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Sustainability of Professional Services in the Plumbing Industry in a Digitalised Environment

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Abstract
The plumbing sector in Gauteng is being confronted with significant challenges, especially with regards to the competition and unregulated services of unqualified plumbers. This has, in no small measure, posed serious concerns and threat to the long-term viability of professional plumbing enterprises in the Gauteng province of South Africa. This study, therefore, investigates the relationship between sustainability and global digitalisation within the context of professional plumbing services in Gauteng, South Africa. Alongside an examination of the economic sustainability of these illicit plumbing services from the unqualified plumbers, the study addresses critical environmental and social sustainability issues impacting the industry and broader societal well-being. A qualitative research design was employed to tackle the complexity of this investigation. Qualitative data were collected through semi-structured interviews while the elicited data were analysed using content analytical method. Comprehensive data analysis revealed the severity of the threat posed by unqualified plumbers but also highlighted the potential benefits of adopting digitalisation and lean-green practices to mitigate this threat. The findings emphasize the growing necessity for plumbing professionals to integrate sustainable practices and digital technologies into their operations. Investments in training and the incorporation of "smart" plumbing solutions are recommended to enhance competitiveness and contribute to environmental conservation. This study provides valuable insights into the sustainability challenges and opportunities within Gauteng's professional plumbing services amidst a rapidly digitalising landscape.

Keywords
Sustainability, Digitalisation, Professional Plumbing Services, Gauteng, South Africa, Lean-Green Practices

1. Introduction
The plumbing industry is a vital cornerstone of modern society, facilitating the distribution of clean water, sanitation, and wastewater management. This intricate network of pipes, valves, and fixtures plays a pivotal role in ensuring the functionality of homes, businesses, and public infrastructure, underpinning the overall well-being of communities (WHO & World Plumbing Council, 2006). Plumbing's significance transcends utility, encompassing critical implications for public health and hygiene while minimising the environmental impact of wastewater disposal. Access to clean water is essential for preventing waterborne diseases and improving personal sanitation, not to mention being a fundamental human right upon which the enjoyment of all other human rights depend (WHO & World Plumbing Council, 2006). Nonetheless, the plumbing industry in South Africa, notably Gauteng, confronts multifaceted challenges that imperil its sustainability and efficacy. The proliferation of unqualified "plumbers" poses a significant concern, raising questions about industry standards and public safety. The influx drives a race-to-the-bottom competition focused on pricing, eroding consumer trust in certified plumbing services (IOPSA, 2019). Concurrently, the industry's digital immaturity hampers its ability to meet evolving consumer expectations. However, adopting digital technologies without a clear purpose can be futile (Diederich, 2022). The implications extend beyond economic dimensions, encompassing public welfare. In the evolving landscape of the digital era, concerns related to compliance, competitive forces, and technological advancements

come to the forefront. This study examines the issues affecting professional plumbing services in a digital world, specifically in South Africa's Gauteng province.

The professional plumbing industry in Gauteng is navigating a complex landscape characterised by multifaceted sustainability challenges exacerbated by the relentless wave of digitalisation. In the often-cited Brundland Report, the World Commission on Environment and Development (WCED) in 1987 summarised sustainability as "meeting the needs of the present generation without compromising the ability of future generations to meet their own needs" (p. 45). Sustainability has become synonymous with its three intrinsically linked domains: conservation of natural resources, promotion of a healthy community and workforce, and the ability to generate sufficient revenue for long-term financial viability (Mollenkamp, 2023; UCLA, 2023; Purvis et al., 2019). Compromising one domain can affect all three, with far-reaching consequences for current and future generations (Purvis et al., 2019; Teixeira et al., 2021).

Authors such as Bhattacharya et al. (2019) emphasise that it is no longer sufficient to measure organisational sustainability using economic criteria alone. Instead, the soundness of an organisation is contingent upon its impact on all three sustainability dimensions. This view aligns with the Triple Bottom-line theory that is foundational to this study.

The foremost sustainability challenge faced by professional plumbers is the proliferation of unqualified plumbers, that impacts the professional plumbers' long-term economic viability. The Institute of Plumbing of South Africa (IOPSA) records a staggering discrepancy between the 125,000 self-professed plumbers of which only 15,000 to 18,000 possess the necessary qualifications (IOPSA, 2021). The market prominence of unqualified plumbers results in competitive challenges, lower prices, and a devaluation of plumbing services that adhere to established quality standards (IOPSA, 2021). Unqualified plumbers tend to offer cheaper services by disregarding safety regulations or using inferior materials (IOPSA, 2021; Reynolds, 2021), thus undercutting the pricing structure of professional plumbers. In a market where price trumps quality, unqualified plumbers have gained a price-competitive advantage among quality-agnostic customers. The result is their impingement of sustainability on all three dimensions. Professional plumbers, on the other hand, are tasked not only with their economic survival but also with environmental and social stewardship that demand equal consideration due to the interconnectedness of the sustainability domains (Giovannoni & Fabietti, 2013; Dyllick & Hockerts, 2002). Given the critical role of professional plumbing services in providing clean water access, sanitation and effective wastewater management, their compromised sustainability becomes a matter of paramount societal and environmental concern (Giovannoni & Fabietti, 2013). Non-compliant plumbing installations are a threat to the environment and society, leading to property damage, water contamination, injuries, and fatalities (PIRB, 2022). The need for sustainable practices is magnified in high-density provinces like Gauteng, which often experience water scarcity (Giovannoni & Fabietti, 2013).

Adding to these challenges is the digitalisation of society, which is profoundly affecting customer expectations and the competitive landscape. Plumbers compete not only amongst themselves but also with other digital service providers (Vor dem Esche & Hennig-Thurau, 2014; Von Leipzig et al., 2017; Hay, 2021). IOPSA (2023) recognises that the Internet of Things and other digital advancements are transforming the global plumbing industry. Despite Gauteng's position as a digital hub, the plumbing industry has been slow to adopt digital technologies that could enhance competitiveness and sustainability (IOPSA, 2023).

Small and medium-sized plumbing enterprises, which dominate the Gauteng professional plumbing landscape (IOPSA, 2021), find the cost of implementing digital technologies and providing staff training prohibitive, potentially exacerbating economic disparities within the industry. Environmental factors also reshape customer perceptions of value (Zauner et al., 2015). Customers increasingly prioritise environmental and social responsibility. Professional plumbers' slow adoption of lean and green practices may hinder the industry's ability to align with evolving customer expectations and environmental standards.

