UNIVERSITY OF KWAZULU-NATAL

AN APPLICATION OF SYSTEMS METHODOLOGIES TO INVESTIGATE SOCIAL COMPLEXITY AT THE FELIXTON MILL AREA

By

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CONFIDENTIALITY CLAUSE

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To Whom It May Concern

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Due to the strategic importance of this research it would be appreciated if the contents remain confidential and not be circulated for a period of 5 years.

Sincerely

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CN Gerwel Proches

ABSTRACT

Soft Systems Methodology (SSM) is one type of systems methodology that was developed in response to the limitations of the systems engineering approach. It uses a flexible, yet organised process to bring about action to improve problematical situations. This research employed SSM and systems science, in combination with standard qualitative methods, towards comprehending social complexity in the context of the Felixton Mill area, an important component of the South African sugar industry. This context is characterised by diverse stakeholders who have multiple and often competing objectives. This research formed part of a larger multi-disciplinary research project, which was aimed at finding improvement processes for use in the sugar cane supply and processing system. Data were collected mainly through in-depth semi-structured interviews and SSM workshops which were held with growers, hauliers, the miller, and industry stakeholders, and processed using thematic analysis. The findings revealed that critical factors such as haulier inefficiencies, cane supply, and cane quality, were affecting the sustainability of the Felixton Mill area. The diverse goals of the stakeholders were found to be characteristic of a purposeful system, as is the case with social systems, but were identified as a potential source of conflict. The research highlighted the value of applying SSM to comprehend social complexity in this type of context. Critical factors such as starting conditions, time allocated, grouping of participants, and prompts by the facilitator, were found to play a role in the SSM process. The study contributed to social complexity theory through the development of a model to illustrate the role of power, organisational culture, decision-making, and value systems in complex social systems. Methodological lessons were provided, and an SSM facilitation model developed, to guide SSM practitioners who intend to facilitate change. Conceptual models were also developed to assist with navigating complexity in multi-stakeholder engagements. The study finally proposes a novel multi-stakeholder leadership model applicable in this and other contexts.

DECLARATION 1

I, Cecile N. Gerwel Proches, declare that:

(i) The research reported in this thesis, except where otherwise indicated, is my original research.

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(iii) This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.

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DECLARATION 2

The four journal articles, that were published in peer-reviewed journals, and which are listed below, each represent a chapter of this thesis, and were co-authored by the candidate and the PhD project supervisor. In all these cases, C.N. Gerwel Proches conceptualised the research, collected and analysed the data, and wrote the paper, and S. Bodhanya supervised the research.

Journal articles

Publication 1 [Chapter 3]

Gerwel Proches, C.N. & Bodhanya, S. (2013). An analysis of multi-stakeholder interactions in the sugar industry using a social complexity framework. *Problems and Perspectives in Management,* 11(4): 77-85.

Publication 2 [Chapter 4]

Gerwel Proches, C.N. & Bodhanya, S. (2015). An Application of Soft Systems Methodology in the Sugar Industry. *International Journal of Qualitative Methods,* 14: 1-15.

Publication 3 [Chapter 5]

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Publication 4 [Chapter 6]

Gerwel Proches, C.N. & Bodhanya, S. Exploring stakeholder interactions through the lens of complexity theory: Lessons from the sugar industry. Published on-line in *Quality & Quantity: International Journal of Methodology* in November 2014.

Additionally included as appendices, are three conference presentations, with contributions from multiple co-authors as follows:

Conference presentations

Appendix 1: Gerwel, C., Hildbrand, S., Bodhanya, S. & Bezuidenhout, C. (2011). *Systemic approaches to understand the complexities at the Umfolozi and Felixton Mill areas*. Proceedings of the 84th Annual Congress of the South African Sugar Technologists' Association (SASTA), pp. 177-181, Durban, South Africa, 17-19 August 2011.

Author contributions: C.N. Gerwel Proches wrote the part of the paper pertaining to the use of SSM in the sugar industry. S. Hildbrand wrote the part of the paper pertaining to the use of VSM in the sugar industry. S. Bodhanya and C.N. Bezuidenhout supervised the research. C.N. Gerwel Proches and S. Hildbrand presented the work at the conference.

Appendix 2: Gerwel, C. & Bodhanya, S. (2011). *Small-scale fishers and small-scale cane growers: Attaining success in big industry*. Poster presentation at the Southern African Institute for Management Scientists (SAIMS) Conference, Durban, South Africa, 11-14 September 2011.

Author contributions: C.N. Gerwel Proches prepared the abstract and poster, and presented the work at the conference. S. Bodhanya supervised the research.

Appendix 3: Gerwel Proches, C.N. & Bodhanya, S. (2013). *Applying Soft Systems Methodology in the Sugar Industry*. Presentation at the 2nd International Conference on Management, Economics & Finance, Kota Kinabalu Sabah, Malaysia, 28-29 October 2013.

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GLOSSARY OF TERMS

CAS	Complex Adaptive Systems
CATWOE	Customers, Actors, Transformation, Worldview, Owners, Environment
CTS	Cane Testing Service
HQ	Headquarters
LSG	Large-scale growers
MGB	Miller Grower Body
NCF	North Coast Forum
RV	Recoverable Value
SASA	South African Sugar Association
SASRI	South African Sugarcane Research Institute
SASTA	South African Sugar Technology Association
SCM	Supply Chain Management
SMRI	Sugar Milling Research Institute
SSG	Small-scale growers
SSM	Soft Systems Methodology
THS	Tongaat Hulett Sugar

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CHAPTER 1: INTRODUCTION

1.1 Introduction

Social complexity arises from the multiple, non-linear dynamic interactions between heterogeneous agents who are bound together by a common goal (Anderson, 1999; Bogg & Geyer, 2007; Cairney, 2012; Levy, 2000; Paralleda, 2002; Stevenson, 2012). Social complex systems are characterised by inherent uncertainty and unpredictability, that make planning and prediction difficult (Boulton, 2010; Cairney, 2012; Marion & Uhl-Bien, 2001; Morcol, 2010; Sargut & McGrath, 2011). Various challenges can arise in managing these complex situations, particularly, in aligning the diverse multiple perspectives, goals, and values that stakeholders hold. Such situations may further be compounded by power differentials, as well as divergent organisational structures, processes, cultures, and strategies (Cicmil & Marshall, 2005; Escobar, 2003; Levy, 2000; Rzevski, 2011). These organisational dynamics may place limitations on the extent to which the interconnected stakeholders are able to form a common identity, interact, share information, and engage in planning for the future (Marion & Uhl-Bien, 2001; Stevenson, 2012). Problem solving in social complex systems can be particularly difficult, as problems cannot be traced to one cause, due to multiple dynamic influences (Gallo, 2013; Ozer & Seker, 2013).

Traditional linear approaches to management can be limited in addressing social complex problems. Systemic methodologies, such as Soft Systems Methodology (SSM), bring diverse stakeholders together to work through the multiple perspectives, values, goals, power dynamics, and overlapping issues (Checkland, 1985; Checkland & Scholes, 1990; Checkland, 2000; Checkland & Poulter, 2006). SSM emphasises relationships, and not only goal-seeking, and also includes processes that facilitate learning, collaboration, dialogue, and sense-making (Checkland, 1985; Checkland & Scholes, 1990; Checkland, 2000; Checkland & Poulter, 2006).

This study examines the use of SSM in comprehending social complexity in the South African sugar industry. This research forms part of a larger multi-disciplinary research project, which was aimed at finding improvement processes for use in the sugar cane supply and processing system. The sugar industry, although typifying a supply chain, has been recognised as a complex adaptive system, due to the multiple interactions

between numerous stakeholders, who hold diverse mental models, and pursue multiple, and often competing objectives (Archer, Higgins & Thorburn, 2009; Bezuidenhout, 2008; Bezuidenhout & Bodhanya, 2010; Choi, Dooley & Rungtusanatham, 2001; Darnhofer, Gobbon & Dedieu, 2012; Higgins et al., 2004; Le Gal et al., 2009; Li et al., 2010; Surana et al., 2005). These stakeholders are interdependent, and often face an array of overlapping problems that threaten the future of the industry. Such complexity makes it difficult for stakeholders to identify the exact causes and effects of the problems, and presents a challenge to planning and intervention, as there are no easy solutions. This necessitates an approach that embraces a holistic perspective, and brings about improvement to a problematical situation.

This chapter sets out the background, preliminary literature review, problem statement, need for the study, aim and research questions, and importance of the study.

1.2 Background and study context

Sugar cane is an agricultural crop of significance for the continent of Africa and the world (DAFF, 2011; Kaye, 2013; Mnisi & Dlamini, 2012). Sugar cane grows in settings characterised by sub-tropical to tropical climates, such as in parts of Australia, Brazil, India, United States, Thailand, Philippines, China, Pakistan, Mauritius, Malawi, Zimbabwe, Swaziland, Zambia, Tanzania, Mozambique, and South Africa (Chidoko & Chimwai, 2011; Higgins et al., 2007; Kaye, 2013; Mnisi & Dlamini, 2012; Smith, Davis & Achary, 2010). Figure 1.1 illustrates a field of sugar cane.

The South African sugar industry is ranked in the top 15 out of 120 countries that produce sugar and is considered a cost-competitive producer (SASA, 2013/2014; Sugar Outlook, 2009). In South Africa, sugar is derived from sugar cane, which is predominantly found in the South African provinces of KwaZulu-Natal and Mpumalanga (DAFF, 2011; Lewis, 1990; Mac Nicol, Ortmann & Ferrer, 2008; SASA, 2013/2014). Approximately R12 billion direct income is generated from the sugar industry per annum in South Africa (SASA, 2013/2014). The landscape of KwaZulu-Natal is in actual fact characterised by the bright green rolling hills of sugar

cane that can be observed to the south, north and west of Durban. It is customary to see trucks carrying sugar cane on the roads, and every now and again, children and even adults chewing on cane that has been dropped along the way. The arrival of approximately 152000 Indian indentured workers in the late 1800s and early 1900s, to provide cheap labour in the early days of the sugar industry, contributed significantly to the rich heritage and culture of the province (Lewis, 1990; CANEGROWERS, 2010/2011).

Figure 1.1: Sugar cane

The sugar industry in South Africa plays an important role in the national economy, both through direct and indirect employment, mainly through cane production and processing, and various supporting industries (Sugar Outlook 2009; SASA, 2013/2014). Roughly 79000 people are employed directly and a further 350000 indirectly (DAFF, 2011; SASA, 2013/2014).

The industry is quite diverse in that there are various products derived from sugar cane, including raw and refined sugar, syrups, and molasses (Sugar Outlook, 2009). Other business opportunities include the haulage of the cane and sugar, fertilisers, other chemicals, as well as marketing (DAFF, 2011; Gass, n.d.). Sugar cane comes second only to maize as South Africa's main field crop (SASA, 2011/2012).

KwaZulu-Natal is quite reliant on the sugar industry, which supports many a household (Castel-Branco, 2012; KwaZulu-Natal Top Business). The sugar industry, unfortunately, faces challenges such as competition from international markets, access to such markets, and heavy reliance on a conducive climate (Bezuidenhout & Singels, 2007a; Everingham et al., 2002; Gauteng Business News, 2013; Marais, 2013; Nair, 2013; Phillips, 2013).

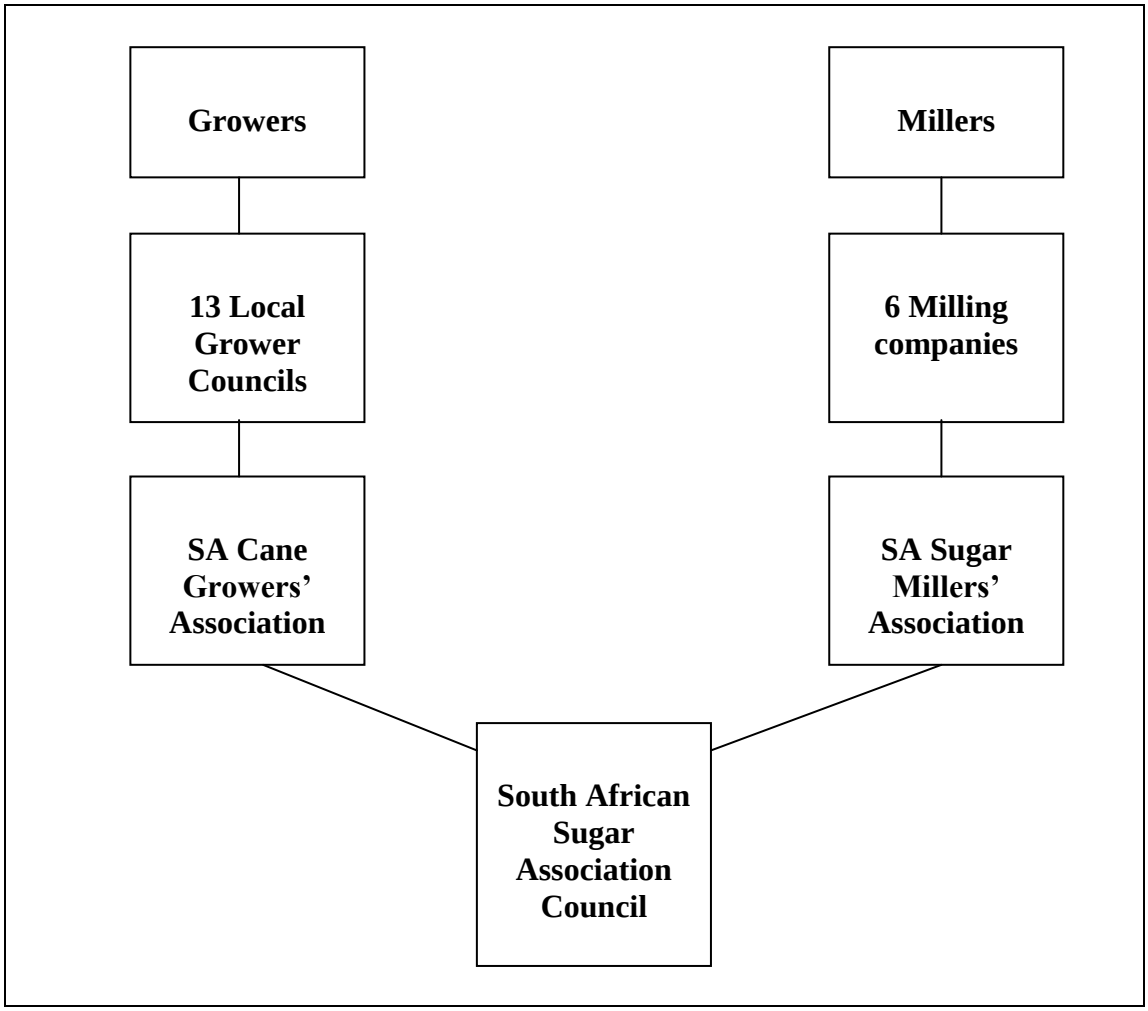

Figure 1.2: South African sugar industry structure (SASA, 2013/2014: 15)

The South African sugar industry is complex. It includes a variety of components, as illustrated in Figure 1.2. There are six milling companies and 14 sugar mills (SASA, 2013/2014).

The sugar value-chain is composed of "growing, harvesting, cane transport, mill processing, sugar transport and storage/shipping/marketing sectors" (Higgins et al., 2007: 612). The main stakeholders are the growers of the sugar cane, the hauliers

responsible for transporting cane to the millers, and the millers who process cane. The ‘division of proceeds' formula is used to ensure that accrued revenue gets equitably distributed to the miller and growers; growers obtain 64.3675% of the proceeds deriving from the sale of sugar and molasses (CANEGROWERS, 2013/2014; Marais, 2013). Those involved in the sugar industry need to understand its long-term nature, and the large commitment required in respect of labour and capital (Gass, n.d.). Initial investment is directed at planting, but thereafter the plant may be cut up to eight times (Gass, n.d.).

The South African sugar industry differs from other sugar producing countries in that there is private ownership of farms, whereas milling companies in countries such as Brazil and the United States, for example, own and govern the land (Higgins et al., 2007). There are roughly 24000 registered farmers who grow sugar cane in South Africa, and approximately 2.3 million tons of sugar, are produced per season (SASA, 2013/2014). Of concern is the dramatic decline in the number of growers over the years. Approximately 29130 growers were registered in the 2011/2012 period (SASA, 2011/2012). There were 38200 registered growers in 2009 (Smit, 2009), while 53000 cane growers were reported in 2001 (Bigman, 2001).

There are an estimated 1413 large-scale growers, which includes 323 emerging black growers, who contribute 84.69% of the entire cane production, while 7.94% is produced by milling companies (SASA, 2013/2014). Only 8.26% of cane is produced by the estimated 22453 small-scale growers (SASA, 2013/2014). In respecting national imperatives for transformation in South Africa, the sugar industry has already transferred “21% of freehold land under commercial sugar cane production from white growers to black growers” (SASA, 2013/2014: 5).

The six milling companies in South Africa are Illovo Sugar Limited, Tongaat Hulett Sugar Limited (THS), TSB Sugar Holdings (Pty) Limited, Gledhow Sugar Company (Pty) Limited, UCL Company Limited and Umfolozi Sugar Mill (Pty) Limited. The 14 sugar mills and their administrative offices count towards the employment of at least 7000 people (SASA, 2013/2014).

The South African Sugar Association (SASA) Council is tasked with matters around competitiveness, profitability, and sustainability. It also assists the growers and

millers and their respective bodies, the South African Canegrowers' Association, and the South African Sugar Millers' Association (SASA, 2013/2014). The Cane Testing Service (CTS) serves to analyse the quality of cane that is received from growers. There are also specific regulations, such as the Sugar Act and the Sugar Agreement Act, which pertain to the sugar industry.

Research in respect of the sugar industry falls under the domain of the South African Sugarcane Research Institute (SASRI) and the Sugar Milling Research Institute (SMRI) respectively (Matshamba, 2006; SASA, 2013/2014; Sugar Outlook 2009). SASRI also extends support in respect of agricultural research, extension, cane testing, as well as training.

Seventy per cent of the approximately 2.2 million tons of sugar per season is sold in the Southern African Customs Union (Botswana, South Africa, Lesotho, Namibia, Swaziland), while the rest is traded in Asia, the Middle East and the rest of Africa (SASA, 2011/2012). Of the 15 member states in the Southern African Development Community, South Africa ranks as the main sugar producer (SASA, 2013/2014). The future of the sugar industry lies in co-generation, ethanol, and animal feed (Higgins et al., 2007; SASA, 2013/2014).

Figure 1.3 depicts the location of the sugar mills in South Africa and the areas of cultivation, while highlighting THS and specifically, the study site, Felixton Mill. The Felixton Mill (Figure 1.4) which is located on the KwaZulu-Natal north coast close to the town of Empangeni, is one of the largest mills in South Africa. The mill is owned by THS, which owns three other mills (Amatikulu Mill, Maidstone Mill and Darnall Mill) on the North Coast of KwaZulu-Natal, as illustrated in Figure 1.3 (see ★ on map). The other mills (see 0 on the map) are owned by the other milling companies.

THS South Africa has grown and milled sugar cane since 1854 (Tongaat Hulett Sugar, 2014). The company was formed in April 1982, as a result of a merger, between Tongaat Group and Huletts Corporation (Tongaat Hulett Sugar, 2014). THS has a central refinery in Durban, and owns a number of sugar estates, as well as an animal feeds' business (SASA, 2013/2014). The THS mills receive cane from large-scale growers (69%), small-/medium-scale growers (17%) and the corporation's own

farms (14%) (Tongaat Hulett Sugar, 2014). THS also has mills in Mozambique and Zimbabwe, as well as cane-related operations in Swaziland.

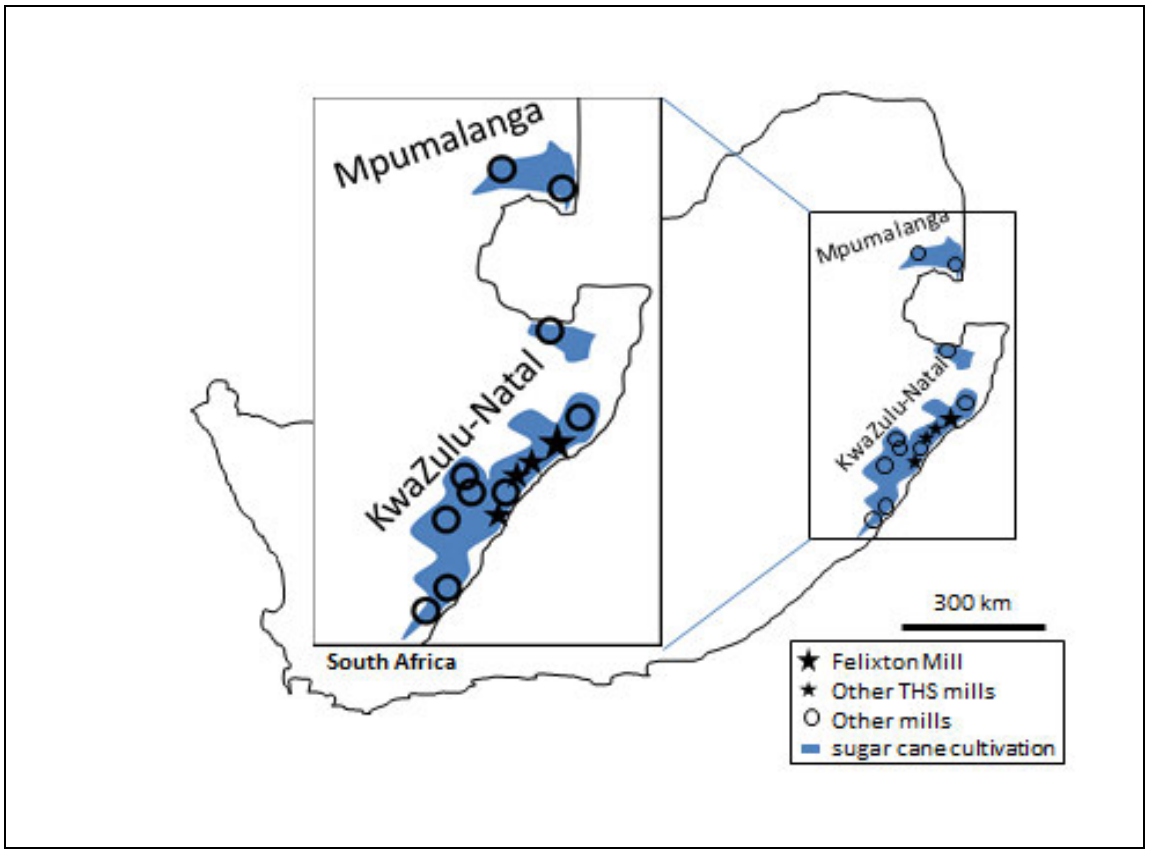

Figure 1.3: Sugar mills and areas of cultivation in South Africa (adapted from SASA, 2013/2014)

The Felixton Mill has a rich history. The original Felixton Mill was founded by Sir JL Hulett in 1911 (Tongaat Hulett Sugar, 2014). Placed nearby the current mill, Felixton Mill was originally able to crush up to 35 tons of cane per hour, eventually moving up to 12000 tons (Tongaat Hulett Sugar, 2014). Twelve kilometers north lay another mill known as the Zululand Sugar Mill, which crushed up to 15 tons per hour. These two mills were then expanded with the aim of having a crushing capacity of 600 tons per hour. At this point, in July, 1981, the construction of the present Felixton Mill began.

Presently, the mill is able to crush 600 tons per hour (THS, n.d). It receives cane from as far as Mtunzini (30 km south west) to Mkuzi (100 km north). Harvesting occurs between April and December, with manual labour being the main method of cutting the cane (Tongaat Hulett Sugar, 2014). Surrounding communities in the Felixton Mill area benefit from direct and indirect job creation (Tongaat Hulett Sugar, 2014). The

creation of the North Coast Forum (NCF) in 2010, which represents the Felixton and Amatikulu Local Grower Councils, provides a platform for negotiations with the miller (CANEGROWERS, 2010/2011).

Figure 1.4: Felixton Mill

A large number of stakeholders are involved in the various stages of the sugar cane supply chain. The mill receives cane from large-scale growers, small-scale growers, and emergent growers. The 2013/14 season saw 2088930 tons of sugar cane being crushed at the Felixton Mill (CANEGROWERS, 2013/2014).

The Felixton Mill area numbered a total of 5348 growers in 2010/2011, comprising 96 large-scale growers and 5252 small-scale growers (CANEGROWERS, 2010/2011). Figure 1.5 provides examples of both large-scale and small-scale farms in the Felixton

Mill area. These different growers have their own dynamics, thus contributing to the complexity of the mill area.

The sheer number of small-scale growers in the Felixton Mill area creates an enormous amount of complexity. These growers have a few hectares each on which to farm the sugar cane. They do not have actual ownership of the land, do not own the necessary equipment, and oftentimes experience challenges with unreliable contractors (Kaye, 2013; Nothard, Ortmann & Meyer, 2005). Compared with small-scale growers, large-scale growers have large farms, better infrastructure and access to necessary resources with which to farm efficiently. Emergent growers, while perhaps having large farms, often encounter difficulties in respect of efficient farming, owing to a lack of experience. Growers may dedicate their entire farm to the sugar cane crop; however, they may also grow other crops such as bananas or macadamia nuts alongside the sugar cane, as represented in Figure 1.6.

A steady supply of cane is critical to the survival of the mill and the sugar industry in general. The Felixton Mill has in the past experienced difficulty with issues such as foreign matter (rocks), limited rail vehicles, and inefficient haulage, as well as with growers' concerns about land reform in South Africa (CANEGROWERS, 2010/2011).

The timely arrival of cane at the mill is critical for ensuring cane quality. Cane should ideally reach the mill within 16 hours of being cut. The manner in which cane is cut by the labourers, and the treatment that the cane receives (use of fertiliser) while growing, are some of the factors contributing to cane quality. Figure 1.7 illustrates cane which has been harvested and is now waiting in the loading zone to be picked up by the haulier.

Efficiency in respect of transport of the cane is of paramount importance. This, however, is an area that requires cooperation, efficient operations, and aligned objectives between the various stakeholders, who may have differing perceptions on these matters in defining success, and addressing problems. Higgins et al. (2007) asserted that better transport scheduling could result in financial benefits of the value chain, consequently affording logistical opportunities. Figure 1.8 and Figure 1.9 respectively, illustrate haulage in respect to rail and road in the Felixton Mill area, and

Figure 1.10 the arrival of the cane at the Felixton Mill. Efficient milling is also an important aspect.

Figure 1.5: Example of large-scale and small-scale farm in the Felixton Mill area

Figure 1.6: Bananas and macadamia nuts grown alongside sugar cane in the Felixton Mill area

Figure 1.7: Cane in the loading zone in the Felixton Mill area

Figure 1.8: Cane transported by road to the Felixton Mill

Figure 1.9: Cane transported by rail to the Felixton Mill

Figure 1.10: Cane arriving at the Felixton Mill by road and rail

This research project hails from background work by Bezuidenhout and Bodhanya (2009) which involved conducting a formal, integrated, supply-chain synthesis, aimed at identifying opportunities within the current systems before developing engineering and management solutions. The research by Bezuidenhout and Bodhanya (2009) was conducted at three South African sugar mills: Amatikulu, Sezela and Malelane. Problems were identified and recommendations proposed into 'hard' and 'soft' aspects of the sugarcane system. Issues that arose included the presence of inefficiencies such as "vehicle over-fleeting, unnecessary risk-averse behavior, incorrect forecasting and planning, and inability to diversify or to add further value to baseline products" (Bezuidenhout & Bodhanya, 2009: 3). A major issue was the existence of competition between the stakeholders, particularly with regard to their individual objectives. Related to this were problems around communication and trust.

The sugar industry, although quite successful and efficient, has areas of inefficiency, which if addressed, can create opportunities for improvement (Bezuidenhout & Bodhanya, 2009; Bezuidenhout & Bodhanya, 2010). As there are various stakeholders, certain situations arise in which there are different and conflicting goals, and at other times, some stakeholders act according to their own self-interests, which, in turn, prevents innovation. An example of divergent goals is provided by Higgins et

al. (2007) in noting that milling companies may be focused on profitability, whereas growers could be farming for a particular lifestyle and for sustainable income.

A major difficulty faced in the industry is that of competition amongst stakeholders, such as millers and growers, who are responsible for independent processes in the supply chain. Growers and millers are viewed by the International Sugar Organisation (2008) as relatively important stakeholders, and as further pointed out by Masuku and Kirsten (2003), require high levels of trust in their relationships to ensure commitment. It is critical to assess not only technical aspects of a system, but to also concentrate on stakeholder relations, information sharing, and innovation.

One of the goals of the Southern African Development Community sugar cooperation agreement is to encourage information sharing, and research and training, in order to enhance cooperation between growers, millers and refiners (SASA, 2010). Sugar production is a particularly complex enterprise, owing to ambiguity in respect of the climate, a multitude of decision-makers, and decision-making occuring at various levels, including the farm and mill (Bezuidenhout & Singels, 2007a; Bezuidenhout & Singels, 2007b; Everingham et al., 2002; Higgins et al., 2007; Jakku et al., 2007; Le Gal et al., 2009; Lejars, Le Gal & Auzoux, 2008; Mac Nicol et al., 2008). As highlighted earlier in this chapter, the Felixton Mill area corresponds to this description, thereby calling for this much-needed research.

1.3 Preliminary literature review

The problems in the sugar industry mainly relate to the multiple, non-linear interactions of stakeholders with divergent views. It is important to gain a systemic perspective of the problematical situation by employing methodologies that bring stakeholders together in order to comprehend social complex systems to enable problem-structuring, learning, accommodation of divergent interests, values, goals, and ultimately bring about improvement.

With this in mind, the study focuses on the following theoretical areas: social complexity, complexity theories, including Complex Adaptive Systems (CAS), systems thinking, and more specifically, SSM, and areas pertaining to ‘soft’ issues in

management. A brief overview of the literature pertinent to these topics is provided below.

1.3.1 Social complexity

Mukherjee (2008) argued that there are many components interacting in a nonlinear, yet interdependent manner, within a complex system, and that complexity arises from simple interactions. The consideration of social complexity is particularly relevant in understanding multi-stakeholder interactions, as found, for example, in the sugar industry. Social complexity involves numerous dynamic interconnected parts, and is understood by observing local behaviour of participants, and associated interactions with others, and the environment (Potgieter et al., 2007). Social complexity is essentially concerned with the actions and interactions of different players, each having their own perspective. There is an acknowledgement of disorder and emergence, as well as the awareness that human systems are complex (Snowden, 2005).

Multiple human interactions, coupled with increasing demands and required skills, can be challenging. Organisational members can become inundated and may even be unable to perform effectively, if they do not possess the required abilities to navigate social complexity. This is a very real problem and accounts for most behaviour within organisations (Jensen, 2004), and as Heywood, Spungin and Tunbull (2007) argued, complexity is an inevitable, growing reality for organisations.

It is critical to find ways of dealing with this reality. Endeavours to handle social complexity should be centred on an attitude of avoiding conventional planning as a means of controlling uncertainty (Modena, 2009). Heywood et al. (2007) pointed to the need for organisations to view complexity as an opportunity rather than as a problem. Novelty and creativity should be encouraged in dynamic organisations, by embracing unpredictable interactions among individual and organisational spheres (Modena, 2009).

Complexity should be welcomed at the institutional and individual level, along with efforts to enable the proper processes, skills, capabilities, and culture (Heywood et al., 2007). Jensen (2004) maintained that people do not naturally possess the skills to

choose how to respond effectively; consequently he questioned just how much was being done to develop the workforce to deliver effectively. There has been a call for research into the appreciation of uncertainties as an advantage for adaptable organisations (Modena, 2009).

Complexity theories hail from the fields of biology and physics, but have in recent years become popular in management studies. Complexity theory is concerned with how interactions between agents evolve over time (Liss, 1999). It is the interactions between agents rather than the rules within a system which create complexity (Mukherjee, 2008). Of particular relevance are the mental models or perspectives held by agents. CAS, according to Ashmos, Duchon and McDaniel (2000), are systems which, as a result of having various heterogeneous agents interacting together, portray complex, adaptive, and emergent behaviour. Developments in the system are non-linear, which implies that behaviour cannot be predicted based on the past, and that minor changes can produce significant effects (Klijn, 2008). The latter principle is referred to as sensitivity to initial conditions.

A few other key concepts encountered in the study of complex systems are that of self-organisation and emergence. Mukherjee (2008) pointed out that self-organisation is the occurrence whereby a group naturally converges to engage in tasks, but of importance is the fact that it is the group and not anyone from outside who determines the way forward. It is therefore of consequence that agents cannot be apart from the system. There are interactions based on local rules and it is this that leads into an emergent population-wide pattern; thus emerges a higher order of complexity from a less ordered state (Stacey, 2007). Emergence, according to Goldstein, Hazy and Silberstang (2008), promotes flexibility. The heterogeneous nature of agents is something which should be capitalised on, in order for the system to be capable of innovation.

Insights from complexity theory can be particularly useful for organisations. Liss (1999) argued that complexity theory may be used as a metaphor for promoting innovative thinking; and that self-organisation, rather than rigidity and hierarchy, should be embraced, which will ultimately allow for greater flexibility. There is an opportunity for gaining insights, which can lead to more effective change and development processes. Mukherjee (2008) highlighted that the emphasis should not be

on agents attempting to gain control, but rather engaging and coping, as situations unfold. He therefore recommended that efforts be made to facilitate co-evolution and possibilities, thereby avoiding a scenario in which there is only one set way of doing things. Ashmos et al. (2000) also recommended that organisations accentuate the relationships between the parts. They mention that conflict may arise from the attainment of multiple objectives and goals. Organisations, while being aware of the importance of the pursuit of goals, also need to facilitate learning and change (Boulton, 2010). It is the acknowledgement of complexity and the consequent approach towards handling it, which produces a difference in outcomes.

1.3.2 Systems thinking

Systems thinking is concerned with interrelationships, the recognition of the whole, and the interactions of the parts. Ashmos et al. (2000) viewed systems thinking as a way to holistically analyse an organisation, particularly to understand where changes may be implemented to ensure systemic improvements. The neglect of systemic thinking will result in a situation in which changes are made to certain parts, without realising that there will be effects elsewhere. Systems thinking is critical in multiple stakeholder scenarios, in which there are independent actions, but which have outcomes and effects for other parties.

A distinction may be made regarding hard and soft systems thinking. Hard systems thinking is characterised by an objective view of reality, whereas soft systems thinking accepts that people construct their reality; hence requiring a reflection on perceptions and the way in which people operate (Stacey, 2007). The schemata or mental models of agents are of particular significance. This was the sentiment expressed by Checkland in his assertion that systems were merely mental constructs of those who are observed (Stacey, 2007). It is desirable to have methods in place to allow stakeholders to jointly have the opportunity of expressing their views and opinions, but more importantly, to unearth the covert drivers of behaviour, and consequently to question deeply-held beliefs.

1.3.3 Soft Systems Methodology (SSM)

Peter Checkland developed SSM, which is a methodology used to comprehend complex situations, in which there is a real-world situation considered problematic and in need of assistance (Brenton, 2007; Pala, Vennix & van Mullekom, 2003; Stacey, 2007). Checkland (1985) argued that SSM involves purposeful action and an organised process of inquiry, and that there is no right or wrong way of looking at human-activity systems. It is a process whereby "users inquire into purposeful human activity by means of systems ideas" (Mathiassen & Nielsen, 2000: 243). A key focus of SSM is on learning and on illuminating the manner in which perceptions are formed (Checkland, 1985; Checkland & Scholes, 1990; Checkland, 2000; Checkland & Poulter, 2006). It is an opportunity of bringing stakeholders together and facilitating the surfacing of their individual perspectives. Presley and Meade (2002) highlighted that SSM tackles vague situations in which there are multiple objectives and different views of a problem. The differing perceptions of people are respected, and no attempt is made at locating a single action, but rather, a path of action is agreed on (Presley & Meade, 2002).

SSM acknowledges the complexity within a system, and furthermore notes the diverse needs of multiple stakeholders and what must be done to achieve a desirable future (Checkland, 1985; Checkland & Scholes, 1990; Checkland, 2000; Checkland & Poulter, 2006; Presley & Meade, 2002). SSM is ideal for situations in which there are many agents with diverse goals and views. SSM works with such complexity by structuring problem situations and identifying problem areas (Reid et al., 1999).

SSM performs well as a research methodology, in that the researcher facilitates learning processes, while gaining valuable insight into organisational and management issues. The underlying processes involved in decision-making by individuals can also come to the fore, especially if there is a realisation that decision-making was based on erroneous assumptions. Key aspects of SSM are those of people having free will and a desire to create changes, as well as maintaining and development of relationships (Stacey, 2007).

SSM is a methodology which does not defy but rather acknowledges the complexity of systems, and also understands the inherent changing nature of systems (Carr &

Lapp, 2005; Presley & Meade, 2002). Furthermore, nothing is assumed as a given, and the future only becomes clear through joint interrogation, learning, and action.

The section that follows briefly describes the SSM process. SSM was originally characterised by seven stages (Checkland, 1985; Checkland & Scholes, 1990; Checkland, 2000; Checkland & Poulter, 2006):

Stage 1: The problem situation unstructured
Stage 2: The problem situation expressed as a rich picture
Stage 3: Root definitions of relevant systems
Stage 4: Deriving conceptual models
Stage 5: Comparing conceptual models with the real world
Stage 6: Defining feasible, desirable changes
Stage 7: Taking action

Checkland later on developed the four-stage process of SSM, as presented in Figure 1.11. The four stages, as explained by Kayaga (2008: 277) are based on Checkland's work (Checkland, 1985; Checkland & Scholes, 1990; Checkland, 2000; Checkland & Poulter, 2006):

- Finding out about the problem situation in the real world that has generated concern, including the analysis of its cultural and political context, and expressing the problem situation in a way that maximises visual communication;
- Formulating some relevant, purposeful, activity models;
- Comparing the models with the real-world situation and utilising the debate initiated by the comparison to seek (i) changes that are regarded as both desirable and culturally feasible, to improve the situation and (ii) accommodation between conflicting interests so that action is not hampered; and
- Taking action to bring about improvement in the real-world situation, which could culminate in a cyclic process.

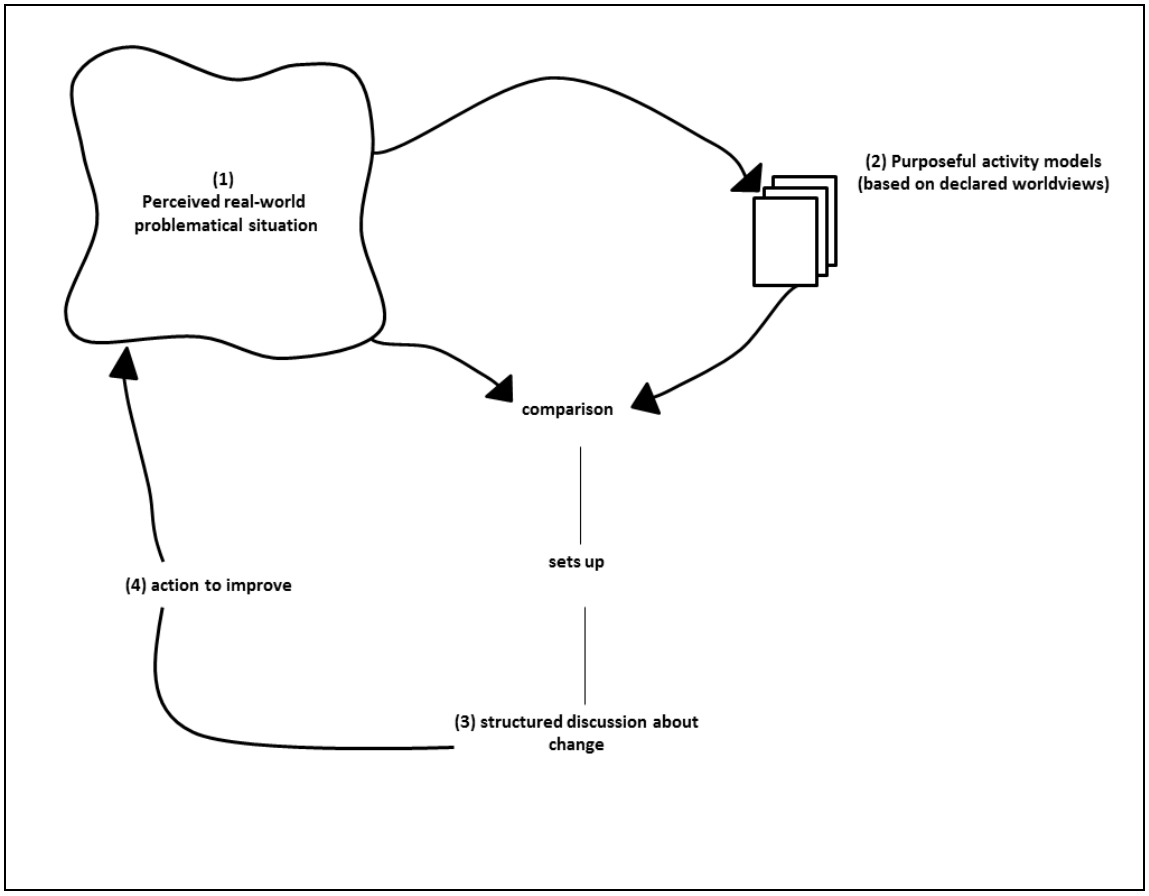

Figure 1.11: The SSM process (Checkland & Poulter, 2006: 13)

Rich pictures are used in SSM and form a means of identifying stakeholders and their respective interests; this then leads to the formulation of the root definition, which comprises the CATWOE (Customers, Actors, Transformation, Worldview, Owners, and Environment) (Checkland, 1985; Checkland & Scholes, 1990; Checkland, 2000; Checkland & Poulter, 2006). Pala et al. (2003) pointed to the way in which rich pictures portray and communicate the diversity of relationships in real-world scenarios. Rich descriptions eventually emerge from all the above-mentioned activities, and this then feeds into the identification of structural and social factors which add to problem situations (Reid et al., 1999). SSM can be considered a form of action research, and more specifically, participatory action research, whereby the focus is on bridging the divide between practitioner and researcher (Fox et al., 2008).

SSM has been documented in many studies and applied in various situations. Brenton (2007) applied SSM to improve communication processes in a health-care context, concluding that it was beneficial for the researcher to assess the whole, thereby better understanding vague and unstructured situations. Kayaga (2008) utilised SSM in a

water-and-sanitation-services context, in which the nature of the problems was not necessarily that of 'hard' problems but of stakeholders who held conflicting values and objectives. Organisational values are critical in fostering a healthy relationship between strategic social partners collaborating across sectors (Austin, 2010). Callo and Packham (1999), in their work, maintained that SSM was undeniably valuable in allowing for a systemic understanding and way of engaging in conversations around change. Sewchurran and Barron (2008) found that SSM applied within an information technology environment permitted an appreciation and understanding of stakeholder environments, and new communication means, which consequently led to the development of a management process. SSM therefore brings together different people, promoting the emergence of individual views to both arise and be tested, which may ultimately lead to the development of answers which are not only around 'hard' issues (Por, 2008).

