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The Effect of Deploying Renewable Energy Mini-Grids to the Productivity of Small to Medium Enterprises (SMEs) in the Manufacturing and Processing Industry in Mashonaland West Province, Zimbabwe

By

[1]Shorai Kavu (PhD Student), [2]Professor Maria Tsvere & [3]Professor Wilbert Mtangi

[1,2&3] Chinhoyi University of Technology (CUT) Private Bag 7724, Chinhoyi, Zimbabwe

[1]Email: kavkajongwe@gmail.com Cell no. +263778240482, +263715015626

[2]Email: mtsvere@cut.ac.zw; Cell no. +263773365751

[3]Email: wmtangi@cut.ac.zw; Cell no. +263782234588, +263713156404

Abstract

The main purpose of the study was to assess the effect of deploying renewable energy mini-grids (REMG) to the productivity of Small to Medium Enterprises (SMEs) in the manufacturing and processing industry in Mashonaland West Province, Zimbabwe. The study adopted a mixed method research approach rooted in Pragmatism research Philosophy. The population of the study were all 4000 registered manufacturing SMEs in Zimbabwe of which 1400 are located in Mashonaland West Province. This research used a sample size of 140 manufacturing SMEs from Mashonaland West Province calculated using the 10% probability rule at 95% confidence level and +-5 margin of error. Respondents were selected from the managerial and senior employees. The researcher employed the use of questionnaires and interview guide in gathering data. Cronbach's alpha coefficient of reliability was used in this study to test validity and reliability of data instruments. The data in this study was analysed using Statistical Package for Social Sciences (SPSS) version 21.0. Descriptive statistics was used for quantitative data using means and Standard Deviation (SD). Qualitative data was analysed using the Nvivo Qualitative Research Analysis Software. The data was presented in the form of tables, graphs, pie charts and themes. However, Karber's (2018) Theory of change (ToC) guided this research study. Research findings indicated that deploying renewable energy mini-grids increases SMEs productivity, quality service delivery, Return On Investment and Return On Asset in Zimbabwe. It was also established that the power supply situation from the National Grid has for decades not been favouring SMEs and as such SMEs require alternative forms of electricity from renewable energy mini-grids. Therefore, there is need for entrepreneurs to acquire the necessary energy management and renewable energy design, operation and maintenance skills to enhance the future survival in the stiff competitive business environment. The Zimbabwe government should create an enabling environment which gives the banking institutions a guarantee that SMEs will meet the financial obligation of repayment of the accessed loans to enable them to deploy renewable energy mini-grids, implement energy efficiency and saving practices and not consider it as costly. Provision of necessary energy demand side management skills for SMEs requires a clear understanding of the different energy policies and regulations like the net-metering regulations, energy efficiency policy, renewable energy policy and Electricity Act, Rural Electrification Act among which empirical evidence this study has established. Longitudinal study need to be done on the effect of deploying renewable energy mini-grids (REMG)to the productivity of all Small to Medium Enterprises (SMEs) in Zimbabwe rather than focusing on those SMEs in the manufacturing and processing alone to have an informed decision.

Key Words: Deploying, Renewable Energy Mini-Grids, Productivity, Small to Medium Enterprises, Manufacturing and Processing, Industry, Mashonaland West Province, Zimbabwe

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Introduction and Background to the Study

Small to Medium Enterprise (SMEs) have grown to be a strong pillar of economies worldwide accounting for more than 50% of any country's GDP (Odero, 2016). Governments have a number of ways to support SMEs to help them cope with externalities in their operating environment (Nyoni, 2018; Brako Ntiamoah et al., 2016). This is so because SMEs have generally weak financial standing and thus any major change in the macro environment can easily shake them as was asserted to by Nyoni, (2018). However, the need to clean energy access for sustainability of SMEs business operations was seen as a backbone of productivity. Small and Medium Enterprises are among the many clients which have been treated as insignificant when it comes to electricity consumption in the convectional supply era (grid extension for rural electrification), (Vinci, 2017; Szabó et al., 2011). Thumps up to the deployment of renewable energy mini-grid for energy access, which need these as anchor customers for sustainability of systems through demand for energy for productive use (Pueyo & DeMartino, 2018). For manufacturing SMEs, the issue of voltage of electricity supplied comes into play as a quality issue unlike for other non-manufacturing SMEs which usually apply electricity to small non-inductive loads (Ye et al., 2017; IEA, 2016b). Clean energy supply for productive use by SMEs in developing countries has become the drive towards clean electricity access through renewable energy mini-grid deployment in urban and rural electrification (Deshmukh et al., 2013). To ensure the right supply voltage for SMEs in the manufacturing sector, the mini-grid design has to be done with the type of loads in mind (Terrapon-Pfaff et al., 2018; Nygaard, 2009).

