Southern African Business Review
DHET accredited
ISSN: 1998-8125

Volume 21
2017

The Effects of Extended Water Supply Disruptions on the Operations of SMEs

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ABSTRACT

The objective of this study was to analyse the effects of extended water supply disruptions on SMEs, in relation to returns, profitability and expenditure patterns. It investigated the impact of regular and/or extended water supply disruptions on the operations of small and medium enterprises (SMEs) in Maun, Botswana. Various studies on the development of SMEs have focused exclusively on financial access and inclusion, licensing and regulatory requirements, as well as the development of the skills of workers and owners of SMEs. Consequently, there is limited academic literature on the key issue of critical infrastructure and its impact on the operations of SMEs. This study aimed to assess the effect of extended water supply disruptions as an underlying factor in the slowing of the SME growth and development rate. The results show that the majority of the respondents experiencing extended water disruptions reported that their monthly returns and profits had been negatively affected. The results of this study give a better perspective on the impact of infrastructural weaknesses on the operations, growth, competitiveness and profitability of SMEs in developing countries.

Key words: SMEs, water supply, profitability, competitiveness

Introduction

Water scarcity has been identified as a severe worldwide problem. According to the United Nations Water report (UN-Water 2016), it is estimated that 700 million people in 43 countries are experiencing water scarcity. The reports of the World Wildlife Fund (WWF 2016) and UN-Water (2016) project that two-thirds of the

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world's population may suffer from water shortages by the year 2025. Botswana, like other countries, and in particular Southern African countries, has been affected by water scarcity, which has a detrimental impact on livelihoods and business.

The incidence of water and power disruptions has risen to a point where it is affecting Botswana's economic growth, which has slowed to 4.4 percent in 2014, from 9.3 percent in 2013 (Baatweng 2015). These disruptions are mainly the result of decreased water supply, which is primarily due to natural causes (drought, climate change, surface runoff, as well as evaporation and transpiration) and human causes (disparity in water supply, urbanisation and population growth, contamination of existing water sources) (Statistics Botswana 2009). The impact of these supply disruptions have been felt throughout various economic sectors. Notably, low water supply confines the operations of the public health sector, industries, agriculture, and development projects (Machete 2011).

In order to help manage and sustain this scarce resource, the government has implemented policies such as the Botswana National Water Policy (BNWP), to promote equity, sustainability and the efficient use of water as a crucial resource (BNWP 2012). Other measures that have been applied to decrease water scarcity are the recycling of water, promoting the rearing of less water-intensive livestock, and raising water conservation awareness, for instance by including conservation in school curricula (Farrington 2015). These efforts are, however, failing, as water supply disruptions continue to occur. Consequently, the productivity of SMEs and other players in the economy is negatively affected.

SMEs play a weighty role in all economies and are key agents of job creation (for both skilled and unskilled workers), innovation and growth (Sathyamoorthi 2002; Sentsho, Maiketso, Sengwaketse, Ndzinge Anderson & Kayawe 2009). These enterprises have been found to contribute over 50 percent of both the GDP and employment in both developing and high-income countries (Essien 2014; Ado & Josiah 2015). Various studies on the development of SMEs have focused exclusively on financial access and inclusion, licensing and regulatory requirements, as well as the development of the skills of workers and owners of SMEs (OECD 2009; Sentsho et al. 2009).

Consequently, there is limited academic literature on the role of key infrastructural necessities for the development and of SMEs and their impact on the operations of such enterprises. Therefore, this study aims to assess the effect of extended water supply disruptions as an underlying factor in the slowing of the SME growth and development rate. This study provides new empirical evidence about the practical realities and constraints experienced by SMEs in developing countries. This evidence

should contribute to wider debates about the necessity of sound infrastructure provision as a key factor in the development of SMEs.

Literature review

SMEs and the infrastructure nexus

Studies have established that inadequate infrastructure provision inhibits the competitiveness and productivity of SMEs (Obokoh & Goldman 2016). In an empirical study by Calderón and Servén (2004), it was argued that an increase in the availability and quality of infrastructure accelerates the growth of SMEs in particular, and economic growth generally. According to Rodriguez, Dahlman & Salmi (2008), infrastructural deficiencies increase the cost of production. In instances where infrastructure is absent or inadequately provided, SMEs resort to self-provision (Obokoh & Goldman 2016). Consequently, the SMEs may be forced to operate below-optimally, as self-provision distorts the cost structure (Obokoh & Goldman 2016). Furthermore, as a coping mechanism to compensate for irregular and deficient supply of key infrastructural inputs such as water and electricity, SMEs may resort to output reduction (Adenikinju 2005). The overall effect of output reduction is, of course, reduced return on investment.