1.3.4 'Soft' issues in management

It is important to understand the role of trust in bringing together diverse stakeholders and gaining their commitment. Trust, which must be earned, is a particularly important aspect of collaboration within the supply chain (Akintoye, McIntosh & Fitzgerald, 2000; Daugherty et al., 2006). The manner in which stakeholders conduct everyday business already impacts on whether trust is built or destroyed (Daugherty et al., 2006). Demonstrating dependability is a particularly important aspect of trust. A genuine interest in stakeholders, and not only on the bottom line, also plays a role in building trust (Weymes, 2005). This may be achieved by ensuring regular meetings, both on a formal and informal basis, and striving to listen to stakeholders' concerns and suggestions, and relaying feedback.

An acknowledgement of diverse values in multi-stakeholder scenarios is critical. These values, which also impact on organisational culture, strategy and performance, require identification (Fitzpatrick, 2007). Shared values, or at the very least, agreement on the values required for achieving goals, are necessary for stakeholders to work together efficiently and harmoniously (Boulton 2010; Cao & Zhang, 2011; Fitzpatrick, 2007).

It is important to align stakeholder goals, understanding that stakeholders pursue their own, as well as system-wide goals (Cao & Zhang, 2011; Christis, 2005). Stakeholders need to regularly engage each other to assess current goals, and match organisational activity (Daugherty et al., 2006; Maxfield, 1998). It is necessary to plan, however, there must be room for adaptation, and questioning into relevance (Choi et al., 2001; Cilliers, 2000). Precise planning and rigid goals should be avoided (Goodwin, 2000). This will ensure survival, particularly during periods of rapid change. Plans may not unfold as intended, and unintended consequences may emerge (Li et al., 2010). It is essential to be open to change, especially when environmental change is rife, thereby necessitating careful consideration of organisational goals, strategy and products (Li et al., 2010). Conducive environments are required to facilitate emergence and change, which are important in ensuring relevant goals that are responsive to present-day conditions. Leaders must have the opportunity of stimulating change, encouraging risk-taking, and fostering necessary connections with which to pursue goals (Regine & Lewin, 2000).

Managers have to consider how best to communicate with diverse stakeholders, when and what to communicate, and the way in which organisational policies and procedures constrain such efforts. A simplistic view of communication does not work well in complex systems. It is important to go beyond information distribution, and instead strive for collaborative efforts. This form of communication is important for surfacing mental models and perspectives on problems of stakeholders who are involved in a problematical situation. A healthy relationship between stakeholders leads to improved communication (Woog et al., 2006). Stakeholders must engage in purposeful conversations in real settings, to enable knowledge creation and shared understanding of complex problems (Dalmau & Tideman, 2011). Constructive communication should not be about imposing views on others.

Sense-making is necessary for stakeholders to derive meaning from past and present experiences; this involves problem-identification, deliberation, and dialogue (Kaivo-oja & Steenvall; 2013). Joint dialogue is required in allowing stakeholders to debate common problems and possible solutions. It is, however, important that stakeholders are willing to listen to and embrace the perspectives of other stakeholders. Regular interactions can lead to a change in perspective (Brocklesby, 2007) and even to innovation (Li et al., 2010). Communication forums which involve multiple

stakeholders at an early stage can lead to social learning and improved products or services (Elsner, Hocker & Schwardt, 2010). Processes that facilitate interaction can enable adaptability, as such interactions can push the system to the edge of chaos (Agar, 2007; Regine & Lewin, 2000; Waltuck, 2012). Regular communication is required in bringing different stakeholders together, and drawing on processes of learning and self-organisation, which are best achieved by enabling stakeholders to connect with one another, despite being separated by boundaries (Coleman, 1999; Lissack, 2000).

Leadership is a particularly important aspect of a complex system. Agents may not respond well to excessive control and power. It is critical that leadership therefore not be centred on traditional command and control, this possibly causing detrimental effects. The actions of agents are self-initiated without external control, owing to their ability to act autonomously (Wycisck et al., 2008). One dominant agent is not capable of forecasting the future (Li et al., 2010). For this reason, distributed or shared leadership is recommended in facilitating collective intelligence, which arises by drawing on diverse capabilities (Liang, 2013). Leaders of complex systems must carefully balance structure and adaptability. Therefore, while a certain degree of control is required, organisations must also emphasise risk-taking, learning, and emergence (Agar, 2007; Boulton, 2010; Chapman, 2002; Fabac, 2010; Maxfield, 1998; Pascale, 1999).

The job of management is to structure enabling environments to facilitate self-organisation (Lissack, 2000) and avoid excessive planning, control, and an overly-rational approach. The new realities of leadership include embracing change, collaboration, diversity, and empowerment (Daft, 2011). Managers may, however, experience difficulty in releasing control, being vulnerable, and calling for independence and self-organisation (Merry, 2000; Pascale, 1999; Regine & Lewin, 2000). Differences in leadership and management are critical. While management may be focused on the short-term, achieving goals and plans, leadership is also necessary for emphasising relationships. Leading in complex systems demands the ability to emphasise the importance of relationships and harness the interconnections that exist (Regine & Lewin, 2000). It is imperative that the inherent complexity within the system be considered by leadership (Choi & Krause, 2006). Leaders also need to encourage various stakeholders to be involved in addressing problem situations early

enough, generating ideas for improvement, and being part of implementation. This is, however, not easy to achieve in reality due to the complexities involved in bringing diverse stakeholders together.

1.4 Problem statement

Sugar forms an essential component of our lives and is found in nearly all products that we consume. The sugar industry is important to the economy of South Africa (DAFF, 2011; Matshamba, 2006; Sugar Outlook, 2009; SASA, 2013/2014). Both formal and informal employment is provided along the various stages of the supply chain, including the production and harvesting of the sugar cane on the farm, transport of the cane from the farm to the mill, processing of the cane at the mill, and sugar refining (Castel-Branco, 2012; Corporate Citizenship, 2014; Engineering News, 2013; Kaye, 2013; Matshamba, 2006; Phillips, 2013; SASA, 2013/2014; Sugar Outlook, 2009).

A number of complex interactions between diverse stakeholders are required to realise the end product in this highly interconnected industry. The sugar industry may be considered a social, complex system, owing to the existence of multiple, autonomous, yet interdependent stakeholders constantly interacting in this dynamic, non-linear environment.

While a drop of sugar so easily adds a touch of sweetness in our lives, the South African sugar industry faces a battle to maintain its sweet lead as one of the top 15 sugar-producing countries (Nair, 2013; Phillips, 2013; SASA, 2013/2014). Various challenges have been threatening the future of the sugar industry. One of the most pressing concerns is that of lack of cane supply, which endangers the very survival of the industry.

The South African sugar industry is also confronted with other problems such as uncertain weather conditions, declining yields, increased imports, international pricing, competition from other sugar-producing countries, labour disputes, increasing input costs, and uncertainty over land claims, farmers leaving South Africa to farm sugar cane up north in Africa where conditions are more conducive, and a dire need for the industry to innovate to remain competitive (Castel-Branco, 2012; Chidoko &

Chimwai, 2011; Corporate Citizenship, 2014; Engineering News, 2013; Everingham et al., 2002; Gauteng Business News, 2013; Kaye, 2013; Le Gal et al., 2008; Marais, 2013; Matshamba, 2006; Mnisi & Dlamini, 2012; Nair, 2013; Mac Nicol et al., 2008; Phillips, 2013; SASA, 2013/2014; Sugar Outlook, 2009).

Challenges are also present at the local mill level as stakeholders have become embroiled in deciding on the ideal length of the milling season, how best to share profits, how to determine best practices for growing cane, how to increase cane supply, how to attain good quality cane, how to ensure optimal mill performance, and how to deliver cane on time to the mill to avoid cane deterioration (Bezuidenhout & Singels, 2007a; Bezuidenhout & Bodhanya, 2009; Chidoko & Chimwai, 2011; DAFF, 2011; Everingham et al., 2002; Gaucher, Le Gal & Soler, 2003; Le Gal et al., 2008; Le Gal et al., 2009; Lejars et al., 2008; Lejars et al., 2010; Sibomana & Bezuidenhout, 2013; Smith et al., 2010).

The future of the sugar industry also hangs in the balance as key stakeholders, for years now, have struggled to deliberate the finer details pertaining to a new Sugar Act (Gauteng Business News, 2013). Exciting prospects signal a move from only focusing on sugar to realising downstream opportunities for the production of biofuels, ethanol, and co-generation (Chidoko & Chimwai, 2011; Corporate Citizenship, 2014; Engineering News, 2013; Marais, 2013; Matshamba, 2006). These prospects require a new way of thinking about business, as stakeholders have tended to adopt a 'silo-like' mentality, and have traditionally pursued separate and sometimes conflicting objectives. The new era, however, requires growers and the miller in particular, to work as partners, in achieving a competitive edge for a given mill area (Matshamba, 2006).

An individual mill area is further rendered complex owing to the existence of thousands of growers, various hauliers, and a miller (Bezuidenhout & Singels, 2007a; Castel-Branco, 2012; Eweg, 2005; Matshamba, 2006; Mnisi & Dlamini, 2012; Smit, 2009). Growers are diverse in nature, have their own set ways of operating their businesses, and may farm for multiple reasons. The various growers (large-scale, small-scale and emergent) operate under very distinctive circumstances. They face unique challenges, and have different levels of involvement in the industry (Bezuidenhout & Bodhanya, 2009; Chidoko & Chimwai, 2011; Darnhofer et al.,

2012; Engineering News, 2013; Eweg, 2005; Lejars et al., 2008; Mnisi & Dlamini, 2012; Nothard, 2011; Nothard et al., 2005; WBCSD, 2004). The miller also has a particular business model that is followed, primarily serving as a profit-making entity. These stakeholders at the mill level are also bound by industry regulation which serves to guide behaviour (Matshamba, 2006; Phillips, 2013).

It becomes obvious that the problems that threaten the sugar industry are not only of a technical nature, but also those that may be considered 'soft', owing to the human element. The situation may be considered messy, which presents with 'wicked' problems that defy easy solution and simple determination of the origins of the problems (Australian Public Service Commission, 2007; Rittel & Webber, 1973). These problems cannot be addressed using traditional linear interventions that seek to apply a reductionist perspective, and entail futile attempts at tracing causality and consequently offering simplistic prescriptions.

In the midst of the ever-present uncertainty, there are limits to decision-making, planning, prediction, and control, owing to the reality that one organisation or stakeholder group cannot address the problems alone (Archer et al., 2009; Bezuidenhout & Bodhanya, 2009; Bezuidenhout & Singels, 2007a; Bezuidenhout & Singels, 2007b; Everingham et al., 2002; Fountas et al., 2006; Gaucher et al., 2003; McCown, 2002; Mac Nicol et al., 2008). Farming systems are increasingly being recognised as complex systems (Darnhofer, Fairweather & Moller, 2010; Darnhofer et al., 2012; Fairweather et al., 2007; Fairweather, 2010).

Stakeholders in the sugar industry, despite being bound together to produce sugar, operate independently, holding their own unique worldviews on which goals to pursue, how and when to do so, which problems are considered important, and even how such problems should be addressed (Bezuidenhout & Bodhanya, 2009; Darnhofer et al., 2010; Darnhofer et al., 2012; Everingham et al., 2002; Jakku et al., 2007; Le Gal et al., 2009; Lejars et al., 2008; Lejars et al., 2010; Nothard, 2011). The problems are systemic in nature, as they permeate through man-made boundaries, and require the involvement of multiple stakeholders, who are impacted by and who impact the system (Bezuidenhout & Bodhanya, 2009; Lejars et al., 2008).

It is critical to avoid a pure focus on objectives and goal setting in this social complex system. Focus should instead shift to relationships, interconnections, cooperation, perceptions, values, trust, learning, innovation, leadership, communication and accommodation of the multiple perspectives that dictate action (Archer et al., 2009; Bezuidenhout & Bodhanya, 2009; Darnhofer et al., 2010; Darnhofer, et al., 2012; Gaucher et al., 2003; Jakku et al., 2007; Kottila & Ronni, 2008; Le Gal et al., 2008; Lejars et al., 2008; WBCSD, 2004). Efficient operations may only be achieved when stakeholders work well together as a collective to jointly respond to the multiple problems that could so easily spell the end of South Africa's sugar-producing days.

Effective multi-stakeholder interactions in the Felixton Mill area are important for an efficient value chain. Growers and the miller, in particular, must have a good relationship (Lejars et al., 2008; Masuku & Kirsten, 2003; Wynne, 2009). The complexity of the sugar chain primarily derives from the "relationships between and within value chain sectors" (Higgins et al., 2007: 618) and the autonomous individual and collective behaviour of agents in accomplishing system-wide objectives. High levels of cooperation are required to ensure that the sugar supply chain functions efficiently.

Previous research has pointed out that the sugar industry is a complex system, particularly as a result of the various stakeholders and the continuing, yet changing, intertwined nature of their interactions (Archer et al., 2009; Bezuidenhout, 2008; Bezuidenhout & Bodhanya, 2010; Darnhofer et al., 2012; Higgins et al., 2004; Higgins & Laredo, 2006; Jakku et al., 2007; Le Gal et al., 2009). Research is required to explore ways of addressing this inherent social complexity within the sugar industry.

Complexity theory may be used to comprehend the multiple, non-linear interactions that occur between the heterogeneous, diverse stakeholders, given the uncertainty and ambiguity that is present (Cairney, 2012; Marion & Uhl-Bien, 2001). The value of complexity theory in the business context and social sciences has been noted (Archer et al., 2009; Chiva, Grandio & Alegre, 2010; Cairney, 2012; Chettiparamb, 2014; Higgins et al., 2004; Levy, 2000). A few authors (Archer et al., 2009; Bezuidenhout et al., 2012a; Li et al., 2010; Choi et al., 2001; Surana et al., 2005) have noted the value of viewing the supply chain as a complex adaptive system. Such an approach also

corresponds well to the need for local solutions for individual issues (Bezuidenhout & Bodhanya, 2009; 2010). The existence of diverse stakeholders in a complex system, who possess their individual mental models, values, and goals, necessitates a systemic methodology characterised by small, yet powerful changes (Bezuidenhout & Bodhanya, 2009; 2010).

SSM is a methodology that promotes a holistic perspective in bringing improvement to complex social problems, by drawing diverse stakeholders together to eventually enable accommodation of conflicting perspectives (Checkland, 1985; Checkland & Scholes, 1990; Checkland, 2000; Checkland & Poulter, 2006). SSM facilitates the interaction of stakeholders who under normal circumstances may not have had opportunities to come together, enabling them to analyse the system by gaining insight into the operations and challenges of other stakeholders. Worldviews which drive behaviour may be surfaced and challenged, and stakeholders are also afforded an opportunity of dealing with overlapping issues. It is important to acknowledge the role of the mental models that stakeholders hold (Anderson, 1999; Cairney, 2012).

The autonomous and purposeful nature of agents, along with the pursuit of multiple goals and divergent perspectives, is what defines social complexity within complex systems (Anderson, 1999; Duek, Brodjonegoro & Rusli, 2010; Bogg & Geyer, 2007; Heylighen, Cillers & Gershenson, 2006), and therefore requires understanding. SSM is an excellent way of approaching the complexity of a social system, such as the sugar industry, as it affords problem structuring and action. SSM does not strive for permanent solutions, owing to the dynamic nature of complex systems, but instead promotes learning, collaboration, and skills which enable stakeholders to take action (Checkland, 1985; Checkland & Scholes, 1990; Checkland, 2000; Checkland & Poulter, 2006).

This thesis, therefore, examines the role of SSM, a systemic methodology, in addressing social complexity within the sugar industry. The study aims to draw on social complexity theory to gain insight into the multiple interactions that occur between stakeholders in the Felixton Mill area, thereafter exploring the way in which SSM may be used to address such complexity.

The use of SSM is particularly appropriate for multi-stakeholder scenarios, in which diverse perspectives exist, however, it requires further exploration (Bezuidenhout & Bodhanya, 2009; 2010). There appears to be a lack of research in the application of systemic methodologies within the sugar industry. This study is supported by the argument of Salner (1999) that systems methodologies have the potential to link sciences and humanities. Rose (1997) argued that Checkland's SSM is one of the most advanced soft systems methodologies, and is ideal as a research instrument.

It is important that stakeholders have the opportunity of engaging in regular interactions to work through the complexity with which they are faced (Cilliers, 2000). Processes that encourage self-organisation, relationship-building and maintenance, and collaboration, are critical. It is with this purpose in mind, that the study seeks to explore the use of SSM by which to comprehend social complexity in the Felixton Mill area. Taking the time to engage multiple perceptions regarding problem situations is one way of addressing complex problems (Lewis et al., 2007; Smith, Ansett & Erez, 2011), such as those that have been highlighted within the sugar industry. SSM was considered the most suitable methodology to use in this research, as it is able to surface the diverse perceptions held by stakeholders in this messy context, in which multiple and possibly conflicting goals are pursued, easy solutions are not within reach to address the problematical situation, and traditional notions of command and control do not apply.

1.5 Need for the study

A number of issues are present in the Felixton Mill area. It is pertinent to not only understand these issues at a local level, but also to formulate individual solutions (Bezuidenhout & Bodhanya, 2009; 2010). This point is also noted by Bigman (2001) in highlighting the importance of empowering local people in the sugar industry to work towards finding answers to their local problems.

There is a need for stakeholders to better manage and appreciate complex adaptive systems; to understand the motivations for people not engaging in constructive behaviour to benefit themselves and others, and to grasp the need for exploring and improving miller-grower relationships (Bezuidenhout & Bodhanya, 2009; 2010). Bezuidenhout and Bodhanya (2009; 2010) called for relevant research to address the

multi-faceted difficulties faced by the stakeholders in the sugar industry. An understanding of the sugar industry as a CAS may be utilised to better comprehend the inherent complexities of the system, which derive from unpredictability.

There is a need for interventions in the sugar industry, as argued by Bezuidenhout and Bodhanya (2009; 2010), which should result in stakeholders having an increased knowledge and understanding of the system. This could result in improvement in how stakeholders respond to complexity, as well as in knowledge of the way in which their behaviour impacts on the whole system. The application of SSM within the sugar industry has been called for. SSM would then be able to examine issues concerning management, leadership, and behaviour, which eventually will impact on other aspects, such as the physical, technological, managerial, and behavioural components of the system (Bezuidenhout & Bodhanya, 2009; 2010).

This study is also conducted to answer the call of Higgins et al. (2007: 613) to create and implement "methodologies to improve chain performance in sugar". Higgins et al. (2007) noted the need for value-chain research incorporating technical and social aspects, and which acknowledges the role of the social and historical setting, drawing on concepts around communication, including social learning, cooperation, and conflict resolution. Establishing opportunities for the value chain necessitates not only technical explanations, but also input throughout the chain (Higgins et al., 2007). Austin (2010: 13) also called for research into ways of facilitating the "collaborative value creation process", which is what this study aims to do. Stakeholder engagement is increasingly being recognised as critical in business (de Blois & de Coninck, 2008; Legault, 2013; Smith et al., 2011; Weaver, 2012; Weymes, 2005). It is, however, necessary to analyse stakeholder engagement using a complexity lens.

The study will assess the extent to which SSM can strengthen the capacity of stakeholders to respond to the problematical situation through facilitating interaction, increasing self-organisation, and illustrating the role that each stakeholder group plays in achieving system-wide goals. This research is necessary in comprehending the multiple interactions occurring in the Felixton Mill area, thereafter determining the way in which SSM may be used to allow the diverse stakeholders to tackle the overlapping problems, working as a collective to enable cooperation and collaboration.

SSM is a reputable methodology acknowledging the limitations of the systems engineering approach. This approach incorporates the role of worldviews and a socially constructivist view of reality (Checkland, 2000; Checkland & Poulter, 2006; Jackson, 2000). The study will also examine claims that SSM is able to provide a platform for diverse stakeholders to view and address diverse issues, surface and challenge mental models, and take action to bring about improvement (Checkland & Poulter, 2006; Winter, 2006). It is necessary to test the assertion by some authors that SSM is ideal for navigating social complexity (Checkland, 2000; Khisty, 1995).

This study is furthermore necessary in answering various calls for research to: determine the factors that impact the effectiveness of SSM (Pala, Vennix & van Mullekom, 2003), provide accounts of SSM facilitation and the challenges that SSM practitioners may face in attempting to facilitate change and learning (Brocklesby, 2007), and detail the necessary competencies for using the methodology (Pala et al., 2003; Salner, 1999).

There is a need for studies that utilise social complexity theory in social systems (Maxfield, 1998) and illustrate the role of complexity theory in connecting the social and natural sciences (Cairney, 2012; Salner, 1999). This study is important in extending knowledge into the use of complexity theory for supply networks (Choi et al., 2001; Hearnshaw & Wilson, 2013).

1.6 Aim and research questions

The main aim of this research is to apply a systems methodology, SSM, in the Felixton Mill area, assessing the impact thereof in comprehending social complexity.

The specific research questions of this study are:

- How does SSM assist participants in dealing with social complexity?
- What contribution can SSM make to the sugar industry as a whole?
- How does the study contribute to the understanding of trust, values, goals, communication, and leadership within the sugar industry?

1.7 Importance and contribution of the study

The study aims to provide an examination into the use of systems methodologies which may ultimately address the immense complexity facing the sugar industry. The main contribution of the research is to explore the extent to which SSM can be applied, from a complexity theory perspective. New insights from such a perspective may emerge, which could make a contribution to both systems and complexity work.

It is hoped that stakeholders in the Felixton Mill area will eventually be empowered to collectively formulate solutions to their own problems, in a spirit of collaboration. The importance of collaboration has been highlighted by Austin (2010), in noting how critical it is, in that the nature of the problems faced by companies is often not within the control of one organisation.

This research forms part of a larger multi-disciplinary research project funded by the National Research Foundation and SASRI. It involved postgraduate students and academics from the fields of Management Studies, Bio-resources and Engineering at UKZN. The project was aimed at finding improvement processes for use in the sugar cane supply and processing system, by conducting research into both the 'hard' and 'soft' aspects of the sugar-cane system. The aim was to generate improvement processes to the integrated supply and processing system. One of the outcomes of this multi-disciplinary research project was a research output (Bezuidenhout et al., 2012) on the 'hard' aspects, in which network-analysis was used as a means of analysing complex supply networks, using the sugar industry as a case study.

This specific research project is of importance in shedding light on the 'soft' aspects of the sugar-cane supply system, such as stakeholder relations, collaboration, leadership, communication, trust, values, and information sharing. This study into the 'soft' aspects of the sugar industry, along with the other studies into the 'hard' aspects, makes an important contribution to the sugar industry. This multi-disciplinary research project even inspired the decision of a SASRI staff member to pursue a PhD research project into how irrigation best-management practices could be adopted in the sugar cane industry of South Africa, which, as derived from the topic, incorporates both the 'hard' and 'soft' aspects.

1.8 Structure of the thesis

This thesis is primarily organised into journal publications (one of the two formats for a PhD thesis accepted at the UKZN which states that "a thesis may comprise one or more original papers of which the student is the prime author, published or in press in peer-reviewed journals approved by the college academic affairs board, accompanied by introductory and concluding integrative material" (rule DR9C in the 2014 handbook of the College of Law and Management Studies, pg. 55). Consequently, Chapters 3-6 represent a journal publication each and as such contain their own Introduction, Literature, Methodology, Results, Discussion, and Conclusion. Besides these chapters, there is a general Introduction (Chapter 1), General Methodology (Chapter 2) and a General Discussion, Recommendations, and Conclusion (Chapter 7), as well as a complete reference list and several appendices.

Chapter 1 introduced the background, preliminary literature review, problem statement, and the need for the study. This chapter also highlighted the aim and research questions, as well as the importance of the research.

Chapter 2 outlines the methodological approach that is followed in this research. This chapter elaborates on the qualitative research approach that was employed in this study, and details matters concerning the sampling, data collection, data analysis, reliability, and validity.

Chapter 3 draws on the social complexity theory to comprehend multiple interactions between stakeholders in the mill area. Data that emanate from in-depth interviews with stakeholders in the mill area are analysed. The main findings point to the existence of multiple, diverse agents who pursue different goals and hold assorted mental models, and who are faced with 'wicked problems' which defy simple problem-solving approaches and straightforward solutions.

Chapter 4 illustrates the use of SSM in the mill area to bring about improvement in the problematical situation outlined in Chapter 3. In-depth interviews and SSM workshops were held with the stakeholders and allowed for data analysis. Key findings highlight the value of SSM in the sugar industry by being able to explore the problem areas, as well as uncover and work with the diverse mental models of

stakeholders. The SSM process also engaged the multiple objectives that stakeholders were pursuing, facilitating the identification of actions to address the concerns.

Chapter 5 focuses on the factors influencing the effectiveness of SSM. Drawing on data from the interviews and the SSM workshops, this study allowed for the identification of significant factors, such as starting conditions, time allocated, grouping, prompts, and strategic initiatives, which impact on the extent to which stakeholders are able to take action and engage the SSM process.

Chapter 6 explores how to manage stakeholder interactions through the lens of complexity theory, by drawing on lessons from the sugar industry. Data from the in-depth interviews were analysed. Key findings which are outlined in conceptual models point to the importance of factors such as cooperation, a collectivist culture, stakeholder interaction, systemic awareness, shared strategy, collective learning and system-wide goals.

Chapter 7 presents the discussion and conclusions to the thesis. The chapter addresses the research questions that are set out in Chapter 1, and also elaborates on the contributions of the study, recommendations for management, as well as for future studies.

1.9 Conclusion

This chapter has provided an overview of the study site, the problem to be investigated, and the need for the study. The aim and objectives were outlined, and a brief overview of the major theoretical areas was provided. The importance of the study and limitations of the study were also discussed.

The next chapter aims to set out the research design that was followed in this study.

CHAPTER 2: RESEARCH DESIGN

2.1 Introduction

This chapter outlines the methodological approach that was followed in this research. The chapter will discuss and compare the qualitative and quantitative approaches, and elaborate on why the qualitative research approach was considered suitable for this study. The method of sampling will then be discussed. Thereafter, details are provided about data collection, with specific reference to the interviews and SSM workshops. The way in which the data was analysed is then covered, and matters pertaining to reliability and validity conclude the chapter.

Figure 2.1 depicts the process that was followed in this study. An iterative, rather than linear approach, consistent with qualitative research, saw the researcher simultaneously engage in various stages of the scientific research process: studying relevant literature (SSM, social complexity), pursuing empirical work (interviews and the SSM workshops), analysing data and drawing findings.

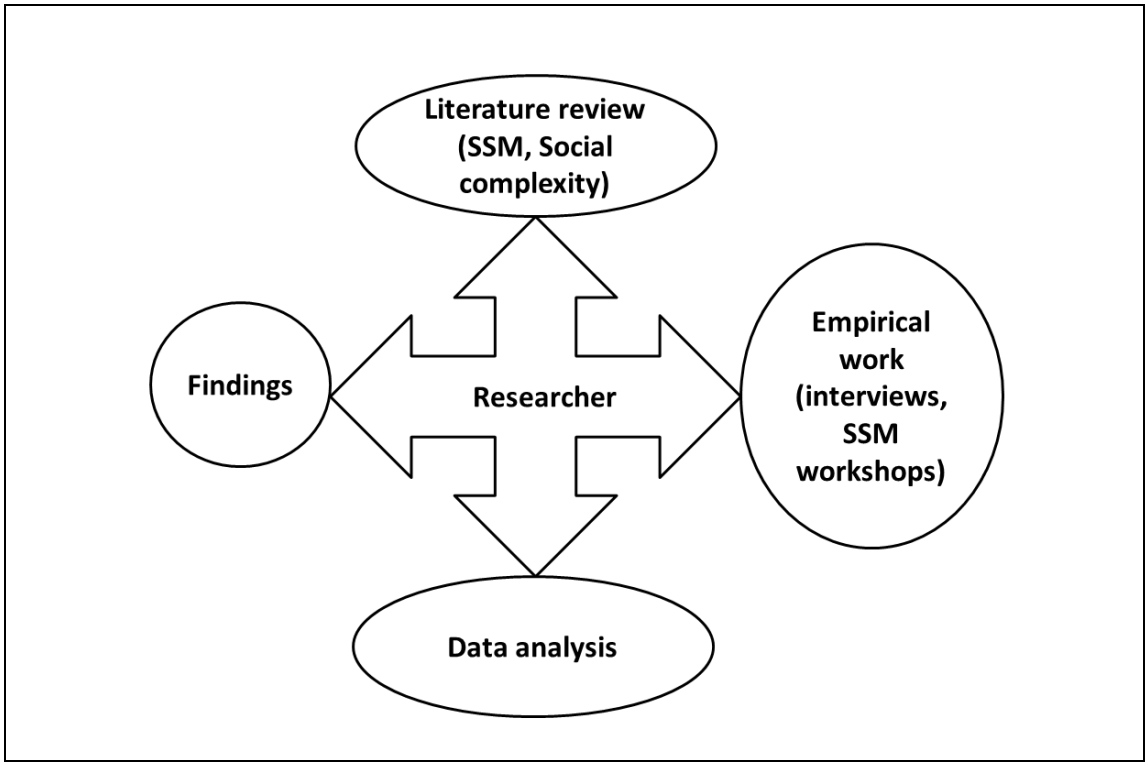

Figure 2.1: Methodological approach of study

2.2 Quantitative and Qualitative Research

Quantitative research assumes a positivist approach which emphasises objectivity, and aims to test hypotheses (Fox, Martin & Green, 2008). Researchers who follow the quantitative approach operate under the assumption that there is a truth to be determined in the world (Thorne, 2000). Quantitative research analyses the relationship between variables (Creswell, 2009). The emphasis is on numbers and quantities pertaining to the study sample (Fox et al., 2008). The quantitative researcher strives for the use of unbiased approaches and the role of the researcher is to remain impartial (Fox et al., 2008). Research follows an approach that is detached from the context and claims a disregard of personal views in order to lead to relatively unbiased conclusions (see for example Leedy & Ormrod, 2013). This form of research also tends to generalise beyond the sample and is replicable (Creswell, 2009). Experimental and survey research are employed (Creswell, 2009). Quantitative research tends to have predetermined methods, concepts and variables (Leedy & Ormrod, 2013). Instruments or tests are used in quantitative research and data is analysed using statistics and hypothesis testing (Creswell, 2009). Deductive reasoning is used and findings are depicted using numbers (Leedy & Ormrod, 2013).

Qualitative research examines phenomena in the real world in order to better comprehend complex situations (Leedy & Ormrod, 2013). Qualitative research is aimed at studying actual behaviours and is less concerned with analysing cause and effect (Salkind, 2012). This is a valid form of research which strives to describe the complexity of observed phenomena (Leedy & Ormrod, 2013). Critics of qualitative research have targeted the subjective nature of this research and the limited control that the researcher is afforded (Hannabuss, 1996). Qualitative research is, however, becoming increasingly popular in social and behavioural science studies because of limitations that are experienced with other research methods (Salkind, 2012). While being valuable in terms of flexibility, qualitative research does take more time than other forms of research (Irvine & Gaffikin, 2006). It is important to bear in mind that qualitative research does not necessarily follow set guidelines and is less prescriptive (Leedy & Ormrod, 2013).

Qualitative research is guided by the need to address a broad problem and use open-ended questions which are posed at the onset or may emerge (Leedy & Ormrod,

2013). The research approach and methods that are used in a study are selected based on the particular problem under investigation (Westbrook, 1994). Qualitative research was considered suitable for this research due to its ability to expose complex aspects of situations, settings and people, and its ability to reveal novel insights about phenomena (Leedy & Ormrod, 2013). This approach is well-suited to discovering and comprehending little-known phenomenon (Strauss & Corbin, 1990; Creswell, 1994). The emphasis is on determining the perceptions of respondents within the given social context (Thorne, 2000). Qualitative research therefore provides an opportunity for the researcher to gain understanding into the Felixton Mill area stakeholders' "values, beliefs, understandings and interpretations of events and other phenomena" (Mittman, 2001: 2).

Qualitative research is not preoccupied with striving for the ultimate truth and in ensuring objectivity, but rather acknowledges that there are multiple perspectives, thereby implying that there may not be one truth (Leedy & Ormrod, 2013). This is in contrast to research methods which hold to the view of an objective world which is free of influence from perceptions and beliefs, and the belief that observation and research leads to confirmation of a reality (Fox et al., 2008). This study followed a phenomenological approach, so emphasis was placed on people's perceptions and understandings (Leedy & Ormrod, 2013). This research also appreciates the existence of a socially constructed world whereby different people socially construct their reality (Fox et al., 2008). This worldview acknowledges that people want to make sense of their world, meaning that the researcher can examine the multiple views and subjective meanings that exist as well as the interactions and historical and cultural contexts of participants (Creswell, 2009). This was considered ideal for the study context in which there are multiple stakeholders, each with their own worldviews.

The study also employed qualitative research due to its resonance with complexity theory because qualitative research examines "local meanings of phenomena and the interactions that create these meanings" and "offers the possibility of stimulating the development of new understandings about the variety and depth with which organisational members experience important organisational phenomena" (Bartunek & Seo, 2002: 240). Another reason for selecting qualitative research was that quantitative research operates under the assumption that fixed variables will apply similarly across various contexts (Bartunek & Seo, 2002). This, however, was not the

case in this study where there were multiple meanings corresponding to complexity theory, which thus required insight into local understandings, dynamics, and an appreciation of the distinctiveness of the study site (Bartunek & Seo, 2002). Furthermore, there was no prior knowledge of the variables involved. The research topic was new and had not previously been applied with the sugar industry participants (Creswell, 2009).

The study followed inductive reasoning: the research did not commence with a pre-determined set of assumptions, but rather drew on occurrences to reach conclusions about objects or events (Leedy & Ormrod, 2013). This is in contrast to deductive logic where the researcher starts with given premises which logically lead to conclusions (Leedy & Ormrod, 2013). Inductivism therefore holds the view that participants' meanings are interpreted, leading to the generation of theory from collected data (Creswell, 2009). This research was inductive and aimed at providing new theoretical insights, which made the use of qualitative research more appealing (Babbie & Mouton, 2001). This method was also selected as it can add value to research pertaining to management and organisations (Mittman, 2001).

The qualitative researcher is concerned with respondents' comments and uses methods such as interviews and surveys (Salkind, 2012). Interviews which were used in this study to collect data are most commonly used in the phenomenological approach, as it allows the researcher to gain insight into the experiences of respondents (Leedy & Ormrod, 2013). Data is in the form of words, as is visible in the write-up of this research (Fox et al., 2008). Because of how involved they become in the field, the qualitative researcher is the main instrument in the research (Leedy & Ormrod, 2013). The researcher personally collected and analysed the data for this study. This entailed a 'close relationship' between the researcher and participants (Lee, 2006).

According to Salkind (2012) qualitative research is not necessarily easier than quantitative research, due to the high levels of effort and complexity involved. This is confirmed by Leedy and Ormrod (2013) who asserted that qualitative research can be demanding and is not suitable when searching for simple and rapid outcomes. This was consistent with the purpose of the study which used SSM to comprehend the social complexity in the Felixton Mill area. Consideration was given to the study

design, sampling, analysis and data collection in order to ensure that the qualitative research study was sound (Sofaer, 2002).

2.3 Sampling

In line with qualitative research, this study purposefully selected participants to enable understanding of the research problem and questions (Creswell, 2009). The researcher therefore engaged in an in-depth investigation with a small community as is characteristic of qualitative research, as argued by Bowen (2008). Qualitative research is less concerned with sample size and more with obtaining an appropriate sample. The researcher therefore selects participants who are knowledgeable about the topic under investigation (Bowen, 2008). The sample included growers, hauliers, the miller, and industry partners, all of whom were able to provide insight into the workings of the Felixton Mill area. A database of growers and hauliers in the Felixton mill area was made available to the researcher. Emails were then sent to these growers and hauliers inviting them to participate in the SSM workshops and interviews. They were requested to contact the researcher to confirm their availability. The researcher was also notified by the project leaders about specific growers, mill staff and industry partners, who were most knowledgeable about the study context. This is confirmed by Lee (2006) who noted how qualitative researchers seek the views of specific people who can relate to the phenomenon, rather than selecting participants randomly. The emphasis of this research was not on representativeness with the aim of inferring to the broader population, as is the case with quantitative studies (Malterud, 2001).

The study also followed the approach of data saturation whereby the researcher eventually detected data replication or redundancy, which then signalled that it was not necessary to further engage with participants (Bowen, 2008). This was observed when the researcher conducted interviews with industry partners. Fieldwork in this research ended when the researcher detected that new participants were echoing the views of other participants. This is known as recurrent patterning and is another way of defining adequate sample size (Forchuk & Roberts, 1993).

2.4 Data Collection

As is the case with qualitative research, the researcher spent much time collecting data in the natural setting (Creswell, 2009). This can be observed in Table 2.1. The research involved extensive site visits to the Felixton Mill area. The researcher also had the opportunity to visit a number of sugar cane farms in the mill area and the Felixton Mill to witness the complexity involved in achieving the final product. This is consistent with qualitative research, where participants are not studied in a laboratory or requested to complete questionnaires (Creswell, 2009).

The empirical component of the study commenced in July 2010, and consisted of interviews and SSM workshops, mainly with stakeholders in the Felixton Mill area. Qualitative research does not only rely on one source of data (Creswell, 2009). This assisted in ensuring triangulation, which according to Bowen (2008) refers to the use of multiple sources of data and methods, and is important in lending credibility to the study. Furthermore, triangulation in this study served to confirm particulars from the different sources of data (Cho & Trent, 2006). This was for example evident in the way that the respondents who were interviewed confirmed details which had been mentioned in the SSM workshops.

Qualitative research entails increased risk to participants due to the close interaction of the participants and researcher during the research (Bowen, 2005). It was therefore critical to follow the University's research guidelines. Ethical clearance (Appendix 20) was obtained from the UKZN Research Office. The importance of observing ethics in research is highlighted by Salkind (2012) and emphasis must be on the rights of participants during the research process (Lee, 2006). Furthermore, as argued by Forchuk and Roberts (1993), the researcher has an ethical obligation to the research process. The researcher thus attempted to treat participants with dignity, did not expose participants to physical or psychological harm, strove to protect their identity, did not coerce participants into being part of the study, and kept records safe (Salkind, 2012).

The identity of the mill area is not revealed in any of the journal publications (Chapters 3-6) to ensure that the confidentiality requests from the industry are fulfilled. Reference is merely made to a mill area in a developing country context in

these chapters. Pseudonyms are used in respect of the industry partners and miller-grower bodies to avoid revealing the organisations' identities.

Each participant in the study received an Informed Consent form (Appendix 4) detailing the aim of the study, an assurance about confidentiality, that their participation was voluntary and that they could withdraw from the study at any stage. According to Salkind (2012), informed consent is critical in ensuring ethical standards in research, particularly when involving human subjects (Bowen, 2005).

Interviews and SSM workshops were used to collect data in this study. Interviews were selected because of the value that they offer in qualitative research (Westbrook, 1994). Interviews were semi-structured, which is common in qualitative research (Leedy & Ormrod, 2013). The interviews were more like a conversation between the researcher and respondents, and not a "formal question-and-answer exchange" (Ehigie & Ehigie, 2002: 627). The researcher considered the following as recommended by Leedy and Ormrod (2013) when conducting the interviews:

- a sample was selected to ensure rich perspectives and the researcher attempted to establish rapport by being respectful to participants and remaining attentive; and
- the researcher also allowed respondents to express their opinions and avoided expressing strong reactions to what was said (Leedy & Ormrod, 2013).

The aim of the interviews was to allow respondents' views to emerge, understand their experiences, identify intentions, and understand informal procedures (Hannabus, 1996). Effort was made to draw on the value of interviews in being able to tap into covert features of human behaviour (Hannabuss, 1996).

All interviews were conducted face-to-face, lasted approximately an hour, and were conducted mainly at the Felixton Mill or at the MGB venue in Empangeni town. These venues provided minimal distractions so that respondents could focus on the contents of the interview (Leedy & Ormrod, 2013). Interviews with the industry stakeholders were held at the SASRI and SASA officers in Mount Edgecombe, Durban. Interviews were digitally recorded and then transcribed in order to capture all responses precisely, as recommended by Leedy and Ormrod (2013), and furthermore

facilitate data analysis. Hannabuss (1996) does, however, warn that respondents could feel inhibited when interviews are recorded.

The approach taken in constructing the interview questions was to essentially build on the accumulated data from the various interviews and SSM workshops, and to eventually move from a point of gaining an understanding of the issues to engaging stakeholders on their recommendations for moving forward and taking action. This corresponded to the collaborative, participatory action research nature of SSM, as moving from expert to process facilitator (Fox et al., 2008). Unstructured, open-ended questions were constructed to allow for the emergence of rich descriptions and stakeholder perspectives, and, as recommended by Hannabuss (1996), Yes/No questions were avoided. The researcher also used the technique of probing, which according to Hannabuss (1996) is critical, but can be challenging. It was important to avoid jargon and avoid interrupting respondents (Hannabuss, 1996). This was particularly relevant when the researcher engaged stakeholders in the SSM process. The researcher took fieldnotes during the interviews and SSM workshops, which reflected observations and sentiments as confirmed by Irvine and Gaffikin (2006). This eventually facilitated sense-making.

The researcher had prior experience in conducting interviews in qualitative research. According to Ehigie and Ehigie (2002) this is critical to facilitate rapport and ensure that the respondent is comfortable with the researcher. Sofaer (2002) also emphasised the importance of training and practice in interviewing, as well as the skill of observing body language and the dynamics of the interview. The researcher was aware of the terminology in the sugar industry and was familiar with the subject matter (Ehigie & Ehigie, 2002). Care was taken to compile open-ended questions and then maintain the flow of questioning during interview (Sofaer, 2002). The advantage of using interviews was that the researcher could probe, ask respondents to elaborate on their responses, ask follow-up questions, and allow for natural conversations (Westbrook, 1994). Another benefit of using interviews was so that the researcher could uncover the undisclosed views of the participants (Ehigie & Ehigie, 2002). This was particularly valuable as the researcher discovered that certain participants were more comfortable expressing their views in the interviews than in the SSM workshops.

Challenges that were encountered in conducting interviews included a willingness on the part of stakeholders to participate in the research. Another difficulty experienced was trying to enable a discussion into 'soft issues' in an industry that is not accustomed to engaging in such research. Creswell (2009) asserts that interviews are limited in respect of responses possibly being biased because of the researcher's presence, that the interviews are not conducted in the natural setting of participants, and that the information is transmitted through the views of participants. While being valuable, interviews can be costly in respect of time and resources (Hannabuss, 1996). Other difficulties with interviews are that respondents can mislead the researcher, and the researcher could encounter difficulties with bias and subjectivity (Hannabuss, 1996). The researcher had to ensure impartiality during the SSM workshops and interviews, particularly when the growers and the miller expressed strong views about one another and the problematic situation that exists.

The SSM workshops were conducted at the MGB venue in Empangeni town, with each workshop lasting approximately half a day. To allow for diverse input, various stakeholders were invited to attend. The workshops were in essence facilitatory in nature, with the researcher taking the lead in presenting and engaging the participants. A large part of the process was to have participants engage in groups. Chapters 4 and 5 elaborate on the process that was followed in conducting the SSM workshops and outline the theoretical underpinning of this approach.

