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Engineering Human Capital Retention Strategies in South African Energy Organizations

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Abstract

The engineering shortage began in the early 2000s, creating a global challenge that makes it difficult for organisations to retain their top talent. As a result, engineering companies are facing high employee turnover, which leads to diminished productivity and subsequent losses in profit and increased recruitment costs. This study examines retention strategies for engineers in the South African energy sector, focusing on their implementation and effectiveness. Data was gathered through a questionnaire, yielding 55 valid responses. Key retention strategies identified as most frequently implemented include job security, the challenging nature of work, and opportunities for career growth. In contrast, strategies related to work-life balance, autonomy, and innovation and technology were found to be inadequately executed within energy organisations. The study highlights gaps in compensation frameworks, leadership and management approaches, and organisational culture that hinder effective retention initiatives. Recommendations include aligning retention efforts, enhancing work-life balance through supportive policies, and fostering inclusive leadership and organisational cultures. Additionally, investing in technology to address autonomy-related challenges is advised. This study presents practical implications for the energy industry, offering managers actionable strategies to retain engineers within their organisations. For academia, it expands the body of knowledge by providing detailed retention strategies and addressing existing gaps in the literature on the subject. The findings emphasise the need for longitudinal studies to assess the evolving effectiveness of retention strategies and their correlation with demographic variables. Ultimately, this research lays the groundwork for developing innovative and proactive retention strategies to address the high turnover rates experienced in the South African energy sector.

Keywords
Retention Strategies, Energy industry, Job Security, Autonomy, Work-Life Balance

1. Introduction
Since the early 2000s, the shortage of engineers has been a global problem in human resource management (Elias et al.,2020). As a result, some organisations experience retention problems; these problems are linked to reduced productivity and profit loss (Alias et al., 2022). The effects of these retention problems are evident in high turnover rates, recruitment costs, and lost productivity (George, 2015; Marais et al., 2017; Useng, 2017). The emerging Industrial economy is not making the situation any better, as engineers have emerged as top-priority individuals in most organisations. Henceforth, retaining engineers is paramount for organisational success (Alias et al., 2022). In general terms, the word retention refers to the strategic process designed for an organisation to foster a long-term commitment between the employees and the organisation (Lahkar Das and Baruah, 2013). The successful adoption and implementation of efficient retention strategies improve engineers' retention. (Amadasu, 2003; Taplin et.al, 2002; Gberevbie, 2008). The strategies include offering competitive compensation packages, providing opportunities for professional growth and development, fostering positive work culture, and implementing initiatives that enhance work-life balance (Sharma & Gupta, 2020). Section 1.1. Below summarizes the aims and objectives of this study.

1.1 Objectives

This study aimed to investigate the best international practices in retention strategies in the energy sector, with a particular emphasis on retaining engineers, and to develop recommendations for implementation within the organisation's framework. The study also evaluated the existing retention strategies utilized in South Africa's energy sector, specifically focusing on engineers, to determine their adoption rates, effectiveness, and potential areas for enhancement. The following sections comprise a literature review, a description of the research methodology, the presentation of findings, and the conclusions.

2. Literature review

According to George (2015), organisations must focus on both the job and organisational levels to ensure the effective retention of engineers. On a personal level, Steven et al. (2003) argues that engineers are more likely to be dissatisfied when they are unhappy with their work and not feeling appreciated. At organisational level hygiene factors that promote satisfaction include organisations ensuring that their policies and procedures promote retention strategies such as work-life balance, effective communication, job security, and Autonomy (Sachau, 2007; Nagabhaskar, 2014; Myeza et al., 2015). Some retention strategies improve morale among existing employees and help preserve knowledge within the organisation (Kuuyelleh et al., 2022; Acton & Golden, 2003). Organisations can improve turnover rates by understanding these strategies and their effects on job satisfaction and employee retention (Nagabhaskar, 2014).

2.1 Strategies to Retain Engineers

Retention strategies encompass other various methods, including rewards and recognition, challenging Nature of work, career development opportunities, leadership, innovation, organizational culture, proficient talent management, implementation of mentorship programs, Job security and alignment of employees' goals with the company's objectives (Maurer, 1997; Huang et al., 2006; Wan Fakeh et al., 2015; Jayasingam et al., 2016; Marais et al., 2017; Useng, 2017; Maqableh et al., 2023).

