The Impacts that the Cost of Quality has On South African's Defence Industry

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Abstract
The purpose of this paper is to evaluate how the cost of quality affects the defense sector in South Africa. The high cost of poor quality is one of the reasons why South Africa's military industry's profits and exports are decreasing. Costs of poor quality (COPQ) affects production efficiency and profitability to customer satisfaction and public reputation. To assess the impact of the cost of poor quality on a company's productivity, profitability, and customer satisfaction, the interview questions were created and distributed to four different military firms to collect data that would allow the researcher to assess the COPQ's influence on each company's productivity. The interview also assisted the researcher in documenting the primary or common causes and effects of poor quality in the defense sector, allowing the author to effectively suggest a strategy to reduce the sources of poor-quality costs in military businesses. To identify and categorize internal and external failure costs from various defense organizations as well as to establish a method for evaluating the cost of poor quality to estimate the impact on an organization, the data entry forms in table 1 to table 4 below were created to record all the poor-quality costs incurred in 2020 that were recorded in each company's database. This helps the researcher calculate the cost of poor quality in 2020 for each company and determine the impact on the company's profitability. The outcomes of the research indicate that the cost of poor quality influences the defense industry’s profitability, productivity, and customer satisfaction. According to the research, a company’s productivity, profitability, and customer satisfaction can increase if the cost of poor-quality decreases.

Keywords
Cost of poor Quality, Customer satisfaction, Profitability, Productivity and Defense industry.

1. Introduction
In recent years, the defense industry has placed a strong emphasis on marketing and operations management, and they are unconcerned about the high cost of poor quality, which has a significant influence on an organization. To survive and thrive in today's competitive environment, every business must prioritize quality. Customer satisfaction and beyond is a major endeavor in strategy makers' objectives. To overcome these problems, is critical to aim for greater quality product at a minimum cost (Mantri &Juju 2015).

According to SA committee on defense, the Defense Industries have a significant economic influence on South Africa. The Maritime, Aerospace and Defense Industries Association compared South African Defense Industry numbers for 2019/20 to those from 2016/17. Revenue decreased by R7 billion, from R19.5 billion to R12.5 billion; exports decreased by nearly 50%, from R12 billion to R6.5 billion; and R&D investment decreased from R1.7 billion to R6.5 billion (pmg.org.za, n.d.).

High Poor quality cost is one of the challenges that some of South African defense industries are facing and is influencing organizations productivity, profitability, and customer satisfaction. Customer satisfaction is directly linked to quality. According to (Biadacz, 2020). Customers who are pleased with an organization's service and product will give it a higher rating in reviews than those that do not provide high-quality goods or services. The high cost of poor quality is one of the reasons why South Africa's military industry's profits and exports are decreasing. Costs of poor quality (COPQ) affects production efficiency and profitability to customer satisfaction and public reputation. (pmg.org.za, n.d.).
Some of South Africa's military sector is presently suffering financial difficulties, with employees being retrenched and global customers being lost. Companies have not yet developed the essential knowledge of the cost of poor quality. To successfully minimize the cost of poor quality, companies must correctly assess the costs associated with poor quality. The main aim of the study is to evaluate the impact that the cost of quality has on South Africa's defense industry.

1.1 Objectives
To fulfill the investigation's goal, the following objectives were studied:

- To evaluate and categorize internal and external failure costs from various defense organizations as well as establish a method for evaluating the cost of poor quality to estimate the impact on an organization.
- To evaluate poor quality affects to company's profitability.
- To evaluate how poor quality affects a company's productivity.
- To identify the main causes and consequences of poor quality in the defense industry.

2. Literature Review
Concepts of Cost of Poor Quality
In the literature, there are numerous concepts of quality costs. When it comes to quality costs, many researchers and authors from numerous scientific departments try to describe the topic in different ways. However, because the idea of cost of poor quality come close to their structure, both quality management philosophy and economic practice frequently describe expenses in terms of their structure. Characteristics of the most significant authority in this field's concepts are regularly discussed. (Biadacz 2020).