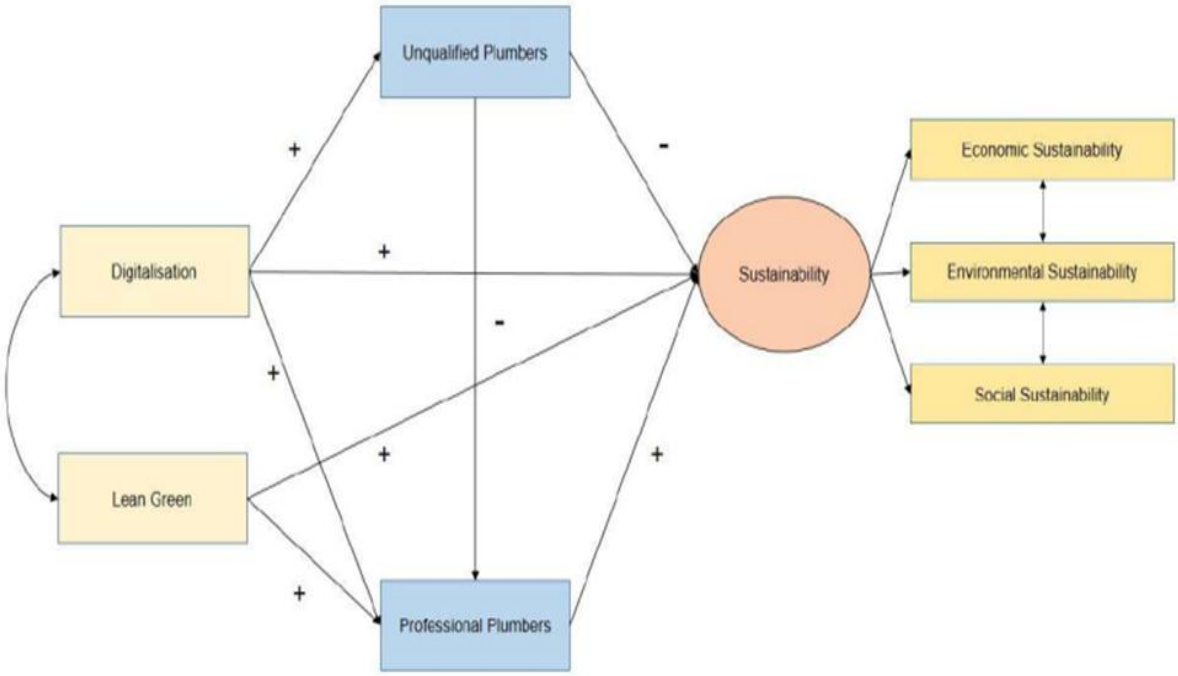
In essence, professional plumbing services in Gauteng face a multifaceted web of challenges stemming from unqualified plumbers, and market dynamics favouring cost over quality and compounded by environmental complexity and the transformation of customer expectations in the digital economy. These challenges jeopardise the sustainability of the industry on all three sustainability dimensions: conservation of natural resources, community well-being, and financial viability. Addressing this issue requires an integrated approach that balances economic, environmental, and social sustainability dimensions. This study explores how digitalisation, with its threats and opportunities, impacts the Gauteng plumbing industry and its customers. It further seeks to understand how professional plumbing services pursue sustainability in a digitalised environment in Gauteng. Specifically, it attempts to understand the following questions: In what way do unqualified plumbers present a threat to the plumbing industry and professional plumbers in Gauteng? How do professional plumbers perceive competition with unqualified plumbers? How might professional plumbers in Gauteng address their loss of revenue that results from shrinking patronage? What impact could digitalisation have on the sustainability of professional plumbers in Gauteng? How might a lean and green (lean–green) approach enhance the sustainability of professional plumbers in Gauteng?

2. Review of Extant Literature

This section draws upon academic literature to offer a thorough examination, elucidating the fundamental theories and concepts relevant to the inquiry into the sustainability of professional plumbing services in Gauteng's digitalised setting. The literature review is driven by the conceptual framework, requiring the use of inductive reasoning to go from specific

concepts and observations towards the discovery of generalisable patterns and conclusions, as recommended by De Vos et al. (2005) and Imenda (2014). Additionally, the literature review will be guided by the theoretical framework encouraging the exploration of the research dilemma from a theoretical perspective by applying deductive reasoning to identify and engage with foundational theoretical perspectives and studies and the light they might shed. In light of this, Figure 1 below will provide the model for the conceptual and literature review.

Fig. 1 The conceptual framework illustrating the relationship between study variables



Source: *Authors' conceptualisation*

The Figure 1 above depicts the interconnectedness of the variables that underline the fulcrum of the study. Hence, the conceptual and literature review here would take into cognizance existing studies that had attempted to understand these variables and their inherent relationship. Indeed, the existing body of literature is in no short supply of studies that have attempted to the problem of unqualified plumbing services in the current digitalised Environment. But then, what is sustainability? The word "sustainability" encompasses three interconnected domains: environmental conservation, social well-being, and economic viability (Giovannoni & Fabietti, 2013; Purvis et al., 2019; Mollenkamp, 2023; UCLA, 2023). These domains are so interdependent that compromising one can adversely affect the others, impacting both current and future generations (WCED, 1987; Teixeira et al., 2021). Giovannoni and Fabietti (2013) emphasize the need for an integrated approach to sustainability, which recognizes both opportunities and the inherent trade-offs among these dimensions. Aligned with the Triple Bottom Line (TBL) framework, Bhattacharya et al. (2019) argue that organizational health depends on balancing all three sustainability dimensions rather than focusing solely on economic metrics. Elkington (2018), Teixeira et al. (2021), and Gimenez et al. (2012) also advocate for consistency and balance among these dimensions as indicators of organizational success. Teixeira et al. (2021) critique the TBL framework for its ambiguity regarding the meaning and requirements for achieving balance and consistency. They highlight that different regions may prioritize different aspects of sustainability, making it challenging to find an optimal balance (Teixeira et al., 2021). Martine and Alves (2015) describe this as a "trilemma," reflecting the increasing difficulty in reconciling the three dimensions amidst widening gaps. Balancing sustainability dimensions is crucial for the plumbing industry, which faces a looming water crisis both in Gauteng and globally. Water efficiency and environmental sustainability must be prioritized, particularly in addressing the impacts of noncompliant plumbing and materials.

In similar vein, the World Plumbing Council and the World Health Organization further underscore the importance of proper plumbing for public health and sanitation, advocating for adequate training and awareness of the hazards associated with poor plumbing practices (WHO, 2006, 2020; Frankel, 2010). Despite South African regulations mandating qualifications, unskilled practitioners are prevalent, undermining the industry's credibility and consumer trust (South African National Building Regulations Act 103 of 1977; South African National Standards Act 8 of 2008; IOPSA, 2021). From a sustainability perspective, the illicit services of uncertified plumbers are socially costly and amount to unfair competition, jeopardizing the economic sustainability of professional plumbers (Bennet et al., 2012; Lapprand, 2020). The industry's dilemma reflects theories such as Porter's Competitive Strategy (1980) and Elkington's TBL (2018).

Uncertified plumbers exploit cost advantages by offering lower prices through the use of inferior materials and omitting critical installation processes (IOPSA, 2021; Reynolds, 2021; Porter, 1997). This cost leadership, despite its compromised quality, makes uncertified plumbers attractive to price-sensitive consumers (IOPSA, 2021).