As with the interviews, the SSM workshops were also aimed at building momentum to enable the stakeholders to take action and address the issues in their mill area. The SSM and interview data were thus continuously jointly analysed to eventually construct findings, as presented in Chapters 3-6. As with the interviews, one of the main difficulties with the SSM workshops was achieving participation by stakeholders.

The researcher also considered secondary data. This consisted mainly of the Felixton MGB minutes that were provided by the company. These minutes served to further triangulate the data. Newspaper articles, reports, and newsletters were also analysed and proved valuable in gaining an understanding of the study context.

The researcher and a fellow PhD student in the project approached the problems in the sugar industry using a soft systems perspective. The researcher investigated the use of SSM at the Felixton Mill area, while the other PhD student, Sandra Hildbrand, explored the application of the Viable Systems Model in the Felixton Mill area.

2.4.1 Description of Empirical Work

The following section provides details pertaining to the interviews and SSM workshop process, and confirms Leedy and Ormrod's (2013) view that fieldwork in qualitative research can take a long time to complete. Table 2.1 provide details of the fieldwork that was carried out in this study.

	Date of stakeholder engagement	Growers	Mill representatives	Hauliers	Industry representatives	Other	Total participants
Interviews round 1	13-15 July 2010	6	3	1	1	1 MGB	12
SSM workshop 1	22 September 2010	2	3	1	2		8
SSM workshop 2	27 October 2010	8	3				11
Interviews round 2	27-28 October 2010	8	3				11
Felixton Local Grower Council Workshop	11 March 2011	8					8
SSM workshop 3	22 March 2011	7	4		4		15
Interviews round 3	22-24 March 2011	6	4		4		14
Interviews round 4	3, 7, 9, 10, 11, 14, 16, 17 November 2011				11		11

Table 2.1: Details of empirical work

2.4.1.1 Interviews round 1

Interviews with various stakeholders in the mill area were conducted from 13-15 July 2010. Table 2.1 provides a breakdown of the respondents who were interviewed. The main aim of the interviews was to establish an understanding of the 'soft' issues (communication, leadership, etc.) affecting the mill area. The semi-structured interviews questions are listed in Appendix 5.

2.4.1.2 SSM workshop 1

The data from the first round of interviews was analysed in order to prepare for the first SSM workshop. The workshop took place on 22 September 2010. This workshop consisted of the participants engaging in constructing Rich Pictures, which is the first step in the SSM process.

The purpose of the workshop was to acquire an understanding of the various issues that were plaguing the mill area. A brief overview of SSM was presented, as well as an overview of the purpose of the study. The construction of rich pictures was presented thereafter and participants were provided with flip chart and markers, and asked to visually represent who they thought the different stakeholders were, what their issues were, etc. They were encouraged to use minimal words, utilise cartoons or stickmen, and were reassured to not be hindered by having to draw. Examples of rich pictures were also provided.

Participants were then divided into two groups. The first group consisted of a grower, two mill representatives and the extension officer. The second group was made up of a grower, haulier, mill representative and the SASA representative. Approximately one hour was allocated for participants to construct the rich pictures. The researcher provided minimal interference but utilised trigger questions to stimulate the creativity of the participants when needed or answered any questions they had (Appendix 6). Participants then had to present their rich pictures (Appendix 7) to the other group and the researcher. As there were two groups, two rich pictures were constructed. Participants had to summarise their pictures, explain what they meant, why they had drawn what they did, and elaborate on the challenges that arose when drawing the picture.

A tea break was allocated and after tea the participants were asked to engage in the Knowledge Café exercise. This entailed having a table host who would lead the discussions throughout, would elicit issues from the two rich pictures (Appendix 7), and note them on flip chart paper. Appendix 6 outlines the questions that were used to assist participants with the exercise. Groups were allocated approximately 15 minutes per rich picture and everyone except the table host was then requested to move to another group. There were thus eventually two tables, with each group having an opportunity to look at the two rich pictures. When the Knowledge Cafe was concluded, the flip chart was placed on the walls and participants were then asked to vote for the issues (Appendix 8) that they felt deserved attention. It was explained that this would allow the researcher to direct energy to the most deserving issues. The workshop concluded with the researcher requesting the participants to evaluate (Appendix 9) the workshop.

Data analysis of the rich pictures, flip charts with the issues from the Knowledge Cafe and the evaluation forms occurred after the first SSM workshop. This data along with the interview data from July 2010, then allowed for the construction of the SSM tools such as CATWOEs, Root Definitions and Conceptual Models (Appendix 10). The SSM tools in Appendix 10 were jointly constructed by the researcher and the other PhD student in the research project, who was investigating the use of the Viable Systems Model in Felixton Mill area.

2.4.1.3 SSM workshop 2 and round 2 of interviews

The aim of the second workshop, which was held on 27 October 2010, was to present the findings to the stakeholders and have them interrogate the SSM tools (Appendix 10) that were constructed so that they could take forward what they considered valuable. A presentation briefly covered the purpose of the exercise and previous stakeholder engagements for those who had not attended the first session. Table 2.1 provides a breakdown of the respondents.

Participants were presented with the root definition descriptions (Appendix 10), and asked to vote for the issues that deserved attention. The stakeholders then had the opportunity to engage the relevant systems that they had selected by way of a group

discussion, facilitated by the researcher. The workshop lasted approximately half a day. Participants also had the opportunity to evaluate the workshop (Appendix 11).

A second round of interviews was conducted with 11 stakeholders on 27-28 October 2010. The interview questions (Appendix 12) were developed based on the SSM tools that were constructed (Appendix 10). Table 2.1 describes the participants. The interview and workshop data from the October 2010 engagement with the stakeholders were then analysed and tentative findings were produced.

2.4.1.4 Workshop with the Felixton Local Grower Council

The findings from the previous stakeholder engagements were collated and presented to the Felixton Local Grower Council on 11 March 2011. Eight growers, representing the grower leadership in the Felixton Mill area were present. Recommendations were also included, and feedback was provided by way of a joint discussion after the presentations, as well as through the evaluation forms (Appendix 13). This feedback allowed for further data analysis.

2.4.1.5 SSM workshop 3 and round 3 of interviews

A third SSM workshop was conducted on 22 March 2011. A total of 15 stakeholders participated, made up of seven growers, four mill representatives, and four industry representatives. The purpose of the workshop was for the participants to engage with the tentative findings and take action on a few issues. The workshop commenced with a presentation (Appendix 14) by the researcher of the key findings of the study. Participants then had an opportunity to debate (Appendix 15) the findings to gain insight into which areas could be interrogated to bring about improvement. Appendix 16 lists the actions that were compiled by the researcher based on the debate stages of SSM workshops 2 and 3 on the concerns facing quality cane. Participants had an opportunity to evaluate (Appendix 17) SSM workshop 3 upon conclusion.

Interviews were also conducted with 14 stakeholders on 22-24 March 2011. Six growers, four mill representatives, and four industry representatives were interviewed. The purpose of the interviews was similar to that of the third SSM workshop in that interviewees were encouraged to come up with recommendations to address the issues

that had surfaced through the various workshop and interview engagements. The interview questions are listed in Appendix 18.

2.4.1.6 Final round of interviews

A final round of interviews was conducted with industry stakeholders (SASA, SASRI, CANEGROWERS) at their offices in Mount Edgecombe in Durban in November 2011 (Table 2.1). Appendix 19 outlines the interview questions. The aim of the interviews was to obtain the perspective of industry stakeholders into the concerns (Appendix 10) that the Felixton Mill area stakeholders had identified.

2.5 Data Analysis

It is important that the researcher methodically analyses the data and is explicit in terms of this critical step by "recording, systematizing and disclosing" the way in which the analysis was conducted (Attride-Stirling, 2001: 386). It is, however, important to note that data analysis draws heavily on creativity, reasoning, inspiration and content matter (Barrett, 2007). Data analysis in qualitative research tends to be a particularly complex phase of the research project (Thorne, 2000).

Data from the interviews and SSM workshops were sorted and categorised using inductive reasoning (Leedy & Ormrod, 2013). The emphasis was on critically analysing and systematically organising the data (Fox et al., 2008). Data analysis and interpretation also occurred with data collection, which is characteristic of qualitative research, as explained by Leedy and Ormrod (2013) and illustrated in Figure 2.1. Data analysis was conducted by identifying themes. This is consistent with the phenomenological approach (Leedy & Ormrod, 2013). Ryan and Bernard (2003: 13) view thematic identification as "one of the most fundamental tasks in qualitative research".

Data from the interviews and SSM workshops were carefully analysed to elicit findings. The transcripts from the interviews were examined along with data from the SSM workshops (fieldnotes, evaluation forms, rich pictures, knowledge café notes) to enable thematic analysis. As experienced in this study and confirmed by Leedy and Ormrod (2013), qualitative data analysis tends to be time-consuming and complex due

to the large amount of data that the researcher faces. Transcriptions from interviews can be lengthy and generally require the researcher to sift through many pages to identify issues, similarities and differences, and organisation into categories (Hannabuss, 1996). This deep engagement with data corresponds with the need for the researcher to be immersed in the data (Lee, 2006). The researcher therefore familiarised herself with the transcriptions and the SSM workshop data. As argued by Malterud (2001), although computer programmes are available for this purpose, it is still the researcher who ultimately does the analysis. Data analysis in qualitative research is subjective in nature as opposed to quantitative research which strives for objectivity throughout the research process (Leedy & Ormrod, 2013).

The data analysis process in this study followed the approach as described by Creswell (cited in Leedy & Ormrod, 2013). Data were first organised. The researcher read and reread the transcriptions, and wrote comments in the margins as ideas about categories or interpretations emerged. Categories or themes were then identified which resulted in sense-making through patterns.

The data analysis stage essentially drew on the inductive approach that Bowen (2008) elaborates on, whereby the researcher searches for patterns and starts to see associations with the theory. As recommended by Bowen (2008), data were compared with data, and the researcher constantly studied the transcriptions and data from the SSM workshops to look for parallels and differences. The 'compare and contrast' method described by Ryan and Bernard (2003) was also used whereby the researcher considered how the text differed from other text and what similarities were identified. As recommended by Ryan and Bernard (2003) the researcher also searched for metaphors and analogies, with the aim of understanding the underlying meanings. Themes were furthermore identified by picking up transitions in content, searching for connectors such as 'because', 'since', and 'as a result' which may indicate causal relationships, and words such as 'if', 'then', and 'rather' which may denote conditional relationships (Ryan & Bernard, 2003). Ryan and Bernard (2003) describe this as word repetition, whereby the researcher looked for words that were used quite often. Themes also emerged as the researcher considered prior theory (Ryan & Bernard, 2003). The researcher picked up on common terms and ideas that were detected across the data, and eventually made the leap from description to interpretive mode, as described by Bowen (2008) where analysis surpasses words and comments.

As pointed out by Thorne (2000), data analytic procedures in qualitative research also involve making an assessment about the theoretical lens, how to collect data, and how the researcher decides what are meaningful data in order to respond to the research questions. The write-up in this study will appear as interpretive narratives in line with qualitative research write-up, rather than presenting "means, medians, correlations, and other summarising statistics" (Leedy & Ormrod, 2013: 97). It takes great skill to avoid presenting superficial impressions and quick summaries which simply put forward what was observed, read or perceived, as opposed to actually interpreting the data (Sofaer, 2002).

2.6 Validity and Reliability

The emphasis in qualitative research shifts to the trustworthiness of the study, with less emphasis on traditional positivist interpretations of validity and reliability (Fox et al., 2008; Bowen, 2005; Bowen, 2008). This is confirmed by Thorne (2000) in arguing that the emphasis is on credibility and that the reader must be able to follow how the researcher derived the findings, and how the data and conclusions are linked. Trustworthiness is important in making the reader feel confident about the findings of the study (Bowen, 2008). The previous section elaborated on how data were analysed to enable the findings.

Validity in qualitative research differs from that of quantitative research (Creswell, 2009). In considering the validity of a qualitative research study, Fox et al. (2008) advise that the researcher consider whether the data were collected accurately for analysis, whether relevant theory is used to make sense of the data, and that preconceived ideas of the researcher do not interfere with the data.

The researcher employed the following strategies as recommended by Creswell (2009) to ensure accuracy of the findings. Data were collected from multiple sources, such as the interviews and SSM workshops to increase validity in respect of identifying themes. Transcriptions were checked against audio recordings to identify mistakes that could have been made during transcribing. Member checking was used when the researcher presented the findings of the study to participants in the second SSM workshop and to the Felixton Local Grower Council, thereby checking for accuracy. This corresponds with Cho and Trent's (2006) view that the aim of member

checking is to engage participants to ensure parallels between the researcher's interpretations and reality.

The publications (Chapters 3-6) attempted to present a rich description of the study setting, as well as illustrate the themes. This enhances the credibility of the study. The researcher also endeavoured to write up a realistic account of what transpired in the research. Much time was spent in the field to comprehend the study setting, and this enabled rich descriptions of the study site and participants. The interdisciplinary nature of the large project that this study was embedded in enabled peer debriefing which meant that the interpretations of the researcher could be verified by peers. As argued by Mittman (2001), recording of interviews, as was done in this study, also ensures data validity. The researcher was personally involved in all stages of data collection (interviews and SSM workshops) and data analysis in this study, which serves to enhance the trustworthiness and credibility of the research.

This research was also deemed more credible through the constant involvement of the project team members and constant interaction with the stakeholders in the Felixton Mill area. Malterud (2001) therefore asserts that the involvement of different investigators enhances the study design through questioning and enriching each other's perspectives. Furthermore, while writing up the data, the researcher endeavoured to convey the multiple meanings of the stakeholders as described by themselves, and ensured that the participants' perspectives were illuminated (Forchuk & Roberts, 1993).

Unlike quantitative research, qualitative research does not strive for generalisability, as the focus is on site-specific descriptions and themes (Creswell, 2009). The study can, however, lead to insights that can be extended beyond the study site, as argued by Malterud (2001). This research was conducted in the Felixton Mill area but can be of value to the broader sugar industry, and other situations where there are multiple stakeholders with divergent views who are faced with 'wicked problems'.

2.7 Conclusion

This chapter elaborated on the methods that were employed in this study in order to spell out how the researcher went about answering the research questions. A rigorous

qualitative research approach, which was suited to the nature of this study and the research questions that were set, was followed.

The following chapters present the results and discussion of the study in four peer-reviewed academic journal publications (Chapters 3-6) which correspond to the overarching purpose of the study as presented in Chapter 1. The journal publications draw on data from the study which utilised the qualitative research approach and which employed semi-structured, face-to-face interviews and the SSM workshops to collect data in order to address the particular objectives. Word count restrictions in the requirements of the journal articles, however, meant that not all of the data from the empirical work could be drawn on in each publication.

Chapter 3 draws on data from the first two rounds of interviews in order to present an analysis of the social complexity involved in the multi-stakeholder interactions in the Felixton Mill area. Chapter 4 uses data from the first two rounds of the interviews and SSM workshops in order to illustrate how SSM was applied in the Felixton Mill area to comprehend the social complexity. Chapter 5 presents an analysis of the factors that influenced the facilitation of the SSM process in the Felixton Mill area and utilises data from the interviews and SSM workshops. Chapter 6 explores multi-stakeholder interactions in the Felixton Mill area through the lens of complexity theory, drawing on data from the interviews. Chapter 7 then presents an integrative discussion to draw together the findings from the journal publications and address the research questions that were set in Chapter 1.

CHAPTER 3: AN ANALYSIS OF MULTI-STAKEHOLDER INTERACTIONS IN THE SUGAR INDUSTRY USING A SOCIAL COMPLEXITY FRAMEWORK

Cecile N. Gerwel Proches (South Africa), Shamim Bodhanya (South Africa)

An analysis of multi-stakeholder interactions in the sugar industry using a social complexity framework

Abstract

This study examines social complexity in the sugar industry. The sugar industry is complex, characterized by multiple stakeholders each with their own objectives. This study focuses on the interrelationships between the stakeholders by analyzing social complexity. The qualitative research approach was employed. Twenty-three in-depth, unstructured interviews were conducted with various stakeholders to collect data on the challenges that exist. The diverse goals of the stakeholders were found to be characteristic of a purposeful system, as is the case with social systems, but were identified as a potential source of conflict. Although the mill is a corporate shareholder entity, local interactions were found to be important in shaping the future. Critical factors, such as haulier inefficiencies, cane supply and cane quality, were found to have significant implications for the sustainability of the mill area.

Keywords: social complexity, stakeholders, relationships, goals, objectives, sugar industry.
JEL Classification: M10.

Introduction

The sugar industry can be considered complex due to the multiple interactions that have to occur between diverse stakeholders to produce a range of products, including raw and refined sugar, and molasses. The main stakeholders at the local level are the growers who grow the sugar cane, the hauliers who are responsible for transporting cane to the millers, and the millers who process the cane. An alternative approach to enhancing performance in the value chain, which focuses on the interrelationships between the people behind the sugar cane, is explored in this paper. Traditional value chain analysis may emphasize the activities required to put forward a product, but may neglect developing or nurturing the inter-relations between the diverse stakeholders who are critical in jointly crafting the future.

Relevant research is thus required to identify the multi-faceted problems faced by the stakeholders in the sugar industry. Social complexity theory will be used as a framework to map out the challenges that arise from multiple stakeholder interactions in the sugar industry. The main aim of this research is therefore to better understand the complex interactions of the agents in a mill area in a developing country context, through the lens of social complexity. The identity of the particular mill will not be revealed, and will be referred to in this paper as the mill. The mill is owned by a corporate shareholder entity and is reliant on hundreds of growers in the area who run independent operations to produce the cane. The mill area is therefore characterized by complexity, which stems from a mixture of technical complexity and the multiple interactions of diverse stakeholders.

1. Social complexity

The sugar industry can be considered a system, and using Anderson's (1999) definition of a system, is as a result of interconnected components functioning together. Complexity is an underlying feature of human social systems (Stevenson, 2012). Complexity theory has evolved from a number of theories, and essentially centres on the idea that a system is complex due to the whole being different from the sum of the parts, and emerging from interactions between the parts (Klijn, 2008; Eoyang, 2004). Eoyang (2004) illustrates complexity through the use of a metaphor of a tapestry as being an outcome of the relationship between the strands of the different colours. The notions of uncertainty and unpredictability are taken as a given in complexity theory, and provide a contrasting view to the reductionist perspective which emphasises order and stability (Marion & Uhl-Bien, 2001). Organizations can no longer be comprehended in a mechanistic way, where assumptions and solutions about the whole are based on an analysis of the individual parts (Stevenson, 2012). The notion of a rational actor also comes into question due to disregarding complexity arising from dynamic systems comprising multiple agents (Levy, 2000). Levy (2000) emphasizes that the field of management can benefit from complexity theory by understanding how effective learning and self-organization can result in new forms occurring.

Complex systems exhibit a number of characteristics, including self-organization, emergence and non-linearity (Klijn, 2008). Self-organization in complex systems derives from the constant interplay between structure and diversity in the system, which respectively gives rise to identity and unpredictability (Eoyang, 2004). Non-linear interactions between agents result in self-organization (Anderson, 1999). Order in a complex system arises spontaneously,

rather than from a central source or master plan (Klijn, 2008; Mukherjee, 2008; Escobar, 2003). The parts in a complex system are intertwined, such that emergent patterns cannot be attributed to any individual part (Eoyang, 2004; Klijn, 2008). Emergence is thus when macro-behavior arises due to the dynamic interactions of multiple agents who follow local rules as opposed to top-down commands (Escobar, 2003). It is furthermore important to note that changes in social systems have unpredictable outcomes due to the complex nature of such systems (Duek, Brodjonegoro & Rusli, 2010). When a small change can fundamentally alter the behavior of the system, and the whole differs from the sum of the components, then this is known as non-linear behavior (Anderson, 1999). Complexity theory, although used in the biological and physical sciences, can be applied in social systems where non-linearity and complex interactions are present (Levy, 2000). The nature of being social entails ever-present and defining interactions that cause stability and change (Marion & Uhl-Bien, 2001).

Social complexity often presents itself in the form of wicked problems, characterized by stakeholders being unable to precisely define the problem, and having no real way of determining success or having any straightforward solutions on hand (Barry & Fourie, 2001; Australian Government, 2007). Wicked problems exist because each stakeholder holds a different view of the problem, with no one perspective of the problem being right or wrong (Australian Government, 2007). This is indicative of the mental models that each stakeholder possesses, which is essentially their perspective as to how they view the world. The behavior of agents (individuals, groups or partnerships between groups) is determined by their schema, which leads to an action based on the perception of the environment (Anderson, 1999). There may be shared schemata between agents, and agent behavior is dependent on other agents' behavior in the system due to the interconnectivity (Anderson, 1999).

Social complexity derives from the dynamic interactions of agents who are committed to achieving a particular goal. Parellada (2002) observes that social organizations exist to fulfil a certain objective, and that such systems contain and transmit ideas, values, culture and concepts (these may or may not be common) which influence the dynamics in the system. Duek et al. (2010) highlight that social systems are characterized by purposeful individuals, who make decisions about their own and the purpose of others. These agents are, however, heterogeneous, autonomous individuals who are purposeful in nature, and strive to fulfil their own objectives (Bogg & Geyer, 2007).

Wicked problems are often characterised by internally conflicting goals, with conflict arising due to the inherently independent nature of the agents (Heylighen, Cilliers & Gershenson, 2007). This point is taken further by Heylighen et al. (2007) in noting the selfish behaviour of agents by arguing that they are independent beings whose aim is to accomplish a particular goal through acting on the environment and other agents. Anderson (1999) thus draws attention to how agents improve their own fitness function or payoff, which is dependent on the decisions of other agents.

Agents in a social system are confined by social conventions and norms (Rzevski, 2011). In order to reach a preferred state, agents in dynamic, social systems are able to respond and evolve in response to the actions of other agents through engaging in learning, collaborating with other agents, developing relevant identities and redefining power relations (Potgieter et al., 2007). Agents in purposeful systems are therefore able to learn and adapt (Duek et al., 2010).

A working definition for social complexity will now be proposed, which is based on the work of other authors (Duek et al., 2010; Parellada, 2002; Heylighen et al., 2007; Rzevski, 2011; Cicmil & Marshall, 2005; Austin, 2010; Conklin, 2006; Australian Government, 2007). Social complexity arises when multiple, heterogeneous agents who are bound together in a purposeful system, draw on their own mental models to interpret and find a balance between achieving their own goals and objectives, with that of the common goal responsible for creating the interdependence between the agents. The mental models will allow the agents to place into perspective, (1) how they define success, (2) which goals to pursue, (3) their own organisational structure and processes, and, (4) what they attribute the causes of the problem to, the severity of the problem and ways to address it. The constructs of power, norms and conventions will, however, limit the freedom that each agent in the system has, and uncertainty and unpredictability in the system derive from this constant tension that agents display as they need to have an individual identity and still achieve success for the system as a whole. Figure 1 below presents a conceptual model of social complexity, based on the working definition.

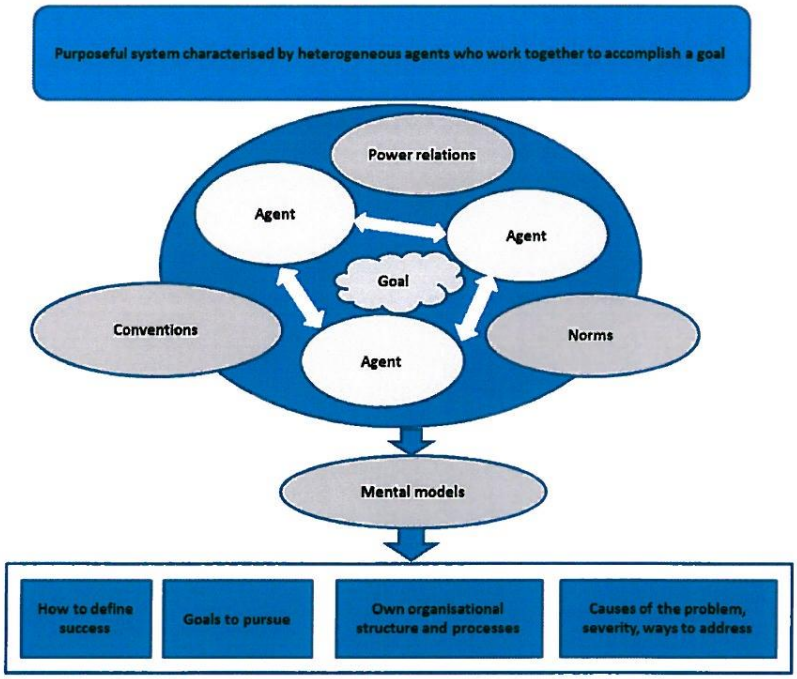

Fig. 1. Conceptual model of social complexity

2. Research method

An exploratory research design was used, with the qualitative research approach found to be most appropriate. This approach was applicable for discovering and comprehending little-known phenomena (Creswell, 1994). Semi-structured, in-depth interviews were used to gather data to allow for the emergence of rich descriptions and stakeholder perspectives. Purposive sampling was used. Two rounds of interviews were conducted with various stakeholder groups to gain a rich understanding of the context.

Stakeholders in the mill area were first approached to be involved in the research and had an opportunity to better understand what the research entails. The research was performed in the natural environment, and therefore involved site visits to the mill area. Ethical clearance to conduct the study was obtained. Participants were presented with an informed consent form and assured about confidentiality. Each interview lasted approximately an hour, and was digitally recorded and transcribed.

The fieldwork commenced in July 2010. This round of fieldwork was used to gain a basic understanding of the context. A total of 12 interviews were conducted, which comprised six growers, three representatives from the mill, one haulier, one representative from the national sugar association, and one representative from the local miller-grower body. The questions centred on determining the goals of the various stakeholders and whether they were considered compatible or competitive, how communication and trust were viewed, how challenges were dealt with, and difficulties that were recently faced. The second round of interviews was conducted with 11 respondents and was held in October 2010. These stakeholders included eight growers and three representatives from the mill. The emphasis of the interviews was on the respondents' views of leadership, communication, transparency, and power relations in the milling area, the working relationships between the stakeholders, and issues pertaining to competitiveness in the mill area.

The interview data were analyzed to enable findings. The transcripts from the interviews were carefully studied and analyzed using thematic analysis. After engaging in analysis, a workshop was organized to present preliminary findings to the stakeholders. This was a way of ensuring member checking.

3. Results

3.1 Multiple stakeholders with divergent goals. The main stakeholders in the mill area found to be most influential in the system were the growers, miller and hauliers. Hauliers were perceived to be quite significant as their actions affected growers and the miller considerably, but were however considered to be outside the system. Respondents expressed the view that the hauliers were not of real consequence as there were only two permanent entities in the sugar industry: the growers and miller.

They (hauliers) are the step children of this family, because they live on the outside ... transport is outside (R6).

Interdependency between growers and the miller was highlighted by respondents who acknowledged that the mill would not exist without the growers, and that growers would have nowhere to take their cane if the mill were not around. Despite this symbiotic relationship, each entity was found to be pursuing its own goals due to its separate existence. These diverse goals as expressed by the respondents are mentioned below.

Growers aimed to grow the crop as cheaply as possible and obtain maximum production from their land, whereas others indicated that growers wanted the cane harvested and expected maximum returns. Growers wanted maximum sucrose and delivery to the mill within 24 hours. Grower goals were about profitability, sustainability and getting value for their crop, which entailed more than just sugar. The goal of hauliers was to deliver cane from the field to the mill, and ensure profitability and efficient utilisation of their equipment. The goal of the millers was to extract maximum sucrose and to make as much money as possible. It was acknowledged that the mill was owned by a corporate that had to maximize profits and satisfy shareholders.

3.2 Being heard. Growers expressed a strong sense of wanting to be viewed as meaningful participants and to become more influential as a collective. The formation of a grower body by the mill-area growers, referred to as the Local Grower Initiative (LGI), allowed growers to respond as a collective to the miller and exert influence. This therefore permitted growers to be more united and able to speak with one voice to the miller. The corporate required such collective action from the growers to produce a more efficient relationship.

The biggest problem the corporate finds is that there is no one voice that is spoken by the growers and the hope is that the LGI will be the one voice that will come through (R4).

To become further organized, growers had to forge stronger ties amongst themselves and contribute in committee forums where strategic decisions were being made. There was a clear need to step out of, what many respondents referred to as a 'comfort zone'. The challenge, however, was to overcome the fact that there were many growers who were individuals and managers in charge of their own farms, and who were traditionally accustomed to working alone, according to their own success criteria.

Respondents indicated that growers have had to become professionals to exert their influence in the arena. This therefore resulted in a move away from the concept of being only a farmer to a well-rounded businessperson who is able to respond to decisions that are made in a boardroom, far away from the mill area. It was noted that some growers required professional assistance, to assist with finances and negotiations, but also general management.

There is a lot of negotiations, business management, organization ... and not every farmer has those skills (R5).

3.3 Power distance. Ground-level relations between the mill staff and growers were considered fairly satisfactory and characterised by trust, but the problem, however, arose with the corporate and hierarchical nature of the business, as it was argued that mill staff could not make high-level decisions.

Trust between the mill manager and growers is not that bad, but unfortunately the mill manager reports to his superiors and I think that is where the problems start occurring ... high up the ladder (R1).

Respondents reflected on the history between growers and millers, which started with growers being dominant many years ago, which was then followed by the phase of engineers, and finally the advent of external shareholders, by way of accountants and efficiencies, which is when the relationship between grower and miller started taking strain. The change from a family-oriented business to a shareholder entity was identified as the source of problems, as it was perceived that the miller lost touch with what was happening on the ground.

Respondents consequently articulated perceptions that were rife. These included the existence of a powerful miller who hid information from growers and who made huge profits for the sake of shareholders, while growers came off second-best as price takers. This was contrasted with the relatively simple operations of growers who were perhaps farming for the sake of achieving a particular lifestyle and making a comparatively modest profit. Major, strategic decisions concerned respondents as they wondered whether these were made with the mill in mind or for the corporate entity, which owned other sugar mills.

They are a huge company, they've got lots of sugar mills, so sometimes we don't understand them, but I'm sure they making the right decisions in their minds (R7).

Respondents mentioned that current communication systems, such as SMS and email, and a Friday breakfast at the mill between the growers and the miller, and other informal gatherings like the golf

day organized by the miller, were noted to be of value in bringing stakeholders together.

While local-level communication efforts were appreciated, respondents indicated that there was a lack of in-depth communication from all sides, particularly concerning strategic discussions. Respondents thus called for the development of a meaningful form of two-way communication.

The need for more ground-level interaction at the mill and the participation of influential players from the corporate headquarters to be part of strategic discussions was raised as a possible way to facilitate interactions and efficiency.

There are players that are influential, who aren't normally part of discussions (R1).

This was, however, not viewed as feasible due to the hierarchical nature of the business.

The corporate is huge. You can't expect one of the big bosses to be attending meetings here. That is why they have different tiers in their hierarchy to attend to those issues ... they just basically seeing how much sugar we're making. How much we can put on the world markets. They are strategic, not hands-on with the operations (R12).

3.4 Strengthening the mill area. Respondents expressed different views on how to strengthen the mill area and raised various problems and possible solutions to boost performance in the mill area.

Mill efficiency was considered largely acceptable, but some respondents reflected on whether the mill would cope with increased cane supply. Others, however, noted that the mill was old and required maintenance to prevent downtime. Growers highlighted that it would be useful to be informed of strategic information about the mill, as opposed to information that was considered filtered. The miller required accurate, updated information on cane delivery from growers. It was thus indicated that there should be communication coming to the mill but also leaving the mill.

Cane supply was considered a major problem by all respondents and was viewed as critical to the survival of the system. Increased cane supply, as explained, was linked to increased throughput and sugar. The fact that the mill had the capacity to crush a large amount of cane, but was unable to due to limited supply, was cited by many as a serious threat to profitability and sustainability of the mill.

This mill is under more serious threat with dwindling cane (R3).

Cane supply was attributed to various factors. Some growers who acquired cane farms could not successfully farm, certain growers sold their land due to fears related to legislation, while others were moving into other crops such as macadamias or bananas, or simply moving into other countries where the costs associated with farming were lower. Increased planting efforts and farm rehabilitation were mentioned as ways to improve cane supply.

Challenges relating to unreliable transport was mentioned by growers and the miller as a serious challenge, especially that it was perceived to be increasing the rift because of poor cane supply. Late delivery of cane negatively affects cane quality and the mill scheduling in respect of processing the cane. Respondents made mention of there being too many hauliers, many of whom were not performing adequately. A suggestion raised was that the miller absorbs the haulage function, thus leaving growers to place their cane on the loading zone, and spend more time focussing on farming. The introduction of a scheduling system was considered another possibility by some to address transport inefficiencies.

Cane quality appeared to be more of a difficulty from the perspective of the miller. Suggestions were made to have growers focus on farm management, such as training of labour and increased attention on base cutting and topping height of the ratoon. Growers, while acknowledging the importance of cane quality, however recommended that the miller use its power to purchase fertilizer to assist growers as they were faced with financial constraints. Growers pointed out that economics affects cane quality.

Responses thus largely centered on addressing transport, cane quality and cane supply as a means to bolster performance.

We talked about transport, we talked about improving yield, we talked about quality ... those things are strategic ... will make the biggest competitiveness difference (R4).

4. Discussion

Figure 2 depicts the social complexity in the mill area, as derived from the results, and will now be used as a basis for the discussion of the results.

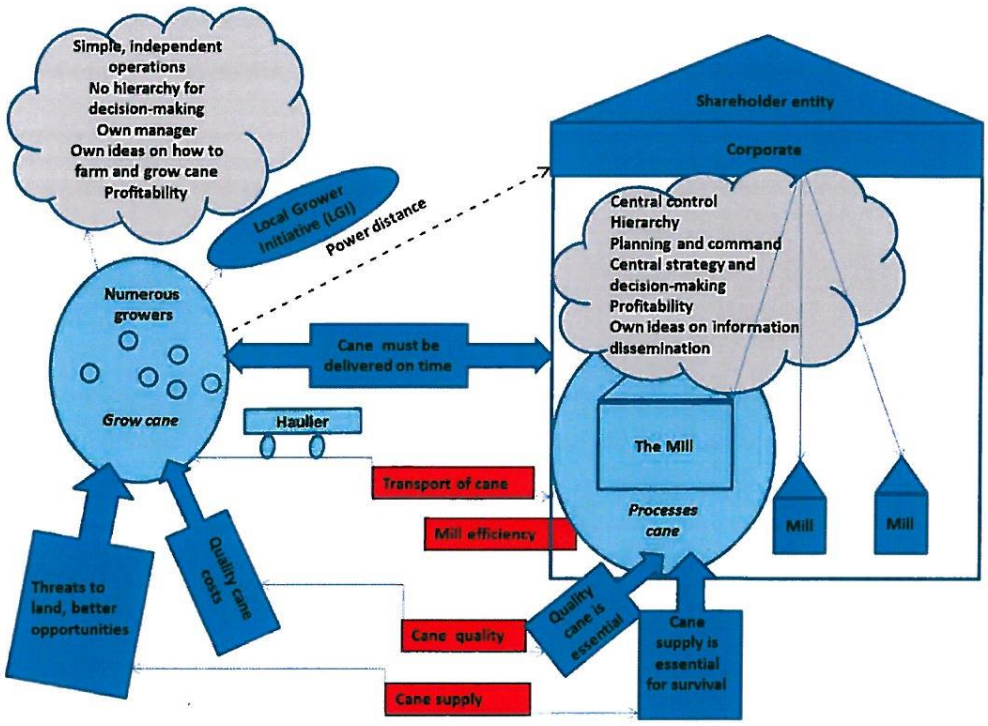

Fig. 2. Social complexity in the mill area

Social complexity in the mill area derives from the presence of major players, which were found to comprise growers, the miller and hauliers. These agents displayed commitment to attaining a higher-level goal, i.e., combining efforts to produce sugar. The results however revealed that the presence of hauliers was found to be impacting heavily on the system, and causing strain to the growers and the miller. Marion and Uhl-Bien (2001) argue that if there are too many interacting agents, then difficulties can arise with respect to achieving a common identity and order. The presence of the hauliers poses an insurmountable challenge to the system, and may require re-examining their role in the system. Anderson (1999) argues that connections between agents can be altered, in that agents can enter or leave the system, and that new agents can arise through grouping thriving aspects of agents. The emergence of the grower body (LGI) is an example of a new agent that has altered the mill area.

Growers and the miller are thus the main stakeholders who display an immense amount of interdependence, as illustrated in Figure 2. This corresponds with Homer-Dixon's (2011) view that complex systems exhibit a high degree of connectivity of the parts. Wynne (2009) notes that a healthy relationship between millers and growers contributes to the wellbeing of the sugar industry, and recommends a closer working relationship, collaboration and internal harmony as a way of strengthening the value chain.

In line with the recommendation of Ashmos, Duchon and McDaniel (2000), it is useful to identify how conflict arises from the attainment of multiple objectives and goals. Growers and the miller were found to pursue their own objectives, which is a characteristic of social complexity. Wynne (2009) highlights that a disjointed approach in the sugar industry has negative implications for adapting to a competitive environment, and that the downfall of one party will see failure for the other as well. Rzevski (2011) however points to a noteworthy characteristic of social systems as that of intelligence, and defines this as the ability of agents to articulate and work towards goals, especially when uncertainty prevails. Rzevski (2011) further notes that intelligence allows for choices to be made by the agents, and that emergent intelligence should be strived for as this is about agents being given the space to get together to decide on how to achieve the most worthy common goals. It is evident that both growers and the miller strive for profitability, maximum sucrose and efficient delivery of the cane to the mill. Such compatibility of goals and consideration as to how to jointly achieve this could allow the agents to better handle the complexity.

Another characteristic of social complexity is the inability of agents to precisely define the problem facing the system, its attributes and solutions. This is due to the existence of the diverse mental models held by the heterogeneous agents who display bounded rationality. The problem as perceived by

stakeholders was attributed to different causes, depending on the particular stakeholder group. The results identified cane supply, cane quality, mill efficiency, and unreliable transport to be most pressing, as indicated in Figure 2. Barry and Fourie (2001) contend that rather than dwelling on efforts to define a problem, we should rather reflect on, analyze and formulate a response to the situation.

Different solutions were proposed depending on the stakeholder's perspective, with respondents viewing certain factors as more serious, e.g., mill efficiency, which was considered acceptable by some respondents, but a cause for concern by those who were anticipating the future. Cilliers (2000) draws attention to how complex systems can organize towards being critically sensitive, a term used to describe the ability of a system to respond to certain issues which are critical to its survival. Figure 2 reveals that the timely transport of cane is an objective equally desired by growers and the miller, as both parties stand to win or lose. Reliable cane supply is an objective that is essential to the survival of the mill and is in part dependent on the decision of growers to continue in cane farming and make a success of their land. The miller also places emphasis on quality cane, but requires the cooperation of the grower who would have to choose to financially invest to accomplish this goal. Mill efficiency is in the domain of the miller but does not dramatically affect the system at present. Agents can form their own insights into what they desire and how they will behave (Teisman & Kleijn, 2008).

When there is no agreement about the origins of the problem or on how to address the problem, the best response is for multiple organizations to work together, and take action at various levels as the problem overlaps more than one organization (Australian Government, 2007). The need for emergent leadership in complex social systems is critical, and comprises an agent who takes initiative in motivating other agents to deal with difficult duties and requirements which are necessary to see the system accomplish its goals (Rzevski, 2011). Growers and the miller would therefore need to find a way to address the problems associated with transport and cane supply. This should ideally be achieved through self-organization. Self-organization is present where there is autonomy to make decisions and accomplish goals (Rzevski, 2011).

Rzevski (2011) does however note that social conventions and norms pose a limitation to the amount of freedom that agents in a social system have. The corporate has structures in place, particularly as a result of the hierarchical nature, and holds a particular view about how business is conducted. Local-level interactions at the mill were found to be satisfactory, but the role of the centralized structure presented a barrier. Local and present interactions shape the future and are derived from how agents communicate, and not necessarily from intentions and strategies of managers (Rodgers, 2010). This corresponds with the view of Cicmil and Marshall (2005) who note that a simplistic view of communication and team cohesion are inadequate due to the existence of ambiguity, unpredictability and power differences.

One of the main differences, as indicated in Figure 2, between the growers and miller was that the miller was a corporate, shareholder entity with clearly defined parameters for success. Growers, on the other hand, were dispersed and solely responsible for how they defined success. Power relations in the mill area were found to be a source of conflict due to the corporate nature of the mill. Concerns were expressed about the goals of the company in relation to the other mills that the business owns. This produced a clear distinction in how business between the miller and growers was conducted and caused tension due to different expectations. In complex systems, the ways in which power and differences are managed become integral (Stacey as cited by Levy, 2000).

It is critical to consider how each organization deals with its mission, values, culture, and processes related to resources, structures and decision-making (Austin, 2010). Agent diversity, which tends to be overlooked, is a source of strength for complex systems (Heylighen et al., 2007; Stevenson, 2012). Growers and the miller can, therefore, capitalize on best practice in their own domains. Effective functioning in the grower-miller social context requires agents to have a strong identity, form relationships and share information (Stevenson, 2012). A strong identity derives from a view of the self in relation to others and their sense of purpose, and serves to create relevance for what we are and do. Relationships entail meaningful connections, defined by mutual respect, authenticity and trust. Information sharing serves a connective function in the social context and is a necessity for learning about self and others, and when inhibited by the inability to share and communicate, leads to an identity crisis. The growers' need to be viewed in a meaningful way through being heard and engaging in strategic discussions can be understood in light of these three critical concepts. Stevenson (2012), however, points out that the values of the group that holds the power will determine what is acceptable in terms of knowledge transmission. The structure of the corporate thus places limitations on how much information and interaction can be achieved.

The miller can be thought of as individualistic, portraying a clear sense of competitiveness and exhibiting classical hierarchical and centralized decision-making. Growers by contrast, due to their sheer numbers, have a simple structure with decision-making and accountability lodged with the individual grower-cum-manager. This difference contributes to increased social complexity in the mill area, and corresponds to the two network types (hierarchies and meshworks) as noted by Escobar (2003). At the one extreme is a hierarchy, which is how the miller can be viewed, characterized by centralized control, clear planning and standardization, and specific rules and behaviour. The growers, on the other hand, can be compared to meshworks, which operate under decentralized decision-making, heterogeneity, variety and no one single goal.

Austin (2010) argues that collaborations between partners need to be characterized by learning and the ability to do so in the partner's territory. This is clearly evident in how growers have demonstrated increased organization through the development of the grower body (LGI), efforts to increase involvement by growers, and awareness of the need for professionalisation. However, growers will have to overcome the independent attitude that they have traditionally been operating under to achieve individual competitiveness. Rzevski (2011) therefore proposes emergent creativity, which is viewed as agents being proactive in reviewing goals, reformulating aims and objectives, predicting trends and paving the way for new prospects. The strategic use of the LGI and other committees could allow growers to revisit their goals and formulate a response as a collective to interact strategically with the miller.