2.1.1 Compensation

Providing employees with compensation above the market average would generally reduce employee turnover (In-Chung et al., 2005). Lahkar-Das and Baruah (2013) argue that compensation not only reduces employee turnover, but also improves employees' motivation, morale and fosters organisational commitment, hence retention. The word 'Employee turnover' in this paper refers to the movement of employees out of the organisation, either voluntarily or involuntarily. The latter is when the employee is laid off or terminated, and the former is when the employee leaves the organization of their own accord (Juma and Arshad, 2019). Moreover, the study by Myeza et al. (2015) is consistent with the study done by (Lahkar-Das and Baruah, 2013) and Ing-Chung et al. (2005). The study emphasised that compensation is vital for retaining engineers. Henceforth, it is recommended to pay engineers' salaries and adjust them as and when required; if possible, add incentive bonuses to the "mix". Nonetheless, Sul Kamal et al. (2015) argue that there should exist a balance between individual efforts and rewards, consistent with the degree of responsibility and the workload for compensation to contribute effectively as a retention strategy. Compensation may emerge as pivotal in fostering a conducive workplace environment and facilitating the retention of engineers.

2.1.2 Rewards and Recognition

According to Social Exchange Theory (SET) when employees receive rewards and recognition in the workplace, they feel obligated to reinvest in greater levels of engagement (Luthans, 2000; Useng, 2016). SET is a sociological concept that revolves around reciprocity, where individuals engage in exchanges anticipating mutual benefits or rewards (Chernyak-Hai & Rabenu, 2018). In addition, Milne (2007) claims that rewards and recognition programmes have a good impact on motivation, performance, and interest in an organisation, which is consistent with the definition of SET. Ali et al. (2019) emphasised that rewards and recognition are essential for improving employee engagement and performance as they improve the overall employment experience, reduce turnover, and motivate employees. It should be noted at this point that failure to adopt and effectively implement this strategy may result in adverse impacts on organisation' retention. Furthermore, organisations should examine gender-specific preferences for job qualities, which have implications for job satisfaction and retention (Milovanska-Farrington, 2023). The literature review highlights the significance of rewards and recognition programs as vital components of employee retention strategies, although not tailored for the energy sector.

2.1.3 Challenging Nature of Work

Engineers remain in organisations when given challenging tasks and opportunities to improve their technical skills and knowledge (Myeza et al., 2015). Marail et al. (2017) suggest the abovementioned claim is particularly relevant to retaining Generation-Y engineers. Moreover, Steven et al. (2003) found a link between job satisfaction and challenging tasks, with demanding work significantly benefiting job satisfaction levels. Furthermore, a study published in the *Journal of Workplace Behavioural Health* found that employees engaged in challenging work reported higher levels of intrinsic motivation and lower turnover intentions compared to those in routine roles (Yukl, 2013). Challenging work offers opportunities for skill enhancement, innovation, and personal growth, aligning with Herzberg's motivation-hygiene theory, which identifies challenging nature of work as a key motivator for employees (Cascio & Boudreau, 2016).

2.1.4 Career development opportunity

The necessity of internal growth, promotions, and transparent career paths, as studies indicate their positive impact on retaining knowledge workers within engineering fields (Lahkar-Das and Baruah, 2013). In the 21st century, career development has mutual benefits for employees and organisations. Henceforth, improving satisfaction, productivity, and innovation drives organisations to actively create opportunities for skill development to retain engineers and achieve a competitive advantage (Nagabharkar, 2014). Organisation managers should provide career development and support to retain knowledge workers effectively (Useng, 2016). The lack of desired career engagement opportunities can lead to turnover intentions among knowledge workers, particularly Generation Y engineers (Marias, 2017). To foster this retention strategies; paying for short courses and offering further study scholarships/bursaries can aid in career development especially for individual who, prioritise self-development (Jayasingam et al. ,2014). Furthermore, a study conducted by Myeza et al. (2015) career advancement opportunities is the most essential factor to keep engineers retained in Eskom generation.