In a study on the performance and competitiveness of SMEs in the manufacturing sector in Botswana, Sentsho et al. (2009) pointed out that most of the firms cited the cost and unreliable supply of water and electricity as one of the main constraints inhibiting their competiveness. The high cost and unreliable supply of these utilities contribute to lost output, increase business uncertainty, and reduce competiveness (Nwanko 2000; Obokoh & Goldman 2016).

The role of water in SME operations

Water is critical to economic growth, social development as well as environmental sustainability (Machete 2011). This is because it is used for various purposes, particularly as a key input or key resource, making it essential for all industry types such as agriculture, manufacturing and service provision. Water is a primary infrastructural need for improving the competitiveness, ability and capacity of SMEs (Kujinga, Vanderpost, Mmopelwa & Wolski 2014). The fulfilment of these important roles is, however, subject to two main factors, namely supply risk and reliability. The interactions of these primary factors are summarised in Figure 1.

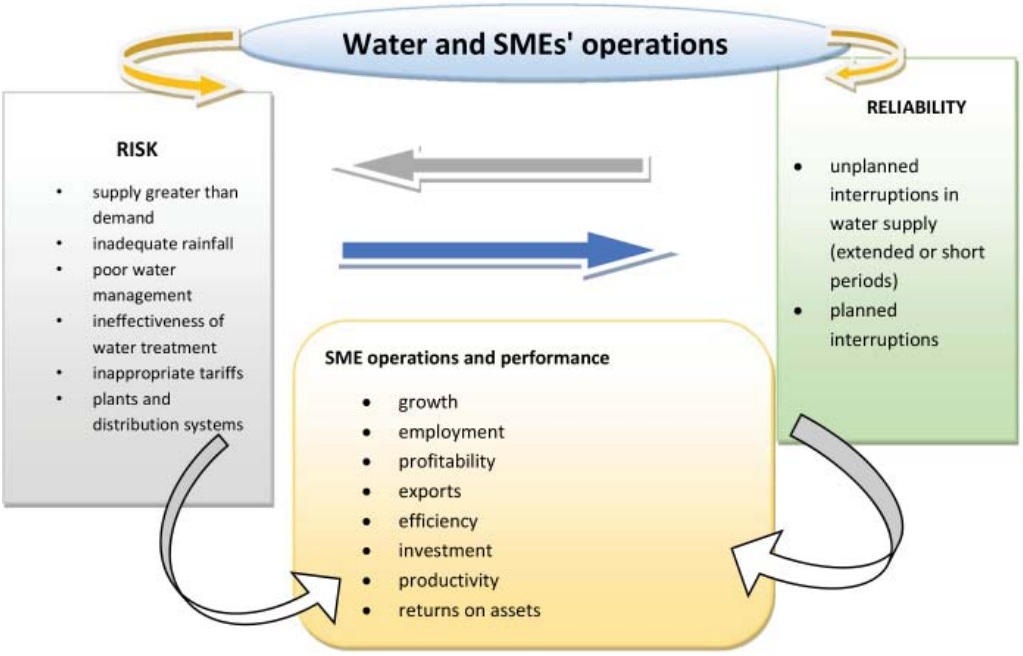

Figure 1: The potential role of water in SME performance (Source: Frederick & Selase 2014)

Supply risk

The supply factor is a precarious factor for the operations of SMEs where water is a key resource. The decline in water quality and quantity, also referred to as the global water crisis, was in 2014 ranked as one of the top five "Global Risks of Highest Concern" by the World Economic Forum, amongst other concerns such as income discrepancy and the failure to adapt to climate changes (Farrington 2015).

As shown in Figure 1 above, there are several factors that lead to the supply risk of water. These risks are classified into two main categories; natural causes and human-induced causes. Several researchers (see generally Machete 2011; Toteng 2008; Kujinga et al. 2014) have identified the following water supply risks:

Natural causes:

- Drought – lack of, or little rainfall in areas over an extended period of time
- Climate change – changes in precipitation patterns and decreasing soil moisture
- Surface runoff – causing a decrease in water or decline in water quality
- Evapo-transpiration from dams and rivers – causing a decrease in water levels

Human-induced causes:

- Disparity in water supply
- Urbanisation and population growth, leading to higher demand
- Contamination of existing water sources, causing a reduction in water quality
- Poor water management, resulting in water losses, e.g. pipe leaks
- Ineffectiveness of water treatment as a result of low private investment in water as a public sector good
- Inappropriate tariffs, causing difficulty in accessing water as a resource
- Lack of maintenance of water sources

Botswana is a water-scarce country, ranking third among the most water-scarce countries in Southern Africa after South Africa and Namibia (Toteng 2008). According to Statistics Botswana (2009), the problem of constrained water resources imposes a potential limit on the development of communities and the economy, as well as national economic growth. The water shortage has primarily resulted in water supply disruptions to communities and markets, as a way to sustain the provision of water as a scarce resource.