Mostly, mini-grids provide electricity at a higher balanced cost than a main T&D network system(Ye et al., 2017; IEA, 2016b). Mini-grids tend to rely on modular generation technologies like solar PV, wind turbines, small-scale hydropower and diesel generators. Like any grid, mini-grids need a stable flow of power to function properly and they often use either a small diesel generator or (increasingly) battery systems for back-up(Ye et al., 2017; IEA, 2016b). Mini-grids require a certain demand threshold to justify the initial investment in the network, and therefore benefit from sizeable anchor loads such as public services or industrial and commercial facilities. Mini-grids can be scaled up in line with rising demand, and eventually be connected to a main T&D network, though mini-grid developers may choose not to invest in more expensive equipment that is required to meet the main T&D system standards if connection to the main grid is not foreseen. Mini-grids that are not compatible with main T&D networks can become stranded assets if the main grid is extended to the area (Pueyo & DeMartino, 2018).

Mini-grids facilitate the continued growth of socioeconomic development in rural areas (Shonali Pachauri & Abeeku Brew-Hammond, n.d.; Vinci et al., 2016). Majority of the population in SSA reside in rural areas and as a result the benefits of electrification through mini-grids enables further development of the bigger population (Moner-girona et al., 2018; Nkiriki & Ustun, 2018). The advantages of RE mini-grids include facilitation of economic development, feasible solutions for sparsely populated community, health and education benefits as well as gender based energy solutions (Nkiriki & Ustun, 2018). Small businesses

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are able to thrive due to extended periods of lighting and with media outlets (television and radio) distance learning and business literacy can be accessed. Due to the high mobile penetration in across Africa, mini-grids provide electrification benefits for areas with poor infrastructure since services may be delivered through mobile technology (ESMAP, 2019b; Howells, Alfstad, Victor, Goldsteinc, Remme, 2016; Sawin et al., 2016). Social institutions such as hospitals and schools that provide public services benefit immensely from mini- grids (Hirmer & Cruickshank, 2014). Energy is central to almost all major challenges and opportunities the world faces today. Be it for jobs, security, climate change, food production or increasing incomes, access to energy for all is essential. Working towards this goal is especially important as it interlinks with other Sustainable Development Goals (Karber, 2018; Renner, 2017). Focusing on universal access to energy, increased energy efficiency and the increased use of renewable energy through new economic and job opportunities is crucial to creating more sustainable and inclusive communities and resilience to environmental issues like climate change (Perera et al., 2015). It is therefore assumed in this study that access to electricity enhanced through mini-grids can contribute positively towards productivity of SMEs in Zimbabwe, mostly those in the manufacturing sector. Access to clean energy by SMEs can also contribute positively towards building their resilience to climate change effects and keep them competitive.

As part of support to SMEs governments also establish institutional framework which facilitates the growth and the development of the sector. In Zimbabwe the structure include the Ministry of Industry and International Trade, Ministry of Women Affairs, Gender, Employment Creation and Enterprise Development, Small Business Advisory Council, Small Business Authority, National Association of SMEs, Business Associations, ZimTrade, Scientific Industrial Development and Research Centre, Standards Association of Zimbabwe, Export Processing Zone, Zimbabwe Investment Centre, The National Productivity Centre, Financial Institutions, and Industrial Task Force (Nyoni, 2002). Government efforts to make the SME sector vibrant in Zimbabwe are being recognised and both public and private institutions have joined hands with the government to make the sector a success (Odero, 2016). It is assumed that, given the appropriate support, including uninterrupted electricity supply, SMEs in all parts of the country can flourish and increase contribution to the country's GDP.

