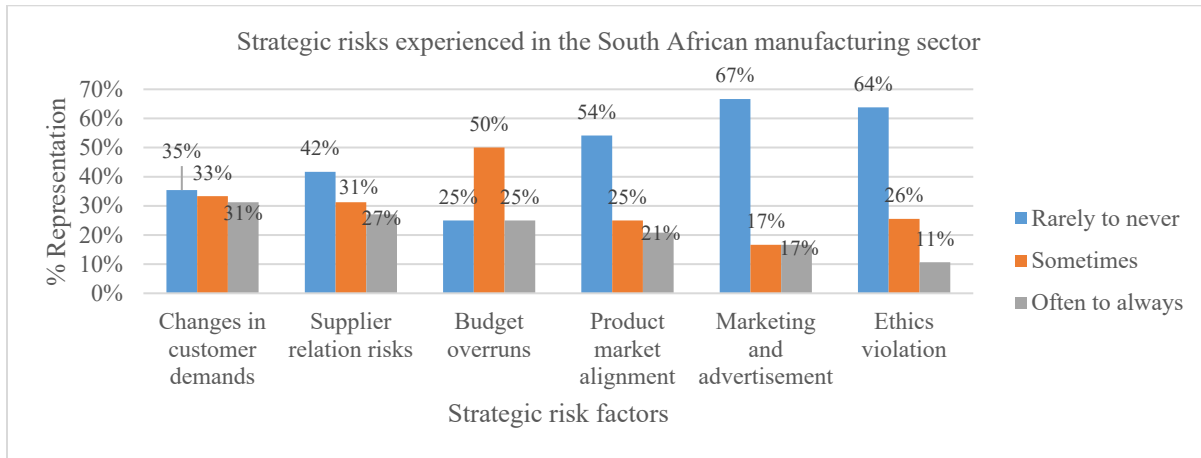


Figure 5. Strategic risks experienced in the South African manufacturing sector

Respondents were asked to rate how often they experience operational risks in their organizations, the items to be rated were 4, the responses are presented graphically in Figure 6. Even though the analysis of results indicates that the majority of the respondents don't experience operational risks often. According to a report on the Business impact of the COVID-19 pandemic in South Africa, conducted by Stats SA (2020), there were disruptions on the supply chain of raw materials within South Africa. The study indicated that businesses were not able to access the required materials, goods and services to run daily operation. This report was published during the period of natural state of disaster. Referring to section 5.1 of this report, the majority of the participants on this research were engineers (43%) and in most cases people who occupy such positions are not involved in the raw material supply chain, the procurement department handles such and often involve production managers as the end users, hence the majority of the respondents are not aware of the operational risks.



Figure 6. Operational risks experienced in the South African manufacturing sector

Respondents were asked to rate how often their organizations experience 4 factors on financial risks, the feedback on the ratings is shown in Figure 7. When the respondents were asked how often they experience negative effects due to changes in exchange rates, 54% of the participants selected rarely and never, 19% selected sometimes and 27% selected often and always.