Swatuk and Kgomotso (2007) argue that the whole region of Ngamiland's water supply is generally at risk. In Maun, the drying of the Thamalakane River due to poor rainfall or drought has exacerbated this problem (Swatuk & Kgomotso 2007). These factors have led to the poor supply of water, causing significant negative effects on the operations and performance of SMEs (Frederick & Selase 2014).

Reliability

The reliability of water supply, which is closely linked to the supply risk, is another factor that affects the operations of SMEs. Reliability is an important measure of service quality in the supply of water (Frederick & Selase 2014). Firms improve the reliability of their key inputs by incurring direct costs towards implementing measures designed to mitigate the negative impacts of supply risk (Wang 2002).

Planned interruptions are more manageable, because potential financial losses due to water supply disruptions could be minimised by using alternative water supply sources such as built-in tanks (Wang 2002; Ado & Josiah 2015). However, enterprises have to incur costs in order to implement these alternative sources in order to improve water reliability.

Unplanned water supply interruptions, on the other hand, have an absolute and often unforeseeable financial implications for business operations. These interruptions adversely affect service delivery quality and end-product quality, and cause delayed deliveries and the cancelation of orders/deliveries, among other things (Ado & Josiah 2015).

The benefits of reliable water supply on SME operations

Farrington (2015), in a study on the water crisis in Gaborone, emphasises the effect that the inability to access fresh water has on the survival of communities. In addition to this, water scarcity threatens to impede the desired development of nations by limiting the competitiveness of firms and the economy at large (Farrington 2015).

Researchers have identified several factors that contribute to the lack of success of SMEs. Key among them are insufficient capital, irregular power supply and infrastructural inadequacies (Onugu 2005; Shemi 2013). It is further argued that an inadequate supply of water and other infrastructural necessities add to the major challenges faced by SMEs (Onugu 2005; Shemi 2013). Businesses use water for a variety of purposes, ranging from washing dishes and flushing toilets in the offices, to manufacturing activities (Essien 2014; Morapedi 2014). An unreliable water supply could therefore affect the general operations of SMEs on a wide front.

Methodology

The current study was conducted in Maun, which is situated in northern Botswana (Figure 2). Maun is the fifth largest town in Botswana. As of 2011, it had a population of 60 263 (Statistics Botswana 2015). Maun is the "tourism capital" of Botswana.

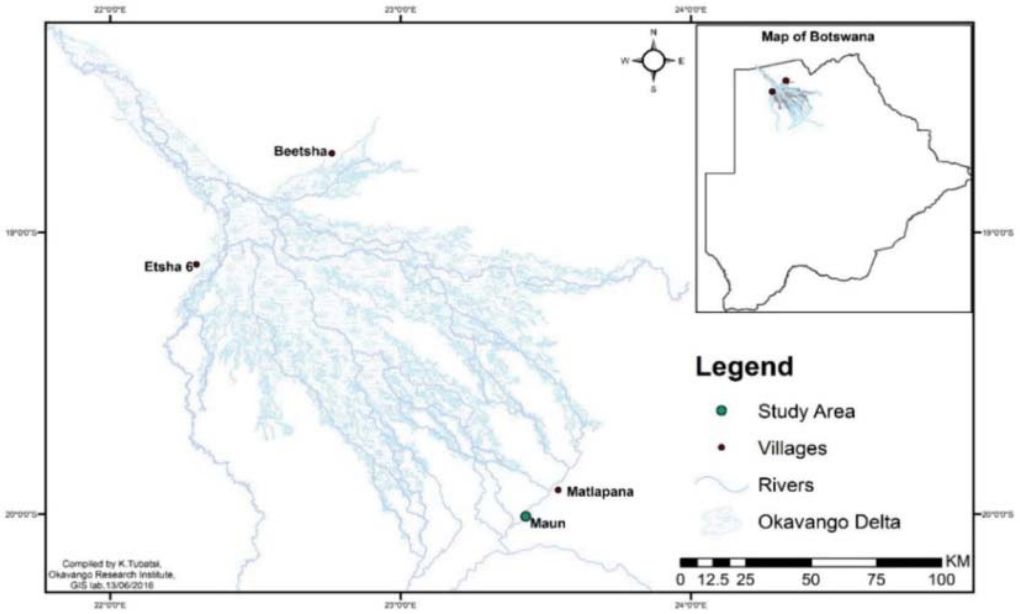

Figure 2: Map showing the location of Maun village in Botswana

Source: Tubatsi 2016

Maun is also known as the administrative centre of the Ngamiland District and the seat of power of the Batawana people. Other ethnic groups in the town are the Hambukushu, Basubiya, Bayei and the Banoka (the River Bushmen), who are the Okavango's original inhabitants, and the Bakgalagadi, and the Baherero, who originate from Namibia (Botswana Tourism Organisation/BTO 2013). Tourists primarily use Maun as a transit point to embark for the Okavango Delta.