Similarly, economic disenfranchisement affects social sustainability, with professional plumbers reducing full-time employment, limiting apprenticeship opportunities, and failing to enhance workforce skills (IOPSA, 2021). Furthermore, the industry faces threats from cheap, imported, and substandard materials, which dominate the market due to their lower costs and higher profit potential. Alarmingly, 70% to 80% of plumbing installations in South Africa fail to meet legal and safety standards, leading to environmentally and socially costly outcomes (Dhlamini, 2015). In the context of water scarcity, such unsustainable practices are untenable. For the Professional plumbers, following formal qualifications and rigorous apprenticeships help in maintaining a culture of quality and regulatory compliance (Gökhan Torlak, 2016). This commitment is evident through membership in organizations like IOPSA and the Plumbing Industry Registration Board (PIRB), which enforce ethical and quality standards and require continuous professional development (Afrisam, 2021). Compliance with plumbing regulations presents dual challenges: non-compliance risks reputation and licensing, while strict adherence necessitates higher costs, precluding competition on price with uncertified plumbers. Professional plumbers understand the dangers of non-compliant installations, making deviation from compliance ethically questionable (Dhlamini, 2015; Masaga, 2021).

Regarding competitiveness, Porter (1997) identifies cost leadership and differentiation as key strategies for achieving competitive advantage (CA). Uncertified plumbers typically enjoy a cost leadership CA due to lower prices, albeit achieved through lower quality. Professional plumbers, therefore, need to explore differentiation strategies to compete effectively. This requires offering unique or superior services that customers value enough to pay premium prices (Porter, 1997). Porter also distinguishes between strategic positioning and operational effectiveness (OE). While OE involves performing similar activities better, a differentiation strategy involves performing different activities or similar activities in unique ways (Porter, 1997). This distinction is crucial for avoiding competitive convergence and maintaining profitability.

The Resource-Based View (RBV) theory emphasizes leveraging firm-specific resources and capabilities to gain a competitive edge. VRIN resources (valuable, rare, inimitable, and non-substitutable) include assets, processes, and knowledge that can enhance competitive positioning (Zauner et al., 2015). Aligning these resources with consumer needs, as advocated by the Customer Perceived Value (CPV) theory, is critical for sustainability and success (Srivastava, Fahey, & Christensen, 2001; Woodruff, 1997). CPV theory suggests that customer perception of value is influenced more by price than quality, especially when customers perceive they are getting a bargain (Dodds et al., 1991; Monroe, 2003; Zauner et al., 2015). This underscores the importance of balancing quality and affordability to enhance perceived value and competitive advantage.

In essence, this literature review has reviewed existing studies and highlighted the factors influencing the sustainability and competitiveness of professional plumbers in Gauteng, guided by theoretical frameworks. Sustainability, reflecting the link between environmental, social, and economic performance, is central to organizational success (Porter, 1991; Porter & Van der Linde, 1995; Jeffers, 2010). The importance of achieving balance among the sustainability dimensions is emphasized, alongside strategies for enhancing competitiveness through the RBV and competitive strategy theories. The role of customer perceived value in determining competitive advantage is also highlighted, suggesting that professional plumbers need to balance quality and affordability to succeed in a challenging market.

3. Methodology

The study utilised a qualitative data-collection instruments to investigate the research questions thoroughly. The Qualitative data was collected through semi-structured interviews, enabling a comprehensive understanding of participants' perspectives and insights. The study used inductive reasoning to analyse qualitative data collected from the semi-structured interviews to find patterns, themes, and emergent concepts. This approach facilitated the generation of novel insights and hypotheses derived from the participants' firsthand experiences and viewpoints, thus enhancing the comprehensive exploration of the research dilemma (Imenda, 2014). Similarly, two populations were relevant and employed for this study, viz: the research questions relative to the public's perception of professional and unqualified plumbers required data collection from a broad population, namely, "existing or prospective plumbing customers in Gauteng". The second population was narrower and represents professional plumbers who provide plumbing services in Gauteng. The study's qualitative research required *purposeful* sampling that optimised the limited available resources by selecting information-rich cases (Cresswell & Plano Clark, 2011; Patton, 2014; Palinkas et al., 2015; Taherdoost, 2016). Applying purposeful sampling, professional plumbers with homogenous characteristics (such as being experienced and qualified plumbers who own or manage prominent plumbing companies in Gauteng) were selected. Moreover, snowball sampling was applied, extending the original sample of professional plumbers from four to thirteen. The result was a selection of information-rich participants with a higher degree of knowledge and experience in the plumbing industry. With an emphasis on similarity, the purposeful sampling strategy renders a depth of understanding that complemented the breadth of understanding achieved through quantitative probability sampling. Analytically, the qualitative data are analysed thematically using content analytical technique and the Nvivo 12 software.

4. Data Presentation and Discussion

In this section, the data analysis and interpretation will be set forth, and key findings will be qualitatively discussed. The analysis and interpretation here will involve thematic coding and interpretation to gain a deeper understanding of

participants' experiences and perspectives. The adoption of qualitative analysis of results will further provide a comprehensive understanding of the phenomenon under study. Hence, the analysis is presented under each research objective which aligns with each of the research question advanced in the introduction section of the study.

Research Objective 1: ***To explore how unqualified plumbers present a threat to the plumbing industry and professional plumbers in Gauteng***

The longevity of a plumbing system relies on the calibre of its constituent parts and the proficiency of the individuals who install it. Suppose the products or materials utilised in a plumbing system are inadequate. In that case, the system cannot be expected to work safely, reliably or proficiently, regardless of how well it is composed (WHO, 2006). Conversely, the highest-grade components or materials might be utilised, but the system will always fail if improperly assembled. The ill-informed practices of unqualified plumbers and the installation of non-compliant components pose a substantial threat to the plumbing industry's sustainability dimensions. Their impact on economic sustainability should become apparent when considering that professional plumbers in Gauteng face a market where price considerations often drive decision-making processes. While prioritising safety and quality is crucial for them, adhering to standards can be expensive. Engaging in price-based competition can have consequences for their long-term sustainability and ethical standards due to associated risks with substandard work. However, the query into the sustainability of professional services in the plumbing industry in Gauteng's digitalised environment should not be mistaken for a study into how professional plumbers can remain profitable or economically sustainable. Because of the significant impact that plumbing has on all three dimensions of sustainability, the plumbing industry and all its stakeholders have a duty to embrace sustainability goals. Professional plumbers play a crucial role here.

The societal impact of unqualified plumbers should also be apparent from the studies and experiential narrative regarding the physical and financial hazards of non-compliant plumbing. From a social sustainability perspective, non-compliant installations and substandard fittings pose grave risks to the public and compromise health, safety and a consistent water supply (Dhlamini, 2015). An imminent water crisis exists not only in Gauteng but globally. Consequently, water efficiency must be high on the agenda, with a concomitant imperative for the global plumbing industry to heed the call for environmental sustainability. It is becoming imperative to acknowledge that plumbing that does not meet the required standards and using inappropriate plumbing materials have harmful consequences for the environment and water management. Therefore, one of the critical considerations of an investigation into the threat of unqualified plumbers should be their severe threat to environmental sustainability.