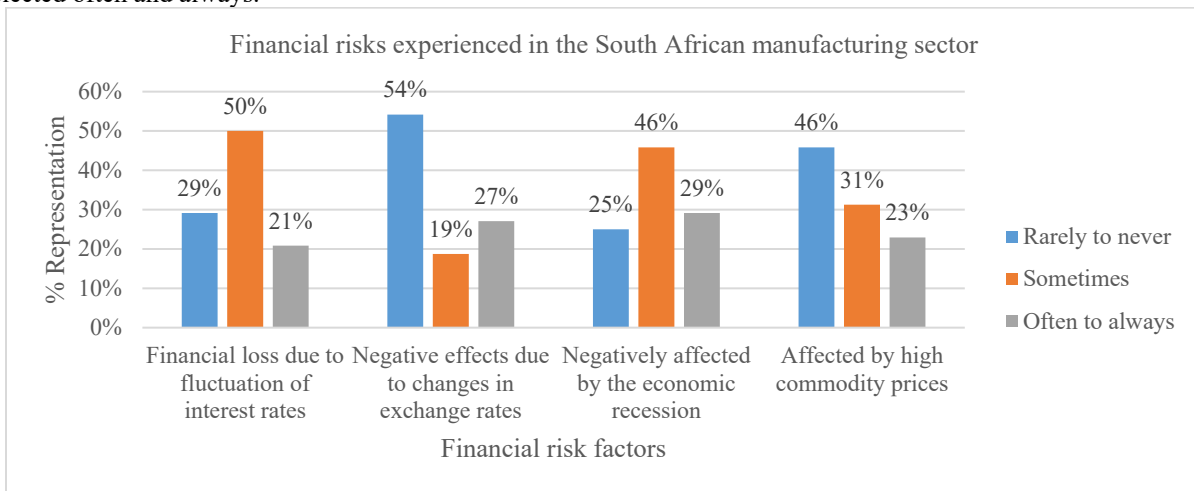


Figure 7. Financial risks experienced in the South African manufacturing sector

Although the results in Figure 7 indicate that the majority of the respondents are not negatively affected by the changes in exchange rates, according to the recent statistics as shown in Figure 8, the rand value to US dollar was very low between November and December 2021, we continue to see changes. This had cost implications on personal finances and business operations. Such cost effects are normally analysed by business executives and accountants, the engineers and the production managers may not be aware of such data since their focus is on the process and product design, hence most of the responses to this question were rarely to never and sometimes.

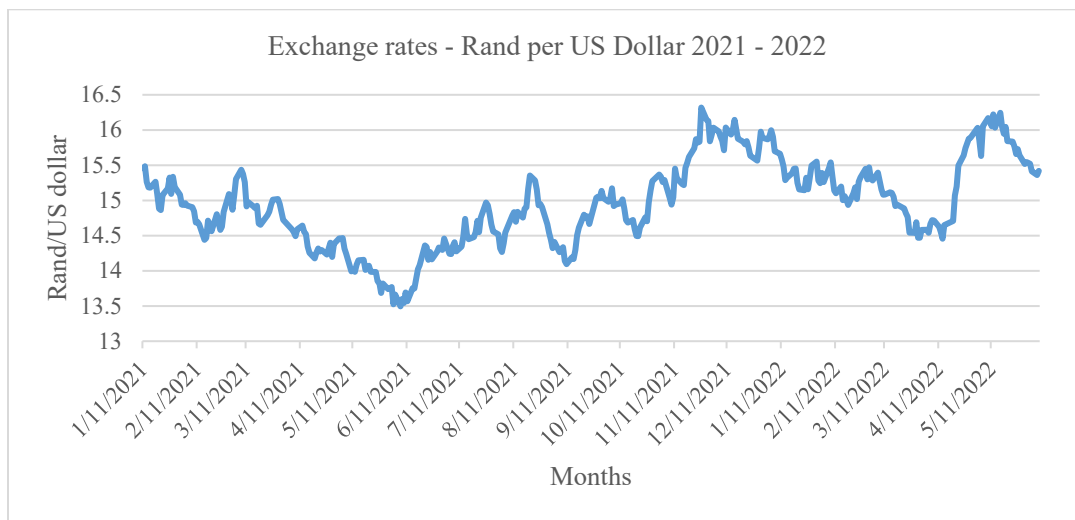


Figure 8. Exchange rates - Rand per US Dollar (Statistics South Africa, 2022)

Respondents were asked to rate how often their organizations experience 5 hazardous risk factors, the graphical presentation of the results is depicted in Figure 9. The majority of the respondents selected rarely to never for all the presented hazardous risks, this was a representation of 75% for non-compliance to law and legislation; a representation of 62% for exposure to health and safety risks; a representation of 69% for exposure to pollution; a representation of 88% for natural disasters and a representation of 46% for disease and pandemics.