The COPQ method can help you achieve better results (Chopra and Garg, 2012). To improve customer satisfaction, organizations must handle COPQ as a combined method and a process for long term, focusing on costs issues (Teli et al., 2017). COPQ has a straight influence in a company's ultimate financial target, and even a slight decrease in COPQ can boost profitability dramatically (Sahu 2013). On a minor scale of defense industry, measuring quality costs is highly significant besides valuable. It is also assisting in the definition of specific quality standards and, as a result, enhances quality (Chopra and Garg 2011). (Lari and Asllani 2013), (Garza-Reyes et al., 2014), (Teli et al., 2017), (Marzuki and Wisrldani, 2014), (Dror, 2010) and (Pomas et al., 2018) have all discussed the advantages of utilizing COPQ systems, as well as the issues and challenges that come with implementing a quality cost system. A quality management support system, according to (Lari and Asllani, 2013), would help the organization to better acquire and assess data on quality costs. Guinot et al. 2016 indicated that If a standard quality cost approach is provided, such a support system can also be used. However, many studies to date have revealed that only a small percentage of businesses use COPQ data. Three reasons for the limited implementation of COPQ, according to Dale and Pursglove, are a lack of understanding of COPQ concepts and principles, a lack of data, and a lack of interest in quality costs on the part of managers.

Classification of COPQ
According to (Defeo, 2017) many businesses aim to improve their financial situation by discovering cost-cutting opportunities in their business operations. When it comes to adjusting processes and reducing costs, the most common mistake firms make is failing to consider customer satisfaction and product quality. Companies should use COPQ as evidence of what improvements should be done and why. Reduced COPQ will improve the financial situation regardless of whatever operation is affected (Defeo 2017). According to (Defeo, 2017), the costs were divided into three groups: appraisal, Internal failure and external failure and inspection costs. See figure 1. In comparison with Feigenbaum Sort the costs into three groups: appraisal, Internal failure and external failure and appraisal and inspection costs.

The importance of measuring and using poor quality cost
Poor quality cost, according to (Teli et al. 2013), is a best way to improve management and staff views of mistakes. The following are some ways that a poor-quality cost can help: Attracting managers and engaging with them in monetary terms provides them with knowledge they can value, transforms content from an idea to a practice that is cost effective and time-efficient the impact on an employee's prospective achievement is higher if he or she changes their perspective regarding failures and the malfunctioning piece of machinery is eliminated.
A bit of metal is discarded in one scenario, while a bill is thrown away in the other. Employees must be aware of the financial consequences of their errors. Increasing the return on problem-solving efforts for poor quality, high-cost issues so that remedial activity can be concentrated on the most effective solutions. By focusing on the total process's poor-quality cost, sub-optimization can be avoided (Teli et al. 2013).

**Consequences of poor quality and its impact in an organization**
The cost of poor quality involves not just product problems, but also costs related to corporate procedures, practices, or activities that result in defects or errors. Poor quality may damage a company's reputation, sabotage customer relationships, and have serious operational and financial implications. Consider the financial and logistical implications of continued billing. Poor quality may have a significant impact on any company, whether it sells goods or services. Poor quality can lead to a loss of reputation, loss of business and a loss of trust. Poor quality generally causes clients to lose faith in the product or service, prompting them to seek out other options (Guest 2017). Errors might result in incorrect product delivery, resulting in chargebacks, higher freight expenses, and even lost revenues. Mistakes at the product development stage, on the other hand, might result in one of many additional expenses. If the first samples are unsatisfactory, more money will be spent on couriers and redevelopment, resulting in production delays, chargebacks, and rejected orders. (Guest 2017) and (Lari and Asllani 2013).

**Impact on organization’s profitability**
Efficiency grows profitability. When workers are involved in a work environment that emphasizes cooperation and strives for high-quality products, the company works more effectively than when quality is a last-minute consideration. Poor quality may have a significant negative influence on a company's bottom line. This might be caused by a lack of financial, human, and physical or intellectual resources needed to accomplish business tasks. For example, Boeing delivered a product that fail to conform to requirement, resulting in significant costs. All the shortcomings should be resolved, resulting in unbillable hours and delivery of free components and services (Barquet et al. 2013). These out of the box failure have both long- and short-term consequences for the brand, as well as revenue. With the implementation of an effective and high-quality QMS platform, this may be avoided in the future. It is possible to eliminate errors and identify patterns (Barquet et al. 2013). Furthermore, all subsequent financial litigations will have a major impact on Boeing's bottom line.