In applying the social complexity lens to examine the interrelationships in the study context, Figure 1 can now be enhanced. What may be seldom emphasized in social complexity theory is that agents are not equal, and furthermore, that the agent with the most power dictates how business will be conducted. Another consideration is how other agents in turn respond to such displays of power, often requiring a fundamental change in operations and organizational structures to compete. Key differences in organizational culture, decision-making and value systems play a particularly critical role in social complexity. Apart from pursuing their own goals, individual agents have the desire to be recognised and to exert influence. A final characteristic for consideration in the social complexity theory is the need for agents, as a collective, to have a common identity which will allow for the goal to be accomplished. This may necessitate collaboration amongst agents who most stand to gain or lose, to create a new group of agents or attempt to expel an agent who is causing strain to the system. The need for collaboration to focus on addressing problems that will ensure survival ultimately supersedes the inherent diversity and competition that agents naturally portray.

Conclusion

The aim of this research was to use social complexity theory as a lens to understand the complex interactions of agents in a mill area in the sugar industry. This research found interrelationships between stakeholders to be critical in producing outcomes. The results revealed that complex interactions in the mill area arose due to the existence of multiple stakeholders with divergent goals. Another finding was that agents had the desire to be recognized and to become influential; however, power dynamics limited interactions due to agents having fundamentally different ways of conducting business. Stakeholders were also found to view the causes of the problems and solutions in the mill area differently due to their own mental models and perspectives.

It is clear that growers and the miller, while being cognisant of their own goals and objectives, will need each other to address haulier inefficiencies and deficiencies in cane supply, which currently pose a threat to survival. This will not be an easy task due to the purposeful nature of the agents and structural differences, and will require firm leadership from both parties. The local-level interactions between growers and the miller, and not the corporate, will be pivotal. The corporate will have to consider the high-level goals of the organization in relation to the mill goals, and perhaps allow more autonomy, which could assist stakeholders to better manage the unique complexities facing the area. This can allow for the connections and differences to be nurtured. As Gharajedaghi and Ackoff (1984) argued, less emphasis must be placed on individual actions, and more on effectively managing how the parts in a system interact.

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CHAPTER 4: AN APPLICATION OF SOFT SYSTEMS METHODOLOGY IN THE SUGAR INDUSTRY

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Article

An Application of Soft Systems Methodology in the Sugar Industry

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Abstract

This research describes and analyses a methodological approach, known as Soft Systems Methodology (SSM). SSM was applied in the sugar industry, which is characterized by diverse stakeholders who have multiple and often competing objectives. SSM is a methodology that was developed in response to the limitations of the systems engineering approach. It uses a flexible, yet organized process to bring about action to improve problematical situations. A qualitative research approach was used. Interviews and SSM workshops were held with growers and the miller, and other stakeholders. Interviews were conducted with the focus on identifying the goals of the various stakeholders in the mill area, and how communication, trust, and overall efficiency were perceived by the stakeholder groups, on their own and as a whole. Data were analyzed using thematic analysis. Purposeful activity models were created after an analysis of the interview transcripts, and rich pictures were constructed by stakeholders in a SSM workshop. Stakeholders were invited to a second SSM workshop where they were presented with SSM tools that were constructed. Participants then chose to work on a model and engaged in debate about how the model compared to the real world, and considered how to take action to bring about improvement. The research illustrated the value of applying SSM in the sugar industry by bringing together diverse stakeholders to identify and address the multiple perspectives held about the overlapping problems. Through the SSM process, various problematic aspects of the sugar industry were uncovered and presented to stakeholders to bring about action. SSM facilitated the identification of the various objectives that the stakeholder groups were individually pursuing, and also created space for discussions into how to jointly create a desired future that could benefit all stakeholders. This collaborative methodology enabled meaningful and systemic interaction between the researcher and participants, by providing an opportunity for

respondents to share their multiple and valid perspectives about the problems, challenges and opportunities in the mill area. Through the use of the SSM tools, further insight was gained into the roles, goals, values, power, and culture of the study context.

Keywords: sugar industry, Soft Systems Methodology, SSM, qualitative research

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Research into the sugar industry has placed emphasis on the relationships between stakeholders, particularly those of growers and millers (Hildebrand, 2002; Measday & Kirsten, 2002; Wynne

there will always be a plethora of problems and multiple perspectives present in a situation (Luckett & Grossenbacher, 2003). SSM uses a flexible, action-oriented and organized process to bring about improvement to problematical situations (Checkland & Poulter, 2006). SSM is therefore ideal to apply in situations with "messy, ill-structured, real-world problems" (Khisty, 1995, p. 97).

SSM originally consisted of seven stages, which are now compressed to four main stages. The SSM process commences by exploring the problematical situation through identifying the issues, as well as analyzing the culture and power relations (Checkland & Poulter, 2006). Rich pictures can be used to express the situation by depicting the stakeholders and the problems that they experience pertaining to workings between stakeholders, as well as interconnections and relationships between the actors (Kayaga, 2008; Khisty, 1995).

The second stage of SSM consists of constructing relevant purposeful activity models, which correspond to a specific worldview. Root definitions, which outline the core purpose of the activity system to be modeled, are constructed (Checkland & Poulter, 2006). The PQR formula is used to populate the root definition, and sets out purposeful activity as a transformation. The P is the *what*, Q the *how*, and the R, the *why*, or as Checkland and Poulter describe, "do P, by Q, in order to help achieve R" (2006, p. 39).

A general model of purposeful activity, known as the CATWOE is then created, and is outlined below (Checkland & Poulter, 2006):

- C for the Customers who are beneficiaries or victims.
- A for the Actors who are responsible for the activities.
- T for the Transformation.
- W for the Worldview.
- O for the Owners who can prevent or change the activity.
- E for the environmental constraints.

Conceptual models are then created from the root definitions, the PQR formula, and the CATWOE. A "system" in SSM terminology refers to the conceptual models that illustrate the ideal set of activities required for a necessary transformation, and not actual reality (Luckett & Grossenbacher, 2003). The models are then used to structure debate about the situation, which forms the third phase of the SSM process (Checkland & Poulter, 2006). Dialogue occurs as stakeholders compare the real world with the models.

The final stage in the SSM process consists of defining and implementing necessary actions with the aim of identifying desirable and culturally feasible changes. Checkland and Poulter (2006) argued that the changes have to appeal to the people in the situation, taking into account their unique history and worldviews.

Methodology

The qualitative research approach was used in this research. Ethical clearance for the study was obtained. Permission was obtained from the participating institutions, which supplied gatekeeper letters that were then used to acquire ethical clearance approval from the university. All respondents received an informed consent form detailing the aim of the study, as well as assurance that their participation was voluntary, that what they said would be confidential, and that they could withdraw from the project at any stage should they so desire. Fieldwork comprised of interviews and SSM workshops. Various stakeholders in the mill area, including the growers, miller, hauliers, Sugar Research Unit, and National Sugar Association, were involved in the research.

Semi-structured, face-to-face interviews of approximately one hour, were conducted in the mill area. Unstructured, open-ended questions were constructed to allow for the emergence of rich descriptions and stakeholder perspectives. The interviews provided a platform for stakeholders to openly express their views in a safe environment.

Interviews were conducted from13–15 July 2010 to gain an initial understanding into the soft issues (communication, leadership, overall efficiency, trust, and goals) that exist in the mill area. Twelve interviews were conducted with six growers, three representatives from the mill, one haulier, and representatives from the local grower body and National Sugar Association. All interviews were digitally recorded and transcribed.

Two SSM workshops took place in the mill area, and each one lasted approximately half a day. Invitations were sent out to all stakeholders in the mill area to allow for diverse input. The workshops were faciliatory in nature, with the researcher taking the lead in engaging the participants in discussions. The SSM workshops, as with the interviews, were aimed at allowing stakeholders to build momentum through identifying the issues regarding cane supply, cane quality, transport, conflicting goals and communication, and eventually taking action to address these issues.

The first SSM workshop occurred on 22 September 2010 with eight participants. In this workshop participants engaged in the construction of rich pictures. Two growers, three representatives from the mill, one haulier, and two representatives from the National Sugar Association and the Sugar Research Unit, respectively, participated in the workshop.

A second SSM workshop, which was held on 27 October 2010, was organized with the purpose of presenting the SSM models to the stakeholders and having them interrogate and take forward what they considered valuable. This workshop was attended by three mill representatives and eight growers.

Data from the SSM workshops and interviews were continuously analyzed using thematic analysis.

Results

Problem Situation

The unstructured problem situation was examined by conducting interviews to gain an initial understanding into the soft issues (i.e., communication, leadership, overall efficiency, trust, and goals). Brenton (2007) argues that this first phase of SSM is aimed at experiencing the problem and investigating it from all perspectives.

The second stage of SSM is to express the problem situation. This was done by having participants construct rich pictures in the first SSM workshop. This allows for the illustration of complex interactions between multiple actors (Checkland & Poulter, 2006). Concerns and interests are depicted using think bubbles, and crossed swords represent conflict between actors. Rich pictures enable the identification of issues (Brenton, 2007).

The researcher encouraged participants to use as few words as possible, and rather to use cartoons or stickmen in the construction of the rich picture. Participants were placed in two groups, provided with a flip chart and markers, and asked to visually represent who they thought the different stakeholders were, what their issues were, and to provide linkages between the stakeholders.

Participants evaluated the rich picture exercise at the end of the workshop. The exercise was described as challenging, interesting, and thought provoking, and a new experience, which was considered frustrating by participants at first. Whilst the major stakeholder groups were present in the workshop, only eight participants were able to attend the workshop. Stakeholders indicated

that larger participation would have been valuable, and that more time for the exercise would have helped. The experience of drawing frustrated some participants, while others would have liked a second opportunity to adapt the rich picture.

Participants described slight difficulty in freely expressing themselves in the presence of a diverse group of people without fear of damaging relationships. It was highlighted that not all ideas could be articulated and that some issues might not have been mentioned as a result of the composition of the group. It was argued that participants might not have been completely honest or that other issues would have been raised had some stakeholders not been present.

Stakeholders were also able to see the benefit of the rich picture exercise as they elaborated on how it enabled them to look at the whole picture and not only at problems affecting one party. Participants were also surprised because they gained insight into the relevant concerns of other stakeholders. Stakeholders realized that it was important to understand how the actions of one party affect the other stakeholders in the system. The real trick with the exercise, according to the participants, was to identify links between stakeholders that could increase efficiency.

Stakeholders acknowledged that fundamental problems existed due to a lack of skills in the ability to handle the immense complexity that resulted from the interrelationships between the many players. The interdependence of stakeholders, and need for transparency, trust, and effective communication was highlighted as critical.

After analyzing the rich pictures from the first SSM workshop in conjunction with data from the interviews, the researcher constructed a rich picture, which is depicted in Figure 1.

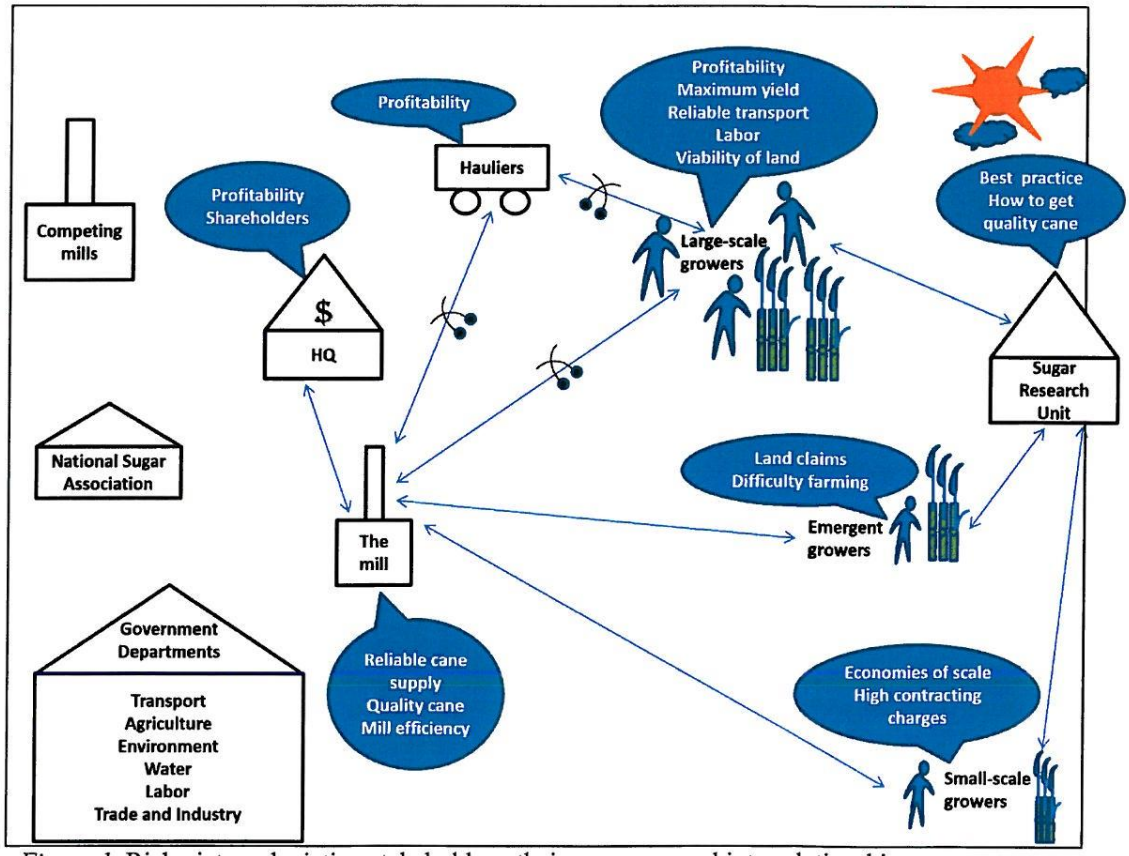

Figure 1. Rich picture depicting stakeholders, their concerns, and interrelationships.

The problem situation is depicted in the rich picture in Figure 1. The weather is considered critical to the survival of all. The mill is central and places emphasis on reliable cane supply, quality cane, and mill efficiency. The headquarters oversees operations at the mill, and is concerned about profitability and its shareholders. The mill receives cane from three distinct categories of growers: (a) large-scale, (b) emergent, and (c) small-scale. Hildebrand (2002) found that the miller and growers are reliant on each other to ensure that they both gain competitively.

As indicated in Figure 1, the various growers had different goals and concerns. Large-scale growers were mainly concerned about transport, efficiency, viability, profitability, and achieving maximum yield. Emergent growers largely experienced difficulty in ensuring sustainability due to lack of experience. Small-scale growers were primarily affected by economies of scale, and grappled with high contracting charges and lack of finances. The rich picture is a valuable tool for researchers to gain insight into competing goals, values, and perspectives of stakeholders in a given context, which might not be easily extracted from standard qualitative research methods.

Hauliers transport the cane from the farms to the mill and are mainly concerned with profitability through efficient utilization of their equipment. The Sugar Research Unit plays a role through the work of extension officers who ensure best practice and research into ways to obtain quality cane. There are competing mills in the broader area that pose a threat to the mill. Farmers could also choose to send their cane to competing areas that are located within a reasonable distance, and which would not dramatically increase transport costs. Government departments play a role through regulations which have an impact on the transport of cane, how agricultural practices and labour can be conducted, how issues around the environment and water in relation to farming occurs, and how the sale of sugar is managed. The National Sugar Association is key at a higher level because it is involved in the sale of sugar, regulation of the sugar industry, and the export of sugar.

The crossed swords in the rich picture indicate tension or conflict between stakeholders. Tension exists mainly between the large-scale growers and the mill. There is an atmosphere of mistrust, which respondents described as resulting from various factors or perceptions that exist. Stakeholders were found to be operating in silos and mainly concerned about their own well–being. Tension also arises due to a perception that the executive leadership of the mill (headquarters or HQ) is only concerned with the well–being of shareholders, and that there is a lack of transparency about what occurs at the mill. Hildebrand (2002) points to the reality of the obligation to shareholders in private mills, who choose to stay on as investors only if they are able to realize economic returns. There is also a feeling that growers are price-takers who cannot influence the mill, and are hence at the mercy of the miller. It is critical for stakeholders to display commitment to the survival of the mill area, to focus on enhanced performance against competitors, and to avoid internal conflict (Hildebrand, 2002). The division of proceeds also appears to fuel the conflict between growers and the miller because it appears that growers are of opinion that they do not receive enough of the proceeds. This matter is, however, perceived as originating at the industry level, but it affects the local level as well.

The rich picture also illustrates conflict between hauliers and the large-scale growers, and hauliers and the mill. Poor performance from the hauliers negatively impacts on the miller and growers because it results in the deterioration of cane, which affects both parties. Effective communication between the various stakeholders was considered critical due to the high levels of interdependency.

This SSM investigation was not commissioned by a client as such, but formed part of a larger research project to explore the hard and soft aspects of the sugar industry. The client, as in the research of Al-Zhrani (2010), can be conceived of as partial clients who do not present as a single entity or company. The partial clients, as perceived by the researcher, are the growers, miller, and

HQ. The researcher assumed the role of practitioner in applying SSM to address the issues in the mill area. The issue or problem owners, as classified by the practitioner, are the growers, miller, HQ, hauliers, Sugar Research Unit, National Sugar Association, and Government. While the Government was not involved in this research, it would be useful to draw them in to become involved in addressing the issues facing the sugar industry.

Engaging in the rich picture transformed an unstructured problem situation into an expressed situation, and enabled the selection of relevant systems from the problem themes (Checkland, 1985). Checkland (1985) advises that the most critical issues be selected. Eight relevant systems relating to the issues identified through data analysis were selected and are listed below:

- Appreciation of the different stakeholders
- Improving the sustainability of small-scale growers
- Improving mill efficiency
- The consistent delivery of quality cane
- Improving communication
- Increasing cane supply
- Better division of proceeds
- Improving working relationships

Root definitions, CATWOEs, and conceptual models were consequently developed for each of the eight systems indicated above. The second SSM workshop was aimed at presenting the eight SSM models to the stakeholders and having them interrogate and take forward what they considered valuable. Participants were presented with the eight models and asked to vote for the issues that deserved attention. Participants then voted on what systems they considered to be most critical. Stakeholder appreciation, sustainability of small-scale growers, the consistent delivery of quality cane, cane supply, and division of proceeds were identified as critical issues. The outcome, based on tallying participants' choices, was to focus on a system for the consistent delivery of quality cane. The next section will outline the root definition, CATWOE, and conceptual model for a system for the consistent delivery of quality cane. The other systems are not presented in this paper.

Root Definition and Conceptual Model

Figure 2 and Figure 3, respectively, present the root definition and conceptual model corresponding to a system for the consistent delivery of quality cane.

A grower- and haulier-owned system, operated by hauliers, growers, and the mill, to enable consistent delivery of quality cane according to the defined rateable daily deliverables, by following good agricultural practices and ensuring efficient transport to the mill to enable the consistent delivery of quality cane, within the constraints of the availability of input resources and weather.

Figure 2. Root definition for the consistent delivery of quality cane.

C	Mill, growers
A	Hauliers, growers, mill
T	Enable consistent delivery of quality cane according to the defined rateable daily deliverables
W	Follow good agricultural practices and ensure efficient transport to the mill to enable the consistent delivery of quality cane
O	Growers, hauliers
E	Available input resources, weather

Figure 3. CATWOE (Customers, Actors, Transformation, Worldview, Owners, and Environment).

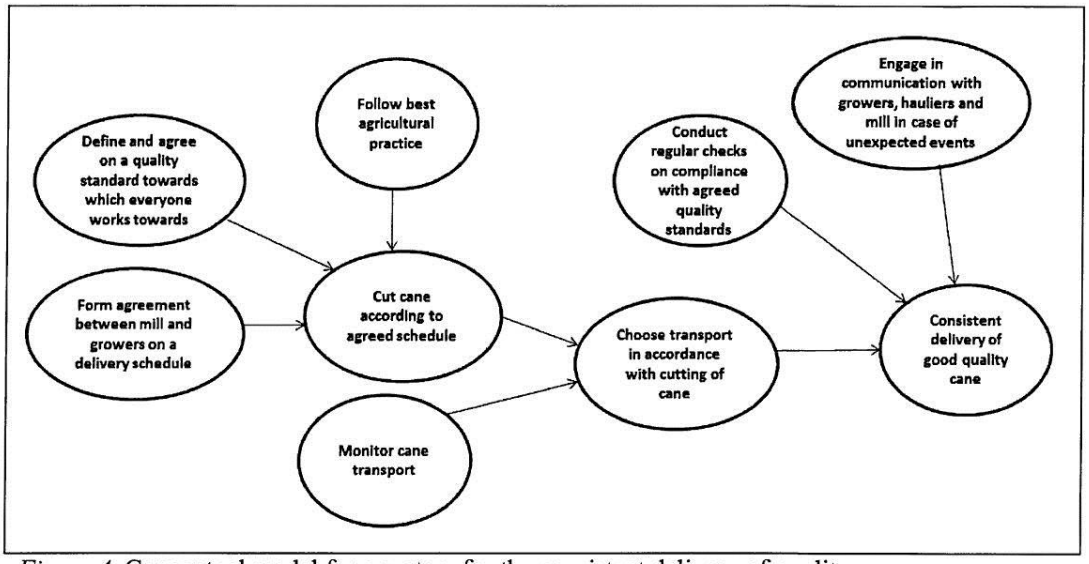

Figure 4. Conceptual model for a system for the consistent delivery of quality cane.

The conceptual model is presented in Figure 4. It is important to bear in mind that there is no right or wrong way of describing activity in conceptual models, and that it is about presenting descriptions derived from multiple, valid interpretations of viewing the world (Khisty, 1995).

Debate and Action

SSM workshop 2 took on a dialogical mode because participants presented their opinions on how to proceed in relation to the conceptual model (Figure 4) that was presented. Participants were encouraged to compare the model in relation to what occurs in the real world. A similar approach to Kayaga's (2008) study in using SSM in the water sector in Uganda was used, whereby stakeholders were encouraged to identify reasons for why the real world situation differed from the ideal model and how the situation could be improved. The conceptual model was therefore critical in initiating debate among the stakeholders.

The systems or models are merely devices to stimulate debate among stakeholders and should not be imposed on the situation (Luckett & Grossenbacher, 2003). The debate does not lead to an improvement of the models but to an accommodation of the perspectives and interests between the stakeholders (Luckett & Grossenbacher, 2003). In interrogating the conceptual model, participants observed that the National Sugar Unit would also have to play a critical role in ensuring quality cane through close working relationships and awareness of best practice with regard to cutting of the cane. The role of an efficient haulier was critical in ensuring quality cane. Participants also highlighted the role of effective communication between the stakeholders to ensure quality cane.

Participants suggested that a vehicle scheduling system be designed, which could involve the mill taking responsibility for haulage, or joint ownership by the miller and the growers. There was, however, concurrence that such action would require coordination between the stakeholders. Participants noted that there were currently approximately 17 hauliers in the mill area, and that ideally there should only be three or four. Such coordination, however, required a willingness to participate from all stakeholders, which was challenging considering that some were in a comfort zone.

Participants pointed to the need for all players to do what they do best (growers to grow cane, the miller to crush cane, and hauliers to deliver cane). It was also highlighted that there were currently three profit centres fighting against each other and that total buy-in and trust were pivotal. It was important to look past resource constraints in order for both parties to benefit. Participants also noted that as much as there was agreement between stakeholders at the workshop about taking action, the involvement of headquarters was critical, as well as commitment from the many growers in the mill area who would need to be approached by the grower leadership.

Evaluations of the workshop indicated that participants valued the opportunity to engage in discussions affecting the system. The workshop was described as practical and comfortable for participants to put forward their opinions. Awareness was raised that stakeholders had to jointly discuss common issues which no one party was able to resolve by themselves. It was also beneficial for stakeholders to see how the issues were overlapping. Stakeholders, however, noted that the attendance of key decision makers, such as the mill executive (HQ) and grower leadership, at the workshop would have made a huge difference. An interesting observation made by participants was that the sugar industry was complex and that it was difficult to implement change.

Based on the rich discussions that were held, possible actions that stakeholders could take to bring about improvement were identified. These actions included introducing one major haulier, investing in replanting and seedcane, improving cane quality, and mentoring for small-scale and emergent growers.

Discussion

The first SSM engagement with stakeholders identified a variety of issues affecting the sugar industry, as reflected in Figure 1. A benefit of SSM is that structural and social factors, which have compounded the problem, can be identified (Reid, Gray, Kelly, & Kemp, 1999). Through the SSM cycle, not only were stakeholders in the sugar industry able to view these issues, but also they were provided with the opportunity to jointly decide which issues to address to bring about improvement. Evaluations from the workshops indicated that stakeholders appreciated the opportunity to jointly discuss common problems plaguing the system. Reid, Gray, Kelly, and Kemp (1999) found that the SSM process organized a poorly-defined situation, which was perceived differently by various stakeholders. As Luckett and Grossenbacher (2003) also found in their research, SSM assisted in thinking about the multiple perspectives in the problem situation and surfacing political issues, as indicated in the rich picture in Figure 1.

This research, which employed traditional qualitative methods and SSM, brought together diverse stakeholders in the sugar industry who possessed different views on the problem, and who ordinarily may have dealt with the over-lapping issues individually. Problem structuring is significant in SSM and assists stakeholders in challenging their worldviews (Winter, 2006). Stakeholders were able to jointly discuss the problem situation and various related aspects. It was evident that stakeholders had engaged in learning, which according to Khisty (1995) is a central part of the SSM process required for participants to take action to bring about improvement to a problematical situation. As Luckett and Grossenbacher (2003) assert, learning occurs through debate about the differences between the conceptual models and reality. This was particularly important because stakeholders were able to jointly discuss issues, and most importantly to understand the worldview of other stakeholders. Cordoba and Farquharson (2008) argue that participants also engage in learning as their views on reality change.

Taylor, Baskett, Hughes, and Wade (2007), in their application of SSM, found that one restriction was that the audience might not have been aware of the methodology or willing to collaborate with other stakeholders. Participants in this research initially experienced resistance with the rich

picture exercise, and may not have realized, as Checkland (1985) described, the value of expressing the situation on paper as they lived through it day by day. Participants also indicated in the evaluations that they may not have been entirely honest about the issues that exist due to the presence of other stakeholders. It is thus critical to realize that stakeholders need to keep up appearances, which are necessary for ordinary real-world interactions. The limitation of SSM in not being able to bring about action in such a situation with the described stakeholder dynamics can be better comprehended using Jackson's (as cited in Warren, 2002) System of Systems Methodology (SOSM) grid. The sugar industry can be classified as complex, displaying both pluralist and coercive aspects. A pluralist situation is characterized by participants in a problem situation who are able to reach consensus or compromise, despite differences in interests and objectives (Mingers & Brocklesby, 1997). A coercive situation, however, is defined by inherent conflict, thereby preventing compromise, and resulting in the use of power to reach an outcome (Mingers & Brocklesby, 1997).

A limitation in this research was that senior decision makers, particularly from the mill, could not be present, thus preventing a firm commitment to taking further action. Checkland and Poulter (2006) outline the reality of not always being able to include senior people in SSM investigations because of their demanding schedules. In addition, stakeholders could not openly discuss issues because of power roles. Checkland and Poulter (2006) found that people are generally reluctant to discuss the culture and politics of a situation because they feel they are familiar with it, but that this is merely a manifestation of their "this is the way we do things around here" attitude. Cordoba and Farquharson (2008) also found in their SSM engagement that younger and less experienced participants were not willing or able to participate in in-depth discussions, thus leading the researchers to deduce that the presence of hierarchy and expertise limited effective interaction. Luckett and Grossenbacher (2003) argued that the political and cultural aspects of the study might be influenced by who the researcher chooses to involve in the investigation. This research study was, however, open for all stakeholders in the mill area to attend.

As suggested and defined by Checkland and Poulter (2006), the researcher can also use SSM to examine the roles, norms, and values, and the inherent political nature of any human social system. Roles refer to the differences in social position among people in a group, which can be formal, through titles held, or informal. Norms represent the expected behaviours that correspond with a role, whereas values signify the standards people use to judge behaviour. Checkland and Poulter (2006) recommend that the practitioner reflect on these three elements in a situation. With reference to the problematical situation, we gradually became aware of marked differences in roles, norms, and values between the miller and growers, which are discussed below.

Growers are individuals tasked with the sole responsibility of attaining success, and who are expected to excel in a variety of areas such as farming, managing labour, utilizing business skills, planning, strategizing, and engaging in effective decision making. Growers may use their limited capital outlay to only invest in sugar cane farming, and will thus be reliant on the miller. They have fairly simple operations and business structures in place, which do not necessarily have to be concealed from other growers to attain a competitive edge. They may not only strive for profits but if losses are incurred, the grower as an individual suffers.

The miller is a corporation with a formalized, hierarchical structure and a clear line of authority, with people at different levels who are tasked to perform certain functions. The miller naturally has a business edge through ready access to diverse skills and resources. With a large capital outlay, the miller has a responsibility first and foremost to shareholders. The organizational culture impacts the extent to which the miller is able to share information and strategy with stakeholders.

Based on the above analysis of the roles and norms, growers' values may center on transparency, rapid decision making, ground level interaction, and not only on profit making. The miller on the other hand, may expect growers to be united and to display business skills, and an appreciation for attaining profits. This analysis is critical as the differences in roles, norms, and behavior between stakeholders could limit the effectiveness of the debate and action stage in the SSM process.

Another useful analysis in the investigation was that of considering how power is expressed in the situation (Checkland & Poulter, 2006). Issues relating to the attainment of power, how it is manifested, and its evolution can be examined (Khisty, 1995). This will be in the form of identifying commodities, which will indicate where power is located in the situation (Checkland & Poulter, 2006). It appeared that the miller had the dominant power by possessing the commodities of financial, human, and intellectual resources. It was also clear that large-scale growers held more power than small-scale and emergent growers due to being well established and familiar with the industry. Cordoba and Farquharson (2008) thus recommend that ways be found to improve the ability of SSM to assist participants to deal with issues around power and how they work within the status quo, and not just to reflect on norms, roles, or values of the problem situation.

This study has illustrated the methodological value of SSM. It was found that the methodology not only allows researchers to identify issues, but also allows stakeholders to present their perspectives on the multiple and overlapping issues that they face. This research has clearly illustrated the reality of multiple, valid perspectives that various individuals hold. The study highlighted how the methodology facilitates a systemic perspective by avoiding a situation where the researcher only focuses on one stakeholder group or on a narrow range of issues. The investigation further emphasized how researchers can gain valuable insight into a study context by engaging in analysis of the roles, norms, values, power, culture, and politics of the problem situation. It was also observed that SSM enables participants, through collective engagement, to identify actions to bring about improvement to these issues. Such engagement also facilitates collective learning among participants because they gain a systemic perspective from rich conversations. These conversations also illustrated how social reality is constructed and reconstructed. The debate that emerges challenges participants' worldviews and provides insight into how to deal with the problems, which ones to address, and how all stakeholders can contribute to bringing about improvement. This methodology highlighted how to engage participants to hear their perspective; this is in line with the principles of qualitative research, where the researcher is not far removed from respondents, and does not come across as the expert.

The study emphasized the value of the diverse SSM tools (rich picture, root definitions, CATWOE, and conceptual models) with which to engage respondents and facilitate debate. The rich picture, in particular, affords the researcher the opportunity to explore the subjective interpretations of participants by analyzing stakeholder goals, values, and perspectives. These SSM tools increase the validity of the research, and provide participants an opportunity to examine the accuracy of the findings, and in so doing, give further meaning to the collaborative aspect of this type of research.

It is also useful to reflect on the limitations of this methodology. As much as SSM provides an opportunity for identifying actions that stakeholders can take to bring about improvement, problems may arise in getting participants to take ownership. Stakeholder participation in the SSM process is therefore critical in influencing the extent to which stakeholders are able to bring about change. There is no guarantee that the methodology will facilitate open and honest dialogue; in fact, a certain maturity and willingness is required from participants. Dynamics and structures in the real world, such as organizational policies, procedures, and culture, as well as

power dynamics, can also affect the SSM process. An enabling environment, along with support and participation from senior decision makers is pertinent to the success of the methodology. Although the methodology provides tools and clearly sets out the stages of the SSM process, there is a lack of guidance for the researcher, who is the key instrument in qualitative research, on how to facilitate beyond the mere identification of issues, and on how to work through the issues to eventually enable action.

Conclusion

The aim of this exploratory research was to explain, illustrate, and critique SSM by reflecting on its application in the sugar industry. This research used traditional qualitative research and SSM to organize and structure thinking about a messy situation where multiple human interactions created complexity. Issues of a traditionally technical nature, such as cane quality, cane supply, and transport, were identified, as well as issues that were related to stakeholders' perceptions of their reality. SSM tools were developed to allow stakeholders to view the situation, and jointly debate how to bring about improvement. Discussions from the workshops resulted in the compilation of a list of possible actions needed to bring about improvement. Due consideration was given to who should be involved, what the limitations were, and what actions should be taken. Roles, norms, values, and power relations in stakeholder interactions in the sugar industry were described. The research revealed the importance of the involvement of all relevant parties, especially those with power and decision-making abilities, to bring about action through the SSM process.

This study, which was the first to apply SSM in the sugar industry, was significant in indicating the value of this methodology. The research illustrated the importance of not only focusing on traditional "hard" aspects alone to solve industry problems, but also the "softer" aspects underpinned by human perceptions and accompanying worldviews. From a methodological perspective, this investigation was particularly valuable in being able to both identify and address issues affecting various stakeholders, who ordinarily may not have had the opportunity to jointly engage in shared concerns about the sugar industry. Furthermore, this study employed a holistic perspective, analyzed the problematical situation, and avoided only focusing on one area of concern or one particular stakeholder group. This research also facilitated the awareness of the interdependence among stakeholders in the sugar industry, and the need to find a common identity, despite the pursuit of individual goals and objectives. Given the complexity of the problematical situation and the overlapping nature of the multi-faceted problems, no-one stakeholder group is in a position to address these problems alone. Stakeholders were able to explore reasons for differences between the real world and the ideal scenario as presented in the models. This methodology enabled a collaborative relationship between researcher and respondents, and provided tools for the researcher to gain insight into the multiple perspectives, values, roles, and norms that were held by different individuals in the study context. It was found that facilitation skills were critical in navigating the methodology. Limitations of the methodology include the following challenges: (a) getting participants to take ownership, (b) getting participants to engage in honest dialogue by displaying willingness and maturity to address the issues, and (c) getting participants to move past real-world organizational dynamics.

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CHAPTER 5: MANAGING LEARNING AND CHANGE: FACTORS INFLUENCING THE EFFECTIVENESS OF SOFT SYSTEMS METHODOLOGY

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Managing Learning and Change: Factors Influencing the Effectiveness of Soft Systems Methodology

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Abstract

Soft Systems Methodology (SSM) aims to bring about learning and change in problematical situations. This study explored the application of SSM in the sugar industry and identified factors that play a role in achieving such outcomes. The qualitative research approach was used. Stakeholders were engaged in interviews and workshops. Data were analysed using thematic analysis. The findings were that critical factors such as starting conditions, time allocated, grouping of participants and prompts by the facilitator affect the SSM process. These factors – along with strategic initiatives led by significant participants that occurred behind the SSM scenes – were found to impact on the extent to which participants were able to confront the issues, engage in learning, and consequently take ownership of the implementation of the proposals directed at change.

Keywords: *Soft Systems Methodology (SSM); systems theory; complex systems; qualitative research; sugar industry.*

1. Introduction

While Soft Systems Methodology (SSM) aims to bring about learning and change in problematical situations, there is a need to examine which factors influence the effectiveness of this methodology. Pala, Vennix and van Mullekom (2003) make a call for systemic studies into the effectiveness of SSM as a methodology – to enrich the learning process of SSM users and practitioners and to produce knowledge about why and how SSM leads to its outcomes. Users of SSM need to be prepared for possible challenges in bringing about change and must be aware of how social processes occur (Brocklesby, 2007). Furthermore, competencies to ensure the success of the methodology must be identified, as well as insight into which of the SSM tools contribute to the success of the methodology and under which conditions – while accounts of facilitation by users should be provided (Pala et al., 2003). Such areas of exploration can be used to enhance the methodology (Salner, 1999).

The current SSM study was conducted in the sugar industry, in a developing country context. The identity of the mill area is not revealed for confidentiality reasons. The sugar industry is defined by diverse stakeholders who engage multiple activities in their own domains to eventually realise the final product. The main stakeholders are growers who grow the cane, hauliers who transport the cane from the grower to the mill, and millers who process the cane. There are also stakeholders involved at industry level. SSM was considered a suitable methodology to use in this context as stakeholders were found to pursue different goals and objectives, and have multiple perspectives on the problems in the industry and how best to address them.

The process that the practitioner followed in employing SSM will be reflected on in this paper, with consideration given to how learning and change is impacted on by factors such as facilitation, group processes, decision making, power, leadership, and conflict.

2. Literature Review

SSM is used by practitioners and academics in various applied disciplines and countries (Jackson, 2003). SSM provides an action-oriented and flexible means of addressing problematical situations – to bring about action to improve (Checkland & Poulter, 2006). Reference is made to 'problematical situations' as opposed to 'problem situations' "since

they may not present a well-defined 'problem' to be 'solved' out of existence", as argued by Checkland and Poulter (2006: 3). The four stages of the SSM cycle, as described by Checkland and Poulter (2006), will be briefly elaborated on. The methodology originally consisted of seven stages – but these are now condensed to four. The first stage is about ascertaining the problematical situation, along with an analysis of the issues, culture and power. Rich Pictures are commonly employed to illustrate stakeholders, structures, processes, and their concerns or interests.

The second stage involves constructing relevant purposeful activity models, based on a particular worldview. The description of the activity systems to be modelled is stated in root definitions, which illustrate the what, how and why of the system. The PQR (do P, by Q, in order to help achieve R) formula is also used to develop the root definition. A general model of purposeful activity is then presented using the CATWOE – to represent: Customers who are the beneficiaries or victims, Actors who are the people who do the activities, the Transformation, the Worldview, Owners who can prevent or change the activity, and Environmental constraints. In the third stage, the models are then used to debate differences between the real world and ideal world, as presented by the models. Ideas for action to bring about change that is desirable and culturally feasible are identified – with the aim of seeking accommodations in the fourth stage (Checkland & Poulter, 2006).

Different worldviews and perceptions of reality are examined and challenged using this systemic methodology. The aim is to enable learning that can result in action for improvement, and in so doing participants can determine what is feasible and desirable in their context (Jackson, 2003). Salner (1999) classifies SSM as a qualitative research methodology due to the analysis of verbal data and emphasis on interpretation and self-reflexivity. SSM is underpinned by the systems thinking approach, in that the methodology does not prescribe to the reductionist stance of the natural sciences (Checkland, 2000). SSM is a different form of research (action research), whereby the facilitator enters and participates in a human situation, and draws on such experience (Checkland & Poulter, 2006).

SSM, which embraces the soft systems approach, brought about a radical shift from the hard systems approach which was classified as functionalist (Jackson, 2003). The hard systems approach is realist, whereas the soft approach is subjectivist or constructionist (Christis, 2005). SSM is underpinned by the phenomenological and interpretive approach, and acknowledges that social reality is continuously reconstructed, and does not correspond to the view that social reality is static and best studied by the objective outside observer (Checkland & Poulter, 2006).

The hard systems approach entails clearly-defined objectives which are achieved through engineering, whereas human-activity systems are classified as messy and ill-defined (Khisty, 1995). Hard systems approaches are suitable at the operational level when there is clear agreement on the goals to pursue and the ways to accomplish such goals (Khisty, 1995). Hard systems methodology accepts goal-seeking behaviour, and uses words such as 'problems' and 'solutions' (Khisty, 1995).

SSM embraces the complexity paradigm (Khisty, 1995). Complexity in problematical situations is defined by different assumptions, as well as multiple relationships and views of reality (Checkland & Poulter, 2006). Problematical situations are dynamic and are composed of purposefully acting individuals – with ever-changing interactions resulting in novel occurrences, descriptions and actions (Brocklesby, 2007). Levy (2000) notes that multiple, complex interactions are visible in economic and social systems. From an ontological perspective, complexity theory discounts the concept of the rational actor with the aim of maximising an objective – as it does not consider the dynamic nature of systems (Levy, 2000).

SSM allows for the exploration of means to handle complexity, and does not seek a solution to an obvious problem (Checkland, 2000). Khisty (1995:106) notes that SSM is applicable "to deal with messy, confusing, and complex problems residing in the swampy lowlands". SSM is a systemic methodology that deals with problems in the real world (Khisty, 1995). Christis (2005) points to the reality of certain situations whereby it is not possible to define the problem – thus requiring a soft systems approach. Such problems in the real world require participation and learning, which are found in the SSM process (Khisty, 1995).

The SSM user should focus on the problematical situation, and the methodology with its set of principles should guide the user in flexibly applying it with the participants – considering their unique context (Checkland & Poulter, 2006). The facilitator's skills become critical in engaging participants in a learning experience and controlling group dynamics (Molineux & Haslett, 2007). Drawing out and working with multiple and possibly conflicting worldviews, especially in the debate and action stage, could be challenging for the SSM user. The facilitator therefore has to be adept in a number of areas, especially when acknowledging that intervention does not occur in a static context – but rather in a dynamic and unpredictable system.

Some of the challenges in facilitating SSM workshops, as found in previous research, are briefly discussed below. Kreher's (1994) study noted how difficult it was for the user to keep track of happenings which are critical in coping with complexity and ensuring coherence. Communication and consultancy skills are also required to manage SSM

interventions (Kreher, 1994). Luckett and Grossenbacher (2003) found that the composition of the group played a role in reaching accommodation in their research, as they involved implementers and not lower-level staff or the public – which according to them could have resulted in disagreements and conflicting perspectives, as well as another take on the political and cultural dynamics of the situation. Molineux and Haslett (2007) recommended that in order to maximise creativity from the SSM process, there should be a diverse group, sufficient organisational and senior management support, adequate time, a positive climate with a sense of challenge but also enjoyment, and intrinsic motivation and willingness to collaborate. It is a challenge for the practitioner in SSM to ignite the couplings, address the deep-rooted perspectives, get people to understand that their worldviews may not reflect reality, shift the situation, get the conversations to flow, and also manage the emotions (Brocklesby, 2007).

3. Research Methodology

The SSM study was conducted in the sugar industry and used an exploratory research design. The study drew on the qualitative research approach. The empirical component of the study commenced in July 2010. Ethical clearance was obtained.

Fieldwork consisted of semi-structured interviews and SSM workshops, as highlighted in Table 1 below. All interviews and workshops were conducted in the mill area. The interviews were semi-structured, conducted face-to-face, and on a one-on-one basis. The interviews enabled the stakeholders to share their in-depth opinions and perspectives on the problem. Interviews lasted approximately an hour and were digitally recorded and transcribed to facilitate data analysis. The workshops, each lasting half a day, were facilitated by the facilitator. The facilitator took notes during the workshops to enable data analysis. Data were analysed using thematic analysis.