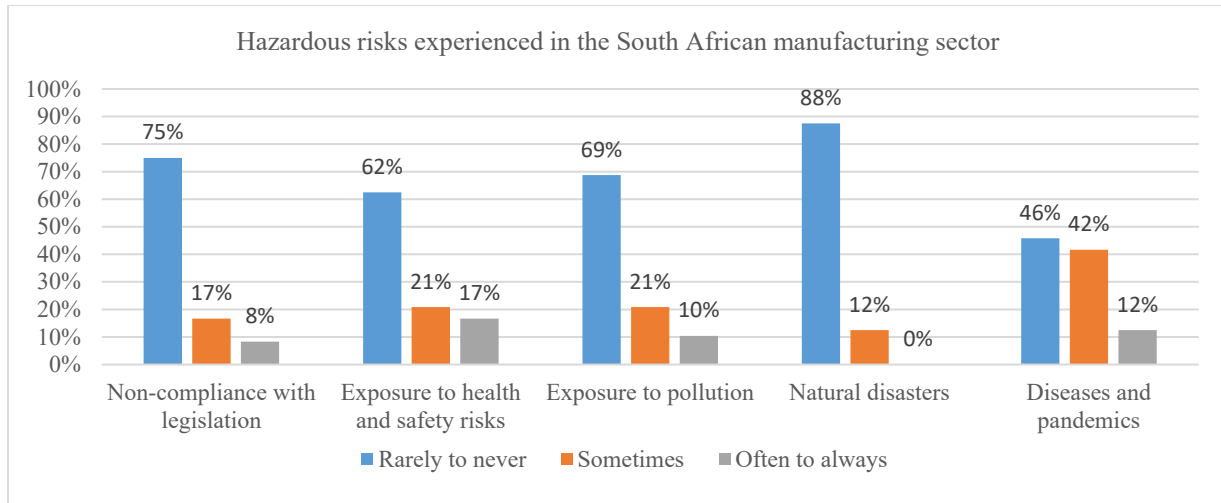


Figure 9. Hazardous risks experienced in the South African manufacturing sector

Even though the results in Figure 9 indicate that hazardous risks do not affect the majority of manufacturing firms. A report published by Stats SA(2020) on the impact of COVID-19 on the business turnover, indicated that the majority of the companies (85%) , had a turnover that was below the normal range in 2020, 13% of the companies had a turnover that was within the normal range and only 1% had a turn over above the normal range, see Figure 10.

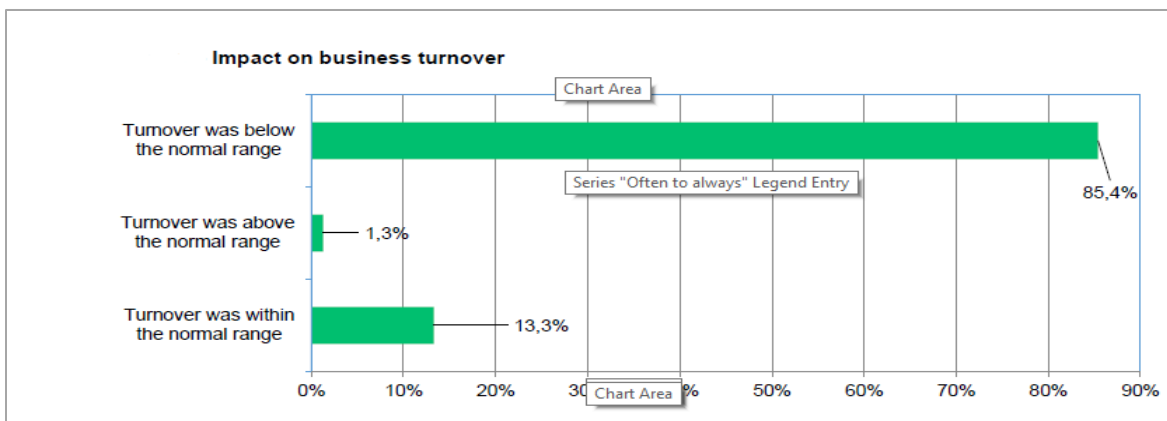


Figure 10. Impact on business turnover (Stats SA,2020)