According to the UN, safe potable water is a global fundamental human right and a prerequisite to the fulfilment of other rights (WHO & World Plumbing Council, 2006, p. vii). As per the World Plumbing Council (2006), about 3.1 million individuals, primarily children under the age of five, lose their lives each year due to preventable diseases associated with water and sanitation. Approximately 1.6 million individuals perish due to diarrheal illness caused by insufficient access to clean drinking water and proper sanitation. Buchholz (2019), on behalf of Statista, confirms that contaminated water, leading to diseases such as cholera, typhoid, and hepatitis A, causes more human deaths per year than the cumulative impact of disasters and conflicts. While it is not asserted that the plumbing industry alone might solve these pressing problems, it is essential to acknowledge that the industry will play a vital role in installing and maintaining the much-needed systems to alleviate these conditions. Despite Gauteng's plumbing industry seemingly being dwarfed by this global concern, no plumber should be exempt from this imperative. Hence, it is incumbent on *all* plumbers to achieve "*the best possible plumbing levels to ensure the highest health benefits from the use of sound plumbing practices"* (WHO & World Plumbing Council, 2006). Therefore, limiting this research dilemma to the competition between professional and unqualified plumbers is misguided. The objective should not be restricted to outwitting or outcompeting unqualified plumbers. Instead, the industry has an overarching obligation to provide plumbing solutions that enhance sustainability and harness all players or stakeholders to achieve the overall sustainability goals with a notable focus on environmental sustainability.

As a point of departure, the sustainability of professional plumbers must be viewed through the lens of the TBL, which forms an overarching theoretical construct for this study and dictates that organisational success hinges equally on economic, environmental and social sustainability. The research revealed that the threat of unqualified plumbers jeopardises the economic sustainability of many professional plumbers and, in fact, the entire industry. Nevertheless, the qualitative data revealed that most professional plumbers are keenly aware of their obligations towards achieving and sustaining social and environmental sustainability with a sense of responsibility towards providing their customers with plumbing solutions compliant with plumbing regulations despite adherence, potentially compromising their economic sustainability.

However, a study by IOPSA (2021) found that the impact of unqualified plumbers creates untenable competitive strain. In pursuit of economic sustainability, some professional plumbers compete in ways that compromise social sustainability, including disinvesting in their industry and cutting costs wherever possible. Examples include replacing permanent employees with casual labour or "cheap" foreign nationals, refusing apprenticeships, and failing to upskill staff. Additional compromises might include the use of inferior materials. When professional plumbers focus exclusively on their financial bottom line (albeit for survival), it compromises their social and environmental bottom lines. Considering the TBL theory, the profit bottom line becomes disproportionate to the people and planet bottom lines, while all three should be instructive to organisational success (Elkington, 2018).

Research Objective 2: ***To examine how professional plumbers perceive competition with unqualified plumbers***

The consensus among the interviewed professional plumbers is that they cannot compete with unqualified plumbers for a variety of reasons, which include their proud commitment to quality and safety, association with industry bodies such as IOPSA and PIRB and their high necessary expenses, including liability insurance, levies and taxes preclude it. Therefore, price-based competition is as much unfathomable as it is untenable.

The research on the competitiveness of professional plumbers was a central theme in the theoretical framework and had a bearing on both RO 2 and 3. The research identified two possible theoretical constructs that could enhance the competitiveness of professional plumbers and potentially confer a competitive advantage that rivals the *cost leadership* competitive advantage of unqualified plumbers, namely the theories on competitive strategy and the resource-based view of the firm (RBV). The scenario surrounding professional and unqualified plumbers finds many touchpoints with Michael Porter's (1997) competitive strategy theory. While unqualified plumbers possess a *cost leadership* competitive advantage, the pertinent question becomes how professional plumbers might formulate a *differentiation* strategy that might see them capture a competitive advantage in their own right.

However, at this juncture, it is essential to consider Porter's description of what strategy is *not*. Most importantly, operational effectiveness (OE), although essential to profitability and strategy execution, does not result in the differentiation required for a strategic competitive advantage. OE introduces a type of competition not previously addressed, namely, the competition between professional plumbers themselves and how their pursuit of OE can escalate the Gauteng plumbing industry's *hyper-competitive* environment and cause competitive convergence amongst professional service providers. Examples of potential OE practices include the race to provide the best possible customer service and experience, which was a recurring theme in the interviews conducted. Alarmingly, Porter alerts one that professional plumbers constantly pursuing OE might result in homogeneity, which furthers the dilemma of declining or static prices and impacts the incumbents' costs. At this point, professional plumbers might consider Porter's exhortation to explore positioning trade-offs instead of trying to be all things to all customers. A plumber opting for positioning trade-offs will purposefully limit the offerings they decide to compete with.

In Gauteng's increasingly digitalised environment, professional plumbers might adopt technology indiscriminately and without a clear strategy for its purpose. If adopted to improve OE, i.e. improving customer service or streamlining work, it might enhance profitability initially but eventually stimulate more competition, price and cost pressures that will only detract from their or the industry's sustainability. Moreover, it will become clear that professional plumbers should carefully consider strategic considerations when embracing and offering "smart" plumbing solutions to their customers. The aim should be to differentiate themselves from rivals and add more value to customers by doing something different or the same thing in different ways, which is the essence of strategy. However, they should be vigilant of what Porter calls the "growth trap" (p. 16). If "smart" plumbing is added only to extend their service repertoire, it might be followed by organisational dissonance when attempting to compete in multiple ways simultaneously, such as a composite of "smart" and traditional services, without seeing the need for a trade-off. When offering "smart" plumbing strategically, the professional plumber must consider the "fit" of their activities and how they relate with one another, mindful that a differentiation competitive advantage is the outcome of both the choice of their services and how they are delivered. The resource-based view of the firm (RBV) is an alternative theory related to the competitiveness of professional plumbers and how they might achieve a competitive advantage to rival the advantage of unqualified plumbers.

The RBV explores how professional plumbers in Gauteng can leverage their resources (such as qualifications and expertise) to compete against unqualified plumbers and adapt to digitalisation. According to the literature, an RBV perspective focuses inwardly on the firm's resources and capabilities to enhance its competitive advantage. Accordingly, RBV might help reassess the resources and capabilities of professional plumbers who are often outwardly focused on the threat of unqualified plumbers. Two strategies emerge: One involves identifying the existing resources and capabilities of the firm, while the other deals with identifying the resources needed for the firm's growth. The fact that some plumbers can survive and compete despite fierce competition indicates they possess specific advantageous resources and capabilities. The pertinent question of RBV is whether professional plumbers might possess skills and capabilities that are valuable, rare, inimitable and non-substitutable (VRIN) to gain a competitive advantage. The theory holds that favourable resources and capabilities will enable plumbers to differentiate themselves from competitors and maintain a competitive edge in the market. Plumbers emphasise their commitment to delivering exceptional customer service as a distinguishing factor and a tool to compete with the lower prices of unqualified plumbers. However, it raises the question of whether this objective is not perhaps limited to the OE identified by Porter (1997). Should the latter theory be accepted, the professional plumbers' pursuit of tools and methods to continually improve customer service might have the opposite effect by creating benchmarks that drive competition amongst homogenous companies, depressing prices and culminating in mutual destruction. On the other hand, their focus on rendering superior customer service contributes to the customers' perception of value. The CPV is theoretically introduced as a tool for professional plumbers to address their shrinking market share and revenue. From that perspective, the value of competing in customer services should not be denigrated despite it not providing a competitive advantage.