Research design

The study aimed to identify and analyse the effects of extended and unexpected water disruptions on SMEs in depth. By virtue of collecting data for a specific investigation from a subset of the population at a specific point in time, this study is a cross-sectional survey.

A thorough social enquiry on measures put in place to cushion enterprises from unexpected and extended water supply disruptions required the gathering of qualitative data, while the data on returns, expenditure and profitability were quantitative in nature. Therefore, the study used a mixed-method approach, which comprised collecting, analysing and integrating both qualitative and quantitative data in order to address the research questions. The mixed-methods approach has the advantage of providing a comprehensive analysis of the research problem where one particular method or data type cannot investigate the study's indicators fully (Creswell 2008 and 2012).

Data collection methods

The research generated primary data through the use of key informant interviews and semi-structured questionnaires. Key informant interviews are qualitative research methods involving the use of thorough individual interviews with a small sample of respondents to explore their views on an unknown phenomenon (Boyce & Neale 2006). Key informant interviews are methods widely utilised in qualitative research and have been identified as important sources in case study research (Bryman 2008). In this study, a key informative interview guide was designed to obtain data from representatives of the Water Utilities Corporation (WUC), a parastatal mandated to supply water resources and services in Botswana. This exercise was crucial in verifying the information obtained from the SMEs on water disruption frequencies, as well as to understand the reasons behind the water supply discrepancies in different locations in Maun.

The semi-structured questionnaire used to collect data in this study contained both open-ended and closed-ended questions. It had four sections. Framing the questions

around sections is vital in reducing the ambiguity of information obtained during the data analysis stage (Malhotra 2004). Section A captured the profile of the company, such as the number of employees, years of operation, monthly turn-over, sectorial classification, and so forth. Section B enquired about the company's experiences with water disruptions, using open-ended questions and, in some instances, a five-point Likert scale ranging from 1 = "strongly agree" to 5= "strongly disagree". The data captured in this section included the company's level of dependency on water resources to perform its core mandate, the frequency of water supply disruptions in a week and in a month, and the effects of such disruptions on the company's general performance and competitiveness.

Section C captured quantitative data on the patterns of the company's returns, profits and expenditure during periods of consistent water supply and disrupted water supply. Section D enquired on the adaptation and mitigation strategies employed by the companies to deal with the problem of water supply disruptions.

One of the key requirements of a qualitative research process is the trustworthiness of the data and the research findings. Validity is more concerned with the quality of the instrument used to collect data and whether or not the instrument measures what it intends to measure, while reliability is concerned with the "consistency, dependability and replicability" of the data (Burns 1999; Lincoln & Guba 1985; Zohrabi 2013). In qualitative research, bias – particularly researcher and respondent bias – can pose a threat to the trustworthiness or the reliability and validity of the research (Shenton 2004). The potential sources of bias in this study were interviewer bias, question-order bias and response bias.

To minimise bias, the study used both the criteria for assessing the trustworthiness of naturalistic inquiries proposed by Guba (1981) and data triangulation to ensure the reliability and validity of the qualitative data gathered in all sections of the questionnaire. Triangulation is defined as "the combination of methodologies in the study of the same phenomenon" (Denzin 1970: 291). In order to improve internal validity, key informant interviews and document analysis in the form of reports from the WUC, among other sources, were consolidated with field data as a means of triangulation. Furthermore, a preliminary administration of the questionnaire was performed in order to establish whether there are any issues with the questionnaire itself, and to better align the questions to the needs of the study.

In addition to using the aforementioned data-triangulation approach, the face-to-face interviews were recorded and documented in order to improve the internal reliability of the research. This process detailed how the patterns or the themes were arrived at and how the data was analysed, which allows the research to be replicated or reproduced.

Cronbach's alpha was also calculated as part of the reliability test to assess how consistent the results were, and all variables were above 0.7 in this study. Additionally, the preliminary administration of the questionnaire also contributed to reliability.

Sampling method and survey

A purposive sampling method was first used to select SMEs for which water was critical or necessary on a daily basis in their business operations. From the sample, three main categories of enterprises were chosen, namely enterprises in catering, accommodation and cleaning services, as their services are essential to the tourism industry. Subsequent to purposively selecting these SMEs, 40 SMEs were sampled through both random and convenience sampling techniques. In the convenience sampling, the respondents were selected based on their accessibility.