2.1.5 Work-Life Balance

The work demands intruding into personal life can lead to stress and emotional exhaustion (Luhkar Das, 2013). When employees are stressed and exhausted, the harmonious balance between work and personal life is affected (George, 2015). Practices like flextime, compressed work weeks, and remote work contribute to work-life balance and retention (Khanyili, 2015). Literature alludes that implementing policies that support work-life balance in a supportive context allows employees to make meaningful choices, contributing to successful retention of engineers (Nagabhaskar, 2014). Some engineers consider work-life balance a hygiene retention factor, because they prioritise family needs over work needs, and value having time for other aspects of life beyond work (Marais, 2017). The literature review emphasises that work-life balance is essential for employee retention as it affects engagement, overall satisfaction, and retention of engineers.

2.1.6 Autonomy in the Work Environment

Autonomy in the work environment is having influence over one's work, and flexibility in workload decisions-making it a critical issue for retaining Engineers (George, 2015). The study by Kamal (2012) also highlighted that Autonomy is crucial for job satisfaction, especially for engineers. Autonomy involves the opportunity to behave autonomously, is influenced by managers' leadership styles at different levels, and is linked to voluntary turnover (Sharma 2020).

2.1.7 Job Security

Ensuring job security is critical for retaining engineers within organisations (Siaw et al, 2022). The study conducted by several researchers, namely Akroush et al. (2013), Aman-Ullah et al. (2021), Shah & Ong (2011), and Siaw et al. (2022), agree and emphasises the significance of job security in affecting numerous work-related outcomes, including organisational commitment, job performance, and employee retention. Moreover, stable employment impacts employee satisfaction and workplace performance, encouraging investment in company-specific skills and improving productivity (Oweidat et al., 2023). Policies that provide job security are beneficial predictors of employee retention in various industries, including energy-related (Nair et al., 2021).

2.1.8 Leadership and Management Style

Effective leadership and management styles play a pivotal role in the retention of engineers within any organisation (Steven,2003). The study by Rottmann et al. (2014) pinpointed essential leadership traits pertinent to engineers, including visionary thinking, ethical conduct, effective communication, and team cohesion. Effective leadership and supportive behavior, underscores the need for organisations to align managerial approaches with the unique

knowledge needed to reduce turnover (George, 2015). Dwipayana and Suwandana (2021) found that leadership style significantly impacted employee retention.

2.1.9 Innovation and Technology

Wipulanusat et al. (2018) highlight that fostering workplace innovation and enhancing career satisfaction can significantly contribute to retaining engineers. Additionally, Liu et al. (2020) stress the importance of cultivating an innovative climate within organisations to facilitate engineers effectively engaging in innovative behaviors. Prasetyaningtyas et al. (2021) argue that technological innovation can enhance employee satisfaction, reduce burnout, and improve overall performance. Furthermore, Gao et al. (2017) support the findings of Prasetyaningtyas et al. (2021) by demonstrating that Enterprise 2.0 technologies foster a more inventive environment for knowledge exchange among employees, thereby bolstering retention efforts (Goto et al., 2020; Gao et al., 2017). The literature review points out that organisations can effectively retain engineering talent by embracing creative ideas, cultivating an innovative culture, creating a suitable work environment, and exploiting technical improvements.

2.1.10 Organisational Culture

Organisational culture refers to the shared values, beliefs, norms, and practices characterising an organisation (Nkomazana et al., 2015). Research highlights the vital role of organisational culture in employee retention, impacting workload, care quality, employee support, professional growth, and policy involvement (Long et al., 2023). Additionally, research has revealed that organisational culture boost individual performance, elevates employee satisfaction, and fosters higher retention rates (Pantiyasa & Michelle, 2017). Moreover, a culture of inclusivity was found to cultivate open communication, knowledge quality, and honesty (Letchmiah & Thomas, 2017). A positive and inclusive culture that values communication supports employee development. Fosters' trust and fairness are essential for enhancing job satisfaction and commitment and ultimately retaining valuable employees.