Contextually, should the RBV theory be preferences, plumbers' professional skills and abilities, certifications, and exceptional knowledge may currently be undervalued resources. Equally, the quantitative data attests to the role of

certifications in the customers' choice of a plumber. Should these resources satisfy the VRIN test and coupled with the necessary capabilities, they could be configured into a competitive edge. However, the level of homogeneity in this respect might mean that a plumber's professional stature is neither rare nor inimitable. Nevertheless, the importance of these resources towards a sustainable industry should not be disparaged.

Research Objective 3: ***To determine how professional plumbers in Gauteng might address their loss of revenue due to shrinking patronage***

The exploration of RO 3 prompted an inquiry into the customer's perception of value (CPV) and the potential application of the shared value (SV) theory. These constructs are also relevant to RO 2, which was discussed previously. The literature review revealed that the customer-perceived value is pivotal to organisational success, even survival. Since the professional plumbers' value proposition is a central theme to achieving sustainability, the CPV theory is highly relevant to RO 2 and 3. Although professional plumbers relate their unwavering focus on service quality, price considerations seem to outweigh the value perceived by customers, exemplified by their buying behaviour rather than the survey results. This is consistent with scholarly findings that CPV is beholden to the customers' subjective evaluation rather than the objective attributes of the offering, and price perceptions mostly outweigh quality considerations. The literature review highlighted tools to enhance the CPV in the service industry, which include service quality, service equity, confidence benefits, and perceived sacrifice vs benefits (Ruiz et al., 2008).

Given plumbing services' intangibility and invisibility, a strong brand perception, or *service equity*, influences the customer's perception of service value. However, due to the commoditisation of plumbing services and the abundance of professional plumbing brands competing for a relatively small market segment, establishing brand recognition and equity will require a sizeable marketing investment. Although most customers do not use plumbing services at short intervals, a professional plumber can provide *confidence benefits* as part of its service value. Plumbers can build trust through word-of-mouth, online reviews, and consistently high service quality. Moreover, cultivating *customer relationships* can encourage a sense of security. Arguably, both these CPV tools fall exclusively in the domain of professional plumbers. Plumbing customers incur monetary and non-monetary sacrifices in return for the service. Although low prices are not necessarily decisive, the customer's perception of value for money is critical to prevent the perceived sacrifice from outweighing the perceived benefit and making the unqualified plumbers' services seem preferable.

In industries like plumbing, which involve high customer contact and a degree of personalised service, professional plumbers that pursue a positive service value perception should focus on their customer relationships while emphasising high *service quality*, reliability, and consistency at every customer interaction and reinforce these by establishing significant brand equity through marketing activities. As long as the CPV cannot be improved, the shrinking revenue of professional plumbers will stimulate further price increases to cover their high overhead costs amidst a shrinking customer base. This vicious cycle exacerbates the price war and compromises the sustainability of professional plumbers. At this juncture, one might also indicate the intersection between the CPV and lean-green theories. Lean-green is conceptually identified as an independent variable and, theoretically, as a tool to achieve the triple bottom line and sustainable plumbing industry. A view gaining traction in theory and practice is that CPV is gaining an "ecological facet", and environmental and contextual variables, such as "green consumption", increasingly impact the customer's perception of value in the service industry. It is postulated that a symbiotic relationship exists between sustainable and ecological consumption and CPV, to the point that these might receive precedence over the price factor.

Arguably, embracing the demands of sustainable plumbing practices and the triple bottom line might allow for sufficient differentiation to justify premium rates (Porter, 1997), provided it resonates with the customer's perception of value, which is pivotal to organisational success. Furthermore, the theory of shared value (SV), with its social, environmental and economic touchpoints, is well aligned with a study into the tridimensional sustainability challenges of professional plumbers. It offers a perspective on RO 2 and 3 related to professional plumbers' views on competing with their unqualified counterparts and how they might supplement their declining revenue. The theory of shared value can potentially contribute to both the economic and social sustainability of professional plumbers and restore their legitimacy in the eyes of the public. Apart from its potential to confer a competitive advantage, the literature indicates an intersection between SV and numerous theories relevant to this study, including the TBL, CPV, and RBV theories.

Using Porter and Kramer's (2011) SV framework, professional plumbers might generate economic value for themselves while simultaneously generating value for society by leveraging a business model rather than charity to address societal humanitarian challenges. A business model that comes to mind is the social franchising system of the Unjani Clinics project. Such a business model will create a positive company and community prosperity cycle, impacting all three sustainability domains. By training and partnering with unqualified plumbers, innovative professional plumbers might launch plumbing franchise establishments in lower-income communities in dire need of plumbing services. Besides uplifting unqualified plumbers, providing an essential service to marginalised communities, and improving the plumbing quality benchmark, professional plumbers also address their shrinking revenue. Some even argue that a successful SV venture can confer a competitive advantage, which would benefit professional plumbers facing the price-competitive advantage of unqualified plumbers. However, the suggestion of such an initiative was met with ambivalence by the interviewed professional plumbers, many of whom doubted its feasibility. Notwithstanding, evidence still indicates that SV enables businesses to have a beneficial social and environmental impact and profit when their business strategies align with societal requirements and difficulties. This perspective reinforces the TBL framework, which serves as the overall

paradigm for this study. Moreover, in their discussion of SV, Porter and Kramer (2011) confirm that as society's sustainability consciousness increases, it progressively demands and values products and services that encompass societal needs. This observation reinforces the apparent interplay between the SV approach and the customer's value perception (CPV).

Research Objective 4: ***To ascertain how digitalisation might impact the sustainability of professional plumbers in Gauteng***

The impact of digitalisation on the sustainability of professional plumbers (RO 4) is topical to this study's research dilemma and relevant in light of rapidly evolving digitalisation both in Gauteng and globally. Digitalisation is a very pertinent and contemporary issue that has the potential to impact professional plumbing services in all three sustainability domains. The digitalisation of the plumbing industry presents both opportunities and challenges. The participants in this study acknowledged that digital tools are vital for improving communication and efficiency. However, they also highlighted that personal connections and traditional customer relationships remain essential in this highly interactive industry. This dual perspective underscores the growing importance of embracing digitalisation while maintaining the personal touch valued by customers.