Data was collected through face-to-face interviews between the researcher and the representative of the company. The selection of interviewees was based on their expertise – only SME personnel with three years of experience within the selected enterprise, as well as information on, and authority over the financial information of the SME, were interviewed. Face-to-face interviews were preferred in order to establish an atmosphere of trust through discussions. The role of the interviewer was therefore to create an atmosphere of trust and to allow the interviewees to "open up" during the interview. Whilst there might have been slight variation in the way in which the interviews were conducted, for example, in respect of the wording and order of the questions, so as to allow the interview to be adapted to better suit the respondent, the interview process guidelines proposed by Merriam (1998) were adopted to reduce interviewer bias and to ensure that the responses were comparable across all 40 interviews.

The data was collected over a period of a week. All 40 questionnaires were returned and correctly completed, providing a response rate of 100%.

Data analysis

Considering that mixed data types were used to address the research questions of the study, the analysis of data required a combination of various steps, depending on the nature of the data. A thematic content analysis approach was used to investigate the qualitative data, thus "identifying, analysing and reporting themes within (the) dataset" in a systematic manner (Braun & Clarke 2006). One of the main advantages of this approach is that it is flexible and it is useful for summarising large datasets, or rather, it allows researchers to work with a wide range of information in a systematic way (Braun & Clarke 2006). The qualitative data underwent data processing that

was informed by the step-by-step guide detailed by Braun and Clarke (2006), which involves organising, cleaning, coding and categorising data into relevant categories.

The main approaches that can be employed when encoding quantitative information are theory-driven, prior-data or prior-research-driven, or inductive (Boyatzis 1998). For the purposes of this research, a concept-driven coding was used to identify patterns and similarities between the various pieces of information reported, and to determine how these patterns were associated with concepts identified in advance by the researchers (Brinkmann 2013). The data was then entered into the Statistical Package for Social Sciences (SPSS version 24.0) for analysis. Thus, the quantitative data was processed and categorised into monthly returns, expenditure and profit.

Before the data was analysed, the inferential data were tested for normality using the Shapiro-Wilk test for normality in order to determine whether to use a parametric or non-parametric test. The Shapiro-Wilk test established that the data were not normal, therefore Chi-square tests and Spearman correlations were used to determine the direction of the relationship between water disruptions and SME performance, and to ascertain the statistical significance of the respective relationships.

Ethical considerations

It was ensured that the participants took part on the basis of informed consent. The confidentiality of the information provided by the respondents and the respondents' anonymity were protected. Prior to the administration of the questionnaires, the respondents were informed about the purposes of the study and the overall meaning of their participation. Participation in the study was voluntary. The interviewees and participants were made aware that the findings would be published.

Results and discussions

Water uses in the operations of SMEs

In this study, all of the respondents indicated that they depend greatly on a consistent water supply to provide the required goods and services to their customers. Therefore, water serves as a key infrastructural input for the growth and success of their businesses. Furthermore, all of the respondents stated that they use water for cleaning and washing, regardless of their different lines of business. Ninety per cent of the respondents indicated that they used water for cooking, while 42.5% used water for maintaining swimming pools and for recreation.

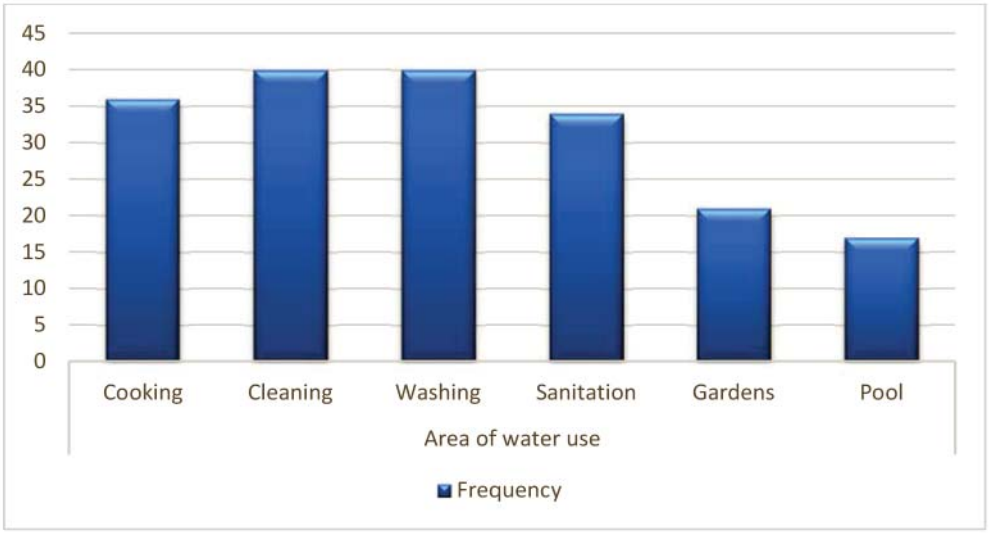

Figure 3: Use of water in businesses

Depending on water as a key input in the service production line implies that water supply disruptions will not only impede the service delivery of SMEs, but will also hamper their overall growth. In view of the fact that the sample was a cross-section of the greater SME population, it can be deduced that the results of the study will also hold for other similar SMEs in Maun and Botswana as a whole. This would mean that extended water disruptions are likely to have huge effects on the nation's development and diversification efforts. Both tourism and SME development have been identified as alternative engines for employment creation, economic diversification and GDP growth (Morapedi 2014).