The Government of Zimbabwe has established the Extended Rural Electrification Programme through an Act of Parliament, the Rural Electrification Fund Act of 2002. The Extended Rural Electrification Programme, has prioritised, under hundred percent subsidy, electrification of shopping centres, Government Institutions, clinics and Chief's homesteads. To date --- shopping centres have been electrified through the grid extension programme. However, due to limited generation, the business centres have suffered long hours of load shedding. This has a negative effect on performance of SMEs in these centres. The Electricity Act of 2002 allows for licencing of privately owned generators above the capacity of 100kW, anything below this can be installed and operated with no government regulation. This therefore means that SMEs have green light to install their electricity generation units for own use or share with the community. In addition, the Government has a Renewable Energy Policy which has some incentives for investment in electricity generation from renewable energy sources; wind, small hydro, biomass, geothermal and solar. However, the main purpose of the study was to assess the effect of deploying renewable energy mini-grids (REMG)to the productivity of Small to Medium Enterprises (SMEs) in the manufacturing and processing industry in Mashonaland West Province, Zimbabwe.

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Statement of the Problem

SMEs sector has grown to become a veritable engine of economic growth globally resulting in employment creation, expansion of domestic and international market as well as widening of tax base among others (UNDP, 2015). SMEs provide more than 50% of productive employment in developed countries whereas in developing nations over 95% people are dependent on SMEs for employment (UNDP, 2015). In Zimbabwe SMEs contribute more than 50% of the country's Gross Domestic Product (GDP) (Odero, 2016). Despite the contribution by SMEs to developing countries' economies, little is being done to prioritise this sector on reliable electricity supply. In that regard, SMEs are required to invest in alternative forms of electricity energy if they are to remain competitive and productive without shifting their operation times. Mostly, SMEs have deployed fossil fuel powered generators to supply energy for productive use as alternative to the unreliable and inaccessible grid. However, with the verge of climate change and the move towards energy transition, renewable energy mini-grids have been proved to be the most cost effective given their low cost of operation and maintenance as well as low levels of pollution. SMEs in Zimbabwe have not embraced the concept of renewable energy mini-grids for their energy for productive use. However, this study sought to assess the effect of deploying renewable energy mini-grids (REMG) to the productivity of Small to Medium Enterprises (SMEs) in the manufacturing and processing industry in Mashonaland West Province, Zimbabwe.

Research Objectives

1. To assess the effect of deploying renewable energy mini-grids (REMG) to the productivity of Small to Medium Enterprises (SMEs) in the manufacturing and processing industry in Mashonaland West Province, Zimbabwe

Theoretical Framework

This research study was guided by theory of change (ToC). ToC is a tool or methodology that uses a process of critical evaluation and backward mapping to identify and communicate the conditions and actions that can lead to a desired outcome, thereby resulting in a logical, practical, and actionable theoretical framework detailing the mechanisms of change. When a change agent uses ToC as a planning tool, they should not start with a specific intervention (program, activity, initiative, action) in mind. Instead, they start by defining the desired goal, then work backwards to identify the necessary contextual conditions (social, political, environmental, economical), and the various change pathways which may enable them to achieve their goal (Karber, 2018; Rolffs et al., 2015). In this study the social change theory lens was used in analysing how mini-grids as a means to provide clean energy for SMEs can impact the social behaviour of communities in Mashonaland West Province of Zimbabwe. The four A's factors of energy access will also come into play in the SMEs behaviour towards adoption of renewable energy mini-grids electrification.