Table 1. Description of interviews and SSM workshops

	Interviews round 1	**SSM workshop 1**	**SSM workshop 2**	**Interviews round 2**	**SSM workshop 3**	**Interviews round 3**
Purpose	Practitioner to gain initial understanding into problematic situation	Participants to construct Rich Pictures	Practitioner to present SSM tools to engage debate for participants to take action	Participants to propose recommendations to bring about action	Participants to take action	Participants to propose recommendations to bring about action
Date	13-15 July 2010	22 September 2010	27 October 2010	27-28 October 2010	22 March 2011	22-24 March 2011
Total participants	12	8	11	11	15	14
Breakdown of participants	6 growers, 3 millers, 1 haulier, 1 industry representative, 1 grower-miller body	2 growers, 3 millers, 1 haulier, 2 industry representatives	8 growers, 3 millers	8 growers, 3 millers	7 growers, 4 millers, 4 industry representatives	6 growers, 4 millers, 4 industry representatives

The purpose of the first round of interviews – held on 13-15 July 2010 – was to gain insight into the context. This was the first meeting between the facilitator and participants, and it was therefore important to build rapport. Interview questions were focused on understanding the goals of the various stakeholders, assessing communication and trust levels, challenges, mechanisms to address difficult matters, stakeholders' contribution towards ensuring success, and how the system could be improved. An initial analysis of this data revealed that there were stakeholder concerns mainly focused around cane quality, cane supply, mill efficiency, and the division of proceeds.

The practitioner then next interacted with participants at the first SSM workshop, which was held on 22 September 2010 in the mill area. This, in essence, represented Stage 1 of the SSM process, which entails discovering more about the problematical situation. This workshop consisted of having the participants engage in constructing Rich Pictures. The purpose of the workshop served to enable stakeholders to provide their perspective into who they considered to be stakeholders, and what the issues or concerns of such stakeholders were.

This allowed the facilitator to gain further insight into the problematical context, and, most importantly, to gather data which could complement initial data gathered from the interviews. Participants were provided with an overview of Rich Pictures, and were encouraged to use minimal words, and to utilise cartoons or stickmen. Participants were provided with a flip chart and markers, and were asked to visually represent who they thought the different stakeholders were, and what their issues were. Examples of Rich Pictures were also provided.

Participants were then divided into two groups. The first group consisted of a grower, two mill representatives, and an industry representative. The second group comprised a grower, haulier, mill representative, and an industry representative. The practitioner then attempted to provide minimal interference – but where needed asked questions to stimulate the creativity of the participants or answered their questions. Approximately one hour was allocated, and participants then had to present their Rich Pictures. Participants had to summarise their pictures, explain what it all meant, why they drew what they did, as well as present the challenges that arose in drawing the pictures.

Participants were thereafter asked to engage in a Knowledge Café exercise. This entailed having a table host who would lead the discussions throughout, and essentially elicit issues from the two Rich Pictures – and note them on flip-chart paper. Groups were allocated approximately 15 minutes per Rich Picture, and were then requested (everyone apart from the table host) to move to another group. There were thus eventually two tables, with each group having an opportunity to look at the two Rich Pictures. When the Knowledge Café was concluded, the flip chart was placed on the walls and participants were then requested to vote for the issues that they felt warranted attention. It was pointed out that this would allow the facilitator to direct energy to the most deserving issues. The workshop concluded with the practitioner requesting the participants to evaluate the workshop. Evaluations of each workshop were done after each of them concluded – and focused on participants describing their experience and whether they were able to think differently about the real world. They were also requested to reflect on how the workshop could be improved, and they had to draw lessons and provide suggestions on how the various stakeholders could move forward.

The facilitator then engaged in intense data analysis, to enable progress towards the next stage in the SSM process. Data from the initial interviews, as well as data (Rich Pictures, flip charts summarising the issues from the Knowledge Café, evaluation forms) from the first SSM workshop, were carefully examined. This analysis essentially culminated in the construction of the SSM tools (CATWOEs, Root Definitions and Conceptual Models) – which corresponds to the second stage of SSM. These SSM tools would be presented to the stakeholders to debate about how these ideal models compare to the real world. The relevant systems were: 1) appreciation of the different stakeholders; 2) improving the sustainability of small-scale growers; 3) improving mill efficiency; 4) the consistent delivery of quality cane; 5) improving communication; 6) increasing cane supply; 7) better division of proceeds; and 8) improving working relationships.

The practitioner was then ready to approach participants to debate about how the real world differs from the ideal world – as represented in the SSM tools that were constructed. This represented the third stage of SSM. The aim of the second workshop – which was held on 27 October 2010 – was therefore to present the SSM tools to the stakeholders so that they could discuss them, but was also to stimulate their thoughts on which systems could be of interest to them in taking action to bring about change (this is characteristic of the fourth and final stage of SSM).

The workshop commenced with a brief presentation reviewing the purpose of the workshop, and preceding stakeholder engagements. Three mill representatives and eight growers participated. Participants were asked to vote for the issues that most deserved attention (based on the eight systems that were developed). Stakeholders were most keen to work on improving the delivery of quality cane. They then had an opportunity to engage the relevant systems that they had selected – by way of a group discussion facilitated by the facilitator. Using the SSM tools as an initial basis to generate ideas, the practitioner then facilitated discussions between the stakeholders who shared their perspectives on the way forward. The workshop concluded with stakeholders evaluating the workshop.

The facilitator also took the opportunity to engage stakeholders in a second round of one-on-one interviews during 27-28 October 2010 – held immediately after the second SSM workshop. The interviews aimed to explore respondents' views on working relationships between stakeholders, transparency, leadership, communication, competitiveness and issues pertaining to cane quality, cane supply, the payment system and mill efficiency. These topics in the semi-structured interview guide essentially corresponded to the relevant systems that were developed in Stage two of the SSM process. The interviews were also important in giving stakeholders an opportunity to discuss their thoughts on the issues on a one-on-one basis with the practitioner – and were therefore particularly valuable to those who were not comfortable with expressing themselves in the workshop.

The facilitator then engaged in data analysis – drawing on data from the second SSM workshop and the October 2010 interviews. This analysis enabled the practitioner to identify areas for potential change, and to understand which recommendations were desirable and culturally feasible. The facilitator was able to see that participants were keen on exploring the following actions to bring about improvement to the problematical situation: reducing the number of hauliers, investing in replanting, improving cane quality, and providing mentoring for small-scale and emergent growers.

A third and final SSM workshop was conducted on 22 March 2011. The purpose of the workshop was to give participants a final opportunity to take forward discussions from the previous workshops and to encourage discussion on how they could further improve the problematical situation. Participants again had an opportunity to evaluate the

workshop, upon conclusion.

A final round of interviews on 22-24 March 2011, was held immediately after the SSM workshop, and concluded the fieldwork in the study. Interview questions centred on obtaining suggestions from stakeholders in order to improve on the various issues that were identified – such as miller-grower conflict, haulier inefficiencies, the payment system, communication, cane quality, and cane supply.

The SSM workshops and interviews were essentially aimed at moving from problem identification to getting stakeholders to take action to address the multiple, overlapping issues facing them.

4. Results

4.1 Starting conditions

A timely start appeared to be critical in facilitating the SSM workshops well, as the late arrival of participants disrupted both the practitioner and participants. Low participation in the first SSM workshop was identified as a challenge by participants – who indicated that broader participation would have been valuable. The practitioner sensed that it was important for the participants to warm up to the facilitator, to each other, and to the idea of participating in the research. This was to be expected, as these stakeholders were ordinarily based at the mill or on a farm.

Participation by the same people appeared to be essential to maintain momentum in the SSM workshops. This could have facilitated compatibility amongst stakeholders. This was detected in the second and third SSM workshops – with the arrival of new participants. This may have also affected outcomes, as time was required for the facilitator to explain the process to the new participants.

The 'old' participants who remained throughout the process were familiar with the research process, whereas the new participants had to be informed and could also not track the flow of events through the SSM workshops. New participants who lacked this perspective were fed information by other participants – possibly resulting in their worldviews being influenced. The practitioner also became aware that some stakeholders, especially those involved in miller and grower committees, had a systemic perspective, which enabled them to make a better contribution than the others. The practitioner noted how two participants in one of the workshops could only raise concerns pertaining to their farms.

Pressing, momentary concerns, such as the weather, had to be carefully managed, as this could have negatively impacted on other important issues and crept into valuable time – but yet were important for the stakeholders. Initial discussions in one of the workshops focused on the lack of rain and how the drought was affecting farmers and the miller.

It was important to be familiar with the professional jargon of the sugar-industry context. The practitioner realised how valuable it was to have critically analysed data from the initial interviews – before meeting stakeholders in the SSM workshops. It was also necessary to simplify the technical terminology of SSM. The degree of information to share about SSM was an important call to make, as it was necessary to inform participants about the methodology, but also to ensure that they did not lose interest. Participants may have been surprised at the interactive nature of the workshops where they were required to be active – rather than passive participants.

The choice to have participants construct the Rich Pictures rather than have participants critique a Rich Picture constructed by the facilitator – could have also influenced outcomes. Needing to draw was a source of frustration for a few, while others even wanted a second chance to adapt the pictures after having viewed the Rich Picture of the other groups. It also appeared that certain participants were more concerned about their lack of artistic ability, and hence did not seem to meaningfully engage in discussions while drawing.

4.2 Time allocation

Managing the time proved to be a challenge, as participants had extremely busy schedules. The workshops could only be scheduled for half a day – thus placing pressure on the practitioner to make the most of the available time.

4.3 Grouping

As reflected in Table 1, the workshops were attended by diverse stakeholders. Group allocation was a difficult issue. Self-organisation and forced grouping each have their own benefits and costs. It was also critical to consider whether it was better to have homogeneous stakeholders in one group, or to have diversity. The latter was selected as the best approach, in order to allow for rich discussions to emerge from the sharing of multiple viewpoints.

In the first SSM workshop, it was observed that the haulier (the only representative haulier) appeared to be

uninvolved and could have possibly felt overwhelmed by the miller and grower stakeholders who were rather emphatic in raising their own concerns.

There was awareness amongst group members of a difference in perspective, which some were able to acknowledge, openly challenge and justify – whereas others could not and may have withdrawn. A participant in one group in the first SSM workshop openly reflected on whether government plays a role – to which another participant immediately indicated that he was of view that it did not. The member who asked the question then disagreed and argued that it did, as government was involved in matters concerning land affairs. This difference in opinion was then brushed aside.

Managing emotions and conflict were particularly challenging in the third SSM workshop. Debate ensued between a grower and mill manager (who had previously not attended the workshops) – as the grower believed that the mill headquarters had lost contact with grower needs and was merely concerned about its shareholders. Both individuals stuck to their viewpoints and argued for nearly 15 minutes. The practitioner initially tried to intervene, but eventually let the argument take its course. There was both value and danger in such furious and explicit display of diverse and conflicting perspectives.

4.4 Prompts

Participants had to be prompted in the first workshop, when it was observed that they experienced difficulty with the construction of the Rich Picture. The actions of the practitioner, in for example, suggesting a certain stakeholder group in order to stimulate the creativity of participants, may have influenced the outcomes of the exercise. The practitioner also had to refrain from interfering with what emerged on paper. For example, it appeared that one group had over emphasised actual processes in the sugar-cane supply chain, such as illustrating effluent from the mill – whereas the other group had less on paper, but at the same time was able to articulate well the issues that exist with stakeholders.

4.5 Influence of significant participants

Senior decision makers or leaders were not present in the first two workshops and this was acknowledged by participants. The third workshop was different in that both the grower and miller leadership took part – possibly due to encouragement from those who attended the first workshop. The emergence of these two significant individuals appeared to add value, but also seemed to hamper the other participants from speaking freely, as was observed in the previous workshops. The presence of the leadership could have resulted in participants being guarded about sharing their views. It was noted that participants seemed to steer clear of contentious issues and thus did not really delve into the 'soft' issues such as communication, stakeholder appreciation and working relationships – which were raised as concerns in the interviews. It was, however, mentioned by the leadership and other participants that it was critical for them to attend and to be exposed to the various issues.

4.6 Strategic initiatives behind the SSM scenes

While facilitating the third workshop, the practitioner became aware that the grower and mill leadership were involved in strategic initiatives, to which most of the participants and even the practitioner had not been privy to. The grower leadership actually approached the practitioner before the workshop to mention that high-level dealings were occurring and that certain sensitive matters should not be raised during the workshops.

Not all growers were part of the leadership and were thus perhaps unaware of such developments. Staff at the mill may also have not been informed about these high-level interactions. The leadership – in the interviews and third workshop – stated that it was not feasible for everyone to know about strategic matters, and that interviews should only be conducted with people who are in formal, local structures. The practitioner was left wondering whether the attempt to have the participants take action did not possibly interfere with these discreet dealings between miller and grower leadership, who may already have had plans in place to address some of the issues. This, however, made the practitioner understand why ordinary participants were reluctant to volunteer to take action.

4.7 Confronting the issues

The Knowledge Café exercise was valuable in concluding the first workshop, as it provided a mechanism to pull together the content of the Rich Pictures, and to leave participants with a clear idea of issues which they had identified. It was

reassuring to detect confirmation of the problems (as represented in the eight relevant systems that were constructed) in the second workshop – based on the discussions between participants.

Much of the time in the second workshop had to be dedicated to discussions about the issues, despite some participants acknowledging that the problems were not new to them. The practitioner pondered whether SSM is less effective when stakeholders are well aware of the deeply entrenched issues, but are unable to take the initiative to bring about improvement.

Participants were not able to openly discuss matters of significance. Mention was made of the difficulty with freedom of expression in a diverse group, given the fear of damaging relationships. Participants indicated that not all ideas were captured and that some issues – that may have come to light with more time or a wider spread of participants – may not have been highlighted. The last round of interviews and evaluation forms highlighted that participants agreed about the issues which were identified, but it was clear that they were unable to fully engage with the findings, possibly due to issues around power.

4.8 Implementation and ownership

A significant problem arose during the second and third workshops when the facilitator suggested that proposals for intervention be taken forward, after stakeholders had easily identified actions. It was challenging to get participants to agree on who would take responsibility for doing this. Participants were reluctant to volunteer and often seemed to defer responsibility to the practitioner. The question as to how the practitioner could do this for the participants, was often raised.

A lack of time and resources (financial and human capital) to take forward the suggestions was noted. Some argued that even though there was agreement about the findings and about the need to address the concerns, further discussion was required to invoke a supportive environment for change. The complex nature of the sugar industry was also raised as an inhibitor to action, as it was pointed out that it was difficult to implement change in the industry. It was also highlighted that there had been some improvement and that there was continual change.

4.9 Value of SSM

Despite some initial difficulty in drawing, participants were quite impressed by the value of the Rich Picture exercise – which they described as interesting, thought provoking, and a mechanism for re-evaluating the problems. They appreciated that insight was gained into other stakeholders, and that they were literally able to look at the whole picture and not only at problems affecting one party. Participants acknowledged how important it was to understand how the actions of one group affected other stakeholders, and that stakeholders were operating in silos and acting according to their own agendas. It was also mentioned that the challenge was to identify links that could increase efficiency. The exercise created awareness for interdependence and skills to effectively handle complexity and multiple players.

The other two SSM workshops were focused on presenting the SSM tools to participants and having them debate and take action. Although stakeholders did not appear to directly engage the CATWOEs and conceptual models, these tools appeared to ignite initial discussions. These workshops were viewed as informative. The workshops were also practical and stakeholders enjoyed discussing issues that were plaguing the system. Participants described having had open, frank and good discussions, and being content that their input was acknowledged.

The value of being able to raise and discuss issues was noted, and that issues were reaffirmed. Participants expressed satisfaction with having had the opportunity to share their views, and hear other stakeholder's opinions on the problems. Stakeholders noted the need for better communication, trust and innovative thinking. Participants were able to experience and view the conflict, mistrust and (mis)perceptions that exist, and see the need for increased transparency – as well as effective and open communication about common issues.

5. Discussion

It is useful to agree with Khisty (1995), in stating that readers may be critical about the time taken to conduct the study or the way in which it was conducted – but that it was important to bear in mind that each human situation is unique and needs a unique remedy. Another consideration is that the SSM interventions, as pointed out by Brocklesby (2007), did not actually occur in the natural setting – but rather through workshops designed to have people engage problems. Such interventions do not have the natural structural coupling, and conversations may not flow as they would normally do in the real world (Brocklesby, 2007).

Checkland and Poulter (2006) recommend that individuals involved in the context conduct the SSM cycle – but that it can also be facilitated by knowledgeable people. The practitioner – being an external party to the sugar industry – noted this point, and analysed the initial interviews to gain insight into the study context. Checkland (2000) cautioned that the 'soft' in SSM did not mean that the study had to be conducted carelessly. Kreher's (1994) research highlighted the need for abstract thinking and thorough analysis in SSM studies, in order to avoid hasty conclusions about defining the problem.

SSM studies are not concerned with repeatability criteria, but data in SSM research must be easily accessible and explicitly outlined in terms of thinking and activity, in order to serve as evidence to back up stated conclusions, and for outsiders to comprehend the process and outcomes (Salner, 1999; Checkland & Poulter, 2006). This can also be valuable to complement research involving hard systems approaches which may be done in conjunction. It was useful, as recommended by Checkland and Poulter (2006), to consider the unique aspects of the problem situation and to realise that these were not standard problems. It takes judgement and interpretation on the part of the practitioner to recognise a problem situation (Checkland, 2000).

As described by Reisman and Oral (2005), the role of the SSM user can be compared to that of a physician, who, before making a diagnosis to lead to a treatment plan, must identify the symptoms, gather history, analyse records, conduct an examination, and perhaps order tests. Such an approach, which is equivalent to gaining a systems view, is used to gain a description of the system (Reisman & Oral, 2005). It was challenging to describe events involving many people with their diverse worldviews, and, as noted by Khisty (1995), it was not possible for the practitioner to comprehensively do justice in describing their lived experience.

The practitioner led the participants to focus on a few issues that were identified through the process of data analysis. It takes judgement on the part of the practitioner to decide which concerns deserve most attention (Jackson, 2003). All experiences and accounts are observer-dependent, and it is important for scientists and others involved in knowledge production to take accountability for choices and actions (Brocklesby, 2007). Checkland and Poulter (2006) are emphatic in stating that the onus is on the user, and not on the methodology, to engage in thinking. The practitioner has to be aware of his or her thinking during the SSM process, and should avoid formula-driven thinking or the imposition of structure, in order to identify new insights (Checkland & Poulter, 2006).

Khisty (1995) highlights that it is impossible for problem solvers to remain entirely neutral. Bergvall-Kareborn, Mirijamdotter and Basden (2004) point to how modelling in system design is constrained by personal perspectives and cultural feasibility. It is also important to bear in mind that the aim is not to identify a permanent solution – due to the inherent complexity (Checkland & Poulter, 2006). This was attested to by participants, indicating that there had been some improvement since the practitioner first intervened.

During the debate stage, as recommended by Checkland and Poulter (2006), the practitioner ensured that the models were close by – for referral when needed. It was however found that participants experienced difficulty in connecting with the root definitions, CATWOEs and conceptual models. These SSM tools appeared to merely facilitate rich discussions (Brocklesby, 2007).

Kreher (1994) found a strong correlation between client readiness for SSM, and participation and commitment. The involvement of stakeholders in SSM is critical, and increases the chance of seeing implementation accomplished (Reisman & Oral, 2005). Participants in this study demonstrated interest, and were able to identify actions. The SSM process may not necessarily produce the most effective actions, however, and it is necessary to examine the effectiveness of the actions before actual implementation in the real world (Pala et al., 2003).

Kreher (1994) found that students who conducted SSM studies experienced difficulty in getting stakeholders to take ownership of the intervention process. Checkland and Winter (2006) – in reflecting on SSM studies – noted that actual action and implementation rarely occurred, and when it did, usually involved undisputed matters at the tactical level. This could explain why participants chose to discuss cane quality, cane supply and transport, and not matters around soft issues (working relationships, appreciation, communication). The lack of guidance in achieving genuine participation in the comparison stage between the ideal and real world, have been found to be problematic (Jackson, 2003). Pala et al. (2003) also note that this stage does not provide clear enough recommendations, and that validity issues are picked up at this time (Pala et al., 2003).

This study highlighted the role of high-level strategic initiatives, to which the practitioner and ordinary participants were not privy to. SSM conversations may not have been acceptable to certain participants (Brocklesby, 2007). It could be that attempts at bringing about change can interfere with possible plans that decision makers already have decided on. Participants may not gain new understandings from the SSM process, due to circumstances involved (Brocklesby, 2007).

It was found that the issues could not be deeply interrogated, and as Kreher (1994) notes, it may have been

difficult to address the fundamental root causes due to restrictions on time and other matters – which result in symptoms being treated quickly. This could explain why participants were able to easily list actions, but not to implement them. Stakeholders identified a lack of time and resources as a challenge, and also that it was difficult to bring about change in the sugar industry. It is also important to realise that SSM challenges people's worldviews and taken-as-given assumptions, and that this process may cause discomfort (Checkland, 2000). Furthermore, Checkland (2000) asserts that what could be an issue for one person, could be considered normal for another.

Power dynamics, as found by Jackson (2003), were found to affect the SSM process. Those in power could have taken centre stage and ensured that other participants did not discuss sensitive matters. Molineux and Haslett (2007) argue for participants to feel safe in SSM workshops – but this could be challenging when stakeholders discuss significant matters that could lead to conflict. Jackson (2003) states that Checkland may not have given adequate consideration to the construct of power, especially if one acknowledges that the world is characterised by power differences and that power is a natural part of social settings. Kreher (1994) however argues that matters related to power and politics do not only arise in SSM – but in any method that addresses real situations.

The presence – but also lack of powerful stakeholders with decision-making abilities – played a significant role in this study. Jackson (2003) points to SSM being better suited to pluralist situations characterised by joint understanding about required actions, and not so much for situations where there is major conflict or coercion. The absence of powerful individuals resulted in stakeholders being able to discuss matters more freely, but when the individuals concerned appeared, the atmosphere became more guarded and discussions did not result in real change.

The nature of the conversations and those that are dominant at a given point will influence the way in which people provide an account of the world, and accompanying actions that are identified (Brocklesby, 2007). Cordoba and Farquharson (2008) note that SSM should be enhanced to show participants their current role and behaviour in power relations, but also to demonstrate how to act once they become aware of this. SSM is considered futile in bringing about meaningful change by those who acknowledge that the world is beset with disagreements, coercion and conflict of interests (Jackson, 2003).

Molineux and Haslett (2007) argue that SSM workshops – particularly when designing Rich Pictures – should be a pleasurable experience to participants and it is important to have a positive group mood. Participants described the benefit of identifying issues and jointly discussing them – but did have difficulty in drawing Rich Pictures, which, according to Molineux and Haslett (2007), can be expected as it may require skill. Molineux and Haslett (2007) emphasise that Rich Pictures can facilitate breaking paradigms. The practitioner was also able to gain a holistic view, as also found by Brenton (2007) – which is consistent with the systemic nature of SSM.

SSM – as a methodology – could have helped participants to better handle social complexity, which according to Levy (2000) should entail focusing on innovation and flexibility, rather than mechanistic structures to deal with complexity. Outcomes and action from strategic plans are less important than addressing concerns, connectivity, and power relations (Levy, 2000).

SSM is of a sense-making nature, in that the methodology allows participants to comprehend the complexity, but is also action-oriented due to resultant changes in perceptions, structural or process change which can occur (Checkland, 2000). This study did not lead to structural or process change, but it can be argued that participants were able to view the complexity and experience a change in perceptions, as they described being able to view the concerns of other stakeholders and the effect of their own actions on others. Brocklesby (2007), however, challenges the view that a change in worldview necessarily leads to dramatic and lasting changes. The argument of changing worldviews also comes under scrutiny – due to neglecting to acknowledge how challenging it is to achieve this without focusing on how organisational, political and economic structures actually influence worldviews (Jackson, 2003).

Participants may have walked away better equipped to deal with social complexity, as presented by the interconnections between stakeholders who are diverse, purposeful agents, and engaged in the pursuit of multiple objectives. Jackson (2003) however argues that SSM has been viewed negatively due to the lack of guidance in constructing complex adaptive systems. Participants may have also realised that the problems they were dealing with were not simple, but were instead viewed differently by each stakeholder and that it was not possible to develop a quick and easy solution. Brocklesby (2007) however raises the limitations of 'non-stickability' and the momentary nature of understandings that arise in interventions like SSM.

Learning in the SSM process can be about the area of application, the methodology, and the concepts employed in the methodology (Checkland, 2000). Figure 1 (below) was constructed based on the practitioner's experience of conducting SSM workshops, and outlines factors impacting on the facilitation of SSM.

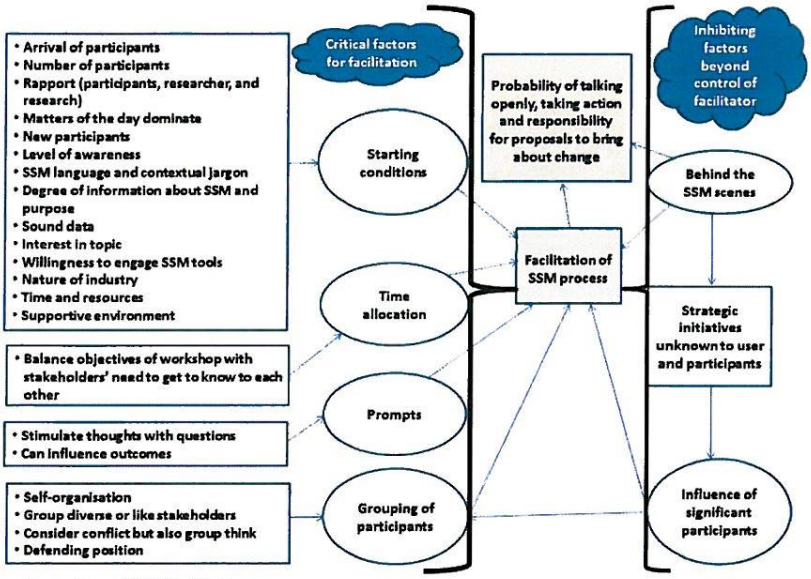

Figure 1. Factors impacting SSM facilitation

Critical factors for facilitation are categorised into four broad themes: starting conditions, time allocation, prompts, and grouping of participants.

The facilitator should consider the effect of the following starting conditions on the SSM process: the time of arrival of participants, how many participants are present, the facilitator and participants having to establish rapport and also with other participants and understanding the idea of the research, matters of the day dominating and possibly overshadowing the process, the arrival of new participants who did not attend former workshops, the level of awareness and exposure of participants, use of SSM language and awareness of the contextual jargon, the extent to which the facilitator goes into detail about SSM and the purpose of the research, the need for sound data to understand the context, the interest of participants in the topic, a willingness to engage the SSM tools, the nature of the industry and its ability for change, time and resources, and a supportive environment.

The facilitator – in allocating time for the various SSM exercises – should balance the need to maximise time with the stakeholders' need to get to know each other. The facilitator may consider introducing prompts if participants struggle to get started, but this could influence outcomes. The grouping of participants is a particularly important consideration; the facilitator can allow stakeholders to self-organise, or could decide to group diverse or like stakeholders, and should note that conflict and group-think could arise from these scenarios. The facilitator should be prepared for the possibility of stakeholders defending their position and how this will impact on other participants and the process.

The facilitator will have to consider that there may be inhibiting factors beyond his or her control, which will impact the SSM process. These could include strategic initiatives that are occurring behind the SSM scenes – that the practitioner and other participants are unaware of. This will most likely be led by significant participants, who, if attending the workshops, will certainly affect the facilitation of the SSM process, and will need to be considered when deciding on how best to group such individuals.

The factors that have been discussed will affect the facilitation process, and will not only impact on the extent to which participants can talk openly – but also on whether they can take action and responsibility for proposals to bring about change.

6. Conclusion

This research which was conducted in the sugar industry was aimed at investigating factors that influence the effectiveness of SSM. The methodology helped participants to identify and discuss issues, and to draw out the multiple perspectives that they hold. Stakeholders could not, however, openly discuss issues or take action to implement proposals to bring about change. The construct of power was found to be visible, as both the lack and presence of

significant stakeholders with decision-making abilities, were found to impact the SSM process. An interesting finding was that strategic initiatives that the practitioner and other participants were unaware of, were occurring in the background, and that the SSM process could have interfered with them.

Lessons learned from applying the methodology, included the critical need to draw on sound data from thorough analysis of interviews. Complementary data from interviews are especially necessary when there are constraints in the workshop setting – preventing stakeholders from freely expressing themselves. The debate stage may be the most challenging to facilitate due to the dynamics that may arise. If the culture is not conducive, then stakeholders may only choose to discuss safe topics, and will be limited in the extent to which they are able to implement identified actions. The politics and power dynamics of the problem situation are particularly relevant in influencing how the facilitator is able to surface and challenge worldviews, bring about learning, and determine what is feasible and desirable.

The interpretivist and constructivist nature of SSM places great responsibility on the practitioner to draw on various skills and to become immersed in a dynamic problem situation – and so to enable change. It is challenging to emphasise relationships rather than sheer goal seeking. Stepping into and leading conversations in conditions characterised by unpredictability, power struggles, and multiple perspectives, demand an array of skills. Such skills include, but are not limited to: judgement; interpretation; self-reflexivity; communication; listening; decision making; trustworthiness; upholding ethics; problem solving; analytical, critical thinking; leadership; project management; planning; organising; negotiation; conflict resolution; flexibility; and accountability. Practitioners need to be aware of the impact of significant stakeholders in enabling or inhibiting change. SSM users should take into account the skills required to facilitate learning and change, and to consider the factors that can impact the effectiveness of the methodology.

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CHAPTER 6: EXPLORING STAKEHOLDER INTERACTIONS THROUGH THE LENS OF COMPLEXITY THEORY: LESSONS FROM THE SUGAR INDUSTRY

Qual Quant
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Exploring stakeholder interactions through the lens of complexity theory: lessons from the sugar industry

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Abstract The aim of this study is to identify challenges in multi-stakeholder relationships and to provide recommendations on how to manage complexity within these complex systems. The sugar industry under investigation is composed of diverse stakeholders who pursue various objectives, and complexity arises from these multiple interactions. Complexity theory is used here to analyse stakeholder relationships in a mill area in the sugar industry. The qualitative research approach is used. In-depth, semi-structured interviews are conducted with various stakeholder groups who are able to provide insight into the challenges in the mill area—and how these can be addressed. Thematic analysis is used. An analysis of the interactions reveals that stakeholders face overlapping problems, increasing demands, and an uncertain future. Relationships are characterised by a lack of trust and transparency, and are further strained by organisational structures, control and bureaucracy. The study highlights a dire need for cooperation and for a collectivist culture to achieve a competitive edge. It reveals that stakeholder interaction contributes to systemic awareness, shared strategy and expertise, collective learning, and system-wide goals which in turn impacts positively on performance. Important factors which are found to influence stakeholder interaction include the capacity for change, information, transparency, distributed leadership, flexible organisational structures, and the capacity of stakeholders to contribute. This study provides a significant contribution by presenting conceptual models to better understand multi-stakeholder scenarios.

Keywords Complexity theory · Stakeholders · Goals · Sugar industry · Sugarcane

1 Introduction

According to Weymes (2005), an organisation comprises a group of people who work together to accomplish a common goal. In any organisation, the emphasis should be on its people,

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not only on its object/purpose (Weaver 2012). The reality, however, is that the multiple interactions that occur between stakeholders can create complexity and challenges in attaining a shared purpose.

The focus of this study is on multi-stakeholder interactions in a mill area in the sugar industry. The study is set in a developing country context. The study site cannot be revealed due to confidentiality agreements. In this study context the sugar industry is defined by the existence of multiple stakeholders who engage in diverse activities to realise the final product. These stakeholders include growers, hauliers, the miller, grower-and-miller associations, as well as industry and government stakeholders. The context of the study corresponds with the view of Surana et al. (2005, p. 4235) of a supply chain as a "complex network with an overwhelming number of interactions and inter-dependencies among different entities, processes and resources". Surana et al. (2005) indicated that supply-chain networks are challenging in respect of management and regulation, and the inability to predict outcomes.

While diverse stakeholders in the sugar industry need to work together to realise the attainment of shared objectives, they often pursue competing goals. The importance of the relationship—particularly between growers and millers in the sugar industry—has been highlighted in previous research (Hildebrand 2002; Wynne 2009).

It is important that stakeholders in the sugar industry have a systemic perspective and gain insight into the problems affecting other parties. This industry requires that each stakeholder group contributes to realise the final product, as levels of interdependency between the stakeholders are high.

Recent research has emphasised the importance of considering the role of stakeholders (Legault 2013; Smith et al. 2011; Weaver 2012; de Blois and De Coninck 2008). Legault (2013) highlighted the role of leadership in identifying stakeholders and interrogating their multiple perceptions, while the importance of stakeholder engagement was advocated by Smith et al. (2011). Weymes (2005) noted that organisational performance is dependent on the quality of the relationships between internal and external stakeholders. Weaver (2012) regarded the identification of common goals through stakeholder communication forums as being critical. It is important to facilitate the development of social capital by establishing robust relationships and by aligning stakeholder objectives (Weaver 2012). The intentions of stakeholders—as well as their actions, perceptions, attitudes, and willingness—can impact on the success of a project (Weaver 2012).

Complexity theory can be used to better understand stakeholder relationships in the sugar industry. Complexity is thus about examining the interactions that occur (Cairney 2012). Complexity theory acknowledges the uncertainty and unpredictability in dynamic systems that arise from the multiple interactions between agents (Marion and Uhl-Bien 2001).

Complexity theory can be used to analyse organisations (Chiva et al. 2010). It can also be used to comprehend the social behaviour of a team, as it is not possible to forecast team behaviour based on an individual's behaviour (Weaver 2012). Complexity is visible in our globalised context and we are increasingly aware of interconnections (Seijts et al. 2010).

Previous research investigating the application of complexity theory in supply-chain contexts is limited. Choi et al. (2001) investigated how supply chains could be better managed if they were viewed as complex adaptive systems. Due to the existence of interdependent entities who pursue their own objectives and perceive the environment differently, Li et al. (2010) argued that supply chains need to be approached as complex, adaptive supply networks. Internal and external relationships are important to leaders who follow the science of complexity (Regine and Lewin 2000).

This study uses complexity theory to provide insights into interpreting behaviour and responses in multidisciplinary stakeholder perspectives as advocated by Ellis (2011). The

study seeks to identify challenges and to provide recommendations on managing complexity in multi-stakeholder systems.

1.1 Complexity theory

Complexity theory originated in the biological and physical sciences, but has recently been applied in the social sciences (Cairney 2012; Chettiparamb 2014). It is a field which draws on theories and concepts from a variety of disciplines.

Human systems are complex and non-linear, as they can be influenced by their environment. Behaviour can be affected by various unrelated variables and it is not possible to observe direct causation (Ozer and Seker 2013). Simple systems—in contrast—have fewer interactions and their dynamics can be more easily anticipated (Sargut and McGrath 2011).

A complex system is characterised by various interconnected parts which display one or more properties which cannot be comprehended by examining and analysing individual properties of individual components (Gallo 2013; Gao et al. 2013). These complex interactions are 'messy' and occur in a systemic way (Boulton 2010). Complexity theory, through the fitness landscape metaphor, helps us understand the unpredictable and rapidly-changing contexts that we face (Cairney 2012).

Complexity theory marks a shift away from reductionist thinking, where the approach was to analyse individual components of the system (Cairney 2012). Organisations were historically viewed and managed as closed systems, wherein people and departments were separated (Montouri 2013). The norm of compartmentalisation was meant to isolate problems rather than to analyse interactions, and refers to a mechanical approach which is still quite commonly used in the organisational context (Boulton 2010). A mechanistic view centred on control, predictability and neutrality is still prevalent in certain major disciplines—including management (Boulton 2010).

Behaviour in complex systems cannot be easily forecast due to the non-linear dynamics which exist in these systems (Cairney 2012). Non-linearity implies that repeatedly engaging in the same thing can lead to different outcomes (Weaver 2012). A seemingly significant action may result in a small effect, and, likewise, minor actions could lead to major effects in complex systems (Cairney 2012; Ozer and Seker 2013; Chettiparamb 2014). Complex systems also exhibit sensitivity to initial conditions (Cairney 2012).

The phenomenon of emergence in complex systems refers to local-level interactions which lead to a new order—as opposed to interactions emanating from central control (Cairney 2012). The ability of the system to self-organise therefore creates a challenge to traditional command and control (Cairney 2012). Control can actually stifle the best developing pattern and instead create more significant, disorderly patterns at a later stage (Brack et al. 2011). The principle of self-organisation therefore questions hierarchical and bureaucratic approaches as means of addressing social concerns (Morcol 2010).

Complex systems comprise multiple interactions among heterogeneous agents who are also adaptive in that they can change in response to environmental changes (Chiva et al. 2010). Actors in complex systems have mental models which influence their actions (Cairney 2012; Anderson 1999). The dynamic and multiple-interacting perceptions of reality held by the various players contribute to the complexity that we face (Checkland and Poulter 2006). Agents in supply networks are heterogeneous (Wycisk et al. 2008). Checkland and Poulter (2006) specifically mentioned the deeply embedded assumptions that people have which constitute their individual perspectives. Human activity systems are essentially messy and cannot be easily defined, and are best understood by examining the perceptions of people

(Khisty 1995). These worldviews need to be unearthed and analysed in order to address problematic situations (Checkland and Poulter 2006).

Managing complex systems still presents difficulties (Sargut and McGrath 2011). Managing a complex system is more challenging as one cannot rely on prediction alone, sensemaking also needs to occur (Sargut and McGrath 2011). The challenge lies in moving away from the traditional command and control paradigm—to accepting and embracing ambiguity (Montouri 2013; Weaver 2012).

2 Materials and methods

The qualitative research approach was used. The study commenced in July 2010. Ethical clearance to conduct the study was obtained. Semi-structured, in-depth interviews were conducted with 48 key informants between July 2010 and November 2011. Interviews were conducted face-to-face, and on a one-on-one basis, and lasted on average an hour. All interviews were digitally recorded and transcribed.

Interviews were held with six growers, three mill representatives, one haulier, one industry representative, and one miller-grower body representative between 13 and 15 July 2010. Respondents were asked to share their views on who they considered to be the main stakeholders, their own goals, challenges, and their perspectives on communication and trust levels. Interviews were then held from 27–28 October 2010 with the aim of gaining an understanding of how stakeholders worked together to address the challenges that they faced, and to propose recommendations on how stakeholders could work together to address the challenges. Three mill representatives and eight growers were interviewed at this time. Interviews with four mill representatives, six growers and four industry representatives were also conducted from 22–24 March 2011. This provided a platform for stakeholders to provide recommendations on how to jointly address various concerns. A final round of interviews was conducted in November 2011. These interviews involved 11 industry stakeholders who were at senior management level and who could provide a holistic perspective into the challenges facing the mill area, and how these could be addressed.

Data were analysed using thematic analysis. The transcriptions were carefully studied to identify themes—which are presented below.

3 Results

3.1 Attaining system-wide goals

Respondents raised concerns about a number of problems which were impacting negatively on the ability of stakeholders to achieve system-wide goals. The one goal mentioned by all respondents was that of performance (as realised through profitability).

These problems—which are briefly discussed—were found to have a negative effect on the system as a whole. The most serious challenge was a shortage of cane supply, which was affecting everyone.

> Cane supply [is]... critical to the survival of the industry. (R1)

Respondents gave a few reasons for the dwindling cane supply. Small-scale and emergent growers, who struggled to farm successfully, contributed to the decline in cane supply. Respondents stated the difficulties that emergent growers face. These growers received the

farms as a result of government land claims but a lack of experience has resulted in unsustainable farms and failing crops and this has eventually contributed to an overall decline in cane supply.

> ... the individuals [emergent farmers] haven't had the skills and haven't had the ability to farm, haven't been trained properly, haven't studied agriculture. So guys have been thrown in the deep end, and it's just not working. (R10)

Some respondents expressed the view that government intervention in the form of redistributing land from large-scale farmers to emergent farmers, had negatively affected the industry, as these farms which originally had the potential to produce high yields, were now going to waste. Land redistribution has also created panic among large-scale growers who fear that they might have to give up their farms, or in the case of some, actually sell their farms, thereby further decreasing cane supply. If they became aware that their farms may be considered for land distribution, large-scale growers could also end up investing less money and effort in the crop.

> So land claims are having a major impact on the sustainability of cane supply. (R4)

Small-scale growers who farm on small plots in the traditional chieftaincy tribal system, struggle to make a success of farming due to economies of scales caused by an imbalance in the size of the land and the costs required to farm. They are furthermore affected by exorbitant rates charged by unscrupulous contractors—thus leaving them powerless. Small-scale growers often lack financial skills and knowledge of good agricultural practices.

> ... [there are] a large number of small-scale growers. I'm not too sure how well the small-scale growers are organised, because I think they have had a lot of trouble with getting appropriate contractors to help them. (R5)

Aside from cane supply, respondents also noted that cane quality, mill efficiency, unreliable haulage, tension between stakeholders derived from the division of proceeds, and challenging weather conditions were further challenges to attaining system-wide goals.

3.2 Systemic awareness

It was considered critical that stakeholders gained insight into each other's businesses, and that they developed a systemic awareness. Respondents indicated how stakeholders needed to adopt a holistic perspective—especially considering how intertwined they were.

> I think they [stakeholders] need to understand each other's businesses... and what affects business, and how a negative thing can stop the whole operation from working. I am not too sure whether there is a willingness to understand each other's problems. (R2)

A classic example of a lack of systemic awareness was highlighted by respondents when they indicated how unreliable hauliers (responsible for transporting cane from the farm to the miller) negatively affected both the miller and growers. Hauliers would contact the customer to indicate that the cane would be collected at a certain time, but would then not turn up, leaving the grower with deteriorating cane (cane has to be processed within 16 h). This delay impacted negatively on cane quality. In this scenario the miller also suffered as a result of a lack of cane supply, resulting in inefficient operations which ultimately negatively impacted on their operation's profitability. Despite the many challenges, respondents noted that there

was a tendency to solve individual problems first—as opposed to focusing on addressing system-wide goals.

> Unfortunately we all have our own agendas. (R7)

Proposals that were developed by respondents to deal with the major concerns of cane supply, cane quality, and haulier inefficiencies, therefore had to be approached with a systemic view in mind. These proposals included establishing a common transport system, investing in replanting and seed cane, creating awareness forums, and mentoring. Such proposals could, however, only materialise if stakeholders had a change in mind-set, particularly in terms of realising how their actions affect each other and what they require to work together to achieve improvement.

3.3 Capacity for change

Respondents noted how important it was that stakeholders demonstrated a capacity for change. An inability to embrace change could result in stagnation or even the demise of the business. An example that was cited was how growers had to develop better business skills, as farming had changed from being simply an agricultural operation to being a complex business entity demanding more than just farming knowledge from growers.

> Growers need to be educated... [there is] lack of knowledge... farming has changed a lot. (R7)

The issue of increased demands and expectations of growers were raised, and it was emphasised how turbulent the farming environment had become with increasing uncertainty and difficult operating conditions. Change was considered a necessity if one hoped to perform in a highly competitive environment. Farmers thus required management skills and business expertise to ensure their survival. Respondents explained that growers lacked access to professional expertise, whereas the miller had ready access to accountants and lawyers.

