

## Contingency Approach to Sustainable Water Cost Management in a South African Brewery

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**ABSTRACT** Water is an increasingly expensive resource with rising costs that eventually affects business costs. Although businesses vary widely in their levels of water-use intensiveness, many of them do not always consider the full costs of their water usage; a factor that determines how far they are willing to reduce water consumption. Using the contingency theory approach, the present research paper provides an understanding to the effect that the determination of water costs should encompass sustaining human welfare, economic growth, ecosystems and the recognition that sustains each of these aspects is dependent on sustaining the others. Findings reveal that the SAB Ltd manages its water resources based on three contingent factors, namely: water recovery for sustainable production; water-use efficiency due to use of economic instruments and pricing; and managing water scarcity due to local nature and water-use licensing and enforcement. The paper recommends the provision of adequate and reliable water-related cost information to enable managers to identify operations with excessive water consumption and wastages and those that present opportunities to reduce such wastages.

### INTRODUCTION

Water is considered scarce when cubic metres of water fall below 1700m<sup>3</sup> (Amarasinghe et al. 1999). In that case, South Africa can be considered a water scarce nation based on its annual rainfall average of 500mm (Lange et al. 2007; Dennis and Dennis 2012). Incidentally, this limitation is compounded by irregularity over time as population and the economy continues to grow without a corresponding increase in water level and for as much as there is increase in pollution level from both diffusion like acid mine drainage and point sources. Consequently, it is imperative to sustaining current water resources, especially in a country like South Africa considered to be water scarce (World Wildlife Fund (WWF) 2012) has become imperative. In the past, water resource management followed an instrumental prediction and control approach dominated by technical end-of-pipe solution that primarily relied on wastewater treatment instead of source control, which has become inefficient to adequately deal with growing uncertainties for today's resource management issues (Pahl-Wostl et al. 2008). Although, defining and measuring sustainability is a major challenge (Loucks 2000); water scarcity, water pollution, and other water related environmental and ecological problems have led to water crisis around the world.

Moreover, with the recognition that sustainable water resources management will require more than individual or separate management of these processes, implementing a sustainable water resources management may rely on adequate data collection efforts (Jayakrishnan et al. 2005; Medema et al. 2008). The increasing water scarcity may lead to a decline in the rate of production more quickly than new supplies can be found (Gleick 2008). Although, businesses vary widely in their level of water intensiveness, many of them do not always consider the full costs of their water usage, a factor that determines how far they are willing to reduce water consumption. Besides water is an economic good and the use of prices is deemed effective to promote equity, efficiency, and sustainability (Rogers et al. 2002).

At any rate, the present paper recognises that water is an increasingly expensive resource with rising costs that can affect business costs. Using the contingency theory approach, this paper provides an understanding to the effect that the determination of water resources costs should encompass sustaining human welfare, economic growth, ecosystems; and the recognition that sustaining each of these aspects is dependent on sustaining the others. The rest of the paper is organised as an overview of water usage in a brewery including a review of water

resources sustainability cost management; background on the SAB Ltd Polokwane Brewery; the method, review of the contingency theory of management accounting; discussions; and conclusion.

### **Overview of Water Usage in a Brewery**

The brewery process consumes large quantities of water during production. Large volumes of water are consumed in the production of beer itself, as well as for the general washing of floors, and cleaning the brew house, cellars, packaging, and cleaning, after each batch is completed. Nevertheless, the availability of accurate quantity or volume of water usage and wastage in the brewery process will provide management with information on specific inefficient practices within the system. At any rate, minimizing wastewater and water pollution will lead to improvements in environmental performance, reduction in water consumption, and increasing reuse and recycling on-site with direct beneficial effect on profitability (Adams and Ghaly 2007). Water consumption in a brewery process is not only an economic parameter, but also a tool to determine process performance in comparison with other breweries (Fillaudeau et al. 2006, 2007). Water resources sustainability costs, such as wastewater and emissions treatment costs; environmental fees, taxes, charges and fines; and prevention and environmental management costs, need to be included to determine inefficient production costs. Subsequently, source reduction rather than wastewater treatment will be an appropriate strategy for reducing inefficient water costs in the brewery process that result in wastages. Besides, both identifying water-wastage sources and determining water-wastage volume and costs are crucial to reducing water wastages during production and attendant environmental impacts.