2.2 The Existing Gap in the Energy Industry Effectively Implements the Retention Strategies to Retain Engineers

The existing gap in the energy industry lies in the effective implementation of retention strategies to retain engineers. While numerous strategies, such as rewards, recognition, career development, and work-life balance, have been identified, organisations often fail to tailor these approaches to meet engineers' unique needs. This disconnects results in moderate adoption, reduced job satisfaction, and continued turnover. Addressing this gap requires intentional implementation, regular feedback, and alignment of strategies with both organisational goals and engineers' professional aspirations.

3. Methodology

Research Methodology is a detailed plan for conducting research (Melnikovas, 2018). It was essential as it aided in ensuring consistency between the chosen tools, techniques, and underlying philosophy. An analogous framework (Research Onion) was introduced by Saunders et al. (2019), and it was used in this study as the basis to develop a comprehensive research methodology. As shown in Figure 1, the philosophy chosen for this study is ‘Pragmatism’. It was chosen on the basis that it focuses on practical solutions, which are in agreement with the aims and objectives of this current study. This research took a deductive research approach as it addresses specific research questions rather than developing new theories (Saunders et al., 2019). The strategy for this study was a survey, with questionnaires selected as the tool for data collection due to its ability to efficiently gather large amounts of data from a significant number of respondents, ensuring a broad representation of the study population (Saunders et al. 2019). The target population for this study comprised engineers employed within the energy sector in South Africa. A snowball sampling was employed for this study, as engineering organisations share common characteristics, such as turnover rates among engineers. The philosophy chosen for the study suggested the use of both qualitative and quantitative approaches which will provides a well-rounded understanding of both the international best practices and the current strategies in South Africa.

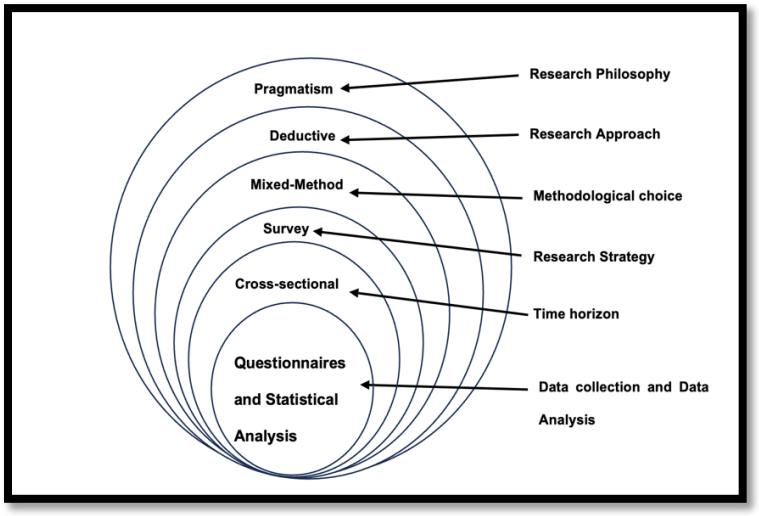

Figure 1: Research union
Source: Adopted from Saunders et al. (2019)

4. Data Collection

Data collection in this study refers to acquiring and arranging information for analysis (Shamile et al., 2014; Saunders et al., 2019). Data was collected systematically using questionnaires to gain insights or make informed decisions. This study employed both quantitative and qualitative approaches to comprehensively investigate the adoption and effectiveness of the retention strategies within energy organisations. The quantitative approach involved numerical data collection and statistical analysis (SPSS) to draw general conclusions or explain phenomena (Astalini et al., 2021; Vijayendra et al., 2023). The questionnaire was implemented via Google Forms, which was chosen because it efficiently reached a broad participant base (Makhanya, 2020). On the adoption level, the respondent was asked to select the most appropriate answers on whether they believe the pre-determined retention strategies are adopted in their respective organisations. The respondent had to choose from Strongly Disagree to Strongly Agree. On the effectiveness, the respondents were asked to choose whether each retention strategy had effectiveness that ranged from Very Poor=1 to Excellent. Furthermore, Participants were posed two open-ended enquiries: (1) to recommend additional retention strategies that organisations might implement beyond those outlined in the questionnaire, and (2) to propose improvements for increasing the effectiveness of existing strategies.