5.2 Discussion of Results

5.2.1 Risks affecting the manufacturing Industry

According to the results, manufacturing firms are experiencing a numerous risks, these risks are influenced by high manufacturing costs, employee engagement, economic state changes, politics and strikes, skills shortage, raw material supply and costs, process failures and quality management, business continuity, demand changes, inexpensive imports, high commodity prices, access to advance machinery, competition, resistance to change, cost in general, stock management, resource availability and diseases. Operational risks were identified to be the key risk factor in the manufacturing environment. This was similar to what Naude and Chiweshe (2017), Dadashnejad and Valmohammadi(2018), Krüger, Dickason and Meyer(2020) and Tupa, et al.(2017) discovered in their studies, operational risks affect manufacturing firms, their effects tend to reduce productivity and increase operational costs. The analysis results on operational risks indicated that risks associated with raw material supply are experienced quite often than risks associated with people, process and technological advancements. Raw material supply risks are a threat mostly to company sizes with 51 to 100 people; 0 to 50 people and those who employ above 200 people. This

was an indication that supply chain risks in manufacturing are key operational risks that need attention by all business stakeholders. According to Xu et al (2019), the contributing factors to supply chain risks include changes in customer demands, high costs of materials, poor inventory management and technological changes.

Out of the 6 strategic risk items provided to the respondents to rate, Budget overruns and changes in customer demands were rated higher than the rest of the risk factors. According to the distribution of results based on company sizes, the two potential causes of strategic risks mostly affects company sizes that employ 51 to 100 people. Changes in interest rates, high exchange rates, commodity prices and economic recession mostly affect manufacturing organizations that employ 51 to 100 employees. Hazardous risks are seldom experienced by the majority of the manufacturing firms. This could be because most firms have measures in place to prevent the exposure to such risks. Even though all the hazardous risks were rated below the average mean, exposure to health and safety risks, diseases and pandemics were the rated above the other hazardous risks.

Literature confirm that manufacturing firms are exposed to almost all the risks mentioned above at different levels. The risks factors include changes in customer demands, budget overruns, product market alignment, ethics violation, mergers, industry consolidators, raw material supply, people management, process management, changing technology, changing interest rates and exchange rates, economic recessions, revenue management, high commodity prices, compliance to law and legislations, health and safety, natural disasters, disease and pandemics and unfavourable weather conditions. These risks can be simple grouped into four groups, strategic risks, operational risks, financial risks and hazardous risks(Mishra *et al.*, 2019).

5.2.2 Risk management strategies employed in the manufacturing industry

Risk management is management of risks through a systematic method, where potential risks are identified, analysed, addressed and later controlled. The second objective of the study was to determine the risk management strategies used by the manufacturing organizations. From the analysis results presented in the previous section, most of the manufacturing firms (77%) that took part in the study consider risks management as a strategy for business management, they report risk management as one of the businesses KPIs in their organizations.

Manufacturing firms use risk informed management strategies, precautionary risk management strategies and discursive risk management strategies. The majority of the manufacturing firms use precautionary strategies to manage risks. Processing risks are managed and the reliability of equipment and machines is continuously improved. According Kumar *et al*(2018), process risks and people risks can be managed through precautionary risk management, this includes improving the maturity of the manufacturing processes, skill set and knowledge of the people in the organization. Precautionary and risk informed strategies are widely used by all the company sizes but mostly by companies with more than 100 employees. Discursive risk management strategies are not intensively used in the manufacturing firm like the other two groups of strategies, but they are also used by bigger organizations. Risk management strategies are mostly used by bigger firms, according to Ferreira et al,(2020a), this is due to the fact that small enterprises do not have enough resources to implement risk management, because risk management can be costly.