**3. Methods**
A mixed method that includes both qualitative and quantitative methods was used to successfully investigate and recommend a strategy to minimize the sources of the cost of poor quality in defense companies, focusing on the review that was published between 2010 and 2020 about the cost of poor quality. The researchers selected to focus on what is thought to be the most thorough review to date. The author looked at a sample of 30 publications from Google Scholar, Research Gate, and the University of Johannesburg data source for the review. The most important findings from publications published between 2010 and 2021 for this study are the percentage of articles categorized as empirical research involving human participants’ vs no empirical research. The percentage of papers classified as quantitative, qualitative, or mixed techniques is also important. The proportions in such publications are compared to the proportions found in papers regarding the cost of poor quality published between 2010 and 2021.

**4. Data Collection**
Interviews, surveys, and records (COPQ reports) were chosen as tools to collect data for this study.

**5. Results and Discussion**
The findings supported the current idea that quality and production are tightly connected. According to the research, productivity improves as defects, scrap, and rework (poor quality) decrease. As a result, as quality improves, so does productivity.

**Cost of poor-quality impact to Profitability**
Figure 1 to 4 depicts a typical Pareto diagram for the cost of poor quality. The COPQ are displayed in ascending sequence, starting with the Total cost of poor quality on the left which shows 90% of the budgeted quality cost at
Hensoldt were used, which shows that the company COPQ is still within the target. A Pareto diagram includes a few components that constitute a significant portion of the total.

Total of COPQ (ZAR) = P+F+A
Hensoldt optronics 2020 total COPQ=R40, 590,706
2020 COPQ target=45,590,706 Revenue in 2020= R1.5 billion
K=100M
Total Revenue(R) - Total COPQ (COPQ) - other expenses (K) = Profit (P)
R+ (-COPQ+K) =Profit
1500M – (40, 590,706+100M) =P
P=R 1,359 409 656
40, 590,706/1,359 409 656*100=2.9% of the profit
COPQ/Revenue in 2020*100=percent of the revenue
40, 590,706/1500M*100=2.7% of the revenue
This shows that Hensoldt quality is outstanding as is being estimated by expert that the cost of quality can be 5 to 30% of the revenue which can also affect the company profit.
RDM 2020 total COPQ=R46, 315,781 R=463M
Approximately 10% of the 2020 revenue.
Denel dynamics 2020 total COPQ=R48, 473,631 R=242.4M
Approximately 20% of the 2020 revenue.
SAAB 2020 total COPQ=R41, 560,231. R323M
Approximately 15% of the 2020 revenue.

Table 1.  Hensoldt Cost of Poor Quality in 2020 (COPQ)

| Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | TOTAL | Average |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|---------|
|       |       |       |       |       |       |       |       |       |       |       |       |       |        |         |
| Total cost of Poor Quality | 2,820,855 | 2,712,004 | 2,734,818 | 1,516,475 | 3,000,048 | 3,972,390 | 4,166,046 | 2,158,803 | 4,405,162 | 2,707,283 | 1,529,557 | 6,864,263 | 40,590,706 | 3,382,559 |
| Prevention Costs | 1,549,400 | 1,409,612 | 1,475,432 | 1,232,645 | 1,776,357 | 1,840,319 | 1,838,374 | 1,555,122 | 1,810,883 | 1,694,050 | 1,766,331 | 1,425,431 | 19,373,956 | 1,614,499 |
| QA Admin. Training | 1,549,400 | 1,409,612 | 1,475,432 | 1,232,645 | 1,776,357 | 1,840,319 | 1,838,374 | 1,555,122 | 1,810,883 | 1,694,050 | 1,766,331 | 1,425,431 | 19,373,956 | 1,614,499 |
| Appraisal Costs | 19,194 | 19,889 | 131,872 | 13,630 | 6,700 | 37,997 | 88,031 | 104,360 | 96,159 | 30,018 | 547,850 | 45,654 |
| Appraisal Expenses (Internal) | 6,500 | 6,500 | 21,450 | 6,175 | 4,550 | 53,300 | 11,050 | 109,525 | 9,127 |
| Vendor Control | - | - | - | - | - | - | - | - | - |
| Measurement and Gauge Control | 6,500 | 6,500 | 21,450 | 6,175 | 4,550 | 53,300 | 11,050 | 109,525 | 9,127 |
| Failure Costs (COPQ) | 1,252,261 | 1,282,504 | 1,127,514 | 283,830 | 1,231,061 | 2,125,371 | 2,289,675 | 603,681 | 2,506,248 | 908,873 | 1,667,067 | 5,408,814 | 20,668,900 | 1,722,408 |
| Internal Failure Costs | 588,247 | 591,999 | 334,088 | 100,100 | 566,626 | 1,391,327 | 613,559 | 546,666 | 1,143,021 | 811,035 | 656,192 | 3,518,164 | 10,861,825 | 905,135 |
| Scrap | 65,789 | 78,769 | 75,493 | - | 60,440 | 94,889 | 163,065 | 70,503 | 89,060 | 297,821 | 194,326 | 2,709,893 | 3,900,048 | 325,004 |
| Rework | 335,258 | 319,530 | 75,295 | 334,586 | 1,085,137 | 251,594 | 275,963 | 817,361 | 277,913 | 204,466 | 622,371 | 4,599,475 | 383,290 |
| Production Orders | 19,194 | 19,889 | 131,872 | 13,630 | 6,700 | 37,997 | 88,031 | 104,360 | 96,159 | 30,018 | 547,850 | 45,654 |
| Obsolescence's | 104,000 | 104,000 | 98,800 | 98,800 | 104,000 | 109,200 | 114,400 | 104,000 | 83,200 | 72,800 | 106,600 | 81,900 | 1,181,700 | 98,475 |
| Internal Failure Analysis | 83,200 | 89,700 | 84,500 | 1,300 | 67,600 | 102,700 | 84,500 | 96,200 | 153,400 | 162,500 | 150,800 | 104,000 | 1,180,400 | 98,367 |
| External Failure Costs | 664,014 | 690,504 | 793,426 | 183,730 | 646,436 | 733,444 | 1,676,117 | 57,015 | 1,363,227 | 97,838 | 1,010,875 | 1,890,651 | 9,807,277 | 817,273 |
| Charges/Costs | 571,714 | 638,504 | 733,626 | 183,730 | 560,636 | 642,444 | 1,638,417 | 185 | 1,307,327 | 40,638 | 988,775 | 1,878,951 | 9,184,577 | 765,381 |
| Analysis | 92,300 | 52,000 | 59,800 | 85,800 | 91,000 | 37,700 | 57,200 | 55,900 | 57,200 | 22,100 | 11,700 | 622,700 | 51,892 |
Figure 1. Hensoldt COPQ Pareto analysis

Based on the figure 1 failure cost at Hensoldt which is R20,668,900 is higher than prevention cost which is R19,373,956 and total failure cost average from January to December in Hensoldt is R3,382,559. The average Costs of defects in products or services prior to shipment or handover to the customer contributed more with R905,135 (internal failure), while remaining defects discovered after shipment or handover to the customer contributed an average cost of R817,273 (External Failure Costs). The costs involved in service to customers under warranty contracts contributed more to the failure cost of R765,381. As a result, it can be concluded that in Hensoldt, warranty charges contributed more to the failure cost in 2020, possibly due to out-of-the-box failure from the client, with all repair or rework occurring after sales and late delivery penalties.

Table 2. RDM Cost of Poor Quality in 2020 (COPQ)