Methodology

The study adopted a mixed method research approach rooted in Pragmatism research Philosophy. The population of the study were all 4000 registered manufacturing SMEs in Zimbabwe of which 1400 are located in Mashonaland West Province. This research used a sample size of 140 manufacturing SMEs from Mashonaland West Province calculated using the 10% probability rule at 95% confidence level and +-5 margin of error. Respondents were

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selected from the managerial and senior employees. The researcher employed the use of questionnaires and interview guide in gathering data. Cronbach's alpha coefficient of reliability was used in this study to test validity and reliability of data instruments. The data in this study was analysed using Statistical Package for Social Sciences (SPSS) version 21.0. Descriptive statistics was used for quantitative data using means and Standard Deviation (SD). Qualitative data was analysed using the Nvivo Qualitative Research Analysis Software. The data was presented in the form of tables, graphs, pie charts and themes. However, Karber's (2018) Theory of change (ToC) guided this research study

Review of Related Literature

2. The effect of deploying renewable energy mini-grids (REMG) to the productivity of Small to Medium Enterprises (SMEs) in the manufacturing and processing industry in Mashonaland West Province, Zimbabwe

Mini-grid systems bridges the gap between large national grid systems and stand-alone systems (MacGill & Watt, 2015). They usually provide electricity to remote locations which may not be economically feasible to connect main grids due to their remoteness but have load densities which allow for inter-connections for higher voltage systems rather than stand-alone (Bopp et al., 2016a; IRENA, 2012). Customers for mini-grids can either be domestic or sorely commercial. They can also connect customers of different categories (Kempener et al., 2015). Mini-grids can be classified based on their source of power for example., renewable energy or fossil fuel based, (diesel or petrol) (Kempener et al., 2015).

As supported by a many researchers, switching to mini grid electricity makes business sense for entrepreneurs as power outages and lack of reliable supply can have a tangible impact on a business's revenues (Bhattacharyya, 2015; Fritzsche et al., 2019; IEA, 2017b). A recent evaluation by (ESMAP, 2019b) found that, in Sub-Saharan Africa, power outages can cost companies as much as a 31 percent loss in sales (ESMAP, 2019b). In some of the largest economies in the region, such as Nigeria, Ghana, and Angola, more than 25 percent of businesses lose more than 10 percent in sales because of power outages, with individual firms reporting losing more than 70 percent (Howells, Alfstad, Victor, Goldsteinc, Remme, 2016; Forkuoh & Li, 2015). The firms with the most significant challenges average more than 200 hours a month without power, while even the companies receiving electricity services with the highest reliability still report more than 10 hours a month without electricity (Ramachandran, Shah, and Moss 2018).

According to a survey by (ESMAP, 2019b), in low energy access, Sub-Saharan Africa, increasing the uptake of productive-use equipment requires access to more than $1 billion in affordable consumer finance. As cited above, this is necessary to boost demand for energy from mini-grids and help make business sense for private players. Assuming an average upfront cost of $1,200 and five appliances per mini grid, approximately $1.3 billion in microfinance will be needed for the purchase of 1.1 million productive-use appliances by 2030. This can also be treated as an entrepreneurial opportunity by mini-grid developers. Although they have relatively high upfront costs, most productive-use appliances and equipment provide opportunities to generate or increase revenue (Barnes & Floor, 1996). Financing the upfront purchase cost of the appliances by the mini grid operator via on-bill financing or by a third party, such as a microfinance organization is a good way to increase productive uses of mini grid electricity (Bhattacharyya & Series, 2011; Brix, 2016). Both financing pathways have benefits and drawbacks for the mini grid operator, and both require the operator to develop new business model capabilities (ESMAP, 2019).

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Industrialized economies have universally benefited from secure, reliable and affordable energy services to underpin their development and prosperity (Mulugetta et al., 2019). For developing countries, access to reliable and affordable energy services is increasingly seen as a vital catalyst to efforts in improvements in human development including productivity, health and safety, gender equality and education (Alstone et al 2015).

SMEs also benefit from the spatial diversification of renewable energy sources for mini-grids. Spatial diversification of renewable sources and mini-grids can allow power system operators to better balance the overall electricity supply and demand within set geographic zones called balancing areas (Malhotra et al., 2017; Ye et al., 2017). Planned spatial diversification of mini-grid systems over these balancing areas can reduce technical integration challenges and increase the operational flexibility through more efficient energy dispatching (Tawanda Hove, 2012). It should be noted that possible mini-grid system upgrades should be considered as part of the planning process when considering renewable energy system diversification. Planned diversification also helps proactively harden the system against the effects of localized weather perturbations on mini-grids system output.