Organizations in manufacturing are keen on identifying potential risks. The process of risk identification was one of the processes that were deemed important by the majority of manufacturing firms, followed by risk assessment and risk response. The manufacturing firms spend more time identifying, assessing and responding to risks than the other process steps in risk management. Manufacturing firms use FMEA more than any other tool to assess risks. Delphi Technique and Monte Carlo simulation are the least used tools, this could be because Delphi Technique is used to drive complex discussions and it requires experts to be part the discussion and Monte Carlo simulation is more technical and requires mathematical abilities and not many people have such abilities

5.3 Proposed Improvements

The recommendations presented below are based on the study results. To manage operational risks as the results indicated that it is a key risk factor among the four risks in the manufacturing environment, the following is recommended to manage risks associated with raw material supply:

- The manufacturing firms should develop KPI's to measure their supplier's performance, the KPI's can be based on delivery time, product quality and flexibility of supply.
- The manufacturing firms should have more than one supplier for raw materials, they should have at least 3 reliable suppliers from different regions.
- The organizations must know and understand the culture of their suppliers, this includes understanding their operations, capabilities and business focus areas.

To effectively manage process and people related risks, the manufacturing firms should continuously improve their processes by adopting world class manufacturing standards. The following is recommended:

- Benchmarking and risk management should be introduced as business management strategies.
- Effective maintenance programs should be implemented, this will minimize other processing risks.
- Skill set should be continuously improved, creating multi skilled and knowledgeable workforce.
- Incentives for good performance should be implemented to encourage teams to perform well and reduce employee turnover.

To manage strategic risks, the manufacturing firms should continuously review their business strategies to align with the market developments and meet the customer needs.

For effective risk management in the organizations, the manufacturing firms should integrate expert and experience based risk management tools.

5.4 Validation

Validity evaluates if the questionnaire measures what it is intended and reliability is the ability of the questionnaire to give stable results on every occasion when administered (Ragab and Arisha, 2017). The validity of the questionnaire was confirmed through face validity, using the supervisor and the co-supervisor whose feedback was highly needed during the final construction of the questionnaire. Reliability of the responses was confirmed by calculating the Cronbach's alpha value for each question, all the values were above the minimum required level of 0.7 which confirmed that the data collected was good to make informed analysis. The correlation for all the evaluated items was positive.

6. Conclusion

The research investigated the risks and risk management strategies in the manufacturing sector. To the answer the first research question, operational risks, strategic risks, financial risks and hazardous risks were identified to be the risks in the manufacturing environment. The results indicated that most manufacturing firms in South Africa are affected by operational risks. Manufacturing firms over spend on operational requirements, surpassing the budgeted amount. This could be due to fluctuations in customer demands, thus keeping high inventory. Covid-19 pandemic contributed on the exposure of certain risks, there was a decline in manufacturing production when the pandemic started, interest rates and exchange rates went up.

To answer the second question of this research, three strategies were identified to be the main risk management strategies in the manufacturing environment, namely these were risk informed strategies, precautionary strategies and discursive strategies. From the results, many manufacturing firms tend to use precautionary strategies more. Their management strategies are more process and machine focused. Reliability of equipment and machines is continuously improved and process risks are managed through various tools. The results indicated that most of the firms use FMEA as a tool to identify and assess risks, they don't use tools that rely on expert judgment and technical abilities like

Delphi Techniques and Monte Carlo analysis. The organizations are more likely to experience the same problems over time because they don't use any tool that is based on past experiences.

6.1 Future Work

- Future studies should incorporate other tools like interviews to address the gap of not being able to ask follow up questions on unclear responses, this will also minimize other questions being skipped.
- Further investigation is required to find out why are people reluctant to answer open ended questions as opposed to close ended questions.
- Further research is required to gain more insight on the effects of risks encountered by the manufacturing firms and evaluate the effectiveness of the risk management strategies.
- The same research should be conducted with the executives and managing directors' only being the unit of observations in the manufacturing firms. It was observed that the majority of the respondents which were engineers are not highly involved in strategic planning, financial management and risk management, their knowledge was not as broad as expected.

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Biography

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