> ... the miller has got... people who know what they are talking about... but the growers, they just grow cane... they need help professionally. (R10)

According to respondents, a source of uncertainty was the pending introduction of a new Sugar Act, of which the details were uncertain but which they felt was bound to lead to dramatic change for all stakeholders. This meant that growers and the miller would have to prepare for the change in order to achieve performance in a new era.

> The Sugar Act will be reviewed... there has to be change for the industry to survive into the future. (R1)

Respondents explained that the cane plant was moving into another era, and that sugar would become a by-product of the process which in future would be centred around energy and ethanol. This provided an opportunity for the downstream involvement of growers.

> ... downstream products... in the future, sugar is not going to be the primary or the only source of income. Co-generation, ethanol... those are two big money spinners. (R4)

The nature of the sugar industry, however, presented a problem—as it was not an industry which was very conducive to change.

> ... [the sugar industry entails] too much bureaucracy and is not flexible enough. (R2)

3.4 Lack of flexible organisational structures

The importance of conducive organisational structures was raised by respondents as being critical in achieving cooperation between stakeholders and consequently improved performance. The hierarchical nature of the miller's organisational structure, for example, was considered problematic. Growers indicated that decisions could often not be made immediately, as the mill manager would have to consult with higher levels in the organisation. The need to engage with the highest level was considered important—but organisational structures could not accommodate this as there was a clear line of authority in place. The miller, however, had to abide by the structures and follow processes that were in place.

> You can't expect one of the big bosses to be attending meetings here... they are strategic, not hands-on... (R12)

3.5 Individualistic versus collectivist culture

Respondents alluded to cultural differences between the miller and growers: a largely individualistic culture with respect to the miller, and a collectivist culture for growers. The individualistic culture resulted in the miller being more focused on its own results, targets, vision, competitiveness, and profitability. It was highlighted that the miller has to outperform competitor mills, and that the resource—rather than the individual supplier—may be a priority for the business. To protect the business edge, the miller may have to make decisions that are in its own best interests and it could be limited in how much it can reveal to other stakeholders. The miller is not dependent on one grower, and is sheltered from business risk by diversification because the company owns various mills and is involved in other businesses.

> ... this is a corporate... it's modern business... it's a corporate that owns other mills. (R3)

The focus on profitability and shareholder satisfaction appeared to create friction between stakeholders—particularly as the miller and growers had very different views on the matter.

> So there is definitely that return on capital that becomes a swear word; it's just gone sour. One of the most amazing and amusing things I noticed is that we [growers] would go into a period of drought, they [miller] were with us all the time, and yet you would still see these accountants demanding, or the executives of the boards demanding increased dividends... irrespective of the fact that we [growers] have been in a drought. (R1)

> They [miller] want profit, they want money. It's a shareholders' company; it's all about the way of business... Growers have to grow up and realise that the whole reason that they are on the stock exchange is to drive down costs and to drive up profit... they're maximising profit... that's their only mandate. (R3)

> ... if we're [miller] not going to make a profit, then we might as well close the place down... (R8)

It was argued that the bureaucratic approach from the miller reinforced an inward-focused or individualistic culture, which would ultimately inhibit cooperation between growers and the miller. Although still focused on profits, growers on the other hand, displayed more of a collectivist culture by expressing concern for one another's wellbeing. Although respondents highlighted the importance of money, emotions also played a role.

> ... that interface of communication and seeing that you care, seeing that you have a vested interest in us [growers], makes a difference... it may seem like a small thing but it is important. And I don't think it is just strategically involved, but just being available to chat, just coming to a meeting and being there. (R13)

> The miller has got to realise that they've got to look after their growers. (R9)

Growers seemed to require acknowledgement of their role in the system and valued cooperation—whereas the miller came across as being more concerned about business, and less so with relationships.

3.6 Need for transparency and information

The miller-grower relationship was described as adequate in respect of communication, but was characterised by a lack of trust derived from a lack of transparency and information.

> It is a pure business relationship, you do communicate, but it is on a different level. (R7)

> There is no trust, so no matter what they going to tell us now... it is going to be viewed with caution. (R6)

Growers argued that the miller did not come across as forthcoming and transparent—but instead filtered guarded information to stakeholders. It was, however, argued that the miller faces limitations about who to involve, who gains access to information, and when information should be released.

> ... within companies there's certain information which is confidential... and I suppose we [miller] release information that we consider to be ok to put out in the public domain. (R8)

This, however, fuelled perceptions that the miller was hiding information.

> ... they [miller] hide quite a lot from us. We [growers] feel in terms of their operations... they cover up... most things get hidden from us... (R7)

3.7 Leadership

The issue of leadership came to the fore with respondents specifically highlighting the critical role that leadership plays in achieving cooperation and performance. Respondents indicated a largely satisfactory working relationship between mill staff and growers but said that problems originated from executive leadership. Growers perceived the executive leadership of the mill to be quite removed from ground-level interactions, and primarily concerned with output and less with relationship management.

> ... there is a good relationship with the miller, plus the neighbouring growers and the extension officers... the only thing is that those head office guys... they don't understand leadership... (R4)

> ... the leadership issues are critical... I think the second-tier leadership of the miller is trying hard to build leadership, but there is a lack of direction coming from the top head office. I think the basics of the relationship are there, but it's being constrained by the very bad interaction at the top, from the miller's side. (R1)

The need for ground-level interaction was highlighted—particularly in engaging stakeholders.

> ... there is zero contact, they [miller executive leadership] could maybe come and address a growers meeting once every two years... that would be something you know... the fact that you can identify with your stakeholders... (R7)

The leadership issues seemed to be coupled with power and control. Power and politics were found to be an inhibitor in attaining effective stakeholder relationships. It is an unbalanced relationship because growers are quite dependent on the miller which is the only place where their cane can be processed.

> The miller holds the power... because he controls the cane supply, he controls all the milling and processing. (R9)

> Sugar cane... has to be processed and to process it is expensive... and because you have your dominant milling companies, people can't get in. Sugar cane farmers... there are no other competitors; they have only one miller to send to. So you are pretty much stuck with your miller. (R10)

The perception that the miller held the power resulted in growers feeling that they were exploited by the miller, and that they were not of any relevance to the miller.

> We are in a position of weakness as growers... farmers are price takers. It is very difficult to dictate to your processor what he must pay you... so you've got to take whatever your price is fixed at. (R5)

3.8 Need for shared strategy and expertise

Respondents expressed the view that there were limited opportunities for growers to engage the miller on strategy formulation. It was clear that there was a desire for growers to discuss and share strategy, and welcome input and participation from the miller regarding the future.

> There is not enough communication regarding strategy going forward. (R5)

The future of the industry—particularly in respect of responding to its changing nature—required stakeholders to collectively conceptualise and implement a strategy. The respondents expressed the view that very often attempts at stakeholder engagement in respect of strategy only translated into information dissemination sessions and that sometimes they were presented with a decision which had already been taken by a few people in senior positions. Stakeholders argued that, due to the interconnectedness of stakeholders, it was necessary to engage in joint decision-making in respect of strategy and that ideally a new strategy be formulated to jointly respond to system-wide goals.

3.9 Capacity to contribute

Respondents alluded to how critical it was for all stakeholders to have the capacity to contribute to the wellbeing of the system. The wellbeing of all growers—including small-scale and emergent farmers—for example, was considered essential so that they could contribute to the survival of the sugar industry.

> ... we can't farm in isolation, our fortunes are linked to their [small-scale farmers] fortunes. If they have a bad time, we have a bad time... the healthy, vibrant small-scale grower is very much in the interest of us all. (R6)

Respondents argued that each stakeholder group had to take the initiative in order to face the various challenges. It was especially necessary that growers were united and able to communicate with one voice with the miller. Respondents also argued that all growers needed to be involved in committees and needed to focus on the future in order to determine how they could succeed as a collective.

> Growers need to form a group and we need to represent ourselves... you need a group to strategise and start thinking out of the box... not looking at the ground now... rather let's look at what's coming up the road. (R3)

3.10 Collective learning, cooperation and performance

Respondents argued that stakeholders could only achieve performance by engaging in joint learning. Growers and the miller would have to work closely together and be proactive in order to realise potential business opportunities. It was therefore critical to collectively analyse the trends and produce innovative responses. Growers and the miller would need to engage in joint planning and would need to reach agreement on the way forward.

A cooperative relationship between the miller and growers was considered a necessity to outperform competitor mills. Respondents highlighted the interdependency between stakeholders.

> Without the mill, the farmers would have nowhere to take the cane. Without the farmers, the mill would be of no use to anybody. So we need the farmers and the mill to be together, to co-exist. (R2)

> What the growers and the miller need to be doing is showing a combined approach to industry. It is pointless growers going with one thing and then we [miller] go with another thing and we are arguing at cross purposes. (R8)

Respondents explained that a spirit of partnership, characterised by high levels of cooperation, was critical for achieving success.

> ... interdependency on each other. You are like a link in the chain. One depends on the other to do their business. So it needs to be as harmonious as possible. (R11)

> I think we've reached that turning point where we realised we've got to have a good relationship if we need to carry on together. (R3)

4 Discussion

Challenges were identified that arise from multi-stakeholder interactions in a complex system such as the sugar industry. Factors such as traditional displays of power, inconducive organisational structures and culture, limited information flow, control, and a lack of transparency from the side of the miller presented a challenge. A lack of insight from stakeholders into the workings of the entire system, and a neglect of system-wide goals, arose as further difficulties. Disregard in respect of gaining multiple inputs when making decisions, and not attempting to surface and capitalise on the diverse views of the various stakeholders, further

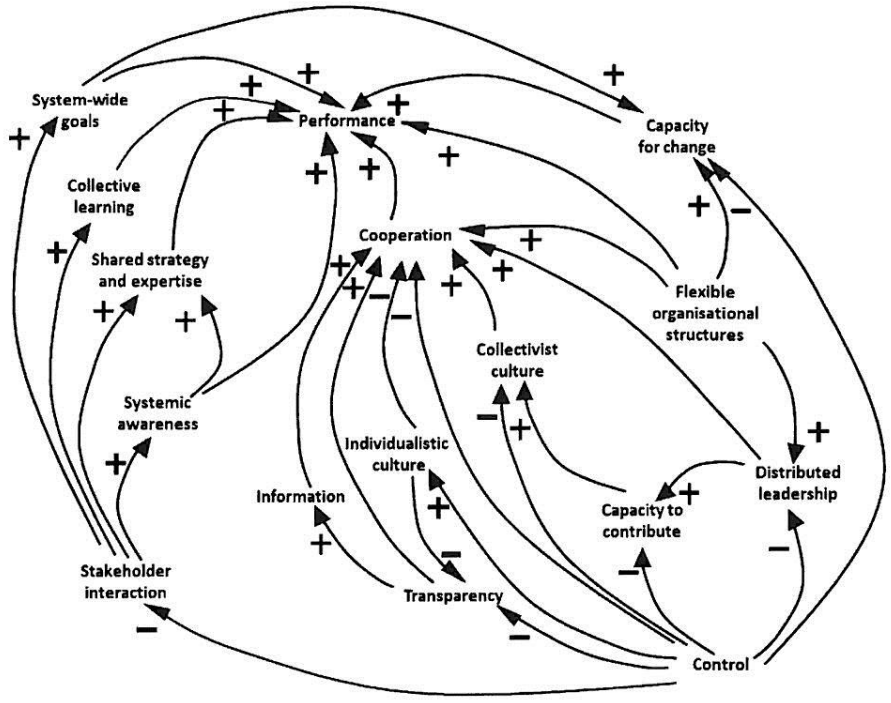

Fig. 1 Cause–effect diagram of stakeholder interactions

stifled this complex system. The findings revealed how critical the management of a dynamic, non-linear system is.

Figure 1 representing a cause-effect diagram, summarises the key findings of the study in respect of stakeholder interactions. This is a systems diagram, which indicates how variables or factors influence one another. The positive (+) and negative (−) sign is used to indicate how a variable will increase or decrease when the preceding variable increases. Given the need for brevity, only few of the influential relationships will be selected for discussion.

Figure 1 is a useful tool to help comprehend the non-linear interactions that are characteristic of a complex system. The findings revealed that stakeholder interactions in the mill area were critical to the performance of the system. This was particularly evident in how each stakeholder group had to perform successfully in their own area of expertise e.g. growers grow the cane, the haulier transports the cane to the miller, and the miller processes it. One organisation is not capable of being in control of the whole supply network, and, due to the complexity that exists, cannot comprehend the entirety thereof (Choi et al. 2001). This corresponds with the view of Surana et al. (2005, p. 4239) who highlight how a supply chain is composed of a network of multiple entities and interactions, rather than being only a "linear chain of one-on-one business relationships". A complex, adaptive systems-view assists in understanding how agents act autonomously to achieve the goals of the individual or system (Wycisk et al. 2008).

According to Choi et al. (2001), the supply network is an emergent phenomenon and furthermore, is a self-organising system. Each organisation makes decisions at the individual level, and therefore cannot control the supply network—meaning that organisation occurs from the regular course of order and disorder (Choi et al. 2001). So, even though the miller holds power by being able to process the sugar cane, it is not able to dictate outcomes.

Likewise, those growers who believe that they stand outside the system and have no influence, need to realise that their behaviour still impacts on the system.

It is also important to note that the findings highlighted what Roberto (2002) referred to as interconnected breakdowns and failures, due to the complex interactions involved. For example, inconsiderate behaviour on the part of hauliers impacts on growers, which in turn affects the miller. Roberto (2002) also highlighted how a minor collapse in a complex system leads to other difficulties due to tight coupling and multiple interactions. This was particularly evident in how challenges pertaining to the ability of emergent growers to farm successfully led to a direct decrease in cane supply—thereby affecting the sustainability of the sugar industry. It is also interesting to note the appearance of unintended consequences. For example, the land redistribution policy was originally designed with the intention of increasing equity and fairness but has resulted in certain large-scale growers exiting the industry because of uncertainty over whether their farms would be affected. Others did not sell their farms, but would not invest too heavily in the farm for fear of losing the investment if the farm were identified for redistribution. This caused cane quality to be affected.

Figure 1 indicates that the interaction of stakeholders facilitates: (1) systemic awareness, (2) shared strategy and expertise, (3) collective learning, and (4) system-wide goals. These factors, in turn, positively influence performance in the system. This concurs with the research of Lewis et al. (2007), who highlighted how the interactions of multiple stakeholders' impacts on organisational performance. These multiple interactions between the various stakeholders, however, intensify the complexity facing the system (Checkland and Poulter 2006). Leaders in complex systems need to be able to identify the various stakeholders and surface their diverse perspectives and needs (Legault 2013). It is important to work through the mental models and multiple perceptions of reality that stakeholders in complex systems hold. The differences in perceptions between the miller and growers—for example in understanding profitability and how business should be conducted—is one area that would need further interrogation.

The findings highlighted how organisational structures—particularly from the miller's side—seemed to inhibit cooperation between stakeholders. de Blois and De Coninck (2008) found that organisational structures can present a challenge to stakeholder engagement. Unsuitable organisational structures can be a barrier to supply-chain partnerships (Akintoye et al. 2000). Cilliers (2000) argued that complex systems, while having structures on different scales, should encourage interaction between the parts. A diversity of worldviews, background and experiences of actors strengthens the ability of a complex system to handle difficulties, and, accordingly, to change (Kaivo-oja and Stenvall 2013). So, while the miller has its own set organisational divisions and processes, it is recommended that an effort be made to cross the interface between those who normally do not get to regularly interact. Organisations should be constructed with the aim of facilitating change and emergence (Coleman 1999). Figure 1 demonstrates how flexible organisational structures can enhance: (1) the capacity for change, (2) cooperation, and (3) performance.

The study emphasised the need for cooperation to address the various challenges that stakeholders were facing. Addressing the transport difficulties, for example, requires a collaborative approach in developing a coordinated, common transport system. As one stakeholder group alone cannot respond, it requires an approach that engages various stakeholders in order to deal with the difficulties facing organisations (Smith et al. 2011). Cao and Zhang (2011) found that collaboration in the supply chain results in collaborative advantage and enhanced performance. As indicated in Fig. 1, cooperation is positively affected by: (1) information flow, (2) transparency, (3) a collectivist culture, (4) distributed leadership, and (5) flexible organisational structures.

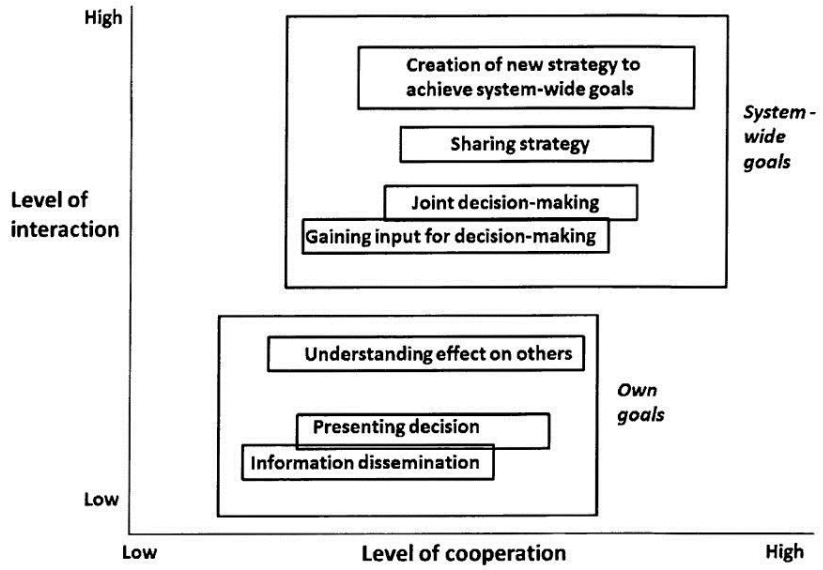

Fig. 2 Level of interaction and level of cooperation (adapted from Daft 2011, p. 219)

The study drew attention to how bureaucracy and a top-down leadership approach do not work well in complex systems. Complexity theory sheds light on how control in the supply chain is contrary to the self-organisation processes which occur naturally. This was particularly evident in how growers could not readily accept bureaucracy from the miller. Li et al. (2010) warned that flawed notions by managers concerning the supply chain can result in unintended consequences—as there are limits to planning. The findings relating to the excessive control by the miller, corresponds with Weymes's (2005) argument that while control is necessary, if it is driven from the top, particularly by way of rules and regulations, it may be detrimental to the organisation.

The work of Gerrits, as cited by Meek (2010), also indicated that excessive control and reliance on planning can lead to unintended consequences. There is no single organisation that drives or controls the supply network, due to self-organisation (Wycisk et al. 2008). Thus, while the miller may hold the power, it is not able to control outcomes. Figure 1 indicates how control presents a major problem to stakeholder interaction. An increase in control negatively affects: (1) transparency, (2) information, (3) the capacity of agents to contribute, (4) a shared understanding, and (5) distributed leadership. These factors in turn negatively affect cooperation, which then results in decreased performance.

Figure 2 highlights a key finding from the study in terms of levels of interaction and cooperation among stakeholders.

The findings revealed how challenging it was for stakeholders to work towards system-wide goals, due to the pursuit of their own goals and objectives. This was, for example, evident in how the miller had to satisfy corporate shareholders first. Wycisk et al. (2008) highlighted that, due to high levels of interdependency, the decisions of individual agents have the potential to create a direct or indirect impact on the whole supply network.

Figure 2 indicates that, while pursuing their own goals, stakeholders can engage in varying degrees of cooperation and interaction. Stakeholders can merely engage in information dissemination, or may only interact with other stakeholders to present a decision which has already been made. Stakeholders may be able to move to a point where they are able to

comprehend the effect of their decisions and actions on other stakeholders—but this very rarely results in a change in decision-making. These moves are considered low in terms of cooperation and interaction, as these actions are very often taken to satisfy individual goals. Stakeholder engagement, which can be time-consuming, should involve dialogue and nurturing relationships, as opposed to one-sided communication to merely inform (Smith et al. 2011). It is critical that while pursuing our goals, we embrace learning and change, and that we engage the multiple perspectives of others (Boulton 2010). Time must be invested in surfacing mental models as stakeholders can have very different versions of reality.

The study emphasised how respondents noted the importance of sharing strategy and expertise to gain a competitive advantage—particularly when approaching the new era that would be entered into with the advent of the new Sugar Act. Growers specifically wanted to know what the miller's strategy would be going forward. Complexity theory emphasises the need for stakeholders to consider how they approach change—as a minor action could have a major effect. Stakeholders have to be cognisant of the principle of sensitivity to initial conditions. Planning must not be centered on excessive control, but rather on adaptation and how changes could result in unintended consequences.

Figure 2 indicates how stakeholder interaction can shift from being focused on only satisfying one's own goals to being cooperative with the aim of achieving system-wide goals. Cao and Zhang (2011) emphasised that partners in the supply chain have to strive for a win-win situation aimed at attaining business synergy, whereby the chain as a whole accomplishes and outperforms competitors. This is characterised by an attempt at gaining input when making decisions, or engaging in joint decision-making. Only when stakeholders get to the point where they are able to share strategy, is there a genuine move to truly engage all stakeholders. The highest level of cooperation and interaction though is when stakeholders are prepared to abandon their own strategy to jointly create a shared strategy to respond as a collective to system-wide goals. Legault (2013) called for conscious leaders who can attend to the purpose of the organisation, while also creating value for stakeholders.

Drawing on the findings of the study, Fig. 3 was constructed to depict a conceptual model of influences on stakeholder interactions.

Figure 3 indicates that before engaging other stakeholders, individual stakeholders must have flexible organisational structures in place, have distributed leadership, the capacity for change, and the capacity to contribute. When stakeholders interact at the group level, a systemic awareness and flow of information and transparency are perceived as enabling factors to enhance multi-stakeholder interactions. The outcomes will be collective learning, a collectivist culture, the ability to respond to system-wide goals, and be able to share strategy and expertise. In order to achieve performance, stakeholders will, however, need to return to their own sphere to achieve individual and system-wide goals in a conducive environment.

Figure 4, constructed based on findings from this study, presents a conceptual model for enabling performance in multi-stakeholder systems, and thus provides recommendations on how to manage complexity in multi-stakeholder systems. The critical components include: (1) leadership, (2) opportunities for sense-making, (3) goals, (4) capacity for change, (5) power, and (6) cooperation. These components are discussed below.

4.1 Leadership

A distributed form of leadership is required to facilitate performance in complex systems (Kaivo-oja and Stenvall 2013). A single decision-maker will experience difficulty in being able to view the whole system (Sargut and McGrath 2011). Input from multiple stakeholders will, however, enable the organisation with a systemic view of threats and opportunities

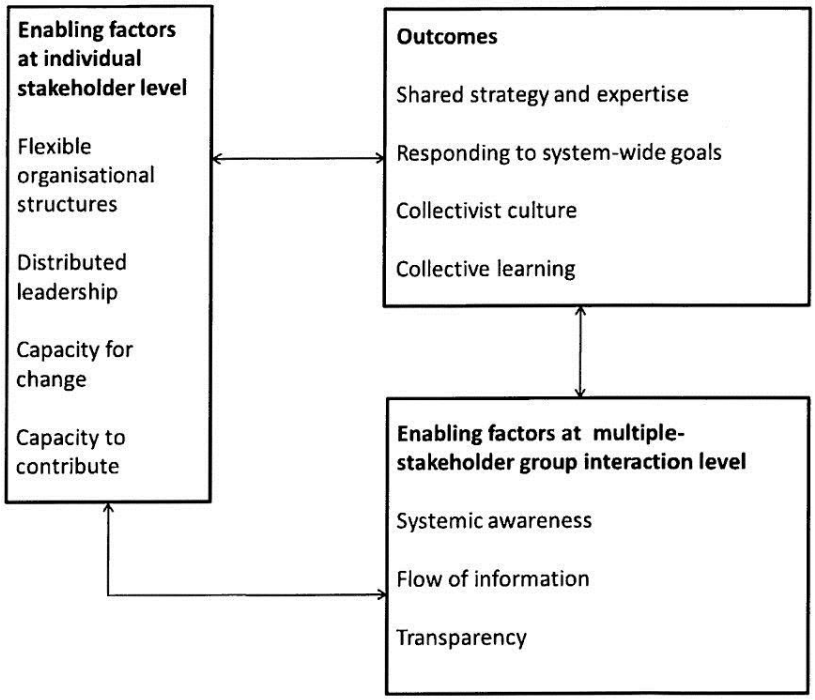

Fig. 3 Conceptual model of influences on stakeholder interactions

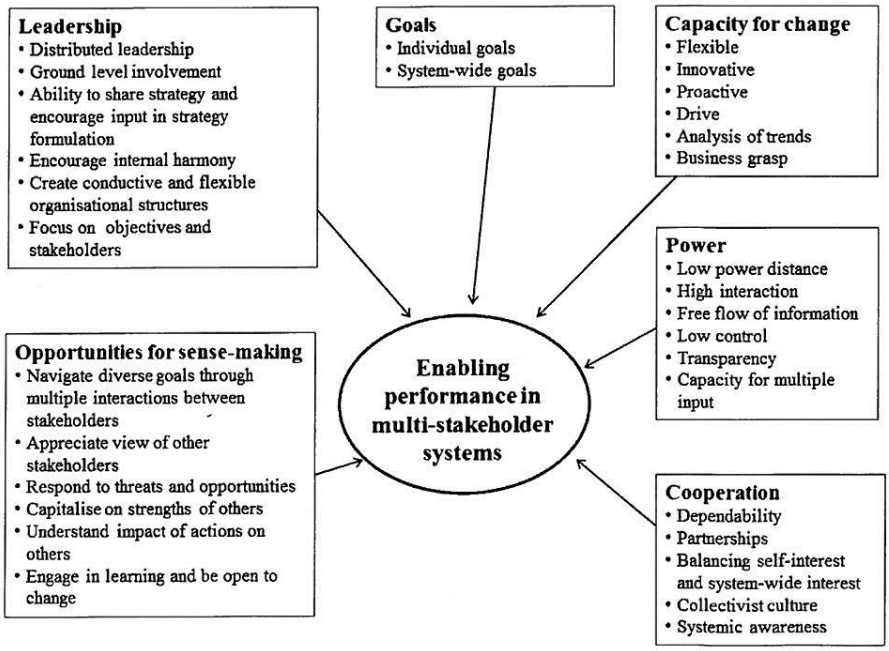

Fig. 4 Conceptual model for enabling performance in multi-stakeholder systems

(Smith et al. 2011). This corresponds with the concept of bounded rationality. Leadership should accept that they require input from others, as argued by Seijts et al. (2010), and that they need to facilitate bottom-up interaction and ground-level involvement. It is critical that stakeholders are able to reach the level where they can eventually share strategy and consider each other's input in strategy formulation. Leadership also needs to strive to encourage internal harmony. Leadership needs to create supportive organisational structures and a culture which is conducive to facilitating learning and experimentation (Seijts et al. 2010; Weaver 2012). Legault (2013) highlighted the role of a supportive organisational culture on the development of conscious leaders, who are critical in producing and maintaining organisations that serve a higher purpose and which aim to add value for all stakeholders.

4.2 Opportunities for sense-making

Opportunities for sense-making need to be created in order to work through the multiple goals and diverse views of stakeholders. Sense-making requires time, as real-world complexity is not grasped instantly (Checkland and Poulter 2006). Complex problems can be addressed by gaining insight into stakeholders' perceptions and dealing with the multiple problems facing the system (Lewis et al. 2007; Legault 2013; Smith et al. 2011). Leaders need to deal with multiple and sometimes contradictory demands from stakeholders (Seijts et al. 2010). Organisations need to have diverse thinkers, as heterogeneity is critical in facilitating the interaction of stakeholders (Sargut and McGrath 2011; Wycisk et al. 2008). It is important to jointly respond to threats and opportunities and to capitalise on each stakeholder group's strengths (Smith et al. 2011). Creating a shared purpose is critical (Weymes 2005; Legault 2013). Stakeholders need to be aware of their role in the system and how their actions affect others (Weaver 2012; Sargut and McGrath 2011). Stakeholders also need to be open to learning and change (Boulton 2010; Chiva et al. 2010).

4.3 Goals

Individual and system-wide goals must be strived for in complex systems. This is especially the case where there is not only one goal that stakeholders are pursuing. The reality, however, is that stakeholders in the supply chain will face difficulties in making decisions for the benefit of the whole and for the good of the organisation. Working towards joint goals is therefore important (Weaver 2012). Li et al. (2010) highlighted that the emphasis should not be on fixed objectives. A collaborative advantage in the supply chain is achieved by the ways in which managers align goals (Cao and Zhang 2011). Adaptive planning is important to achieve goals; the emphasis shifts from precise planning to an approach that is open to change based on the present state, feedback and creativeness (Li et al. 2010).

4.4 Capacity for change

The capacity for change is an important component in managing performance. This can be realised through flexibility, a drive to succeed, analysing business trends, and having a business grasp (Horth 2011). Being proactive, having foresight, and emphasising innovation is critical (Smith et al. 2011; Boulton 2010; Lewis et al. 2007; Kaivo-oja and Stenvall 2013). Creativity is vital in complex systems (Brack et al. 2011). If an organisation views stakeholder engagement as a threat, then prospects for innovation fade (Smith et al. 2011). The knowledge and resources from multiple stakeholders drawing on their different perspectives, create a constructive platform for innovation (Smith et al. 2011).

4.5 Power

Low power distance coupled with high interaction is another requirement to enable performance in complex systems (Kaivo-oja and Stenvall 2013; Meek 2010; Weymes 2005). It is critical that there be a free flow of information, low levels of control, transparency, and the capacity for multiple input. Power needs to be distributed throughout the system, and there should be a spirit of collective influence (Seijts et al. 2010). Relying on control and prediction does not take one very far in a complex system (Boulton 2010). As emphasised by Pascale (1999), excessive order and stability hampers fresh perspectives.

4.6 Cooperation

Cooperation between stakeholders, along with dependability and efforts to enable partnerships are critical to navigate complexity (Weaver 2012; Smith et al. 2011). Akintoye et al. (2000) found that trust was critical in supply-chain collaboration. Interaction, communication and the development of enduring collaborative relationships can increase the performance of supply networks (Li et al. 2010). Stakeholders should attempt to balance self-interest and system-wide interest. It is important to mould a collectivist culture, along with systemic awareness (Gallo 2013). Root causes of problems need to be identified by adopting a systemic view, engaging others, and striving for sustainable solutions rather than short-term solutions (Smith et al. 2011).

5 Conclusion

This study examined multi-stakeholder relationships in the sugar industry with the aim of identifying challenges that arise in stakeholder interactions in complex systems, and how such complexity can best be navigated.

The study found that the context was plagued by overlapping problems, increased demands, and an uncertain future. Complex stakeholder interactions were furthermore characterised by a lack of trust and transparency. The study drew attention to the fact that the supply chain does not flow as smoothly as anticipated due to the multiple interactions required by diverse stakeholders to realise the final product. The results also highlighted the role of leadership and organisational structures in enabling or inhibiting cooperation, and consequently performance.

It was found that the actions of one stakeholder group impacted on other groups. Hence it was necessary for stakeholders to grasp the big picture and to understand how their individual goals correspond to the system goals. The findings also pointed to the role that each stakeholder group plays in contributing to the success of the system. The pursuit of individual and system-wide goals was considered necessary to ensure performance in complex systems. Control was found to be an inhibiting factor in stakeholder interactions.

Although business success was of significance, the study indicated that stakeholder relationships were equally, if not more important. It was found that a distributed form of leadership and collective expertise is required to ensure that the system is responsive to change, and is flexible enough to handle the complexity. The study also illustrated how stakeholders can focus on achieving their own or system-wide goals by analysing decision-making and strategy-formulation processes.

This study emphasised the importance of high information flow, low power distance and low control in the face of increasing uncertainty and difficult operating conditions in

multi-stakeholder systems like the sugar industry. Recommendations for management include the need to create opportunities for sense-making, and to cultivate a spirit of partnership, collectivism, capacity for change, and the ability to contribute to the greater good.

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CHAPTER 7: DISCUSSION, RECOMMENDATIONS AND CONCLUSIONS

7.1 Introduction

The main aim of this research was to apply SSM at the Felixton Mill area and assess its impact in comprehending social complexity.

The study employed the qualitative research approach. Data were collected primarily through in-depth semi-structured interviews and SSM workshops. A total of 48 interviews and three SSM workshops were conducted. Data were analysed using thematic analysis.

The thesis commenced with the introductory chapter which presented the background, preliminary literature review, problem statement, need for the study, aim and research questions, and importance of the study. Chapter 2 outlined the methodological approach that was followed in the study. Chapter 3 mapped out the social complexity of the sugar industry. Chapter 4 outlined the application of SSM in the sugar industry to address social complexity. Chapter 5 explored the factors that influence the effectiveness of SSM, drawing on the findings from its application thereof in the sugar industry. Chapter 6 identified the challenges of engaging in multi-stakeholder relationships, such as found in the sugar industry, with the aim of presenting recommendations for better management of its complexity.

The purpose of this chapter is to answer the research questions that were constructed at the onset of this study and to also serve as integration for the key findings from the various journal publications (Chapters 3-6). The chapter also outlines the contributions of the thesis, and presents recommendations for management in addressing the problematical situation, as well as for future studies.

7.2 Answering the research questions

7.2.1 How does SSM assist participants in dealing with social complexity?

Social complexity comprises multiple interactions between heterogeneous agents whose actions are impacted by their diverse mental models. The existence of a multitude of stakeholders with their own interests and concerns challenges the formation of a common identity which is required for effective collaboration to achieve the shared purpose or goal that stakeholders are striving for (Fabac, 2010; Maxfield, 1998). Challenges arising from social complexity include varying levels of emphasis on which goals to pursue, how problems are defined and generated, and how best to address them. As stakeholders separately pursue activities to realise the common goal, these independent entities can very easily neglect relationship building, the appreciation of the unique contribution of other parties, and how their own actions affect the system (Brocklesby, 2007; Cao & Zhang, 2011; Goodwin, 2000; Maxfield, 1998; Regine & Lewin, 2000).

A shared understanding and a systemic perspective of the interconnections between the various stakeholders are critical in managing social complexity. A shift from independence towards interdependence is a necessity for stakeholders to come to grips with the uncertainty and disorder that is prevalent in social systems. Social complexity by its very nature entails a multitude of realities within which traditional, linear approaches to management, that emphasise control, coordination and command, are of limited value in producing outcomes (Boulton, 2010; Lissack, 2000; Wallis, 2013). Adaptable organisational structures, multiple inputs from diverse stakeholders, cross-boundary interaction, collective learning, and collaboration are critical aspects which are required to facilitate interaction and self-organisation in conditions characterised by social complexity (Cilliers, 2000; Coleman, 1999; Escobar, 2003; Maxfield, 1998; Pascale, 1999).

The study findings identified a context beset with complex interactions between stakeholders in the Felixton Mill area, characteristic of social complexity (Chapters 3 and 6). The main stakeholders were the growers, hauliers, and the miller, however, actions of other stakeholders, such as industry partners (SASA, SASRI), competing mills, and even government, were found to also contribute to the high levels of social

complexity in the mill area (Chapter 3). These multiple agents displayed independence in their actions, they engaged in various activities, and rarely had opportunities for meaningful conversations about addressing problems and identifying opportunities in the Felixton Mill area. While perhaps at first glance, the study site may appear to have exhibited signs of a traditional linear supply chain, the findings, however, pointed to diverse stakeholder interests, goals, and perceptions (Chapters 3, 4 and 6).

The findings highlighted critical differences between the growers and the miller, in respect of power, values, and organisational structures (Chapters 3 and 4). The miller was found to be individualistic, hierarchical, centrally controlled, and mainly focused on profits to ensure shareholder satisfaction, whereas growers were more collectivist, less bureaucratic, concerned with transparency, and did not only farm to achieve a profit. These differences presented a challenge to collaboration and performance (Chapter 6).

The study identified high levels of mistrust, lack of transparency, and limited understanding of the true extent of individual stakeholder actions affecting the Felixton Mill area (Chapters 3 and 6). This was particularly evident in the way in which stakeholders continuously went back to the impact of the hauliers' actions on growers and the miller, and consequently, cane quality (Chapters 3 and 4). Varying perceptions were also identified on how stakeholders could best manage problems pertaining to cane supply, cane quality, and transport inefficiencies (Chapters 3 and 4; Appendix 16). A particularly pressing problem such as lack of cane supply, which served to challenge the very survival of the mill area, became an overlapping concern, necessitating multi-stakeholder input. The findings demonstrated the urgent need for a platform on which to nurture connections, explore perceptions and interpretations, and facilitate joint problem-solving and collective action so as to manage social complexity in the Felixton Mill area.

The study revealed a number of different ways in which SSM was able to help stakeholders in the Felixton Mill area better manage social complexity. SSM served to firstly bring together the diverse stakeholders, such as the growers, miller, and hauliers, forging ahead towards collaborative efforts (Chapter 4). While perhaps being superficially aware of the key stakeholders in the mill area, stakeholders had the

opportunity of visually grasping the views of others on this matter, and of understanding their concerns and interests (Appendix 7). Stakeholders therefore had an opportunity of developing a systemic perspective and shared understanding, rather than focusing solely on their own problems (Brenton, 2007; Checkland, 2000; Khisty, 1995).

SSM further shed light on the interconnections between stakeholders and how their actions affect one another (Appendix 7), while emphasising the importance of relationship building and maintenance (Checkland & Poulter, 2006; Khisty, 1995). SSM enabled stakeholders to identify and deliberate the various goals that were being pursued. By exposing the diversity in goals and perceptions, stakeholders realised the necessity of taking collective action to address the many problems that posed a threat to the Felixton Mill area. Stakeholders were able to generate multiple possibilities as a result of capitalising on the inherent diversity within the system, which presented opportunities for the system (Appendices 10 and 16).

Profound conversations (Appendix 15) into the root causes of the problems and possible solutions highlighted the complexity of problem-solving, and, in essence, provided structure for the problem situation (Checkland & Poulter, 2006; Vo, Chae & Olson, 2007). This was noticeable in the way in which the stakeholders eventually chose to focus on finding ways of addressing transport inefficiencies (Chapter 4). SSM therefore facilitated emergence through the rich interactions which led to generative potential (Maxfield, 1998; Waltuck, 2012; Wycisk, McKelvey & Hülsmann, 2008). Stakeholders were also able to surface and question the host of mental models that governed action and perhaps impeded more efficient ways of operating (Chapter 4). This was visible in the way in which a grower challenged the miller executive leadership in one of the SSM workshops about their lack of contact with growers on the ground. The ability of SSM to identify, explore, and engage mental models of the various stakeholders, was particularly powerful in instigating a process of change. As seen in Appendix 8, stakeholders realised that mindset change is an antecedent to process and structural change, which, if not carefully attended to, can derail the best of strategies (Brack et al., 2011). The value of the involvement of all relevant parties as opposed to a select few in determining the future, was illustrated in the study (Appendix 7).

The significance of SSM in engaging debate (Appendix 15) enhanced awareness of the need for stakeholders, especially the growers and the miller, regularly to converge in improving the problematic situation, by surfacing and dealing with the multiple perspectives of reality that became visible (Brockelsby, 2007; Jackson, 1991; Khisty, 1995). The findings highlighted the way in which SSM enabled collective learning, collaboration, and emergent intelligence (Checkland & Poulter, 2006; Checkland & Winter, 2006; Mingers & White, 2010). The ability of SSM to explore matters concerning power, roles, norms and values (Chapter 4), provided a means of dealing with social complexity in the Felixton Mill area (Checkland & Poulter, 2006; Checkland & Winter, 2006). The study also illustrated the way in which SSM, by facilitating interactions, created awareness among stakeholders of the importance of adaptability, innovation, learning, and flexible organisational structures in complex systems, such as in the Felixton Mill area, to be able effectively to respond to uncertainty.

SSM is a powerful methodology for stimulating much-needed conversations between diverse stakeholders who may not have many opportunities of engaging at a level where mental models are surfaced and challenged, and diversity capitalised on so as to provoke collective intelligence. Local level interactions between stakeholders produce emergence, moving the system to new levels of order (Waltuck, 2012; Wycisck et al., 2008). The heterogeneity that agents present with, as is witnessed in diverse objectives and multiple perspectives of reality, is not easily dealt with using conventional methods that organisational science has tended to recommend in managing organisations (Lissack 2000; Wycisck et al., 2008).

Multi-stakeholder scenarios are characterised by the presence of diverse agents with power differentials who are required to work together, but who cannot easily come to agreement on which goals to pursue, the factors contributing to the problem, and ways of solving the problem, these goals each requiring a fundamentally different approach (Christis, 2005). SSM, being free of the typical formula-driven, step-by step approaches advocated in conventional management studies, is ideally suited to foster connections and facilitate conversations into ways in which each stakeholder group is able to contribute in moving the system forward (Boulton, 2010; Checkland & Poulter, 2006; Cilliers, 2000; Kurtz & Snowden, 2003; Merry, 2000; Wallis, 2013).

The effect of multiple perceptions of reality on organisational life is perhaps underestimated, however, this study has illustrated ways in which SSM endeavours to illuminate and engage the mental models of individuals, which are the true drivers of behaviour. Approaches to strategy formulation and change management, which neglect meaningful involvement of relevant parties, will be of limited value if stakeholders do not feel that their voices are heard (Pascale, 1999). SSM affords an opportunity for multiple stakeholders, rather than one entity alone, to jointly present their views on problems that exist and how to bring about change, especially when certainty regarding outcomes is limited, as is common in complex systems.

Prospects for capitalising on the rich diversity of heterogeneous agents bound together by a common purpose may be realised in applying SSM to similar problematic situations found in the study. Emphasis shifts from prediction, control, precise answers, and perfect solutions, to a future that emerges as people engage in rich dialogue, learning their way into a new reality with multiple possibilities realised through cross-boundary interactions (Boulton, 2010; Pascale, 1999; Regine & Lewin, 2000). This new organisational reality which SSM enables is not bound up in hierarchies, bureaucracies, order, status, or a future envisioned by a select few (Cilliers, 2000; Coleman, 1999; Escobar, 2003). A conducive culture is instead strived for by facilitating collaborative efforts which tap into dynamic perceptions of reality and deep-seated assumptions, in line with the non-linearity and unpredictability of complex systems, which defy prediction and control (Checkland & Poulter, 2006).

SSM provides an ideal approach with which to handle social complexity through emphasising relationships, viewing the system holistically, intervening as a collective, and developing skills for navigating constant change. This is a more meaningful way for management to respond to multiple perspectives, overlapping issues, and diverse objectives.

7.2.2 What contribution can SSM make to the sugar industry as a whole?

7.2.2.1 Addressing the problematical situation and enabling relationship building

The study illustrated the way in which the Felixton Mill area is characterised by a problematical situation, mainly arising from the multiple, interacting perceptions of

reality held by the diverse stakeholders (Chapters 3 and 6). These stakeholders were found to be pursuing multiple, diverse objectives, and experiencing challenges in reaching solutions to address overlapping issues. The problematical situation was further compounded by constant unpredictability and uncertainty, as well as stakeholders' own value systems and power dynamics (Chapters 3, 4 and 6). The messy situation that was characteristic of the Felixton Mill area, but also the broader sugar industry, required an intervention that could draw together the stakeholders to understand the true extent of their interconnected situation, and grasp the need for jointly determining a holistic view of the problems (Chapter 4). It was also critical that a way should be identified for the various stakeholders to appreciate each other's contributions and diverse ways of conducting business. The sugar industry has tended to emphasise matters around technical issues, efficiencies, resources, inputs and outputs, costs and benefits, placing less emphasis on perceptions driving human behaviour.