Results and Discussion

The sample of 140 employees was used and questionnaires were distributed both manually and electronically. Interviews were also conducted online due to Covid 19 Pandemic lockdown measures. The majority of the questionnaires were distributed electronically as a result of the COVID-19 pandemic movement restrictions. From the 140 questionnaires, only 120 were completed and returned (Refer to Table 1.1).

Table 1.1: Response rate

Description	Number of questionnaires administered	Number of questionnaires administered and returned	Percentage (%) of response rate
SMEs owners/managers	140	120	86
Description	Number of interviews	Number of interviews conducted	Percentage of response rate
Key informant Interviews	10	6	60

Source: Survey (2021)

The results in Table 1.1 show a high response rate of 86%. High response rate was achieved through phone calls and email follow-ups. From this sample size, meaningful results can be obtained. Likewise, of the 10 interviews scheduled, only 6 were successfully conducted translating to 60% response rate. Inference to literature, Sounders.et.al (2007) submitted that in a study, 50% response rate is acceptable, whilst 60% is viewed as good and any, that is 70% or above is regarded as highly acceptable. Therefore, the study's response rate was highly acceptable and findings from such a threshold were not just dependable but shaped a comprehensive base for drawing conclusions.

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Descriptive statistics

Effects of deploying renewable energy mini-grids to the productivity/ growth of SMEs in the manufacturing and processing industry in Mashonaland West Province, Zimbabwe.

The effects of deploying renewable energy mini-grids to the productivity of SMEs in the manufacturing and processing industry were examined. The descriptive statistics for the items are displayed in Table 1.2

Table 1.2: Effects of deploying renewable energy mini-grids to the productivity of SMEs descriptive statistics

Items	**Mean**	**SD**
Deployment of renewable energy mini-grids affect working hours in manufacturing SMEs	4.82	0.39
Deployment of renewable energy mini-grids affect cost of production of SMEs	4.80	0.40
Deployment of mini-grids reduces cost of energy in SMEs	4.63	0.63
Deployment of renewable energy mini-grids reduces cost of unavailability of electricty to manufacturing SMEs	4.73	0.45
Deployment of renewable energy mini-grids triggers energy management skills in manufacturing SMEs	4.68	0.57
Overall score	**4.73**	**0.48**

Source: Survey (2021)

According to the results displayed in Table 1.2 the majority of the respondents were in agreement with the asked items as indicated by the overall mean score value of 4.73 which is associated with a low standard deviation of 0.48. These results suggest that the items raised provide enough information on the effects of deploying renewable energy mini-grids to the productivity of SMEs in the manufacturing and processing industry in Mashonaland West Province, Zimbabwe. The implication of the results is that renewable energy mini-grid deployment positively affects productivity of manufacturing SMEs in Mashonaland West Province of Zimbabwe (AfDB 2020).

Emerging themes analysis was used to establish the opinion of interviewees on what way can renewable energy mini-grid deployment contribute to the competitiveness of SMEs in Mashonaland West Province, Zimbabwe. Top 3 emerging themes included products, carbon and footprint. The word “products” was mentioned by 5 out of the 6 interviewees for 8 times. Hence, it emerged as the top theme. A word tree output of the word was extracted. The words that emerged as the second most discussed themes by the interviewees were carbon and foot print. They were both mentioned by 4 respondents for 4 times.