Although study participants acknowledged the value of digital technologies to enhance communication and workflow using elementary digital tools like WhatsApp and software for bookkeeping and work scheduling, the general perception was that it would not play a noteworthy role in plumbing for at least the next 10 – 15 years. Arguably, this viewpoint raises questions about the degree of agility and perceptiveness of professional plumbers in Gauteng. The deceptive notion that the plumbing industry is not in jeopardy of digital disruption will turn out to be costly if one considers the exhortation from Weill & Woerner (2018) that "digital transformation is not about technology – it is about change. And it is not a matter of *if*, but a question about when and how" (p. 1). Nevertheless, scholars emphasise that digital technologies should not be adopted merely for the sake of it. Instead, customer-centricity should be pre-eminent while exploiting data and digital skills must focus on creating new customer value. Once again, the question of OE arises, which should remind professional plumbers that digital technologies will not provide a defensible strategic position or competitive advantage if not used to capture differentiation. Nevertheless, one should not disparage the capability of OE to enhance profitability. Hence, it remains a noble pursuit despite not being capable of maintaining a long-term successful competitive position because of its inimitability.

Similarly, regarding the RBV, using digital technologies (primarily how professional plumbers use it currently) is not a VRIN resource that may competitively distinguish firms. However, some view the dynamic capabilities that allow a firm to continually reconfigure and adapt to the accelerated rate of change in the digital economy as VRIN resources that might benefit nimble professional plumbers. Still, based on this study's qualitative data and narrative, dynamic capabilities to exploit digital opportunities are currently not prevalent in Gauteng's professional plumbing industry. Without explicitly referencing Porter's competitive strategy theory or the RBV, Satell et al. (2021) emphasise that digital technologies cannot give rise to a competitive advantage since they are only a vehicle and can be incorporated by any firm. Conversely, as discussed, the literature holds that a competitive edge might be available to professional plumbers who harness data and data-enabled learning in the digital age.

Another perspective involves professional plumbers using digital technologies to enhance workflow and decrease costs. Consequently, digital technologies might yet enhance professional plumbers' cost structure, profitability, market share, and sustainability by enabling price competition. Nevertheless, one might contend that professional plumbers face far more complex problems, and merely adopting technology for cost savings will not solve them. Although digital technologies, as presently used by professional plumbers, are capable of streamlining workflow, successful digitalisation, according to the literature, hinges on the centrality of the customer. Moreover, scholars like Satell et al. (2021) argue that the power of digital tools does not lie in their ability to enhance efficiency or cut costs. Moreover, attempting to compete on price while trying to maintain a premium value proposition and reputation might dilute a potential differentiation competitive advantage and cause organisational dissonance. Therefore, the impact on brand equity and the CPV should also not be underestimated. However, there is another dimension to the evolving digitalisation phenomenon in the plumbing industry. Professional plumbers can harness technology to provide customers with eco-solutions to their plumbing problems. As highlighted earlier, environmental sustainability is high on the global agenda, transcending industries while environmental considerations increasingly influence the CPV. When deployed strategically, "smart" plumbing solutions that support the environmental cause might see the early adopters amongst professional plumbers capture a niche market and differentiated strategic position, establishing a competitive advantage *vis-à-vis* both their contemporaries and unqualified rivals while concomitantly justifying premium prices. From this perspective, internal and external digitalisation initiatives might diminish the threat of unqualified plumbers (RO 1) while improving competitiveness (RO 2) and supplementing professional plumbers' revenue and market share (RO 3), culminating in enhanced sustainability. Despite the attractiveness of this proposition, it does not yet resonate with the qualitative data rendered by this study. The interviewed professional plumbers deem digitalisation inconsequential in the Gauteng plumbing industry. Ultimately, one might summarise that digitalisation is a matter of strategy, not technology. This view is borne out by scholarly opinion. Whether deploying digitalisation internally or externally (by offering "smart" plumbing solutions), it should be done strategically with customer-centricity and value creation being pivotal. In this sense, an intersection exists between digitalisation and the theoretical constructs of the lean-green methodology and CPV.

Research Objective 5: ***To explore how a lean–green approach might enhance the sustainability of professional plumbers in Gauteng***

From a theoretical perspective, a clear consistency exists between the TBL theory and the objectives of the lean-green theory, with a reciprocal relationship between plumbing, public health and safety, and the environment. With its CPV and TBL touchpoints, the lean-green theory highlights how professional plumbers can optimise their operations and customer value creation while minimising waste and their environmental impact, culminating in their enhanced sustainability. The qualitative data suggested that most participants believed that green plumbing was between somewhat and absolutely essential. By subscribing to the lean philosophy, professional plumbers could benefit from lean constructs such as waste reduction, continuous improvement and the efficient use of resources. These practices might decrease operating expenses and service costs, empowering them to compete on price without compromising quality standards. Considering the symbiotic relationship between lean and green, the cost savings will be augmented by environmental accountability, which, as discussed, might resonate with the customer's perception of value, indicating the intersection between the lean-green construct and the CPV theory.

On the other hand, viewed from Porter's (1997) competitive strategy theory, such an application of lean measures cannot confer a competitive advantage but merely contribute to OE. Albeit essential to profitability, OE might eventually lead to competitive convergence in hyper-competition scenarios (such as the plumbing industry in Gauteng). Furthermore, many plumbing companies, instead of focusing on maximising resources and reducing waste, tend to expand their services, business activities, and marketing efforts to counter declining revenue and growth. However, this approach is counterintuitive to the lean-green paradigm and often comes at significant costs. In most cases, when expenses rise and profits decline, the customer bears the brunt. Aligned with earlier observations regarding the looming threat of water scarcity, Elton and Wolfe (2011) highlight the significant importance of experienced plumbers in ensuring water efficiency. They are responsible for deciding on installations and digital technologies that will impact water usage in the long term. This statement succinctly illustrates the significance of skilled plumbers in advancing the environmental goal and sustainability agenda.

The interviewees displayed genuine dedication to eco-friendly practices and emphasised their belief that green plumbing would be the future of the plumbing industry. They acknowledge the necessity of installing eco-friendly plumbing fixtures, such as solar hot water systems, tankless water heaters, low-flow toilets, and tap aerators. The contribution of these "green" measures to environmental sustainability should not be underestimated. The World Plumbing Council (2006) reports that in residential premises equipped with flushing toilets, the toilet can contribute to around 33% of the total daily water use of the household. Conversely, low-flush toilets have a water consumption of 5 or 6 litres each flush compared to the previous standard of roughly 20 litres. "Smart" water metering systems can also play a pivotal role in water conservation. According to the World Plumbing Council (2006), a minor leak measuring 3 mm in a water pipe or a dripping tap, when subjected to regular pressure, can result in the wastage of 340 litres of water each day. This quantity is sufficient to meet the needs of a family of three. The relentless energy and water supply interruptions in Gauteng and beyond create an opportunity for professional plumbers to differentiate themselves with eco-friendly and off-grid plumbing solutions, including rainwater and greywater harvesting and other water-efficient technologies. Continued progress can advance environmental protection and move the plumbing industry toward a circular economy. Nonetheless, there is a perception that the relatively high cost of green plumbing solutions deters its implementation in Gauteng and beyond. In contrast, some believe that customers will start to perceive green plumbing as an investment that will pay off in the long run.