Water supply issues in Maun

The average number of days without water supply in Maun

As reflected in Figure 4, 37.5% of respondents reported that water disruptions occurred between 5 and 10 days in a month, and 35% reported that water disruptions occurred on more than 16 days in a month. This was confirmed by Keakabetse (2015), who indicated that the problem of water shortage (hence disruptions) seemed to be worsening over the years, as most parts of Maun would run for weeks without a single drop of water. The varying responses regarding the frequency of water disruptions are largely due to the locations of the businesses. Some parts of Maun are more affected by water supply disruptions than others. In an interview with a

key respondent from the WUC, it emerged that the Corporation currently supplies potable water resources from 6 main reservoirs. The respondent highlighted that,

> *Sometimes some of our distribution channels experience water supply problems due to a number of varying reasons. In such cases, the businesses depending on that particular channel by virtue of being located in a specific area supplied through the channel will be affected.*

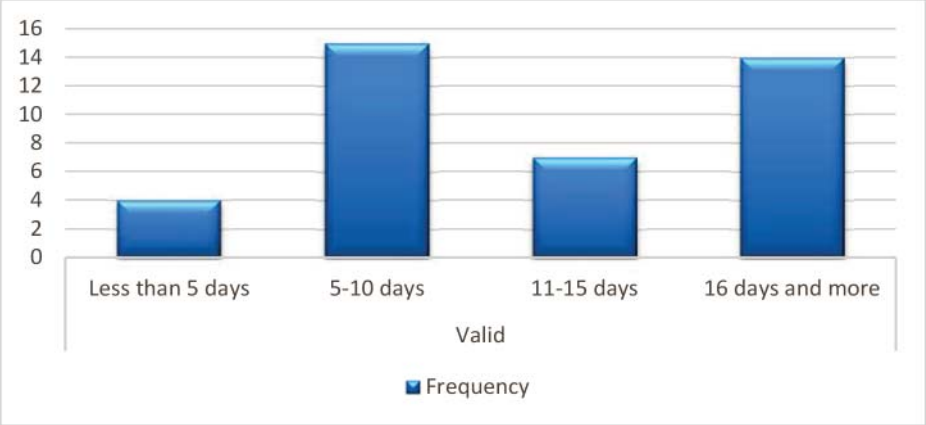

Figure 4: Figure showing the frequency of water disruptions (in days per month) in Maun

Average hourly periods of water supply disruptions in a day

From Figure 5, it is evident that only 2.5% of the respondents indicated that water supply disruptions in their businesses do not last longer than an hour, while the majority of respondents (87.5%) reported an average disruption of over 6 hours. The businesses that normally do not experience water supply disruptions of more than an hour were those who do not depend on the WUC as their primary supplier of potable water.

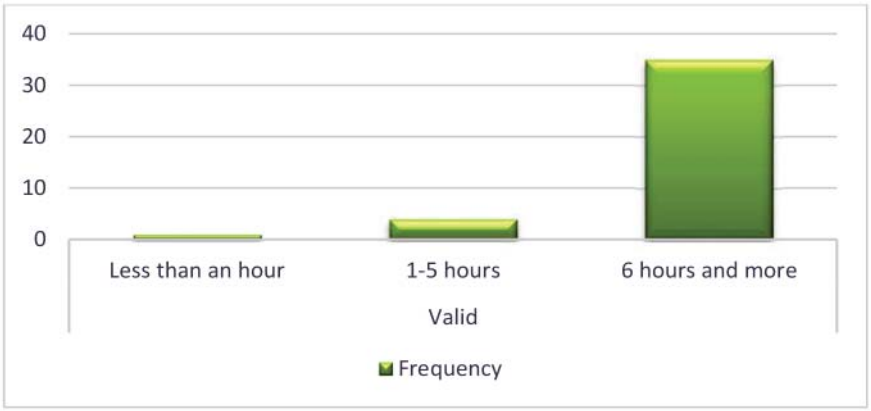

Figure 5: Duration of the average period of disruption in a day (in hours)

Magnitude of water supply disruption

The researchers investigated the extent and magnitude of these disruptions (as reported by respondents) as the main independent variable of the study. The variable of "extended water supply disruption" was computed from the duration and frequency of water supply disruptions in a day and in a month respectively. Disruptions of more than 10 days in a month and lasting over 2 hours in a day were considered to be extended water supply disruptions.