SSM can be of value to the sugar industry in a number of ways. Various stakeholders, especially those who are most influential, may be identified, so as to commence discussions on common issues and possible ways of bringing about improvement to the whole system, in the light of the intertwined nature of the sugar industry (Appendices 7 and 8). Efforts should be made to include the miller executive leadership and mill management, all growers (large-scale, small-scale and emergent) and hauliers, who in this study, were found critical to ensuring smooth operations and efficiency in the sugar industry (Chapters 3 and 4).

An additional finding was that government also needs to be involved, particularly as it plays a role in the sustainability of the sugar industry by way of policies such as the Land Reform policy, but also by being instrumental in the Sugar Act and co-generation (Chapters 3, 4 and 6). Industry stakeholders such as SASA, SASRI, the MGB, relevant CANEGROWERS Associations and Grower Councils, and even the SMRI can converge to jointly determine the future. The role and challenges of each stakeholder group in realising the final product may be emphasised, and stakeholders may interrogate whether change is required. Pressing concerns about declining cane supply, the effect of the weather, haulier inefficiencies, increasing input costs and cane quality may hence be reflected on and potential solutions found. SSM is able to facilitate an awareness of the importance of agent connectivity or relationships within

the sugar industry and generative potential thereof, rather than only goal-seeking behaviour (Brocklesby, 2007; Cilliers, 2000; Coleman, 1999; Maxfield, 1998; Mefford, 2011).

7.2.2.2 Illustrating social complexity

SSM, with its wealth of tools, can illustrate the true complexity of the system, which presents a challenge in deriving quick and easy solutions within this industry. The rich picture, by outlining stakeholders and their interests, allows for stakeholders to gain insight into the workings of each independent entity, understanding the limitations of viewing the supply chain as merely being about ways in which materials and goods move from suppliers to consumers (Chapter 4; Appendix 7). Concerns that growers raised such as lack of transparency, limited information, predominant interest by the miller in shareholder satisfaction, and the division of proceeds, may be illustrated and addressed (Chapters 3, 4 and 6). This can help the supply-chain partners understand that the problems in the sugar industry extend beyond planting, ripening, harvesting, and delivery times. The millers may likewise illustrate their interests, such as their purpose of being a corporate entity aimed at deriving profits, owning other mills, having other business interests, and perhaps having businesses outside the country. This predominantly linear notion of the supply chain is not applicable in multi-stakeholder scenarios, such as the sugar industry.

The root definitions, CATWOE and conceptual models (Appendix 10) present an ideal way for all parties to comprehend the nodes along the chain which arise from competing objectives, multiple schema, contrasting assumptions, conflicting values, ambiguity, and manifold views on ways of defining success, addressing issues and achieving individual and system-wide goals (Li et al., 2010). The vastly different assumptions that the stakeholders, particularly growers and miller have, for example around cane-supply agreement, the miller viewing this as a necessity, but the grower considering it as anti-competitive, may be challenged and debated. The CATWOE and conceptual models can allow for comparison of the ideal situation against the present reality, thereby offering a realistic view of the supply chain, rather than oversimplistic images of a smooth chain through which materials and goods flow.

The study highlighted that the weather plays a critical role in the sugar industry, but equally important are outcomes determined from the multiple interactions between the multiple stakeholders (Chapters 3, 4 and 6; Appendix 7). It was found that factors such as labour, strike action, social issues, mill staff capabilities and management skills of growers, impact on the supply chain. The human element behind the processes in the various stages of the supply chain adds an undetermined dimension, which can propel the system into chaos without warning. This interpretation of the supply chain is in line with a complex adaptive systems view, as confirmed by previous research (Choi et al., 2001; Hearnshaw & Wilson, 2013; Li et al., 2010; Surana et al., 2005).

7.2.2.3 Facilitating collaborative action

The collaborative aspects that SSM presents may be beneficial to the supply chain as a whole, particularly in respect of gaining a competitive advantage (Akintoye et al., 2000; Cao & Zhang, 2011; Daugherty et al., 2006; Kumar & Banerjee, 2014; Mefford, 2011). The findings pointed to the need for collective action to respond to the threat posed by competitor mills, but also by being proactive in respect of vertical slicing (Chapters 3, 4 and 6). The need for collaboration in the supply chain may be achieved through corresponding goals, distribution of resources, knowledge creation and communication (Cao & Zhang, 2011); all of which may be attained in SSM. This can allow for problems such as cane supply, cane quality, haulier inefficiencies, and other issues, to be addressed. Stakeholders through the SSM process can comprehend the importance of not competing against one another, but rather responding as a collective to the systemic problems that are threatening the sugar industry (Appendix 8).

SSM can also demonstrate to leaders of the various aspects of the supply chain that facilitating interaction and self-organisation in a complex system, such as the sugar industry, is a better approach to management in such a fragmented industry where stakeholders are geographically and mentally dispersed (Elsner et al., 2010; Plowman et al., 2007). The study indicated the need for the various stakeholders in the sugar industry to form a true partnership, and not be merely bound by cane supply agreements. SSM is capable of illustrating facts to stakeholders, preparing them to be adaptable in the face of unknown outcomes, such as the pending Sugar Act, and

possible unintended consequences thereof. This can afford stakeholders the opportunity of being proactive, and also reflecting on lessons learnt from other policies, such as the Land Restitution and Distribution policies, which resulted in several unintended consequences, including lack of cane supply.

Instead of emphasising excessive control and planning by one stakeholder group, such as the miller or industry partners, SSM can facilitate a conducive environment for input by multiple groups, who are affected by and who affect the industry. This is a necessary approach, as it is not only one organisation that stands to gain or lose (Akintoye et al., 2000; Escobar, 2003; Wycisck et al. 2006). This is particularly critical in respect of the crisis pertaining to the land claims situation which saw farmers being uncertain about their future leading to decreased investments in the land, farms being sold as growers moved north to more conducive farming conditions, fertile land being left fallow, and a cane supply crisis in South Africa. The study highlighted ways in which these challenges pose a dilemma to planning and long-term forecasting. Stakeholders who are under the assumption that control can work in complex systems can have this, and other assumptions tested in SSM, to extract other stakeholders' views, determining possible consequences of actions (Brack et al., 2013).

7.2.2.4 Addressing differences in values

The study, while indicating the importance of stakeholders working together, however, highlighted the way in which the supply chain partners exhibit differences in values, which can present a challenge to collaborative efforts (Chapters 3 and 4). Growers tended to exhibit more collectivist behaviour, while the miller was mainly individualistic and profit-driven. SSM analyses I and II specifically allow for an analysis of values, which can facilitate values alignment or even change of values to meet external or internal demands (Fitzpatrick, 2007). It was evident that cooperation and trust is dependent on the sugar industry stakeholders working through the differences in values that caused divide (Chapter 6). Another inhibitor to effective collaboration is that of differences in organisational culture, which was demonstrated in the study. It is important to examine organisational culture, so that stakeholders can gain insight into 'the different ways in which things are done' and understand values which guide behaviour. A cohesive organisational culture, both internally and

externally, is critical for commitment and a competitive advantage (Chapter 6). SSM can allow stakeholders to work through these and other differences.

7.2.2.5 Enabling learning and understanding power dynamics

The study highlighted the risk averse nature of the sugar industry, which threatens its ability to effectively respond to its multiple challenges, such as international pricing and imports from other sugar-producing countries. SSM is particularly important in enabling learning and adaptation, which is important for organisational longevity (Maxfield, 1998; Waltuck, 2012). It was found that there are power differentials that exist in the sugar industry, such as that the miller has more power than the growers, and large-scale growers more power than small-scale growers (Chapters 3 and 4). The research revealed how complicated it was to get stakeholders to address the haulier inefficiencies, this despite their easily agreeing on actions, such as the common haulier, and other schemes, to bring about improvement (Chapters 4 and 5). An analysis of power afforded by SSM is particularly critical in understanding ways in which partners in the supply chain experience difficulty in taking action, due to owning financial, intellectual, and human commodities.

7.2.2.6 Surfacing and challenging mental models

Another constraint to collaboration in the supply chain is the existence of entrenched mental models of diverse stakeholders. Through debate, SSM surfaces and challenges these worldviews, which affect behaviour and performance in the supply chain. One such perception that came to the fore in the study was that of the haulier not being of real consequence, it only being the growers and the miller who are considered permanent in the industry (Chapters 3 and 4). This was also observed in the attendance of the engagements in the study being mostly by growers and the miller. Yet the actions of the hauliers were found to be most significant. SSM ultimately aims for accommodation of these differing worldviews, which can lead to the identification of actions which bring about change to a problematical situation.

The views of the miller reflected the importance for growers to pay attention to the presence of rocks in the cane that is sent to the mill, and also to attend to cane quality (Chapter 3). SSM allowed growers to voice their concern about cane quality being

affected by finances, which may not be such an easy consideration for them (Chapter 4). Another contentious clash in worldviews impacting behaviour was that of the growers being concerned about the miller's profit-driven focus and shareholder satisfaction (Chapters 3 and 4). SSM, however, allows for this to be debated, as the miller can point to the nature of the business, as well as its commitment to its other mills and business interests, which may result in its being unable to be as forthcoming and responsive as growers expect. Accommodation can be reached through the SSM process.

7.2.2.7 SSM practitioner actions

While advocating for the use of SSM in the sugar industry, it is important to highlight a few key points critical to the effective facilitation of the methodology (Chapter 5). The SSM practitioner, who plays a central role in the process, needs to be flexible and able to handle ambiguity (Kreher, 1994). It can be difficult for managers and other stakeholders to discuss organisational matters openly, especially in light of constraints imposed by organisational culture, structures, processes, and power dynamics. This is in contrast to the argument of Jackson (1991) that SSM will not be strange to managers. The success of SSM is highly dependent on stakeholder participation, commitment, and open and honest dialogue. The miller's challenges in respect of not being able to make decisions immediately, having to defer to higher authority, and being restricted in terms of information-sharing, may have a negative effect on the SSM process (Chapters 3, 4 and 5).

The various stakeholders in the sugar industry must be committed to the process. Other critical factors are group composition, group dynamics, willingness for stakeholders to discuss and confront worldviews, and readiness to compromise on individual objectives (Chapter 5). Reaching an accommodation under such circumstances may be challenging for the practitioner. Time must be taken to examine the nature of the organisational context and accompanying dynamics. SSM may not work well in autocratic organisations (Rose, 1997), where issues around power may prevent stakeholders from taking ownership to bring about change. The SSM process may be more successful when working with mills which are less bureaucratic, or with those that are grower-owned.

The role of leadership is a particularly important aspect that impacts the SSM process. Leadership may on a cursory level, agree to the process, but once the debate stage emerges, could experience reluctance in continuing with the process (Chapter 5). One of the key findings of the study pointed to the impact of behind-the-scenes strategy processes to which only leadership was privy. This implies a constraint on how much information ordinary participants may access. The SSM process can, however, tread into these sensitive aspects of organisational life.

Examining organisational behaviour theory could be useful in making sense of organisational dynamics. Classified strategic initiatives, starting conditions, time, prompts, grouping and inhibiting factors, may impact the SSM facilitation process (Chapter 5). Support from senior management in the various stakeholder groups in the sugar industry and government which allows for interrogation of their actions and logic is imperative to the success of the methodology. Permission from authorising institutions is critical, but the SSM process could be constrained by agendas and hierarchy (Jackson, 1991; Maxfield, 1998).

While SSM offers an analysis into values, roles, norms and power, actually engaging and attempting to change these areas can be demanding (Chapters 4 and 5). The effect of differences in power in the sugar industry, for example between miller and growers, cannot simply be disregarded, in the SSM process. Using existing theory to better understand power in the organisational context can be of value. An assessment of organisational culture is also important, as this can be an inhibitor or facilitator of change. This should ideally be done before the debate and action stage.

Another difficult aspect to steer through is conflict-ridden situations, which may not result in actual change. What may seem to be rational to the practitioner in respect of required actions to bring about change, such as implementing the common haulier proposal, which participants conceptualised, may not be easy for participants to implement in the real world (Chapters 4 and 5). A change in worldviews may not lead to a change in organisational processes. The SSM practitioner is not in a position to enforce change, whether in mental models or actual actions, to improve the problematical situation. At best, the SSM practitioner aims to skilfully channel debate to lead stakeholders to question thinking that leads to action. It is recommended that

the practitioner and client work closely together. Those who are in power will be key in the implementation stage.

The SSM practitioner must be prepared to deal with a situation in which stakeholders may not wish to engage intensely, or simply only want quick answers from the practitioner (Chapter 5). An ample amount of time, self-analysis and honesty is required by the participants to regularly engage change and to discover root causes, not only working through symptoms (Kreher, 1994). It was observed in this research that stakeholders will lean towards easy answers and quick solutions. Participants who may have confided to the interviewer in private during one-on-one interviews about the problem situation, could experience hesitancy in speaking openly amongst other stakeholders, and could even counter such views in public with other stakeholders present, in order to keep up appearances. The facilitator should therefore not depend on stakeholders openly testifying to critical findings. Care needs to be taken in presenting views of the various stakeholders, especially in the midst of a conflict-ridden situation. This was experienced in this research where stakeholders were comfortable in the interviews when confiding to the researcher, however, could not speak openly in the SSM process in the presence of other stakeholders.

Careful consideration must go into which stakeholders to include, and at what stages of the SSM process. The debate and action stage of SSM can be particularly challenging (Chapters 4 and 5). The practitioner must have a certain level of expertise, and must be prepared to put in effort and thought, to engage the problematical situation (Brocklesby, 2007). The SSM tools need to be used flexibly, and other methods, such as interviews and the knowledge café, may also be incorporated. The cause-effect diagram is another useful tool that may be used to examine complex non-linear interactions (Chapter 6).

The facilitator should assess how amenable stakeholders are to engaging the various tools and how much time is available. Those who have to attend to business can feel particularly pressurised. The practitioner should also be aware that circumstances may change during the engagement with participants, and accordingly adapt the process as necessary, in line with the dynamical nature of complex systems. It was observed, for example, that the growers and miller started off particularly antagonistic, but over time, and with the rise of the NCF, became more cohesive. The facilitator's own

perspectives may influence the SSM process. It may be difficult to narrow down issues to examine further, especially when there are diverse worldviews that exist. Abstract thinking and continuous analysis of emerging data are a necessity.

7.2.3 How does the study contribute to the understanding of trust, values, goals, communication, and leadership within the sugar industry?

7.2.3.1 Managing in a multi-stakeholder environment

Some modern-day organisations appear to struggle to interact naturally with other organisations due to notions around competitiveness which places restrictions on information-sharing, strategy formulation and communication. Multi-stakeholder relationships should, however, be approached differently owing to the inability of stakeholders to individually respond to problems that span boundaries, and for which an easy solution does not exist. The study demonstrated the overlapping problems of cane supply, cane quality, and haulier inefficiencies, which required coordinated efforts of the stakeholders to respond as a collective (Chapters 3, 4 and 6). A lack of interaction could lead to stagnation and decreased responsiveness in addressing challenges and constraints. This was particularly evident in the way in which cane supply has decreased over the years, thereby threatening the survival of the sugar industry.

7.2.3.2 Diverse mental models

Being a leader of an organisation operating within a multi-stakeholder context can be challenging, owing to the existence of a multitude of diverse, autonomous agents, who operate in a dynamic environment requiring cooperation to achieve efficiency. This is, however, not easy to realise, each stakeholder group operating under a different set of assumptions, driven largely by their own valid perspectives. The study emphasised the critical role that the miller executive leadership and grower leadership play in ensuring performance and smooth relations between stakeholders (Chapters 3, 4 and 6).

7.2.3.3 Trust, values, goals and communication

Stakeholders are also bound by constraints, such as organisational culture, structures, and power dynamics, which in part, emanate from the desires of leadership, who by virtue of their legitimate power, command authority. This was witnessed in the way in which the organisational dynamics of the miller created dissatisfaction amongst growers (Chapters 3, 4 and 6).

It is of paramount importance to consider what is commonly viewed as 'soft' aspects of management, but yet which are most critical in driving outcomes. Careful consideration must be focused on the role of trust, values, goals, communication and leadership, and not only on the traditionally 'hard' aspects of management. The study highlighted the critical nature of these facets of organisational life in the sugar industry (Chapters 3 and 4). While the miller tended to emphasise efficiency, competitiveness, and profit maximisation, the growers expressed dissatisfaction with the bureaucracy and limited information from the miller, lack of trust between growers and the miller, differences in values, and disappointment with the style of leadership portrayed by the miller.

The 'hard' aspects are often easier for managers to handle as many may have formal training in these areas, which include finance and planning. A pure focus on optimisation, goals, and regulations, is of limited value in the organisational context, which is dominated by matters concerning history, culture, and politics (Jackson, 1991). This was visible in the way in which differences between a collectivist and individualistic culture led to tension between the growers and the miller, to the point where they were unable to take action to bring about improvement to the problematical situation facing them (Chapters 3, 4 and 5).

'Soft' aspects of management are compounded by the human element which is unpredictable, and capable of derailing the best of plans, budgets, strategies, and forecasts. An example of this was seen in the way in which stakeholders battled to adhere to delivery times, owing to the number of stakeholder interactions, particularly between the growers and hauliers that were required (Chapters 3, 4 and 6). There is, unfortunately, no algorithm or formula to prepare for managing in such contexts, except for immersion into each unique situation, and a willingness to engage

stakeholders. There is thus a gap in emphasising the importance of these ‘soft’ aspects and ways in which leadership can best approach these sensitive areas of organisational life that are critical within complex systems.

The study illustrates the innate complexity that besets multi-stakeholder scenarios, in which relationship-building and maintenance is imperative to success (Chapters 3, 4 and 6). The sugar industry must move to vertical slicing in which growers and the miller are united. However, the study revealed the level of difficulty for the miller and growers to work together, moving past their differences. The management of these relationships is a critical aspect of achieving performance. Simply calling for collaboration to facilitate performance is not enough.

7.2.3.4 Leadership

A major observation in this research was the way in which the miller and grower leadership dictated outcomes (Chapters 4 and 5). It was, for example, witnessed that stakeholders in the joint forum (SSM) were able to easily conceptualise actions required to bring about improvement. The challenge, however, arose when stakeholders actually had to take action. It became clear that conflict arose through differences in strategy, culture, processes, and policies, goals and values, and that these factors were capable of limiting action. It was observed that leadership plays a critical role in moulding the organisational context such that it may be conducive to change, and also, through their actions, determining ways in which relationships with stakeholders will unfold.

Figure 7.1, which was constructed based on findings of the study, illustrates the two-fold role of the leader, who operates within a dynamic, non-linear, multi-stakeholder context.

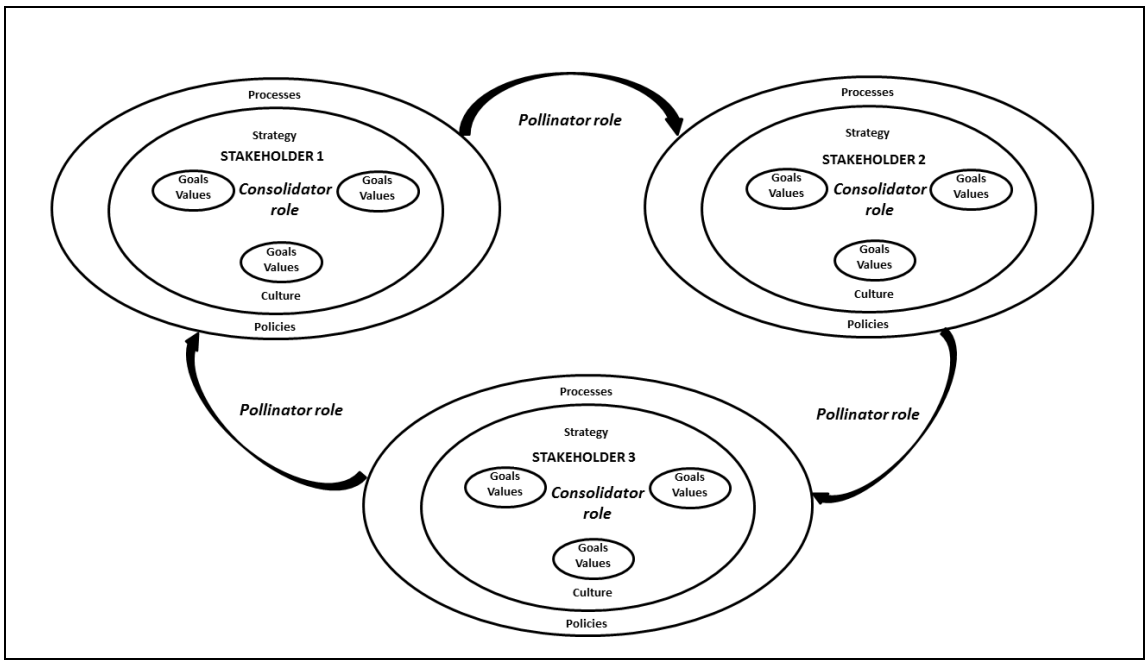

Figure 7.1: Multi-stakeholder leadership model

The role of the leader who operates within a dynamic, non-linear multi-stakeholder context is essentially that of a person who can sustain a constant, delicate balancing act between leading effectively within the organisation, which calls for the *consolidator* role, and leading within the multi-stakeholder arena, which necessitates the *pollinator* role.

Such a leader must firstly act as *consolidator* in respect of his or her own organisation. The leader must pay careful attention to the following internal organisational matters: goals, values, strategy, organisational culture, processes, and policies. These matters will not only define the mental models held by the organisation, but also affect the success of collaboration between stakeholders. All agents within the organisation need to be "playing to one tune". The leader will have to deal with the tension arising between processes and policies, which on the one hand aim to ensure stability, and strategy and culture, which are more fluid and emergent. While there may be a set strategy and a desired organisational culture which the organisation aims to promote, these will be influenced by the multiple interactions of agents. The organisational context is not static, and demands that the leader manage the complexity in real time by facilitating responsiveness, adaptability, emergence, and change. The leader must also consider the multiple goals and diverse values that

are ever-present in the organisation, and must assess the interplay between goals and values, and the strategy and culture.

Once the leader has played the *consolidator* role ensuring adaptive capacity in their own organisation, the leader must take on the role of a *pollinator* to ensure pluralistic stakeholder interaction, in order to transfer and capitalise on the diversity existing within each stakeholder group. This *pollination* can stimulate and strengthen the capacity of the stakeholder partnership to flourish from the crossover of diversity that occurs, and successfully address uncertainty and turbulence within the environment. This ensures innovation and enhanced capacity for collective action. It is, however, important to bear in mind that stakeholders will ultimately need to return to their own organisations to realise performance, and it is here again, that the *consolidator* role of the leader becomes critical. The leader will have to not only balance a results-orientation with relationship management, but also structure with adaptability, and will need to emphasise risk-taking, learning, and emergence (Agar, 2007; Boulton, 2010; Chapman, 2002; Daft, 2011; Fabac, 2010; Maxfield, 1998; Pascale, 1999; Regine & Lewin, 2000). Leadership is a particularly important aspect of multi-stakeholder contexts.

Multi-stakeholder interaction can, however, only be fruitful under conditions characterised by regular communication, which can build trust between the various stakeholders. Levels of trust can increase when leaders perform the *pollinator* role. The actions of leadership, their dependability, and sense of appreciation for stakeholder contributions and not only results, as well as willingness to listen to concerns and suggestions, can go far in nurturing relationships, and consequently building trust. Adaptability in respect of the organisational strategy and culture, as well as having enabling policies and processes within an individual organisation, can facilitate the multiple stakeholders in engaging the diverse mental models that are held, and in achieving a common identity.

It is important that stakeholders be purposefully drawn together in communication forums in which *consolidation* and *pollination* occur as a result of processes stimulating self-organisation and emergence. Communication forums, such as SSM, may be used to facilitate an awareness of the multiple perspectives that exist, in order to ensure that stakeholders gain a systemic perspective. Stakeholders should ideally

achieve accommodation in their diverse perspectives to enable cooperation and performance. Communication in the multi-stakeholder context should extend beyond information distribution to sense-making, joint dialogue, collective learning, and self-organisation.

7.3 Contributions of the study

The study contributed to a different approach to dealing with managerial problems. The field of management has tended to simplify the process by which people work together to achieve a purpose or goal of an organisation. Simplistic definitions which emphasise command, control and coordination, are more suited to simple systems. Complex systems involve a multitude of stakeholders involved in meeting a specified need. This study has demonstrated the value of adopting an alternative view of management in light of the complex interactions occurring in non-linear dynamic systems. The very idea of one purpose or goal being achieved came under the spotlight. This does not seem to stand alone, as stakeholders work to achieve the system-wide goal, as well as their individual goals.

Managing under these conditions in which stakeholders hold different views, individuals find themselves embedded in power plays, and are further tussled by competing values, goals, organisational cultures and structures, each of which requires a fundamentally different approach. The study has illustrated the need for definitions of management in social complex systems to incorporate the ability to steer stakeholders to work together, and navigate multiple perceptions. An appreciation of acknowledging and managing uncertainty, without a clear formula, is paramount. Problems cannot be traced to a single source, situations are not static, and there are no lasting solutions. In essence, the research demonstrated that conventional approaches of control and planning are of limited value when multiple stakeholders are involved.

This research draws attention to the role of values, communication, goals, trust and leadership, critical in achieving collaboration and performance. A multi-stakeholder leadership model (Chapter 7) aims to serve to extend the literature in respect of leading in complex social contexts. Previous research has seldom placed great emphasis on these aspects of organisational life. The focus of business is usually on the tangible, such as finance-related features. Although the impact of complex

interactions cannot be completely ascertained, this study illustrates how critical it is that organisations start paying attention to these matters that demand skills to approach uncertainty and unpredictability, which may not be popular phrases in organisational theory.

Calls have been made to assess the applicability of complexity theory in social contexts (Cairney, 2012; Maxfield, 1998). This study contributed to such understanding by drawing on empirical data to model a real system, rather than only through a theoretical interrogation, which many previous studies have done. This research lends support to the use of complexity theory in the organisational context, and adds to calls to see which principles are relevant in this context. Quite often, concepts from biological and physical sciences have merely been transferred, without regard for their relevance to social sciences. While multiple interactions, uncertainty and unpredictability are a given, the study highlighted the importance of considering power, and organisational culture and structures, as also playing a role (Chapters 3 and 4). A conceptual model of social complexity (Chapter 3) was constructed to illustrate this, and extends understanding of this critical area. The study, by applying the complexity lens, offers insights into organisational behaviour, which few other studies have done. Complexity theory also offered a much-needed, fresh perspective into the use of SSM, to better comprehend stakeholder interactions. This study has further improved understanding of ways of managing within complex systems (Chapter 6).

The research sheds light on and illustrates the value of interdisciplinary studies, particularly to bridge natural and social sciences. The use of systems science and complexity theory offered an innovative way of approaching a study context often neglecting the 'soft' aspects. The research was conducted in a holistic and dynamic way. While emphasis was placed on the more technical aspects, the study highlighted the critical importance of acknowledging the role that multiple stakeholders play in moving the supply chain along. Attention was also drawn to the supply chain not necessarily being smooth and only focused on materials and resources, but rather greatly depending on human interaction to achieve performance.

From a methodological perspective, this study has demonstrated the value of SSM to be not only suitable in addressing social complex problems, but also in the

management context. Previous research has indicated the limitations of employing linear interventions in the social context (Morcol, 2010). The research demonstrated ways of using SSM to engage a systemic perspective by involving multiple stakeholders and focusing on various issues. Unlike many studies in the management context, this study assumed a collaborative approach, in which the researcher did not assume the role of an expert. The methodological approach of blending traditional, qualitative interviews and a knowledge café exercise, with the SSM tools, is also unique. A cause-effect diagram, which is not commonly seen in SSM studies, is another contribution, which may further assist researchers in examining problem situations. The study also presents SSM as an approach to enhancing qualitative research (Chapter 4).

The study has furthermore contributed to calls by previous research (Brocklesby, 2007; Pala et al., 2003) for a much-needed realistic understanding of the realities of facilitating SSM in complex systems, and accounts of the effectiveness of SSM in enabling learning (Chapters 4 and 5). An SSM facilitation model was constructed, which may be used by future practitioners (Chapter 5). Most SSM studies tend to focus on analysing and advancing the SSM tools, or presenting applications of SSM only. Here, SSM has led to the development of various conceptual models of multi-stakeholder engagements (Chapter 6), as well as a multi-stakeholder leadership model (Chapter 7).

7.4 Recommendations for management

As highlighted in Chapter 3 and Appendix 1, stakeholders in the Felixton Mill area must urgently address pressing concerns around cane supply, cane quality, and transport inefficiencies. The actions (Appendix 16) that stakeholders themselves identified to address problems associated with haulage, cane supply, and cane quality may be a starting point, while bearing in mind the desirability and cultural feasibility of this within the Felixton Mill area. Appendix 10 may also be used by stakeholders to guide improvement in the other areas of concern as they consider ways in which the real world differs from the models.

Stakeholders must be afforded regular opportunities to engage in dialogue about these and other overlapping problems that they face, and to derive suggestions for

improvement, as well as to explore the attainment of multiple objectives. One organisation is not able to grasp the complexity of the supply network but does, however, contribute to its formation by participating in localised decision-making (Choi et al., 2001). The various objectives that the stakeholders are pursuing must regularly be deliberated, jointly considered for relevance, and challenged where areas of conflict concerning goal-seeking are identified. Supply-chain partners may be faced with the dilemma of conflicting goals as a result of the need for self-interest of the organisation and that of the whole supply chain (Simatupang, Wright & Sridharan, 2004). The rich pictures (Appendix 7, Chapter 4) that were generated may serve to direct the initial attention of stakeholders.

The critical role of mental models was identified in the study, as well as differences in culture, structures, and values, particularly between the growers and miller. Perceptions, as highlighted in Chapters 3, 4 and 5, determine reality, and consequently affect stakeholder relationships. Working relationships may only be improved if the stakeholders are able to acknowledge these differences and reach consensus on how to move forward. The role of miller and grower leadership is particularly pertinent in encouraging stakeholders to collaborate and ensure performance for the supply chain. The interdependency of stakeholders must continuously be emphasised, and stakeholders have to bear in mind that their actions affect others in the supply chain.

The position of small-scale and emergent growers, and the government's role in the agricultural industry, requires careful analysis, as this study indicated their role in the present cane supply crisis. These growers operate differently from large-scale growers, and have distinct challenges. Government must be involved in exploring ways of improving their viability and carefully consider policy regarding land claims, as this study has indicated the negative impact thereof on large-scale growers, and consequently on the industry.

As recommended in Appendix 2, attention must be directed at developing the business and husbandry skills of emergent and small-scale growers, and cooperatives could be considered to address feasibility issues for small-scale growers. Mentoring is suggested as another way of facilitating the development of these stakeholders, and ensuring their viability and that of the sugar industry. Growers in general require a

more united stance by becoming more actively involved in forums, developing their management skills, and taking initiative.

The study also clearly indicated the role of miller-grower unity in achieving performance. Cross-boundary interaction is particularly important between these key stakeholders in the Felixton Mill area, especially in dealing with the poor relationship between commercial growers and the miller (Bezuidenhout, Bodhanya & Brenchley, 2012b). The mill leadership has to be more visible to the multiple stakeholders, engaging them regularly in problem-solving and innovation. It is suggested that the miller focus on interrelationships, and not only on the resources when viewing the value chain. The hierarchical structure and processes of the company must be balanced against the need for flexibility, so that the organisation becomes more responsive, especially to external stakeholders. The miller should attempt to engage the growers in strategy formulation and implementation, thus giving them an opportunity of feeling acknowledged. The multi-stakeholder leadership model and conceptual models in Chapter 6 serve as a starting point for stakeholders in the Felixton Mill area, to find ways of managing the uncertainty and unpredictability facing the system.

Although stakeholders in the Felixton Mill area experience difficulty in respect of the degree of transparency and information they can share, owing to the organisational structures, processes, politics and power dynamics, effort will nonetheless have to be made to break down these barriers, as these constraints further intensify the levels of mistrust. Existing forums in the Felixton Mill area, such as the NCF, MGB, local grower councils, and those at industry level must manage these and other issues. The role of the organisational culture in achieving or hindering collaboration must be examined.

The supply chain must be viewed through a complexity lens, in order to realise the limitations of traditional notions of linearity, advanced planning, and fixed objectives, in ensuring smooth functioning of the supply chain. Stakeholders must instead develop the art of embracing the ambiguity that is at play, as a result of the multiple stakeholders who continuously interact. In this regard, stakeholders in the Felixton Mill area, but also in the broader sugar industry, must develop change-management skills and strive for continuous learning, adaptation, and a proactive, collaborative

approach which can enable a synergistic effect. This will become particularly important as stakeholders in the sugar industry prepare for the new Sugar Act. It will be critical for stakeholders to bear in mind that small changes can result in large effects, and vice versa, and that there may be unintended consequences that arise. It is recommended that the industry be more flexible in facilitating change at the local mill area level.

7.5 Limitations of the study

As found by many others, time on the part of the researcher, as well as participants, presented a limitation in this research. A few limitations, which were outside the control of the researcher, were experienced with respect to the SSM engagements with the stakeholders. The study strongly relied on the willingness of stakeholders to sacrifice their time, to participate in the interviews and SSM workshops. The study is limited in respect of the number of stakeholders who could avail themselves to participate in the research.

Another challenge was that this was the first time that SSM was being applied in this study context. Stakeholders were new to such interventions, and had no experience with being in open dialogue about 'soft' issues. While perhaps confirming and acknowledging the importance of the 'soft' issues, stakeholders were evidently more comfortable discussing the 'hard' issues in the open forum. Stakeholders were also less responsive to some of the SSM tools (root definitions, CATWOE, conceptual models), which may have been too technical. It was observed that stakeholders required time to engage debate about the many issues in the sugar industry. This created pressure on the researcher to ensure that enough time was allocated to the SSM activities, as there was limited time with the stakeholders.

The SSM workshops were not held in the real, everyday world setting (mill or farm) of the stakeholders, which, as noted by Brocklesby (2007), is common, but can, however, present a limitation in achieving coupling between people, getting conversations to flow naturally, and may be ineffective or unsatisfactory to the participants.

The SSM engagements, although leading to proposed actions to bring about improvement, did not lead to action in the real world. Coming in as an outsider also presented a challenge on the part of the researcher, as it was not possible to be completely aware of the dynamics associated with the study site. The researcher only became aware of the shadow system as participants became more comfortable with the researcher.

The grower and miller organisational dynamics associated with power, politics, structures, cultures, processes and strategies only became known to the researcher over time, but nevertheless had an immense impact on the SSM process from the beginning. The researcher, while perhaps being in a position to stimulate debate about stakeholders' actions, could not intervene to change these fundamental aspects of individual, group and organisational behaviour.

The success of the SSM process also largely depended on the willingness of the grower and miller leadership to engage open and honest debate with the other stakeholders, and to permit their followers to do so. This is also largely why stakeholders could not take action in the real world. The bureaucratic and hierarchical nature of the miller meant that stakeholders' desire to engage in the SSM process, and to take action based on decisions taken in this forum, could not materialise. The requests of the leadership for confidentiality about strategic matters and negotiations that were being conducted in private, also had an impact on the SSM process.

7.6 Recommendations for future studies

Future studies can explore ways of engaging participants in the SSM process to achieve open dialogue by integrating theory on organisational behaviour, systems theories, communication, learning, and change management. The relationship between the real world and the SSM intervention world should also be investigated to determine how to achieve a more authentic learning environment. Future research can also examine ways of assisting stakeholders to take action, so that the proposals for recommendations from the SSM process do not merely remain on paper.

As identified in this research, the constructs of culture, power, and structures, play an important role in social complexity, but require further exploration. A study which

incorporates the use of system dynamics or other systemic methodologies with social complexity theory may be conducted in the organisational context. Supply chain management and agricultural studies should utilise organisational behaviour theory, drawing on system sciences to investigate problems that incorporate both 'hard' and 'soft' aspects.

7.7 Conclusion

The research set out to explore the role of SSM in comprehending social complexity. The objectives which set to examine ways in which SSM can assist in dealing with social complexity, the contribution of SSM to the sugar industry, and ways in which the study contributes to the understanding of trust, values, goals, communication and leadership within the sugar industry, have now been addressed. This study has made a number of modest contributions to the systems, complexity, organisational behaviour/science and management theory. It has also provided methodological contributions. Implications for management have emanated from the study findings and recommendations for future studies have been made.

"A science of qualities extends the science of quantities to include the different ways of knowing that we can use to understand the complex webs of relationship within which we are embedded at every moment of our lives. Focus on quality of life by the cultivation of the antennae needed to participate responsibly in these webs is not new. We do it naturally all the time, and all human cultures have developed these qualities of participation to a greater or lesser degree. We have chosen to do so to a lesser degree in our culture and there is a growing consensus that it is time to recover our balance."

(Goodwin, 2000: 48)

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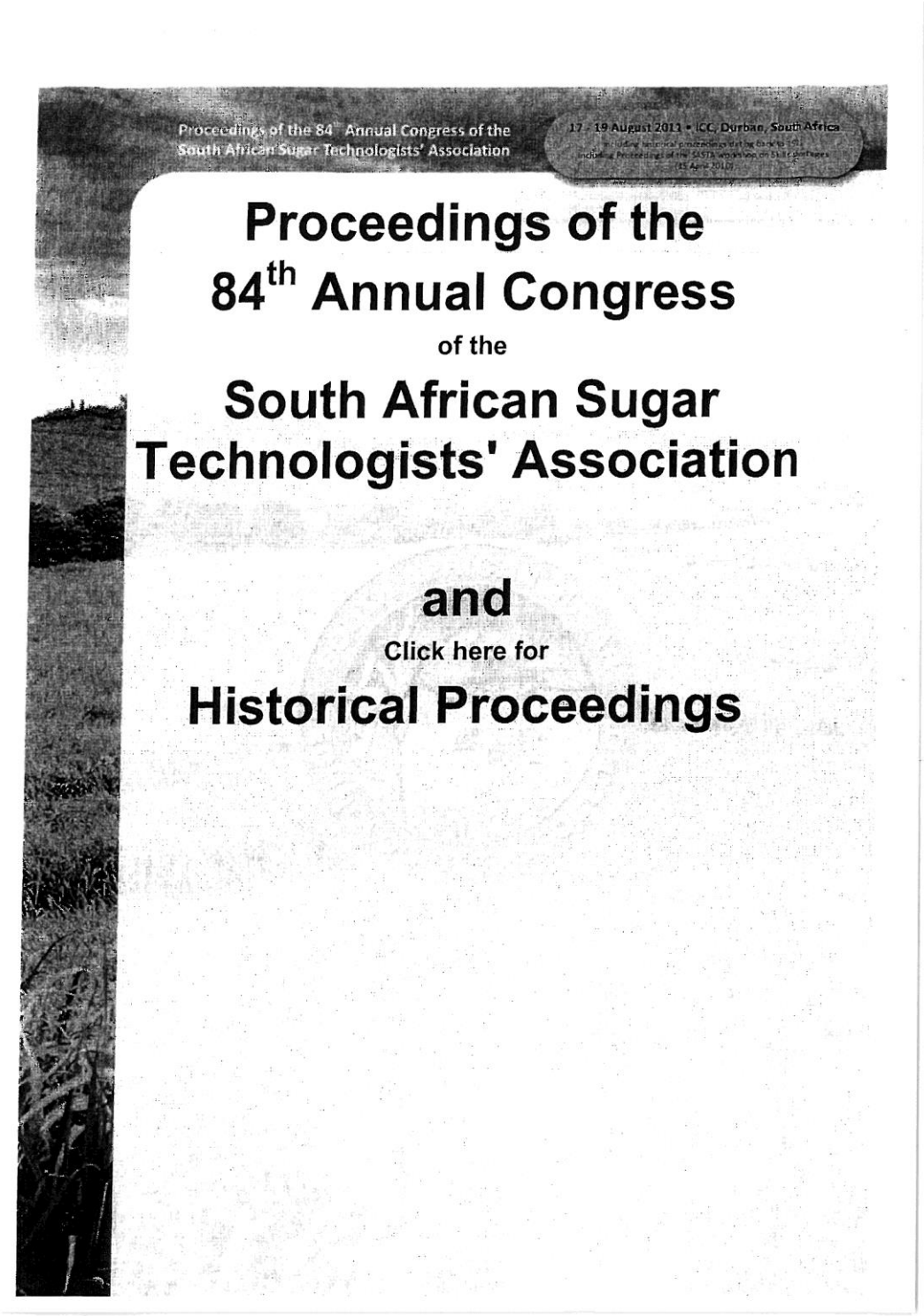
Tongaat Hulett Sugar. Available at http://www.huletts.co.za/ops/south-africa/mills/felixton.asp Accessed 10 October 2014.

APPENDIX 1: CONFERENCE PAPER

Gerwel, C., Hildbrand, S., Bodhanya, S. & Bezuidenhout, C. (2011). *Systemic approaches to understand the complexities at the Umfolozi and Felixton Mill areas.* Proceedings of the 84th Annual Congress of the South African Sugar Technologists' Association (SASTA), 177-181, Durban, South Africa, 17-19 August 2011.



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SHORT, NON-REFEREED PAPER

SYSTEMIC APPROACHES TO UNDERSTAND THE COMPLEXITIES AT THE UMFOLOZI AND FELIXTON MILL AREAS

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Abstract

In sugarcane supply chains, emphasis is usually placed on 'technical, hard issues' around cane quality and supply, mill efficiency, and division of proceeds, as a way of bringing about improvements to a particular mill area. This short paper, however, argues that intervention by focusing on 'soft issues' such as leadership, communication, trust, and exploring multiple values and goals, can make a positive contribution to address the 'hard issues' around performance and efficiency. The focus of this paper is thus on outlining the methodologies that were employed as a means to reveal existing soft issues, and to start improving the working relationships between the 'people behind the cane' at the Umfolozi and Felixton mill areas, on the northern KwaZulu-Natal coast. These areas are characterised by complexity which arises from the interactions between the multiple stakeholders, some of whom include millers, growers and hauliers. The paper commences by briefly outlining the theoretical areas that form the core of the studies. A description is then provided of the various, well-established methodologies that are employed in the empirical work, and tentative findings are outlined. The paper concludes by highlighting the potential of the methodologies to the sugar industry, and delineates the way forward.

Keywords: sugar industry, systems thinking, Soft Systems Methodology, SSM, Viable System Model, VSM

Introduction

It is important to consider issues such as leadership, communication, trust, values and goals, and not only hard technical approaches when aiming for improvement in the sugarcane supply chain (Bezuidenhout and Bodhanya, 2010). When dealing with complex human activity systems, the design of a systemic intervention enables system improvement through incremental adjustments. This short paper argues that a positive contribution to the 'hard' issues around performance and efficiency can be made by focusing on the 'soft' issues. One way of achieving this is through the use of systems methodologies, such as Soft Systems

Methodology (SSM) and the Viable System Model (VSM). This paper reports on the preliminary use of such methodologies in the two milling areas of Umfolozi and Felixton.