5. Results and Discussion

Section 5.1 provides demographic information; Section 5.2 presents the quantitative data analysis, and Section 5.3 presents the industry perspective quality analysis.

5.1 Demographics Characteristics

Table 2 below highlights demographic information of all the participants of this study. The age group is from 18 years of age to be in compliance with the ethical standards for doing research, and it is the legal age to get employment in South Africa. The educational background, starting from National Diploma to a master's degree, is also highlighted together with the years of experience at work.

Table 1: Demographics Information (N=55)

Age Group (Years)	**Percentages (%)**
18-30	35
31-43	53
44-56	13
Education Background	**Percentages (%)**
B. Eng/ B. Eng.Tech (Hon)	60
B. Tech/ B. Eng.Tech	16
Masters	13
Design Droughting Certificate	2
National Diploma	9
Years of Experience	**Percentages (%)**
4-10	47
16-20	15
Over 21	5
11-15	22
0-3	11

Source: Authors Compilation

This study's 55 participants' demographic data reveals their age, educational background, and energy industry experience. Table 2 above summarises the demographics results. Most participants were 31–43 years old and had a B. Eng/B/B-Eng Tech (Honours Degree), suggesting a sector trend towards undergraduate qualifications. The result further highlights that 47% of participants had 4–10 years of working experience, indicating a mid-career engineer. Moreover, the results revealed that 53% of the participants were aged between 31 and 43 years, a range that aligns with the age group referred to as Generation Y Engineers by Marail et al. (2017).

5.2 Best Practice Retention Strategies

This section provides a detailed summary of the key findings from this study, highlighting three critical areas: 5.2.1 Adoption, which explores the extent and manner in which the subject has been embraced; 5.2.3 Effectiveness, examining how well it performs in real-world applications; and the Industry Perspective, offering insights into how these findings resonate within the broader context of the industry.

5.2.1 Adoption of Retention Strategies.

Table 3 below highlights the Adoption Level of the retention strategies investigated in this study. Each retention strategy is assigned corresponding statistical data: mean(M), interquartile range (IQR) and ranking by mean in descending order. From Job- security to work life balance, with means 4,07 and 3,38, respectively.

Table 2. Adoption Level Items Statistics (N=55)

Strategies	M	IQR	RANKING BY Mean
Job Security	4.07	1	1st
Challenging Nature of Work	3.85	1	2nd
Career Advancement Opportunity	3.71	2	3rd
Leadership and Management	3.60	1	4th
Organisational Culture	3.60	1	4th
Compensation	3.56	1	5th
Reward and Recognition	3.56	1	5th
Innovation and Technology	3.47	1	6th
Autonomy In the Work Environment	3.45	1	7th
Work-Life Balance	3.38	3	8th

Table 3 above contains 10 items with Cronbach's alpha (α=0.922). The Cronbach's alpha (α=0.922>0.700) solidifies the reliability of the data collected (Sunder et al., 2019). They revealed that engineers agree (M=4.07) that 'Job Security' is the most adopted retention strategy in energy organisations. The respondents' opinions were essentially unanimous (IQR=1) regarding the 'Job Security' level of adoption. The challenging nature of work was second and the Career Advancement Opportunity is found to be the third most-rated adopted retention strategy, although the participants had different views (IQR=2) about this level of adoption. The different views of this strategy suggest an opportunity to investigate further the underlying cause(s) of this statistical dispersion (Table 3). Most retention strategies have a mean of at least 3.5, which is the acceptable level of adoption. However, few retention strategies (3 of 10) had a mean of less than 3.5. These strategies include 'Innovation and Technology', 'Autonomy in the Work', and 'Work-life Balance. The latter is the least adopted retention strategy (M=3.38), with respondents showing the highest level of divided opinions (IQR=3). As mentioned earlier, the three least adopted retention strategies are the focus areas for strengthening the adoption level in energy organisations and consequently improving the retention of engineers.

5.2.2 Effectiveness of the retention strategies

Table 3 below highlights the effective Level of the retention strategies investigated in this study. Each retention strategy is assigned corresponding statistical data: mean(M), interquartile range (IQR) and ranking by mean in descending order. From Job- security to work life balance, with means of 4,04 and 3,16, respectively.