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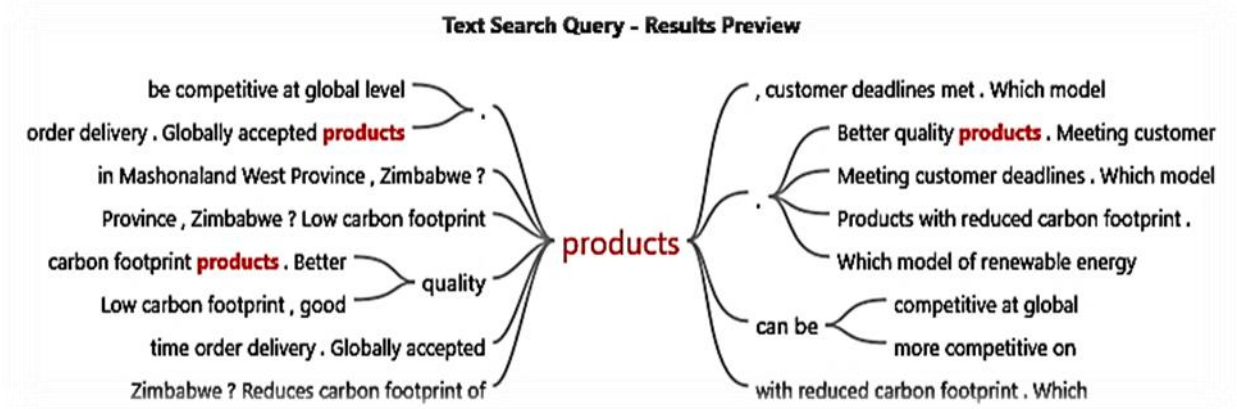

Figure 1.1: Word tree on the effect of REMG deployment on competitiveness of SMEs in Mashonaland West Province in Zimbabwe

As the word "product" came out top followed by carbon and footprint, the results indicate that deployment of renewable energy mini-grid deployment positively affect the quality of product and make them more competitive on the market. Also due to the global move towards low carbon processes, the renewable energy mini-grids when used to supply electricity for productive use by SMEs in Mashonaland West Province, the product carbon footprint is reduced thereby rendering products more competitive at global markets. To further strengthen the results, for qualitative analysis, the actual words of the peoples were extracted as below;

Respondent 1: "*Renewable energy mini-grid deployment reduces the carbon footprint of products and make products more competitive on the global market."*

Respondent 2: "*With renewable energy mini-grid deployment SMEs improve on product quality and meet customer deadlines, making them more competitive at local and global level."*

Respondent 3: "*SMEs will produce good quality products with low carbon footprint. The SMEs are put on the global market."*

The results imply that deployment of renewable energy mini-grid for improvement of availability and reliability of supply of electricity to SMEs improves competitiveness of the firms. Inferring to literature, ggenerally, access to reliable electricity, allows SMEs to improve on quality of products and hence, competitive advantage (Baurzhan and Jenkins 2016; Hasbani 2016; Moner-Girona 2008). However, (Scott et al. 2014) argued that access to reliable electricity supply have no direct bearing on quality of products and hence competitiveness of SMEs. This holds for SMEs that use generators during power outages, despite their higher cost of electricity according to. These generators are usually diesel or petrol fired. With the age of climate change, and the need to use clean energy, SMEs has to shift their alternative form of energy to renewable sources (Scott et al. 2014). According to Cissokho and Seck (2013), electricity insecurity on overall firms' costs is very insignificant thus its limited impact on cost competitiveness of SMEs. The competitiveness of manufacturing firms depends on product quality and the ability to meet orders on time, as

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well as unit costs. These factors can also be affected by electricity insecurity. Quality can be reduced by spoilage of materials or poorly functioning equipment, as well as efforts to reduce overall costs that might be stimulated by higher electricity costs. Interruptions due to outages affect SMEs' production schedules and the delivery of goods to deadlines(Scott et al. 2014). Several questions concerning the implementation of renewable energy mini-grid solutions in various companies were asked and respondents highlighted their views. The descriptive statistics are displayed in Table 5.10. The questions asked also sought to establish the effect of renewable energy mini-grid deployment on performance of the SMEs.