|                | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       | TOTAL     | Average   |
|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Total Cost of poor quality | 4,835,087 | 2,019,529 | 3,124,578 | 3,240,215 | 3,740,244 | 1,671,925 | 4,250,477 | 4,685,537 | 8,331,647 | 4,102,724 | 4,685,537 | 8,331,647 | 46,315,781 | 3,859,648 |
| Prevention Costs | 1,122,419 | 1,543,462 | 1,473,069 | 1,549,124 | 1,388,062 | 1,359,586 | 1,341,588 | 1,415,868 | 1,561,080 | 1,020,587 | 13,997,629 | 3,333,136 | 16,741,930 | 1,395,161 |
| QA Admin, Training | 1,122,419 | 1,543,462 | 1,473,069 | 1,549,124 | 1,388,062 | 1,359,586 | 1,341,588 | 1,415,868 | 1,561,080 | 1,020,587 | 13,997,629 | 3,333,136 | 16,741,930 | 1,395,161 |
| Appraisal Expenses (Internal) | 358,107 | 350,038   | 399,300   | 65,891    | 74,818    | 95,110    | 99,908    | 24,207    | 27,720    | 27,620    | 714,012 | 59,501   | 714,012 | 59,501 |
| Vendor Control | 65,991    | 122,971   | 74,818    | 95,110    | 99,908    | 24,207    | 27,720    | 27,620    | 714,012 | 59,501   | 714,012 | 59,501 |
| Failure Costs | 3,277,572 | 8,680,572 | 1,056,322 | 1,225,110 | 1,292,935 | 1,907,336 | 93,821    | 2,551,778 | 2,748,299 | 6,213,575 | 23,999,740 | 1,999,978 | 23,999,740 | 1,999,978 |
| Scrap | 40,999    | 174,393   | 34,891    | 337,377   | 96,330    | 186,333   | 68,688    | 150,255   | 1,311,228 | 291,987   | 2,964,708 | 247,059 | 2,964,708 | 247,059 |
| Rework Production Orders | 211,552 | 259,051   | 338,289   | 180,552   | 552,681   | 260,589   | 195,404   | 1,901,897 | 1,980,963 | 2,070,668 | 8,258,978 | 688,248 |
| Internal Failure Analysis | 116,160 | 188,320   | 193,600   | 193,600   | 193,600   | 193,600   | 193,600   | 193,600   | 193,600   | 193,600   | 193,600 | 193,600 |

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Table 2 and figure 2 shows that the total failure cost average from January to December at Rheinmetall Denel Munition is R 1,999,978 which the average Costs of defects in products or services prior to shipment or handover to the customer contributed more with R 1,194,349 (internal failure), while remaining defects discovered after shipment or handover to the customer contributed an average cost of R805,630 (External Failure Costs).

Table 3. Denel Cost of Poor Quality in 2020 (COPQ)

Table 2 and figure 2 shows that the total failure cost average from January to December at Rheinmetall Denel Munition is R 1,999,978 which the average Costs of defects in products or services prior to shipment or handover to the customer contributed more with R 1,194,349 (internal failure), while remaining defects discovered after shipment or handover to the customer contributed an average cost of R805,630 (External Failure Costs). As a result, it can be concluded that in Rheinmetall Denel Munition, warranty charges contributed more to the failure cost in 2020, possibly due to out-of-the-box failure from the client, with all repair or rework occurring after sales and late delivery penalties. For this company to minimize the external failure cost they must invest more in preventative action and Appraisal Costs.
The costs involved in service to customers under warranty contracts contributed more to the failure cost of R 1,318,000. As a result, it can be concluded that in Denel, warranty charges contributed more to the failure cost in 2020, possibly due to out-of-box failure from the client, with all repair or rework occurring after sales and late delivery penalties. For this company to minimize the external failure cost they must invest more in preventative action and Appraisal Costs.

Table 3 and figure 3 shows that the total failure cost average from January to December at Denel is R2,334,864, which is 57.8% of the total cost of quality and the average Costs of defects discovered after shipment or handover to the customer contributed an average cost of R 911,557 in year of 2020 at Denel. while remaining defects discovered prior to shipment or handover to the customer contributed an average cost of R911,557 (internal Failure Costs contribute 22.57% of total cost of quality).

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<th>Month</th>
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<th>Total Cost of Poor Quality (COPQ)</th>
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<tr>
<td>Average</td>
<td>41,560,231</td>
<td>3,463,353</td>
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The costs involved in service to customers under warranty contracts contributed more to the failure cost of R 1,318 000. As a result, it can be concluded that in Denel, warranty charges contributed more to the failure cost in 2020, possibly due to out-of-box failure from the client, with all repair or rework occurring after sales and late delivery penalties. For this company to minimize the external failure cost they must invest more in preventative action and Appraisal Costs.
Table 4 and Figure 4 shows that the total failure cost average from January to December at SAAB is R 3,463,353 and the average Costs of defects discovered after shipment or handover to the customer contributed an average cost of R 1,039,003, while remaining defects discovered prior to shipment or handover to the customer contributed an average cost of R 810,230. The costs involved in service to customers under warranty contracts contributed more to the failure cost of R 11,422,592.