Table 3: Effective Level item Statistics(N=55)

Retention Strategies	M	(IQR)	Ranking by Mean
Job Security	4,04	2	1st
Challenging Nature of Work	3,49	1	2nd
Career Advancement Opportunity	3,49	2	2nd
Compensation	3,45	1	3rd
Reward and Recognition	3,42	1	4th
Leadership and Management	3,35	2	5th
Autonomy In the Work Environment	3,33	1	6th
Innovation and Technology	3,31	1	7th
Organisational Culture	3,29	2	8th
Work-Life Balance	3,16	2	9th

Table 3 above contains ten retention strategies studied in this section with Cronbach's alpha (α=0.903). This Cronbach's alpha indicates the internal consistency is higher than the minimum threshold Cronbach's alpha (α=0.7). Job Security was rated the highest by mean (M=4,04); however, the respondents had mixed views (IQR=2). The mixed views of the participants on the level of effectiveness of this strategy highlight areas for further investigation. The Challenge of Work and Career Advancement Opportunities are tied for second place (M=3.49). Respondents' views about the level of effectiveness were varied (IQR=2). The results further reveal that those strategies—namely, Work-life balance (M = 3.16, IQR = 2), organisational culture (M = 3.29, IQR = 2), and innovation and technology (M = 3.31, IQR = 1) are perceived by respondents as relatively less effective retention strategies (M < 3.5). Respondents demonstrated similar views regarding innovation and technology, while opinions on work-life balance and organisational culture were more varied (IQR=2). These observations pinpoint the importance of fostering a positive organisational culture and a work environment that supports career advancement, prioritises work-life balance, and promotes career development. By prioritizing these elements, organisations can strengthen employee retention efforts, fostering a supportive and progressive work environment that aligns with individual values.

5.2.3 Industry Perception

The analysis involved a thematic approach, such as Table 4, where responses were systematically reviewed to identify recurring themes, patterns, and unique insights. Key themes were categorized and interpreted to highlight actionable recommendations and address the challenges of retaining engineers.

Table 4. Thematic analysis of Industry perception on the retention Strategies (N=55)

Theme	Codes	Insights
Job Security	Stability, long-term growth, commitment to transition strategies.	Engineers in the energy sector value clear communication about job stability and future roles, especially during industry transitions like renewable energy adoption.
Challenging Nature of Work	Innovative projects, meaningful contributions, problem-solving opportunities.	Engineers seek opportunities to work on cutting-edge technologies, projects addressing climate change, and roles with visible impact.
Career Advancement Opportunities	Training programs, mentorship, upskilling initiatives, lateral mobility.	Providing structured career paths, access to certifications, and growth opportunities is essential to retain top talent.
Leadership and Management	Transparent communication, empathetic leadership, inclusive decision-making.	Strong, supportive leadership that aligns with modern values fosters employee loyalty and engagement.

Theme	Codes	Insights
Organisational Culture	Diversity, inclusion, ethical practices, family-friendly policies.	Engineers prefer inclusive, diverse, and family-supportive work environments, promoting equity and mutual respect.
Compensation	Competitive pay, performance bonuses, equity options	While remuneration remains important, benefits that match industry standards play a significant role in engineers' retention.
Reward and Recognition	Tailored acknowledgement, peer recognition, performance awards.	Personalised recognition for contributions boosts morale and retention.
Innovation and Technology	Access to modern tools, digital transformation, and Artificial Intelligence integration	Engineers value companies investing in cutting-edge technology to simplify workflows and expand capabilities.
Autonomy in the Work Environment	Flexible scheduling, trust, freedom to innovate	Autonomy, particularly in remote or hybrid work models, enhances job satisfaction and retention.
Work-Life Balance	Flexible hours, mental health resources, family benefits	Balancing work with personal life through flexible policies and wellness programs is increasingly essential to keep engineers engaged.