### **Sustainable Water Resources Cost Management**

Determining the cost of managing water resources by an organization may necessitate the application of clean technologies in the production process to reduce wastewater, wastage and pollution so as to improve both its environmental and social performance. In a situation where water resources management costs cannot be

determined or passed on to product costs, an organization might not be able to evaluate the effect of water inefficiencies in production against the organization's water usage reduction strategy (Burritt and Saka 2006). The objective of placing monetary values on production inefficiencies (in this case, water inefficiency), according to Burritt and Saka (2006), is to quantify the cost of inefficiencies on the environment and the possible effect of internalizing the cost on product prices by brewery managers so as to enable managers take precautions to minimize continued wastage. As such, managers need to adopt sustainability cost-gathering methods and techniques that yield effectiveness in terms of product quality at a reduced cost. It is worth noting that as much as the brewing process involves both chemical and biological reactions, especially in water consumption, wastewater and solid-liquid separation presents cost-savings opportunities for increased economic benefit. Determining the water-wastage costs created through the production process will promote the adoption of pollution-control systems by organizations and ensure that low-emitting processes are adopted (Zhang et al. 2008).

Water providers like municipalities can make organizations' water minimization efforts very effective by initiating water management policies that seek to enforce rather than encourage compliance. Actually, the use of penalties has a wide acceptability in shaping and promoting positive behaviour among polluting organizations. However, a water policy instrument will enable organizations to curb inefficient water usage and costs and limit the unsustainable use of resources and eliminate inefficiencies in production. Since inefficiency cost contributes to the magnitude of the environmental damage caused by an organization on the society, a water policy instrument becomes necessary, such as penalties that force organizations to limit their water wastage and influence individual organization's creativity and innovativeness to adjust its operation for improved environmental performance. While it is easy to identify water wastage, reducing its unsustainable use can be a difficult issue because of the different individuals that make up the organization (Steen 2005). Thus, individual organizations need to devise a more responsible and innovative approach to minimize water wastage costs related to it.

### **The SAB Ltd Polokwane Brewery**

The Polokwane plant is the smallest in terms of production capacity among nine SAB Ltd plants in South Africa. It is located in the North-Eastern part of the country which is experiencing acute freshwater shortage. The brewery lies within the Polokwane Municipality of the Limpopo Province. It produces an estimated 1.7 hectolitres of beer annually. Both the Polokwane Municipality and the Polokwane plant entered into an agreement to supply water to the plant. By the same token, the Polokwane brewery plant is the largest industrial consumer of water supplies (about 30%) apart from those supplied to households and other industries within the municipality. However, brewing process consumes high volume of water during production and other usage like housekeeping with water cost taking a large portion of the input materials costs.

### **METHODOLOGY**

This paper used the contingency theory approach to management accounting to analyse a case study of SAB Ltd to provide an understanding to the effect that the determination of water resources costs encompasses sustaining human welfare, economic growth, ecosystems; and the recognition that sustaining each of these aspects is dependent on sustaining the others. The case study approach was adopted in this paper because it provides a deeper understanding of the role of an organization to account for its water scarcity, water pollution, and other water related environmental and ecological costs. Essentially, case studies are particularly useful for exploratory study so that an inductive inference can be made by using theory to explain empirical observations to inform refinements and extension of theory (Yin 2010). The interview is a significant method in a case study research. In this study, interviews were necessary because of the unique nature of the phenomenon being discussed. This made the brewery to internalize its water usage cost for efficient management. As such, interview questions were developed from the literature on the effect of managing its water usage costs in order to reduce its wastage. A series of semi-structured interviews enabled participants to develop issues and tell stories about areas of particular concern for them. This approach allowed sup-

plementary questions to be asked based on key issues identified by staff members of the organization who participated in the study. In such instances, the questions that propped up relate to matters that were not raised in the literature. Just as Yin (2010) described an interview as the cornerstone of case study research and acknowledges a need to triangulate evidence by collecting and integrating information from a range of sources. In this study, information about the SAB Ltd plant was also collected from their water usage and management system. The sources used were internal, namely, the company's website and the production, the finance and management of the plant. The approach was to gain a better understanding of the participants' actions, because participants are able to describe current reality as they tell their stories (Baxter and Jack 2008). A total of three interviews were conducted. These include the brew master, the financial advisor and the Chief Executive Officer (CEO). The length of the interviews ranged between 30 minutes and 1 hour, and they were digitally recorded.