Elton and Wolfe (2011) propose the concept of "Green Plumbing" as an environmental undertaking dedicated to promoting global water efficiency and conservation. "Green plumbing" pertains to implementing and using water-efficient methods and devices primarily aimed at reducing financial costs and easing water scarcity issues. The authors argue that those who embrace green plumbing practices early on might reap considerable financial rewards by establishing a niche position in the market. This contention aligns well with the lean-green construct and resonates with Porter's (1997) exhortation to embrace a differentiation strategy in pursuit of a competitive advantage. Ultimately, it culminates in furthering the economic and environmental sustainability objectives of those who heed the call. Finally, a juncture exists between the theoretical and conceptual constructs of digitalisation and lean-green. The circular economy, which is of growing contemporary importance, can be regarded as a manifestation of the lean-green philosophy with its focus on waste minimisation and optimal use of resources. As highlighted in the literature review, studies have found that digitalisation is a key driver and determinant of the success of the circular economy. The embrace of the circular economy in the Gauteng plumbing industry is not far off as evidenced by the narrative of the interviewees, who emphasised the importance of water recycling initiatives, including black and grey water recycling. The circular economy is recognised by Berg and Wilts (2019) as a potential remedy for a number of the most crucial sustainability issues. Thus, one could argue that it is the "way of the future," and technologically savvy, innovative plumbers who become adept at providing the "green solutions" of the circular economy can even gain a competitive edge in this specialised sector. Embracing lean-green practices, professional plumbers might accomplish their sustainability objectives with renewable resources and waste reduction throughout the supply chain. Besides the environmental and economic sustainability benefits, these practices may enhance a company's reputation and competitiveness.

In essence, Gauteng's plumbing sector is at a crossroads where lean-green and digitalisation can be combined to address environmental issues and overall sustainability objectives while satisfying consumer demand. However, building a sustainable, environmentally conscious, and digitally driven plumbing sector in Gauteng will take coordinated efforts from all stakeholders, including plumbers, legislators, customers, and environmental campaigners.

5. Conclusion

This research study into the sustainability of professional plumbing services in the digitalised environment of Gauteng, South Africa, aimed to provide insights into the complex sustainability issues faced by the professional plumbing industry in Gauteng, South Africa. These challenges, arising from the impact of digitalisation, the influx of unqualified plumbers and evolving customer expectations in the digital era, have significant implications for the industry's economic, environmental, and social sustainability. Proficient plumbing is a linchpin that upholds the three vital dimensions of sustainability: economic, environmental, and social. This multifaceted relationship underscores its significance in addressing pressing challenges. Economically, a robust professional plumbing industry generates revenue and contributes to the broader economy. Sustainable plumbing practices foster resource efficiency, trim operational costs, and contribute to economic stability and growth. From an environmental sustainability viewpoint, professional plumbers are guardians of natural resources, averting environmental degradation. Adherence to industry standards and eco-friendly practices minimises water wastage, curtails harmful substance release, and diminishes their ecological footprint. Social sustainability is intrinsically linked to plumbing, which directly impacts public health and safety. Maintaining functional, safe plumbing systems is imperative, and upholding public health is a cornerstone of societal well-being. However, the marginalisation of professional plumbers by unqualified plumbers offering cheap services can be detrimental to all three sustainability dimensions. Economically, unqualified plumbers' undercutting of prices may lead to a race to the bottom, eroding the economic viability of the professional plumbing industry. Environmentally, non-compliant installations and components can result in resource wastage, increased water contamination, and ecosystem damage. Societally, the lack of adherence to safety standards and best practices can jeopardise public health and safety, potentially leading to waterborne diseases and other health hazards. These significant ramifications prompted this research study that explored sustainable strategies for professional plumbers to compete while simultaneously promoting economic stability, environmental responsibility, and the well-being of society, ensuring that professional plumbing services continue to fulfil their vital role in preserving public health, safeguarding the environment, and contributing to economic advancement in the digital economy. While highlighting the risks and futility of price-driven competition, this study advocated alternative competitive approaches based on the RBV and the competitive strategy theory while suggesting shared value and customer-perceived value as tools to enhance their competitiveness. Meanwhile, digitalisation was recognised as a tool to enhance customer satisfaction, streamline effectiveness and workflow and minimise costs. By integrating the principles of lean and green methodologies, this study seeks to enhance economic, environmental, and societal sustainability within the plumbing industry, ensuring that professional plumbing services continue to fulfil their vital role in preserving public health, safeguarding the environment, and contributing to economic advancement in the digital economy.

Summarily, this study has provided a comprehensive understanding of the dynamics within professional plumbing services in Gauteng, including the impact of rapid digitalization and associated sustainability challenges. These insights can guide strategic decision-making and foster collaborative efforts to create a resilient and sustainable plumbing sector meeting the needs of present and future generations. Furthermore, our findings underscore the complexity of these sustainability challenges, emphasizing the importance of a balanced approach encompassing economic viability, technological adaptation, and unwavering commitment to environmental sustainability. Policymakers, industry stakeholders, and plumbing professionals must work together effectively to navigate these challenges and ensure the industry's growth and relevance in a dynamic and ever-evolving landscape.

References

1. Afrisam. (2021). *Plumbers in South Africa*. Afrisam. https://www.afrisam.co.za/wpcontent/uploads/2021/10/54.-Choosing-a-Plumber.pdf
2. Bennett, V. M., Pierce, L., Snyder, J. A., & Toffel, M. (2012). Competition and Illicit quality. *Harvard Business School*, *12*(071).
3. Bhattacharya, A., Nand, A., & Castka, P. (2019). Lean-green integration and its impact on sustainability performance: A critical review. *Journal of Cleaner Production*, *236*, 117697. https://doi.org/10.1016/j.jclepro.2019.117697.
4. Cresswell, J. W., & Plano Clark, V. L. (2011). Designing and Conducting Mixed Method Research; 2nd Sage: Thousand Oaks. *Search in*.
5. De Vos. A.S. (2005). Qualitative data analysis and interpretation. In De Vos, A.S. (Ed.), Strydom, H., Fouché, C.B. & Delport, C.S.L. Research at Grassroots: For the Social Sciences and Human Service Professions. 3rd ed. Pretoria: Van Schaik Publishers.
6. Dhlamini, N. (2015, November 23). *Geyser explosion survivor has lost everything*. Kempton Express. https://kemptonexpress.co.za/95113/geyser-explosion-survivor-has-losteverything/