Table 1.3: Implementation of renewable energy mini-grid solutions and its effect on performance of SMEs descriptive statistics

Item	**Mean**	**SD**
Deployment of renewable energy mini-grid deployment improves innovation in SMEs	4.73	0.48
Renewable energy mini-grid deployment improves profitability of SMEs.	4.68	0.47
Renewable energy mini-grid deployment improves internal rate of return of (IRR) SMEs	4.71	0.46
Renewable energy mini-grid deployment improves contribution of SMEs to the GDP of a country	4.73	0.47
Deployment of Renewable Energy mini-grids improves SMEs resilience to climate change.	4.74	0.44
Deployment of Renewable Energy mini-grids improves SMEs independence from the National Electricity Grid	4.77	0.44
Deployment of renewable energy mini-grids improves quality of supply of electricity to SMEs	4.67	0.49
Overall score	**4.72**	**0.46**

Source: Survey (2021)

The results in Table 1.3 shows an overall mean score of 4.72 suggesting that the most of the respondents were strongly agreeing with the construct items. The overall standard deviation of 0.05 is relatively low implying low variability in the responses. These items indeed provide all the information concerning effect of the implementation of renewable energy mini-grid solutions on performance of SMEs. The results imply that SMEs' performance is bound to improve if they deploy renewable energy mini-grids for supply of electricity for their productive use. Responses analysed indicate that majority of respondents support that deployment of renewable energy mini-grid improves the overall performance of SMEs as this improves profitability, innovativeness, resilience to climate change among others. UNIDO, (2017) suggest that at a local level, renewable energy mini-grid deployment enhances energy access facilitates development by enhancing the productivity of existing economic activities for example agriculture products processing centers. This implies as deployment of renewable energy mini-grids ensures energy access, it improves performance of SMEs through increased contribution to the local and country GDP.

The interviewees submitted their own opinion, on how access to clean energy from renewable energy mini-grids is related to the performance of SMEs in Mashonaland West

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Province, in Zimbabwe. The analysis of responses indicated that the Top 3 emerging themes included improves, hours and supply.

Figure 1.2: Top 3 emerging themes from interviews
Source: Survey (2021)

The word "improves" emerged as the most discussed theme, which was mentioned by 4 interviewees for 8 times. This implies that the interviewees indicated that the deployment of renewable energy mini-grids for clean energy access improves performance of SMEs in Mashonaland West Province in Zimbabwe. Then followed, supply and hours followed by uninterrupted, time and working, increases, etc. This result concurs with the results from the quantitative analysis that renewable energy mini-grid deployment improves reliability of electricity supply to SMEs thereby improving their performance as well.

Businesses and consumers are increasingly considering the energy efficiency and cleanliness of the products and services they buy and use (UNECA 2011). Thus given that renewable energy mini-grid deployment reduces the chances of GHG emissions, they make products from such SMEs more competitive (Anja and Wolfgang 2009). Results of this study imply that as cleanliness of energy used is becoming a strategic factor in competition globally, it offers a special growth opportunity for SMEs in Mashonaland West Province and Zimbabwe at large. A good time to optimize processes and production facilities of a manufacturing SME is when production lines are not running at full capacity (do not have to be interrupted). More- over, reducing energy costs directly improves a company's bottom line (Hartmann Anja; Huhn Wolfgang 2009). It is important therefore manufacturing SMEs are provided with reliable electricity with no interruptions to ensure adequate man-hours and good product quality.

Conclusions

Results of this study imply that as cleanliness of energy used is becoming a strategic factor in competition globally, it offers a special growth opportunity for SMEs in Mashonaland West Province and Zimbabwe at large. From the study results we conclude that a positive and statistically significant relationship between renewable energy minigrid (REMD) and competitiveness of SMEs. It means the more REMD exist, the more SMEs in Mashonaland West Province become competitive. As a result of the economic and political facts surrounding the need to curb the effects of climate change through reduction of Greenhouse (GHG) emissions, energy has become one of the strategic factors driving business decision-making.

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Recommendations

It is important therefore manufacturing SMEs are provided with reliable electricity with no interruptions to ensure adequate man-hours and good product quality. Energy research and Entrepreneurship is a field that need proper funding and local protection laws that are deliberately incentivising to technocrats and entrepreneurs to enhance local content in design, installation, operation and maintenance as well as business case of clean and renewable energy sources and practices. Acceptance and promotion of design and optimisation tools which are locally developed brings sustainability in the whole energy transition path. While private participation can speed up deployment of renewable energy mini-grids, this can however, be costlier for small enterprises thus the need for government policy and regulation intervention to share the costs.

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