Table 1: Magnitude of water supply disruptions

Magnitude of the water supply disruption		
	Frequency	Percentage (%)
Short disruptions	19	47.5
Extended disruptions	21	52.5
Total	40	100

As summarised in Table 1, a slightly higher proportion of respondents (52.5%) reported extended water supply disruptions in Maun. According to Keakabetse (2015), Maun has had water shortage problems for a decade.

Water supply disruptions and SME performance

This section investigates extended water disruptions as a factor influencing the performance of SMEs. The performance of SMEs was measured mainly by their business profitability, expenditure patterns and monthly returns.

Effects of water disruptions on monthly returns

The study examined the statistical relationship between water supply disruptions and the monthly returns of SMEs in order to address the first specific research objective. The results are summarised in Table 2:

Table 2: Chi-square test for water supply disruptions and businesses' monthly returns

	Value	df	Asymptotic significance (2-sided)
Pearson chi square	.760[a]	1	.040
Likelihood ratio	.762	1	.040
N of valid cases	40		
a. 0 cells (0.0%) have an expected count of less than 5. The minimum expected count is 5.70.			

According to the results (chi-square = 0.760 and p = .040 < 0.05), there is a relationship between water supply disruptions and the monthly returns. The degree or frequency of water supply disruptions influences the number of clients served negatively. This negative influence is then propagated to the monthly returns of the SMEs.

Table 3: The effect of water supply disruptions on businesses' monthly returns

	Have your returns been affected by disruptions?			Total
		No (%)	Yes (%)	
Magnitude of the disruption	Short	36.80	63.20	100.00
	Extended	23.80	76.20	100.00
Total		30.00	70.00	100.00

Table 3 above shows that 76.2% of respondents experiencing extended water disruptions have had their returns affected negatively. This means that decreased monthly returns were even more pronounced among respondents with extended water supply disruptions than among those with shorter supply disruptions. Obokoh and Goldman (2016) argue that risks related to water, such as water supply disruptions, significantly inhibit the operations and revenue of SMEs, leading to limited growth of the businesses.

The interviews with stakeholders of SMEs revealed that the financial returns of businesses were mainly affected negatively because extended water disruptions forced the operators of some accommodation, catering and cleaning facilities to return customers unserved on several occasions. According to one of the respondents,

We face embarrasing situations because of lack of water in some days. There have been

instances where customers have to be checked out of the rooms because they can't shower or use toilets. In such cases, we even have to ask water from our competitors using containers to at least help for the time being.

Responses regarding the effects of water disruptions on the monthly returns of businesses not only varied with respect to location, but also with respect to the age of the business. That is, the water disruptions in some areas were not as extreme and/or prolonged as in other areas; hence their effects on monthly returns varied equally. With regard to the age of businesses, most businesses older than 10 years had stable water supply alternatives and were less reliant on water supply by the WUC.

Effects of water disruptions on expenditure patterns

Results show that among respondents experiencing extended water supply disruptions, the majority (45%) pay an estimated cost of between BWP2001[1] and BWP10 000 on alternative sources, regardless of the magnitude of the water disruptions (see Table 4).

Table 4: Monthly expenditure patterns for alternative supplies in response to water supply disruptions

		Expenditure patterns			**Total**
		BWP0–500 (%)	BWP501–2000 (%)	BWP2001–10000 (%)	%
Magnitude of the disruption	Short	43.80	12.50	43.80	100.00
	Extended	25.00	30.00	45.00	100.00
Total		33.30	22.20	44.40	100.00

The study further employed the chi-square test to determine independence between the water supply disruptions and monthly expenditure incurrence of SMEs. The results are as indicated in Table 5.

Table 5: Chi-square test results for water supply disruptions and expenditure patterns

	Value	**df**	**Asymptotic significance (2-sided)**
Pearson chi square	2.166[a]	2	.339
Likelihood ratio	2.233	2	.327
Linear-by-linear association	.452	1	.502
N of valid cases	36		

The chi-square = 2.166 and p = .339 > 0.05, which means that the relationship between the magnitude of the water disruptions and the expenditure patterns of businesses is not statistically significant. The chi-square test only provides information about whether the variables are independent or dependent and does not provide information about the direction of dependence between the variables. The statistical insignificance of the relationship between the aforementioned variables could be due to the small sample size of the study, or other reasons not identified in the study. It could also be due to the fact that the expenditure associated with alternative sources of water is significantly lower than the other expenditures, such as the cost of labour and rent.

A test run on Spearman's correlation also supported the chi-square analysis. Spearman's correlation results give r = .373 and p = .088 > .05, as indicated in Table 6. The results imply that there is a statistically insignificant relationship between water supply disruption and the cost of alternative sources. However, r = .373 > .000 shows that there is a weak positive relationship between the two variables. That is, increasing magnitudes of water supply disruptions result in increasing expenditure on alternative water supply sources.