7. Diederich, C. (2022, September). *Five Ways How Design Thinking and Digital Transformation Complement Each Other – innovate.d*. Www.innovate-D.com. https://www.innovate-d.com/insight-209/.
8. Dodds, W. B., Monroe, K. B., & Grewal, D. (1991). Effects of Price, Brand, and Store Information on Buyers' Product Evaluations. *Journal of Marketing Research*, *28*(3), 307–319. https://doi.org/10.2307/3172866.
9. Elkington, J. (2018, June 25). *25 years ago I coined the phrase "triple bottom line." here's why it's time to rethink it*. Harvard Business Review. https://hbr.org/2018/06/25-yearsago-i-coined-the-phrase-triple-bottom-line-heres-why-im-giving-up-on-it.
10. Elton, K., & Wolfe, S. E. (2011). Water Efficiency and the Professional Plumbing Sector: How Capacity and Capability Influence Knowledge Acquisition and Innovation. *Water Resources Management*, *26*(2), 595–608. https://doi.org/10.1007/s11269-011-9934-7
11. Frankel, M. (2010). *Facility piping systems handbook*. McGraw-Hill.
12. Gimenez, C., Sierra, V., & Rodon, J. (2012). Sustainable Operations: Their Impact on the Triple Bottom Line. *International Journal of Production Economics*, *140*(1), 149–159.
13. Giovannoni, E., & Fabietti, G. (2013). What is sustainability? A review of the concept and its applications. Integrated reporting: Concepts and cases that redefine corporate accountability, 21-40.
14. Gökhan Torlak, N. (2016). Organizational Change Management Strategies in Modern Business. *Advances in Logistics, Operations, and Management Science*. https://doi.org/10.4018/978-1-4666-9533-7.
15. Hay, L. (2021, September 10). *Insurance innovation and insurtech Insights - KPMG Global*. KPMG. https://kpmg.com/xx/en/home/insights/2020/12/insurance-innovation-andinsurtech-insights.html *Health Services Research*, *42*(5), 533–544. NCBI. https://doi.org/10.1007%2Fs10488013-0528-y https://www.investopedia.com/terms/s/sustainability.asp
16. Imenda, S. (2014). Is There a Conceptual Difference between Theoretical and Conceptual Frameworks? Journal of Social Sciences, 38, 185-195. https://doi.org/10.1080/09718923.2014.11893249.
17. IOPSA. (2021). *Municipality and Local Authority Plumbing Survey and Research Paper* (pp. 1–32). Institute of Plumbing South Africa.
18. IOPSA. (2023, January 25). *IOPSA - 15 plumbing trends to keep an eye on for 2023*. www.iopsa.org. https://www.iopsa.org/news/13071755. Its Applications. *Integrated Reporting*, 21–40. https://doi.org/10.1007/978-3-319-021683_2
19. Jeffers, P. (2010). "Embracing sustainability: information technology and the strategic leveraging of operations in third-party logistics. *International Journal of Operations and Production Management*, *30*(3), 260–287.
20. Lapprand, D. (2020). Illicit Trade and Private Business. *International Security Management*, 209–223. https://doi.org/10.1007/978-3-030-42523-4_15
21. Masaga (2021) reports on a geyser explosion that occurred at a sports centre in Pretoria. Pretoria Rekord.
22. Mollenkamp, D. (2023, April 8). *What is Sustainability?* Investopedia.
23. Monroe, K. (2003). *Pricing: Making Profitable Decisions* (3rd ed.). McGraw Hill. MWJiOTg5M2UtNGQ1Mi00MTY0LWJhODctZWYyMzVlYzQ2YTQ2XzAxMw%3D%3D&msgOverlay=true&trackingId=5y4fdDNVTOCsMLigm1KgNQ%3D%3D.
24. Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research. *Administration and Policy in Mental Health and Mental*
25. Patton, M. Q. (2014). *Qualitative Research & Evaluation Methods* (3rd ed.). SAGE Publications.
26. PIRB. (2022, April 1). *Dangers of plumbing: when standards are not followed – Plumbing*. Plumbing Industry Regulation Board. https://pirb.co.za/dangers-of-plumbing-whenstandards-are-not-followed/.
27. Porter, M. (1991). *"America's green strategy." 264*(4), p 168. Scientific American.
28. Porter, M. E., & Kramer, M. R. (2011, January). *Creating Shared Value*. Harvard Business Review. https://hbr.org/2011/01/the-big-idea-creating-shared-value
29. Porter, M., & Van der Linde, C. (1995). Green and competitive: ending the stalemate. *Long Range Planning*, *28*(6), 128–129. https://doi.org/10.1016/0024-6301(95)99997-e
30. Purvis, B., Mao, Y., & Robinson, D. (2019). Three Pillars of sustainability: in Search of Conceptual Origins. *Sustainability Science*, *14*(3), 681–695. springer. https://doi.org/10.1007/s11625-018-0627-5.
31. Reynolds, B. (2021, January 26). *LESS THAN 1 IN 5 "PLUMBERS" IN SOUTH AFRICA ARE ACTUALLY QUALIFIED*. Www.linkedin.com. https://www.linkedin.com/pulse/lessthan-1-5-plumbers-south-africa-actually-brendan-reynolds/?msgControlName=view_message_button&msgConversationId=2-
32. Ruiz, D. M., Gremler, D. D., Washburn, J. H., & Carrión, G. C. (2008). Service value revisited: Specifying a higher-order, formative measure. *Journal of Business Research*, *61*(12), 1278–1291. https://doi.org/10.1016/j.jbusres.2008.01.015.
33. Satell, G., Kates, A., & McLees, T. (2021, November 30). *4 Principles to Guide Your Digital Transformation*. Harvard Business Review. https://hbr.org/2021/11/4-principles-to-guideyour-digital-transformation. South African National Standard Act 8 of 2008.

https://tkp.tourism.gov.za/Style%20Library/Toursim%20Compendium/Compendium%20Set%202/pdfs/national-tourism-phase2_standards.pdf
34. Taherdoost, H. (2016). Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research. *SSRN Electronic Journal*, *5*(2), 18–27. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3205035
35. Teixeira, P., Sá, J. C., Silva, F. J. G., Ferreira, L. P., Santos, G., & Fontoura, P. (2021). Connecting lea and green with sustainability towards a conceptual model. *Journal of Cleaner Production*, *322*, 129047. https://doi.org/10.1016/j.jclepro.2021.129047.
36. UCLA. (2023). What is Sustainability? UCLA Sustainability; UCLA. https://www.sustain.ucla.edu/what-is-sustainability/
37. Vor dem Esche, J., & Hennig-Thurau, T. (2014). *German Digitalisation Consumer Report 2014* (DOI:10.13140/2.1.3071.0402 ed.).
38. Weill, P., & Woerner, S. L. (2018). *What's your digital business model?: six questions to help you build the next-generation enterprise*. Harvard Business Review Press.
39. Woodruff, R. B. (1997). Customer value: The next source for competitive advantage. *Journal of the Academy of Marketing Science*, *25*(2), 139–153.
40. World Health Organization (WHO) & World Plumbing Council. (2006). Health aspects of plumbing. World Health Organization. https://www.who.int/publications/i/item/9241563184.
41. World Commission on Environment and Development. (1987). *Our common future*. Oxford University Press.
42. Zauner, A., Koller, M., & Hatak, I. (2015). Customer perceived value—Conceptualization and avenues for future research. *Applied Psychology R.*