The results revealed that retention of engineers in the energy industry is a critical challenge amid rapid technological advancements, energy transitions, and shifting workforce expectations. The thematic analysis presented in Table 4 above offers a structured synthesis of key factors affecting engineer retention in the energy sector as per the current study. Table 4 categorises insights into ten themes (retention strategies), each supported by codes derived from qualitative results of the study, recent literature and energy industry trends. These themes, ranging from job security and compensation to innovation and work-life balance, reflect the complex interplay of factors influencing employee satisfaction and commitment in the workplace. Similarly, engineers' desire for autonomy aligns with a growing preference for hybrid and remote work models, reshaping traditional energy workplaces.

5.3 Strategies to Close Existing Gab

Table 5 below outlines critical focus areas, corresponding strategies for improvement, and the resulting benefits. These strategies aim to address key challenges faced by engineers, particularly in the energy industry, and to foster a supportive and productive work environment.

Table 5. Improvement Strategies and their benefit by focus area (N=55)

Focus Area	Strategy for Improvement	Benefits
Work-Life Balance	Implement flexible work schedules, offer mental health resources, and provide family-friendly benefits such as parental leave and childcare.	Improves employee well-being, reduces stress, and increases job satisfaction and retention.
Compensation	Regularly review salary benchmarks, implement performance-based bonuses, and offer equity-sharing options.	Attracts top talent, improves job satisfaction, and fosters organisational loyalty.
Leadership and Management	Provide leadership training, promote inclusive and ethical practices, and encourage participative decision-making processes.	Builds trust, enhances team collaboration, and strengthens organisational culture.
Organisational Culture	Foster diversity and inclusion, uphold ethical practices, and introduce employee-centric policies.	Enhances employee engagement, loyalty, and overall workplace morale.
Innovation and Technology	Invest in modern tools, digital transformation, and AI integration to support employee tasks and decision-making.	Boosts productivity, reduces repetitive tasks, and enhances creative problem-solving.
Career Advancement	Offer training programs, mentorship opportunities, and clear pathways for promotion and skill development.	Encourages employee growth, reduces turnover, and builds a talent pipeline for future needs.

Focus Area	Strategy for Improvement	Benefits
Autonomy in the Work Environment	Allow engineers flexibility in decision-making, invest in tools that reduce micromanagement, and encourage ownership of projects.	Boosts innovation, increases employee satisfaction, and enhances job performance.
Reward and Recognition	Establish tailored recognition programs, peer acknowledgement platforms, and regular performance awards.	Strengthens employee engagement, motivation, and retention.
Job Security	Communicate clear pathways for long-term career stability, invest in employee training, and support organisational transitions effectively.	Enhances employee trust, reduces anxiety, and improves long-term loyalty.
Challenging Work	Design projects that encourage problem-solving, innovation, and skill development, and ensure resource availability to tackle complex tasks.	Keeps employees engaged, builds expertise, and fosters professional growth.

Table 5 above presents improvement strategies. Thus, the table is developed from the analysis of results, and it shows the benefits for both employees and the organisation. Moreover, organisations across engineering industries face ongoing challenges in retaining skilled employees, particularly in high-demand sectors such as energy (Yukl, 2013). Work-life balance is foundational to employee well-being, particularly in demanding fields like energy and engineering in general. Flexible work arrangements, access to mental health resources, and family-friendly benefits enhance employees' ability to manage their personal and professional lives. Schein's (2010) study has shown that organisations prioritising work-life balance report increased employee satisfaction and reduced absenteeism. Flexible scheduling enables employees to optimise their productivity during their most effective hours, while mental health resources mitigate stress, reducing burnout (Deloitte, 2023).

5.4 Proposed Improvements

To address the identified gaps in retention strategies within the South African energy sector, the following improvements are recommended:

- **Enhanced Compensation Framework:** Review and revise compensation packages to ensure they are competitive within the industry. This should include not only salary adjustments but also performance incentives, bonuses, and non-monetary benefits that recognize and reward employee contributions effectively.
- **Prioritization of Work-Life Balance:** Develop policies that promote a healthy work-life balance. Implement flexible working arrangements, such as remote work options and adjustable hours, to accommodate the diverse needs of employees. Additionally, consider introducing wellness programs that support mental and physical health.
- **Career Development Opportunities:** Create structured career development programs, including mentorship, skills training, and leadership workshops, to foster continuous professional growth. Providing clear career progression paths can enhance employee commitment and motivation.
- **Fostering Autonomy and Innovation:** Encourage a culture of innovation where engineers feel empowered to contribute ideas and participate in decision-making processes. Allowing for greater autonomy in their roles can lead to increased job satisfaction and a sense of ownership over their work.
- **Strengthening Leadership and Management Practices**: Invest in leadership development programs that focus on inclusive and supportive management styles. Strong leadership that values open communication and provides regular feedback can significantly impact employee retention.
- **Cultivating an Inclusive Organizational Culture:** Promote diversity and inclusion initiatives that create a sense of belonging within the workplace. This can be achieved through employee resource groups, diversity training, and engagement activities that celebrate different backgrounds and perspectives.
- **Regular Assessment and Feedback Mechanisms**: Implement ongoing employee surveys and feedback channels to monitor satisfaction and engagement levels. Regularly evaluate the effectiveness of retention strategies and adjust them based on employee input and changing industry dynamics.
- **Focus on Technological Investment:** Invest in technology that supports autonomy in the workplace by providing tools that enhance productivity and enable remote work capabilities. This can also include training on how to effectively utilise these technologies.

By implementing these proposed improvements, energy organisations in South Africa can better retain their engineering talent, ultimately leading to increased productivity and enhanced organisational success.

5.5 Validation and Reliability

Validation and reliability are critical components in research that ensure the results obtained from a study are credible, accurate, and can be generalised to a larger population. In this section, we will discuss both concepts in detail, highlighting their importance and application in the context of this study. Validation refers to the process of assessing whether a measurement tool or instrument accurately captures the concept it is intended to measure. In this study, various retention strategies were examined to understand their effectiveness in retaining engineers within the energy sector. To validate the measurement instruments used, several steps were taken:

- Content Validity: This was established through a comprehensive literature review and by obtaining expert opinions from practitioners in the field. Expert feedback ensured that the questions posed in the survey comprehensively covered key aspects of employee retention.

Reliability refers to the consistency and stability of a measurement instrument over time. A reliable instrument yields similar results under consistent conditions. This study employed several methods to ascertain reliability:

- Internal Consistency: This was measured using Cronbach's alpha, a statistic that evaluates the degree to which different questions on the survey that measure the same construct yield similar results. In this study, a Cronbach's alpha of 0.922 was achieved, which far exceeds the acceptable threshold of 0.700. This high score indicates a strong internal consistency among the items related to retention strategies, reinforcing the reliability of the data.
- Test-Retest Reliability: In this study, conducting a pilot test with a smaller sample and re-administering the survey after a certain period help determine the stability of the instrument over time. If the results remain consistent across different administrations, this supports the reliability of the measure.
- Inter-Rater Reliability: When qualitative assessments are involved, ensuring that different raters produce similar scores is essential. In this quantitative study, the focus was primarily on structured surveys, so this aspect was less relevant.

6. Conclusion and Recommendations

This study underscores the critical importance of effective human capital retention strategies in the South African energy sector, particularly concerning engineers. Given the ongoing shortage of skilled engineers and the challenges posed by high turnover rates, it is clear that organisations must adopt a multifaceted approach to enhance retention. The findings indicate that while certain strategies such as job security and opportunities for career growth are frequently implemented, there are significant gaps in areas such as work-life balance, autonomy, and innovative practices.

To effectively address these retention challenges, organisations should focus on aligning their retention strategies with the needs and expectations of engineers. This includes enhancing work-life balance through supportive organisational policies, implementing inclusive leadership practices, and fostering a culture that encourages technological advancement and employee autonomy. By addressing the identified shortcomings and investing in comprehensive retention initiatives, energy organisations can improve employee satisfaction, reduce turnover, and ultimately enhance productivity and profitability.

Future research should aim to explore the long-term effectiveness of these retention strategies and their relationship with demographic variables within the engineering workforce. This will not only contribute to the existing body of knowledge but also provide valuable insights for organisational leaders seeking to build a resilient and committed engineering team in the face of evolving industry challenges. Ultimately, the proactive implementation of robust retention strategies will play a vital role in securing the future success of the South African energy sector.

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