Table 6: Spearman correlation between water supply disruptions and expenditure patterns

			Expenditure patterns
Spearman's rho	Magnitude of the disruption	Correlation coefficient	.373
		Sig. (1-tailed)	.088
		N	40

Effects of water disruptions on profits

From Table 7, it is observed that a higher proportion of respondents experiencing extended water supply disruptions have had their profits affected negatively (81%). Still, 57.9% of those experiencing short water supply disruptions also reported that water disruptions negatively affect their profits. Prolonged water supply disruptions therefore increased the probability of making less profit. The returns of the businesses surveyed had significantly decreased, while their costs increased. The findings on the effect of water supply disruptions follow the standard definition of profit, where profit is defined as the difference between costs and returns.

One of the interviewed respondents mentioned that water supply disruptions force them to incur costs and "lose clients", therefore they are "working at a loss" (SME07).

Generally, the unavailability and/or cost of a primary input, such as electricity and water, leads to adverse effects on the profitability of SMEs (Wang 2002).

Table 7: The effects water supply disruptions on profitability

	Profits affected			**Total**
		No (%)	Yes (%)	%
Magnitude of the disruption	Short	42.10	57.90	100.00
	Extended	19.00	81.00	100.00
Total		30.00	70.00	100.00

A Spearman's correlation analysis was used to establish the dependence of profits generated by SMEs on the magnitude of the water supply disruptions experienced, and the direction of the dependence. Table 8 summarises the results as follows:

Table 8: Spearman's correlation for the magnitude of water disruptions and profits

			Profitability
Spearman's rho	Magnitude of the disruption	Correlation coefficient	-.251
		Sig. (2-tailed)	.039
		N	40

The Pearson correlation test shows that there is a weak negative relationship between the amount of profits generated by SMEs ($r = -.251 > 0.00$). Although weak, the relationship is considered statistically significant ($p = .039 < .05$). That is, increasing disruptions may result in a decrease in the profitability of the SMEs.

Conversely, improvements in infrastructural inputs such a water may improve the operational performance of SMEs (Ado & Josiah 2015). It is clear that water-related risks and reliability issues could significantly alter the revenue and costs of a business and thus limit its growth and profitability.

Conclusions

In most developing countries, SMEs are faced with an array of challenges. These challenges include lack of financial access, managerial issues, and limited access to infrastructure. Therefore, there is a pertinent need to create a suitable environment for SMEs to operate efficiently and effectively to reach their full potential of diversification and economic growth. Water, energy, telecommunications and transport have been identified as key infrastructural necessities required for improving the competitiveness of SMEs. However, Botswana is facing considerable water shortages and/or scarcity, resulting in extended and unexpected water supply

disruptions which affect households, agriculture and different SMEs in various industries.

Water supply disruptions lead to low levels of competitiveness and entrepreneurial activity amongst SMEs, particularly those who depend directly on water as a key input or resource. Research on the operations and performance of SMEs is largely biased towards management, financial and technological aspects. The objective of this study was to determine the effects of water flow disruptions on the performance of SMEs, particularly on their monthly returns, expenditure patterns and profits. The study revealed that the supply of water to SMEs is subject to risks and poor reliability. The risks encompass the quality of the water supplied as affected by treatment systems, distribution channels and low rainfall, which leads to a reduced potable water supply. SMEs can improve the reliability of water resources by incurring direct costs towards implementing measures designed to mitigate the negative impacts of the supply risk of water.

The relationship between monthly returns and water supply disruptions was statistically significant. Similarly, there was a significant statistical relationship between profits and water supply disruptions. Pearson correlation results showed that there is a positive correlation between water supply disruption and the costs of alternative sources, although this is statistically insignificant. The study argues that the extended water supply disruptions experienced in Maun are detrimental to the operations of SMEs. The findings confirmed the importance of water and other key types of infrastructure in enhancing the profitability and competitiveness of SMEs in developing countries. Sound and reliable infrastructure provision is crucial to the profitability and competiveness of SMEs. This study contributes to the body of knowledge on the profitability of SMEs operating in developing countries. The study concludes that the productivity and development of SMEs is dependent on their access to reliable and affordable water.

It is recommended that the Water Utilities Corporation (WUC) should communicate water supply disruptions schedules to SMEs in order to allow them to make contingency plans for their production. Planning for production and distribution is an all but impossible task in cases where SMEs are not forewarned about water shortages by the WUC. A detailed, advance announcement of water interruptions could help control the shortcomings of water supply in Botswana and allow SMEs to take alternative measures in good time, and plan their production.

As a cross-sectional study, this study only analyses the effects of water supply disruptions at a given point in time. A longitudinal study on the whole area is recommended. Such a larger sample size will help to establish the long-term effects of water supply disruptions on SMEs.

Endnote

1. US$1 = BWP10.21 (currency: Botswana Pula)

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