### **The Contingency Theory of Management Accounting**

The contingency theory of management accounting suggests that a management accounting information system should be designed in a flexible manner that considers the environment variables confronting an organization (Riahi-Belkaoui 2002). It means that a management accounting information system needs to adapt to specific organizational needs, like the effect of its activities on the environment. In fact, accounting information systems should be designed within this adaptive framework. The contingency theory of management accounting takes into account the environment, organizational attributes, and managerial decision-making styles (Riahi-Belkaoui 2002). Woods (2009) indicates that the contingency theory approach to management accounting is based on the premise that there is no universally appropriate accounting system applicable to all organizations in all circumstances. Rather, a contingency theory should attempt to identify specific aspects of an accounting system that is associated with certain defined circumstances to demonstrate an appropriate matching of the organization's en-

vironmental impact on the society (Chang and Deegan 2010).

In designing an effective management accounting system, it is necessary to consider the circumstances in which it will be used. This is because the applicability of a management accounting system is contingent on situational factors faced by the organization; one of which is the internalization of externality costs. Contingent factors such as the internalization of external costs are imposed on the society as a result of an organization's activities. It is necessary, therefore, that organizations develop a management accounting information system that addresses such contingent environmental issues. Examples of such externality costs from a water resource management perspective are the effect of wastewater discharges, water scarcity, water pollution, and other water-related environmental and ecological costs on society. Contingency theory expands the scope of strategic and management control by emphasizing on the balance between external environmental factors and internal resources of the organization (Bouma and van der Veen 2002). The contingency theory approach to management accounting is used in this study because of its effectiveness to analyse and provide insights into the relationship between business strategies, in this case, water resources management and management accounting systems. De Benedetto and Klemeš (2009) indicate that, to measure the effectiveness of sustainability costing systems, there is a need to measure an organization's environmental performance. The prime reason for allocating environmental costs like wastewater treatment costs, water scarcity, water pollution, and other water related environmental and ecological costs to processes is economic; such allocation will assist managers to identify profitable options for water-related waste-reduction. Internalizing an organization's external environmental cost is a business strategy rather than an environmental management strategy (Tsoulfas and Pappis 2006). The effectiveness of an accounting system to measure organizations' external environmental costs will help to provide support for its water usage reduction decisions for improved environmental management strategy. A logical approach is for an organization with relatively high water costs to implement an accounting system that enables it to control its water usage and costs. In fact, the contingency

theory approach is an indication that the matching of strategy and management control systems is related to ensuring organizational environmental effectiveness.

## DISCUSSION

### Contingency Theory Approach to Management Accounting Analysis

The contingency approach to management accounting is used to analyse the effectiveness of SAB Ltd to provide an understanding to the effect of determining water resources management costs. The reason for this approach is each organization is unique and is exposed to different situations or contingent factors that cannot be studied separately (Otley 2001). In addition, contingent factors relating to the current study are classified into categories that appear to make sense in terms of explaining the relationship between management accounting information and the external environment. The major contingent factors identified in the current study are classified into the following categories: *water recovery for sustainable production; water use efficiency due to use of economic instruments and pricing; and managing water scarcity due to local nature and water use licensing and enforcement.*

#### *Water Recovery for Sustainable Production*

Water consumption during brewing generates a lot of wastewater. The brewery recovers its wastewater by recycling through treatment plants and reuses such wastewater for house-keeping and for other cleaning activities. Although, not all wastewater can be recovered for reuse in the brewery, even for cleaning brewing equipment, the recovered water needs to meet specific required international standard, that is, ISO 22000, for it to be used in cleaning the pipes. Along these lines, the brew master has this to say:

*“Some of the water we recover and use for cleaning. We do not just send all of the wastewater to the drains. We treat wastewater to meet water quality standards as benchmarked by the SAB Ltd.”*

While the SAB Ltd recovers wastewater for reuse in the cleaning of pipes and for other house-keeping activities, the costs of treating waste-

water to meet standards is enormous and difficult to determine in product costs. Moreover, the cost per litre of water from the municipality is increasing on a yearly basis because only 3.5% of water users in the country is allocated to the industrial sector (DWAF 2008). The need to apportion costs to inefficient water use by the brewer will help to identify activities that give rise to water wastage cost so managers can make appropriate decisions to reduce its occurrence. Notwithstanding, the SAB Ltd provides its senior managers with the necessary knowledge to enable them access the broader issues around water management by engaging with stakeholders through established partnerships so as to address water-related impact of the brewery on the community to improve its operations. Despite this measure, the SAB Ltd managers need to determine the costs associated with its water use inefficiencies in order to reduce or eliminate its occurrence where possible.