As a result, it can be concluded that in Denel, warranty charges contributed more to the failure cost in 2020, possibly due to out-of-the-box failure from the client, with all repair or rework occurring after sales and late delivery penalties. For this company to minimize the external failure cost they must invest more in preventative action and Appraisal Costs.

6. Conclusion
This research only focused on South Africa defense companies. Costs of poor-quality affects defense companies' production efficiency, profitability, customer satisfaction and public reputation. To identify and categorize internal and external failure costs from various defense organizations as well as establish a method for evaluating the cost of poor quality to estimate the impact on an organization. The study confirm that poor quality affects a company's profitability, productivity, and customer satisfaction.

In military firms, excessive rework has a significant influence on organizational performance. However, frequent rework occurrences, as well as their impact on performance and productivity, should not be considered unavoidable. The development of proper awareness as well as organized procedures for rework management may significantly improve the unfavorable results associated with rework.

Company profitability and Quality have a strong relationship, according to this research. In fact, for every given profitability, better quality yields a larger return on investment. Furthermore, increases in productivity of the company, capabilities to meet customer needs, or even other quality characteristics result in higher sales and market share. Customers who are happy with the company's quality are more likely to have positive feelings about it than those who do not receive high-quality items. Customers who are dissatisfied with a company's quality are more inclined to
complain and criticize. Customer loss can occur because of poor quality in an organization, and this can also have an impact on the company's brand image when marketing new consumers.

The study also identifies that the most main causes of poor quality in south Africa defense sector contribute in COPQ include Scrap, rework production Orders, cost of monitoring & managing component obsolescence and Warranty Charges/Costs. The study also reveal that some employees struggle to measure COPQ, they require help doing the measures. It's also possible that the staff don't have the ability to accomplish it. Most of it is mostly due to a shortage of resources. One participant agrees, pointing out the issue of resources needed to use the measurements. Even though many measures are taken, due to the absence of time and resources to evaluate them, they are not completely utilized. Some businesses also have the mindset that "they don't need to measure." Measuring the success of a firm is especially important if it is doing well.

The study supports the idea of (Guest, 2017) that Poor quality can lead to a loss of reputation of the company, loss of business and a loss of trust from the customer. Poor quality generally causes clients to lose faith in the product or service, prompting them to seek out other options. Poor quality can cost an organization a large sum of money. Employees would waste their time on inefficient processes and resolving issues on a regular basis if quality is not a proactive strategy.

References
SJ Guest Understanding the True Cost of Poor Quality and How to Reduce It. [online] Sourcing Journal. Available at: https://sourcingjournal.com/topics/compliance/understanding-true-costpoor-quality-reduce-64659, 2017
Biographies

Khathutshelo Mushavhanamadi is a Senior Lecturer, highly Knowledgeable Academic and a Business Professional, an Esteemed Leader who’s highly Focused and Committed with a Consistent track record. As an out of the ordinary dynamic individual, she appeals to an astute can-do positive attitude focused on creative solutions which always propels her to challenge convention. Dr Mushavhanamadi holds a PHD Degree in Engineering Management and possess extensive experience in the Academic, Research, Consulting & Advisory Industries. An Esteemed Leader in the Training & Development Space of ERP, Operations Management, Production Planning and Control & Project Management. Her research interests involve green supply chain management, operations management issues, production planning and control, operations management, and Quality.

Ambani Mofamade is a Hensoldt South Africa Quality Controller with experience in quality, design, manufacturing, after-sales service, and validation engineering. Throughout many quality initiatives, he has demonstrated a consistent capacity to improve quality in production areas and documentation, reducing compliance risks. Effective at improving functional improvements minimizing quality costs. He formerly worked at Rheinmetall Denel Munition in Potchefstroom, one of the world's premier military corporations. He worked as a quality assurance technologist, a senior quality assurance inspector, and an intern mechanical engineer. He graduated from Vaal University of Technology with a National diploma and baccalaureus Technologiae in Mechanical Engineering, and a baccalaureus Technologiae in Operations Management, as well as a postgraduate diploma in operations management.