#### ***Water Use Efficiency Due to Use of Economic Instruments and Pricing***

In order to save the cost on water inefficiency, the SAB Ltd specifically adopts process water reduction strategy to create value for both the business and society. The SAB Ltd initiated a programme designed to achieve social responsibility, sustainability and profitability, all at the same time. The scheme is strategized to reduce its environmental impact through cleaner production by reducing brewery process waste most of which relates to water wastage (see Table 1). This strategy encouraged the SAB Ltd to use less litres of water to produce a litre of beer by setting annual waste-reduction targets in terms of quantity and costs.

Although the SAB Ltd provides data on its water uses in the value chain that answers the important question of how much water is being used as well as the physical locality of the water use, determining the overall water-usage cost is a challenge for the finance division. While the SAB Ltd provides strategic information that is

required to assess water-use related risks, this risk in context refers only to physical availability without specific provision of water resources management-related cost information that would have made visible the magnitude of the inefficiency in the system.

#### ***Managing Water Scarcity Due to Local Nature and Water Use Licensing and Enforcement***

Losses occur due to unplanned shutdown in production due to lack of water supply from the Polokwane Municipality.

*"We have incidences where we don't have water and we have to shut down, leading to a very big waste in current production."*

The brewery faces challenges from government regulations on water-usage efficiency. The water-usage efficiency is regulated by the South African Water Act. This Act governs the preferential allocation of water for domestic consumption before industrial water users. Specifically, the SAB Ltd manages its water usage through a water-recovery system to ensure the availability of water for irrigating its farms. This strategy is beneficial since water licenses are withheld by the authorities for certain types of activities considered to have a detrimental impact on water resources.

## **CONCLUSION**

The future success of brewery business hinges around water efficiency and its ability to sustaining human life, economic growth, healthy ecosystem, and the recognition that sustaining each of these aspects is dependent on sustaining the others. Besides, the future challenges surrounding water resources, management is likely to become more critical due to continued pressures from civil society and governments as water scarcity exacerbates. This is in addition to the complexity of determining and attributing water-footprint impact to individual and organi-

**Table 1: SAB Ltd Waste-reduction targets for 2008-2013**

	<i>Baseline targets 2008</i>	<i>Actual reduction achieved 2012</i>	<i>Actual reduction for 2013</i>
Water targets	4.43 litres per bottle of beer	3.45 litres per bottle of beer	3.40 litres per bottle of beer

zational users for improved usage. Significantly, the scarcity of available water resources to household and industrial consumption increases; and assessment of water footprint may become extremely diverse and difficult to understand, measure, and engage.

### RECOMMENDATIONS

Under the preceding circumstances, and coupled with the underlying complexity of determining an organization's accurate water footprint and cost, organisations will have to depend more on the level of detailed information presented with regards to its social, environmental and economic impacts within the local community in which it operates. Further, the provision of adequate and reliable water-related cost information will enable managers identify operations with excessive water consumption and wastages and those that present opportunities to reduce such wastages. These water-usage costs should include water pollution costs, water treatment costs, ecological costs, water spillage costs, water pollution litigation costs, and other water inefficiency related costs. Moreover, this has become necessary since, in the near future, government might make use of stringent economic instrument to control water usage. The present paper recommends the provision of adequate and reliable water-related cost information to enable managers to identify operations with excessive water consumption and wastages, and those that present opportunities to reduce such wastages.

### LIMITATIONS

This paper acknowledges some inherent limitations in the use of a case study, such as subjectivity and the lack of ability to generalize the findings and reliance on the experiences of interviewees. In addition, the research findings obtained from this case study may not be applicable to other cases since every case is distinct and unique in its own right; however, every case may involve a number of commonalities. While generalizability is a controversial issue in a case study research, attempts were made to overcome this limitation in this paper by asking open-ended questions, but this is unlikely to overcome the limitation completely.

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