These milling areas are characterised by complexity that arises due to the existence of multiple stakeholders with diverse mental models, goals, values, expectations and strategies. This could create competing objectives, resulting in conflicts and tension within the supply chain.

Theoretical underpinnings

Systems thinking is useful in understanding that a holistic view is necessary, due to the effects of one part of a system having effects elsewhere (Ng, 2004). This is particularly relevant in the sugar industry where there are diverse stakeholders interacting each with their own objectives. There are growers, hauliers and the mill, as well as influences from relevant bodies such as the South African Sugarcane Research Institute (SASRI), the South African Sugar Association (SASA), and even the Government. Complex systems, as in the case of the sugar industry, are characterised by non-linear developments where predictions from the past can not necessarily be used to determine the future, where seemingly minor changes have significant effects, and where conventional planning has limitations in controlling uncertainty (Mukherjee, 2008; Klijn, 2008).

SSM is a methodology that allows for intervention in complex, real-life situations where there are problematic areas (Checkland, 1985). The focus is on learning, through constructive conversations, where relevant stakeholders jointly 'surface' perceptions and deal with issues. The emphasis is on accommodations between the different stakeholders, and on reaching an agreed path of action (Presley and Meade, 2002). The stages in SSM involve finding out about the problem situation, and then generating models that allow for debate by comparing how things are in the real world as opposed to how they could be, and then deciding on a course of action to bring about improvement. Different tools are used, such as the generation of 'rich pictures' which are used to identify stakeholders and their interests.

VSM investigates those characteristics in a system that makes it viable (Jackson, 2000; Beer, 1984). The five subsystems can be summarised as, (a) basic operations, (b) coordination of the operations, (c) daily management and control, (d) development for looking at the environment and future, and (e) policy to ensure the necessary coherence and vision for the whole system. The viability of an organisation requires the entire and proper functioning of all five systems and their channels (Schwaninger and Rios, 2008). VSM is perceived as suitable to deal with the complexity of the sugarcane supply chain, as it is a tool to assess stakeholder interactions and to reveal deficiencies and improvements options (Burnett and Durant-Law, 2008; Cezarino and Beltran, 2009). System coherence and a common understanding is essential for a well functioning supply chain, as too much fragmentation reduces efficiencies and prevents the implementation and approval of technical solutions. Additionally, VSM assists stakeholders aiming for different goals to anticipate, plan for and implement change (Kinloch *et al.*, 2009).

Methods

The empirical work[1] consisted of standard qualitative research methods such as interviews, which were integrated with SSM and VSM. By using different tools, mainly from SSM, the stakeholders played a key role in uncovering issues, as well as in leading discussions around ways to address the concerns. The stakeholders consisted of representatives from the mills, growers (large scale, small scale growers (SSGs) and emergent) and hauliers.

A first round of interviews (a total of 25 in the two milling areas) was conducted in July 2010 to determine how things work and to surface some issues. The data was analysed to identify themes and the stakeholders were then engaged in the first SSM workshop in September 2010. This involved participants drawing rich pictures to identify the main stakeholders and their concerns. The rich pictures provided data that allowed the researchers to better understand the challenges and design the next SSM workshop, which was hosted in October 2010. This workshop focused on the presentation of systems that were designed by the researchers to address the issues. Interviews were also conducted (a total of 20 in the two milling areas) to allow more detailed probing of the issues that were noted. The engagements revealed existing challenges which were inhibiting technical system improvements, and indicated opportunities for a possible way forward.

Findings

Tentative findings that are generally applicable to both mills, but in some instances are more specific to one mill, are listed below.

- A lack of appreciation and understanding of the various contributions of the different stakeholders exists. Some stakeholders noted that not enough people had a holistic view and were more concerned with their own workings. Certain stakeholders also mentioned that they felt like "small cogs in the big wheel". There was tension between the goals of the millers – which some perceived to be merely about producing a profit – and that of some growers who would have liked more interaction and assistance. The division of proceeds creates further discord.

- Problems with communication and transparency exist. Many stakeholders felt that, although there was basic communication in place, that such communication is superficial. There is also room for two-way communication between miller and growers. Linked to this is perceived mistrust. There is a need to have more cohesion between the growers and they should be encouraged to be more actively involved in the workings of their areas.

- SSG operations and sustainability present a serious threat to the industry, as their wellbeing affects cane supply. SSGs experience problems such as lack of finance, infrastructure and support, and their limited knowledge of cane farming.

[1]Unpublished data from PhD studies, CN Gerwel and S Hildbrand, UKZN, Durban, South Africa.

- The consistent delivery of quality cane is critical and is something that can be realised only through efficient interactions between all stakeholders. Reliable transport is considered essential as this is linked to cane deterioration. Mill efficiency and maintenance is also a concern.

- An increase in cane supply is of importance but is constrained by weather, soil fertility, alternative crops, declining interest in cane farming, land and the availability of input resources.

- There is a clear desire from stakeholders that working relationships be improved and that the sources of conflict and blame be identified and addressed. This can, however, only be achieved by bringing about a mindset change and by allowing stakeholders to understand how their actions affect the system. There is an awareness that stakeholders depend on each other, but there is a need to develop skills to be able to handle working in such a complex and uncertain environment.

Recommendations based on these findings include the creation of new or adaptation of existing forums, where key stakeholder representatives can raise concerns in a safe environment. It is also critical that upper management/leadership from both the millers and growers promote two-way communication and that more responsibility be taken in ensuring ground-level contact. Rich interactions between the millers and growers, composed of honest conversations concerning mutual problems, will go a long way in achieving a mindset change. Consultations with relevant stakeholders at an early stage regarding proposed changes or existing problems can prevent the occurrence of unintended consequences at a later stage. Use of a common haulier could increase efficiencies which are currently not being realised; and SSGs should make more effort to become cohesive and share the responsibilities that will ensure success.

Evaluation forms revealed that some participants felt overwhelmed by being exposed to such activities in the first workshop, while others indicated that it was interesting and informative, and was key in providing insight into what the other stakeholders were doing. Some mentioned that it was slightly difficult to be completely honest in the presence of certain stakeholders, particularly with the history that exists between miller and grower.

Comments from the evaluations of the second workshops indicated that practically all participants valued discussions around the important issues that were raised, and some also mentioned how critical it was to have all parties air their views in an open forum where miller, haulier and grower were present.

The key findings will be further interrogated through SSM and VSM by continuously reassessing the situation and asking pertinent questions involving what actions can be taken and specifically by whom to bring about systemic improvements. Such discussions by key role players may pave the way towards improved communication and cohesion, led by a form of collective leadership, which will ultimately strengthen the system as a whole.

Conclusion

The use of systemic methodologies provided a better understanding of the issues that were plaguing the Felixton and Umfolozi mill areas. There should be on-going efforts to engage with these issues, as well as any new issues that arise. These methodologies can present a useful tool to other mill areas by interrogating concerns that affect diverse stakeholders, who all stand to lose or gain through the complex nature of their interactions. Through discussions aimed at surfacing deeply held beliefs and perceptions, stakeholders can together make systemic improvements which can ultimately lead to increased efficiencies in their area.

Acknowledgements

This research was funded by the NRF and SASRI. The stakeholders at the Felixton and Umfolozi mill areas who participated in the workshops and interviews are sincerely acknowledged for their contributions.

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APPENDIX 2: CONFERENCE ABSTRACT

Gerwel, C. & Bodhanya, S. (2011). *Small-scale fishers and small-scale cane growers: Attaining success in big industry.* Poster presentation at the Southern African Institute for Management Scientists (SAIMS) Conference, Durban, South Africa, 11-14 September 2011.

Small-scale fishers and small-scale cane growers: Attaining success in big industry

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Keywords: Small-scale players, fisheries, cane, business, viability

Small-scale players in the fisheries and cane business may be likened to small fish immersed in a big pond. The demands of competing in such industries are large and require an entrepreneurial spirit, combined with a host of skills including financial, marketing, and general management skills. A question that can thus be asked is whether a symbiotic relationship can be established between the small-scale and large-scale actors, given the unique South African context of apartheid, and obvious consequences such as resource ownership, but also covert ones such as educational, linguistic and business abilities. Current debates in the country are partly focused on this question, by way of the spotlight being cast on land and natural resources, particularly within the mining context. This paper will however only address a specific part of this question by focusing on the identification of key factors required to ensure the viability of small-scale actors, specifically in cane farming and fisheries. The aim of this paper is thus to draw on findings of completed research involving small-scale fishers in the Western Cape (WC) and current research pointing to small-scale cane growers in KwaZulu-Natal (KZN). Such research, within the South African context, is critical in providing a better understanding into pressing issues with

significant outcomes for a diverse range of players. The focus of the first study was on a policy change in the Western Cape fisheries which impacted a variety of stakeholders. The second study involved an application of systemic methodologies to investigate social complexity in a milling area in KwaZulu-Natal. Both studies utilised a systems thinking perspective which acknowledges holism by understanding how the parts interact. Furthermore, complexity theory also served as the basis for understanding how complexity arises from the actions and interactions of players with diverse perspectives. Other literature focused on the role of leadership, communication and change in multiple-stakeholder scenarios. Qualitative research involving in-depth interviews was conducted in both studies and multiple stakeholders were targeted. The findings, although from two separate studies, point to a variety of factors which impact on the viability of small-scale players who are trying to be successful in the bigger context. Firstly, small-scale actors do not go about business as usual. This is as a result of challenges related to limited financial management and general business skills which impede their ability to run their businesses successfully and access credit. Specific industry knowledge and a comprehension of the broader structures impacting them, as well as a limited educational base and language command play a critical role in how successful small players are in communicating and negotiating with big industry. Socio-economic factors play a tremendously important role, and constraints are especially faced in terms of limited employment opportunities in the towns and also the skills base that the individuals possess. Operational support and knowledge requirements are pivotal and small-scale players need to be able to strategise and relate to large-scale and industry players. The role of government is undeniable, particularly in providing an array of services from the various departments. Mentoring support or corporate social responsibility by large-scale players and industry comes into question. There is a need for small players to pool their resources, whether through co-operatives or other means, but a challenge is getting small-scale actors to work together, be adaptive and responsive to change, and most importantly, competitive. Recommendations in terms of key factors that are needed to ensure the success of small-scale players centre on aspects around business skills, entrepreneurship, access to capital, and key questions around ownership.

Small-scale fishers and small-scale cane growers: Attaining success in big industry

leadership centre UNIVERSITY OF KWAZULU-NATAL

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UNIVERSITY OF KWAZULU-NATAL INYUVESI YAKWAZULU-NATALI

INTRODUCTION

Small-scale players in the fisheries and cane business may be likened to small fish immersed in a big pond.

Competing in such industries is demanding and requires an entrepreneurial spirit, combined with financial, marketing, and general management skills.

A question that can be posed is whether a symbiotic relationship can be established between the small-scale and large-scale actors, given the unique South African context of apartheid, and obvious consequences such as resource ownership, but also covert ones such as educational, linguistic and business abilities?

This research focuses on the identification of key factors required to ensure the viability of small-scale actors, specifically in cane farming and fisheries.

The aim of the research is thus to draw on findings of completed research involving small-scale fishers in the Western Cape and current research pointing to small-scale cane growers in KwaZulu-Natal.

Although the contexts differ, such research, within the South African context, is critical in providing a better understanding into pressing issues with significant outcomes for a diverse range of players.

DESCRIPTION OF THE STUDIES

The focus of the first study was on a policy change in the Western Cape fisheries which impacted a variety of stakeholders.

The second study involved an application of systemic methodologies to investigate social complexity in a sugar milling area in KwaZulu-Natal.

Both studies utilised a systems thinking perspective which acknowledges holism by understanding how the parts interact.

Complexity theory also served as the basis for understanding how complexity arises from the actions and interactions of players with diverse perspectives. Other literature focused on the role of leadership, communication and change in multiple stakeholder scenarios.

Qualitative research involving in-depth interviews was conducted in both studies and multiple stakeholders were targeted.

- Fisheries: Small-scale fishers from the fishing communities, Marine and Coastal Management staff, representatives from the commercial and recreational sector and non-governmental organisations representing the fishers.
- Cane: Growers (large-scale, small-scale, emergent), millers and hauliers.

The interviews were recorded and transcribed and data analysis was based on thematic clustering.

FINDINGS

Small-scale actors do not go about business as usual.

Challenges experienced relate to limited financial management and general business skills which impede their ability to run their businesses successfully and access credit.

Specific industry knowledge and a comprehension of the broader structures impacting them, as well as a limited educational base and language command play a critical role in how successful small businesses are in communicating and negotiating with big industry.

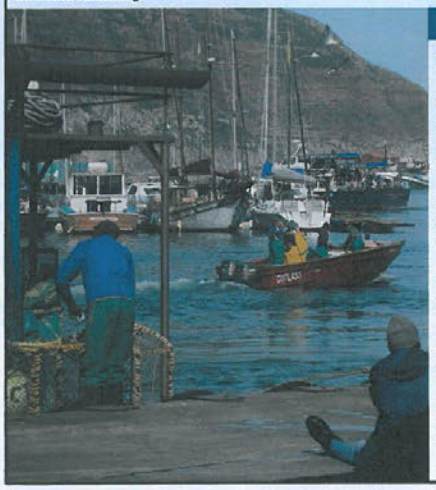
Socio-economic factors play a tremendously important role, and constraints are especially faced in terms of limited employment opportunities in the towns and also the skills base that the individuals possess.

The success of the businesses of small-scale actors appear to be severely impacted by wider community factors and structures.

Operational support and knowledge requirements are pivotal and small-scale players need to be able to strategise and relate to large-scale and industry players.

The role of Government is undeniable, particularly in providing an array of services from the various departments. Mentoring support or corporate social responsibility by large-scale players and industry comes into the question.

Small-scale players need to pool their resources, whether through co-operatives or other means, but a challenge is getting them to work together, be adaptive and responsive to change, and most importantly, competitive.



RECOMMENDATIONS

The following recommendations are made to address the issues facing small-scale actors:

- Business skills and entrepreneurship workshops need to be offered by credible training providers. Incentives should perhaps be offered to those who have engaged in skills development.
- Credit applications and financing processes for small business in particular requires urgent attention.
- Government must intensify efforts to increase education and investment for communities who are in need of assistance or who are solely reliant on one industry. The fisheries, in particular, is an industry facing tremendous pressure from multiple users.
- The role of the various Government departments in providing support to small-scale actors needs to be critically evaluated to determine the current and desired states.
- Communication forums between the different stakeholders, and amongst small-scale players need to be created to address common problems.
- Small-scale players need to consider joint ventures, such as cooperatives to strengthen their businesses. Trustworthy individuals must spearhead such initiatives and issues regarding leadership, decision-making and the handling of money will be particularly critical.

APPENDIX 3: CONFERENCE ABSTRACT

Gerwel Proches, C.N. & Bodhanya, S. (2013). Applying Soft Systems Methodology in the Sugar Industry. Presentation at the 2nd International Conference on Management, Economics & Finance, Kota Kinabalu Sabah, Malaysia, 28-29 October 2013.

APPLYING SOFT SYSTEMS METHODOLOGY IN THE SUGAR INDUSTRY

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Abstract

This presentation is based on a study conducted at the Felixton Sugar Mill in northern KwaZulu-Natal, South Africa, with the aim of applying Soft Systems Methodology (SSM) in the sugar industry. SSM is a methodology which uses a flexible, yet organised process to bring about action to improve problematical situations (Checkland & Poulter, 1990). The qualitative research approach was used, and consisted of traditional interviews and facilitatory workshops with growers, millers and hauliers. Interviews were conducted in July 2010 with the focus on identifying the goals of the various stakeholders, and how stakeholders perceived communication, trust and overall efficiency. Data were analysed using thematic analysis. Purposeful activity models were created after engaging in analysis of the interview transcripts, as well as rich pictures which were constructed by stakeholders in a workshop in September 2010. The models focused on creating a system for: 1) appreciation of the different stakeholders, 2) improving the sustainability of small-scale growers, 3) improving mill efficiency, 4) the consistent delivery of quality cane, 5) improving communication, 6) increasing cane supply, 7) better division of proceeds, and 8)

improving working relationships. Stakeholders were invited to a second SSM workshop in October 2010 to present the SSM tools that were constructed. Stakeholders chose to interrogate the model that aimed to create a system to ensure the consistent delivery of quality cane, and engaged structured discussion into how the real world situation differs from the model. Discussions from the workshop showed that there was a need for a common, coordinated transport system as current inefficiencies severely impacted the growers and the mill. Participants however noted that communication and levels of trust between the stakeholders would have to improve. Evaluations from the workshops indicated that stakeholders appreciated the opportunity to jointly discuss common issues plaguing the system.

Keywords: Sugar industry, soft systems methodology, qualitative research.

APPENDIX 4: INFORMED CONSENT FORMS

University Of KwaZulu-Natal
Leadership Centre

PhD (Leadership Studies)
Researcher: Cecile Gerwel (0312608318)
Supervisor: Shamim Bodhanya (0312601493)
Research Office: Ms P Ximba (0312603587)

Dear Respondent,

I, Cecile Gerwel am a PhD student in the Leadership Centre at the University of KwaZulu-Natal. My PhD study is entitled "An application of systems methodologies to investigate social complexity at the Felixton Mill area". The main aim is to enable systemic improvements in the sugar industry. The interview will mainly address soft aspects, i.e. communication, stakeholder relationships, managerial and leadership issues.

Your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequence. There will be no monetary gain from participating in this interview. Confidentiality and anonymity of records identifying you as a participant will be maintained by the Leadership Centre, UKZN. However, in the case of a focus group please be aware that I cannot assure that other focus group members will retain confidentiality.

If you have any questions or concerns about participating in this study, please contact me or my supervisor at the numbers listed above. The focus group discussion / interview should be approximately 1 hour. I hope you will take the time to participate.

Sincerely

Investigator's signature_____Date_____

This page is to be retained by the participant.

University Of KwaZulu-Natal

Leadership Centre

PhD (Leadership Studies)

Researcher: Cecile Gerwel (0312608318)

Supervisor: Shamim Bodhanya (0312601493)

Research Office: Ms P Ximba (0312603587)

CONSENT

I_____(full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project. I understand that I am at liberty to withdraw from the project at any time, should I so desire.

_____ _____

Signature of Participant Date

This page is to be retained by the researcher.

APPENDIX 5: JULY 2010 INTERVIEW QUESTIONS

- What are the various goals of the growers, hauliers and millers and do you consider them to be compatible with each other or are they competitive? Why do you think so?
- How do you feel specifically regarding communication, and trust between the stakeholders?
- How do you currently deal with those issues and do you consider this as appropriate? What would you recommend?
- How influential is your own position and that of your stakeholder group both towards the overall success?
- What can be done to improve overall system efficiency and would you run things differently if it were one company (miller, haulier and grower)?
- What major issues have you been confronted with in the last 6 months?
- If you were one company how would you resolve it?
- What have we missed / should we have been asking you?

APPENDIX 6: SEPTEMBER 2010 SSM WORKSHOP 1

Questions for Rich Picture exercise

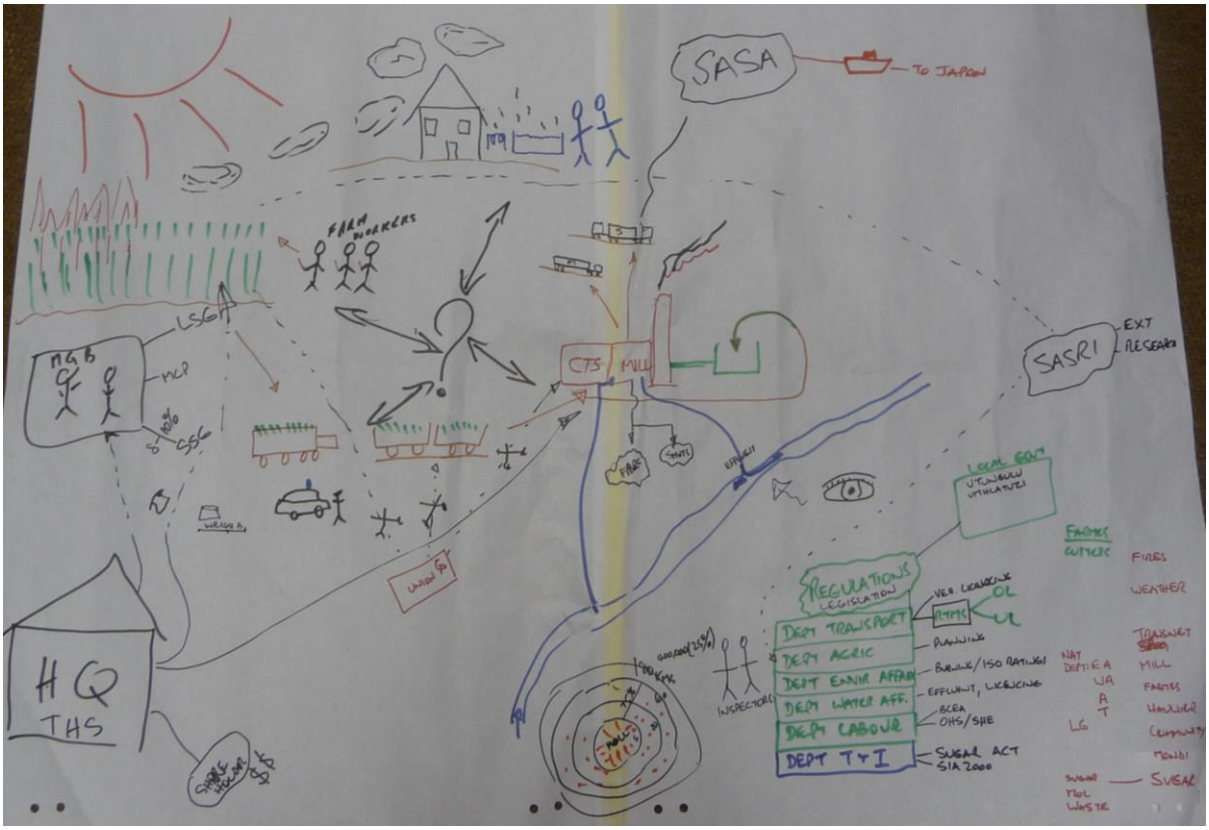
- Who are the stakeholders?
- Who is affected or involved in the system here?
- What are their objectives or goals?
- What are the issues?
- What are the challenges?
- How is one thing related to another thing?
- Are there linkages? What linkages are there?
- What institutions are involved?
- What are things that bother you?
- Where do you see conflicts?
- What are the concerns of the different stakeholder groups?
- What are the interests of the different stakeholder groups?
- What affects you?
- What are the problems in this area? And how do you deal with them?
- How are things working here in your milling area?
- What is the motivation of the different stakeholder groups?

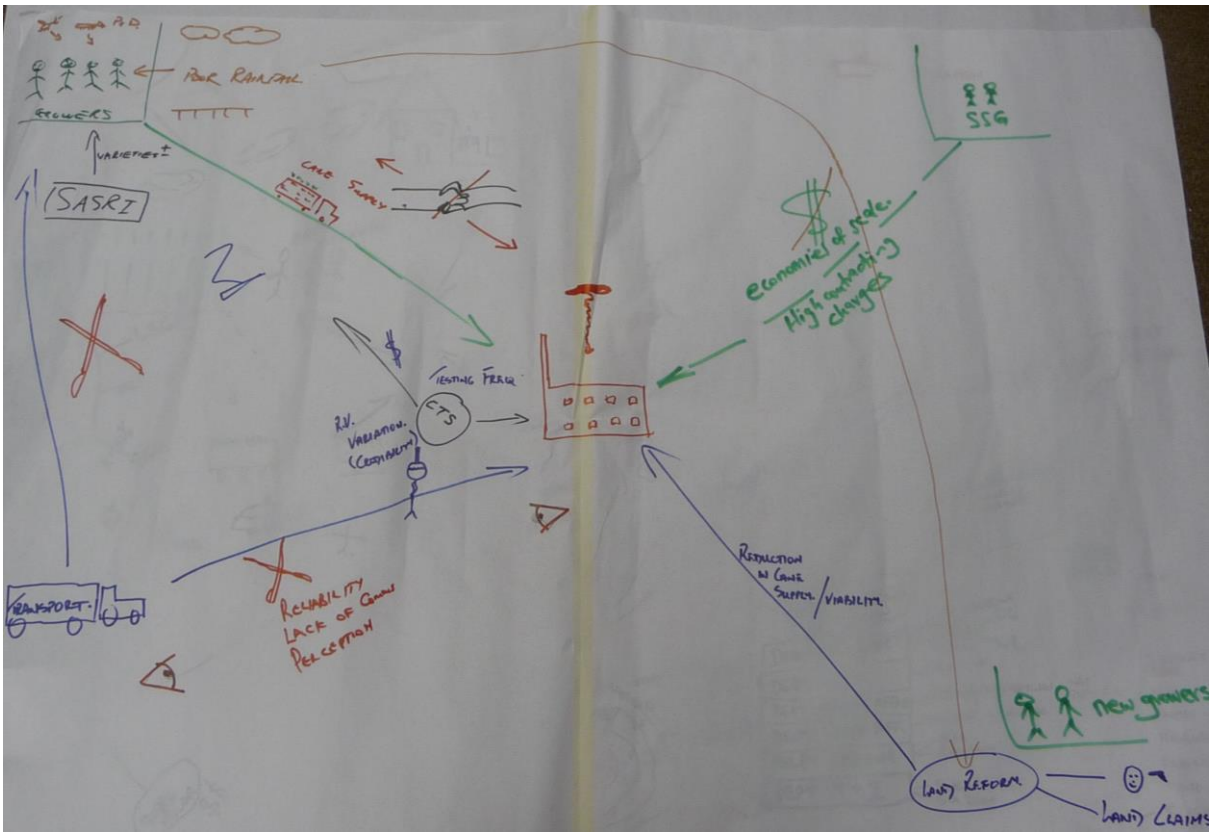
Questions for the Knowledge Café exercise

- What are the major topics or themes this picture tells you?
- What stands out for you?
- What is embodied in this picture?
- Who is affected by the situation?
- Who are the stakeholders in this picture?
- How do the stakeholders perceive the situation?
- What do you see in the picture?
- Which concerns stand out for you?
- What are the fundamental issues?
- What are the problems in this picture? And how are they dealt with?
- What linkages can you see in the picture and why are they linked?

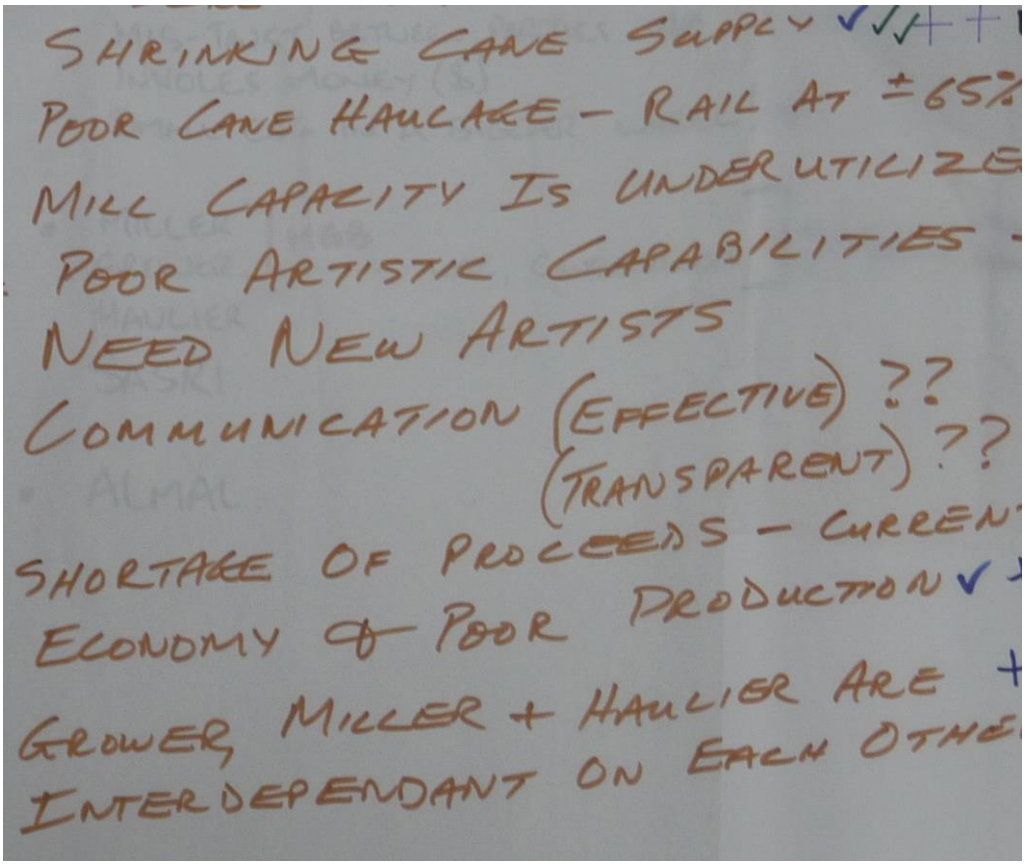
- How is one thing related to another? What impact does x have on y?
- What can you see about the working situation in your milling area in this picture?
- What are the key challenges that need to be addressed?
- Can you see why it is so difficult to change the situation?
- Who or which organisations or groups should be involved if you want to change something about the situation? Why?

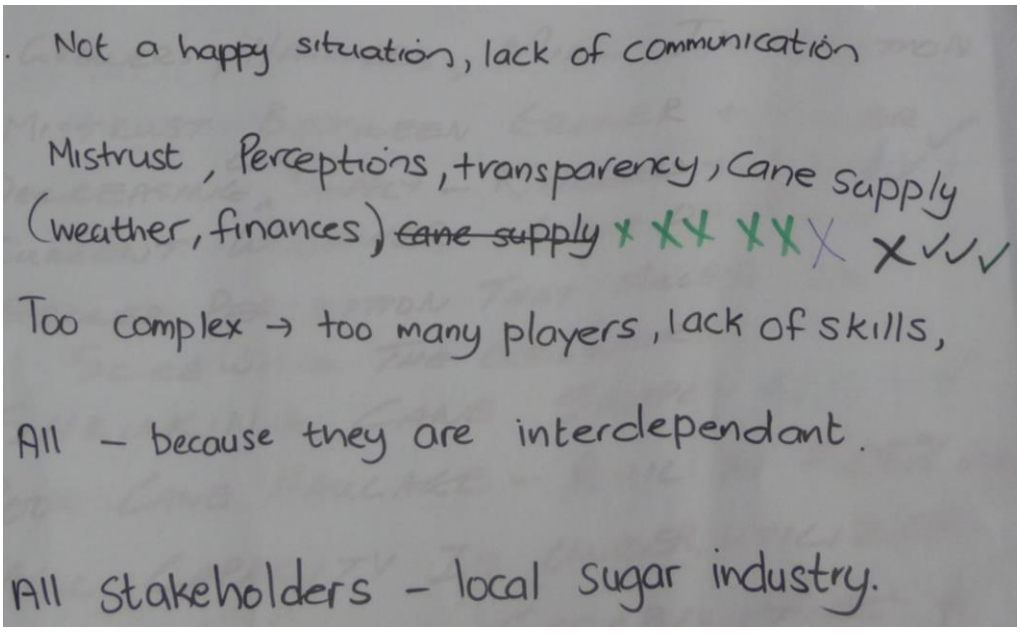
APPENDIX 7: RICH PICTURES FROM SSM WORKSHOP 1

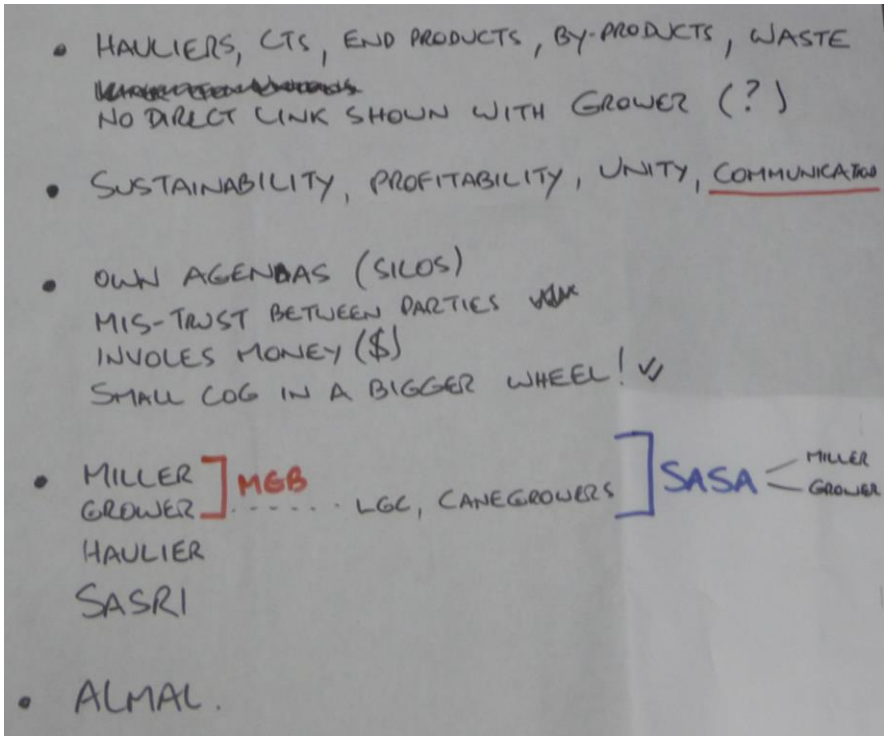


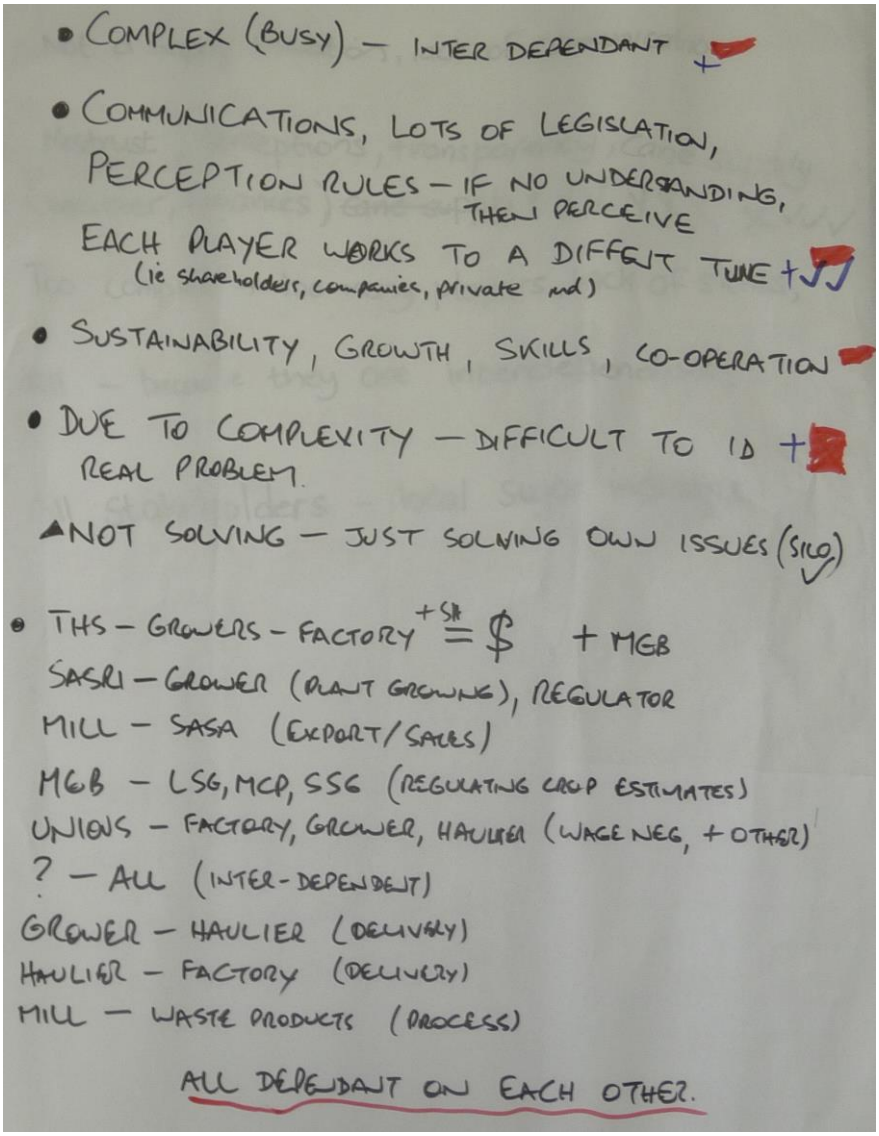


APPENDIX 8: ISSUES DERIVED FROM RICH PICTURES USING KNOWLEDGE CAFÉ EXERCISE IN SSM WORKSHOP 1






HAULIERS, CTS, END PRODUCTS, BY-PRODUCTS, WASTE
NO DIRECT LINK SHOWN WITH GROWER (?)
SUSTAINABILITY, PROFITABILITY, UNITY, COMMUNICATION
OWN AGENDAS (SILOS)
MIS-TRUST BETWEEN PARTIES
INVOLES MONEY ($)
SMALL COG IN A BIGGER WHEEL!
MILLER
GROWER
MGB
LGC, CANEGROWERS
SASA
MILLER
GROWER
HAULIER
SASRI
ALMAL.


COMPLEX (BUSY) – INTER DEPENDANT
COMMUNICATIONS, LOTS OF LEGISLATION,
PERCEPTION RULES – IF NO UNDERSTANDING, THEN PERCEIVE
EACH PLAYER WORKS TO A DIFFENT TUNE
(ie shareholders, companies, private ind)
SUSTAINABILITY, GROWTH, SKILLS, CO-OPERATION
DUE TO COMPLEXITY – DIFFICULT TO ID REAL PROBLEM
NOT SOLVING – JUST SOLVING OWN ISSUES (SILO)
THS – GROWERS – FACTORY + SR = $ + MGB
SASRI – GROWER (PLANT GROWING), REGULATOR
MILL – SASA (EXPORT/SALES)
MGB – LSG, MCP, SSG (REGULATING CROP ESTIMATES)
UNIONS – FACTORY, GROWER, HAULIER (WAGE NEG, + OTHER)
? – ALL (INTER-DEPENDENT)
GROWER – HAULIER (DELIVERY)
HAULIER – FACTORY (DELIVERY)
MILL – WASTE PRODUCTS (PROCESS)
ALL DEPENDANT ON EACH OTHER.

APPENDIX 9: EVALUATION OF SSM WORKSHOP 1

Thank you for taking the time to participate in the exercise. Please complete the following questions regarding your participation in the exercise.

- How would you describe your experience in the exercise?

- Has your participation in the exercise made you think differently about your real world, life, or work? Please describe.

- What could have been done better in the exercise?

- What are the lessons that were learnt from the exercise, regarding the sugar industry?

- What are your suggestions for how the following groups in the sugar industry can do things differently, in order to move forward as a collective whole?

Growers / farmers:
Millers:
Hauliers:
Other stakeholders:

- Is there anything else that you wish to add that was not covered in the workshop process or any other opinions that you have?

- In order to assist us in planning our future workshops, please indicate which days in a week / week of the month is most suitable for you to attend?

Thank you!

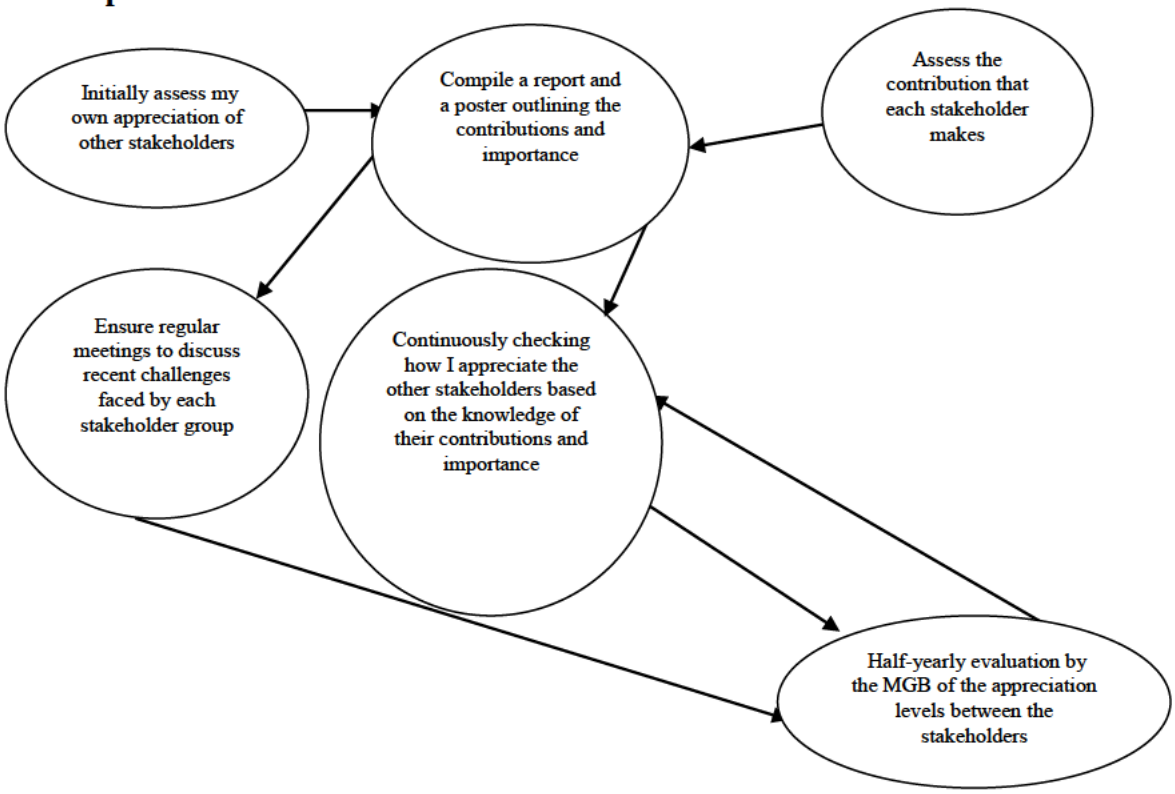
APPENDIX 10: SSM TOOLS FOR SSM WORKSHOP 2 – ROOT DEFINITIONS, CATWOE AND CONCEPTUAL MODELS

Root Definition 1 – Appreciation of the different stakeholders

A system jointly owned and operated by growers, hauliers, miller and MGB to improve appreciation of the different stakeholders by indicating their importance and contributions to the system, in order to improve the overall efficiency of the system, within the constraints of stakeholders who are not willing to be appreciative of the other stakeholders.

C	Growers, hauliers, miller
A	Growers, hauliers, miller, MGB
T	Improve appreciation of the different stakeholders
W	Indicating stakeholders' importance and contribution helps to improve appreciation of the different stakeholders / Improving appreciation of the different stakeholders improves the overall efficiency of the system
O	Growers, hauliers, miller
E	Stakeholders who are not willing to be appreciative of the other stakeholders

Conceptual Model

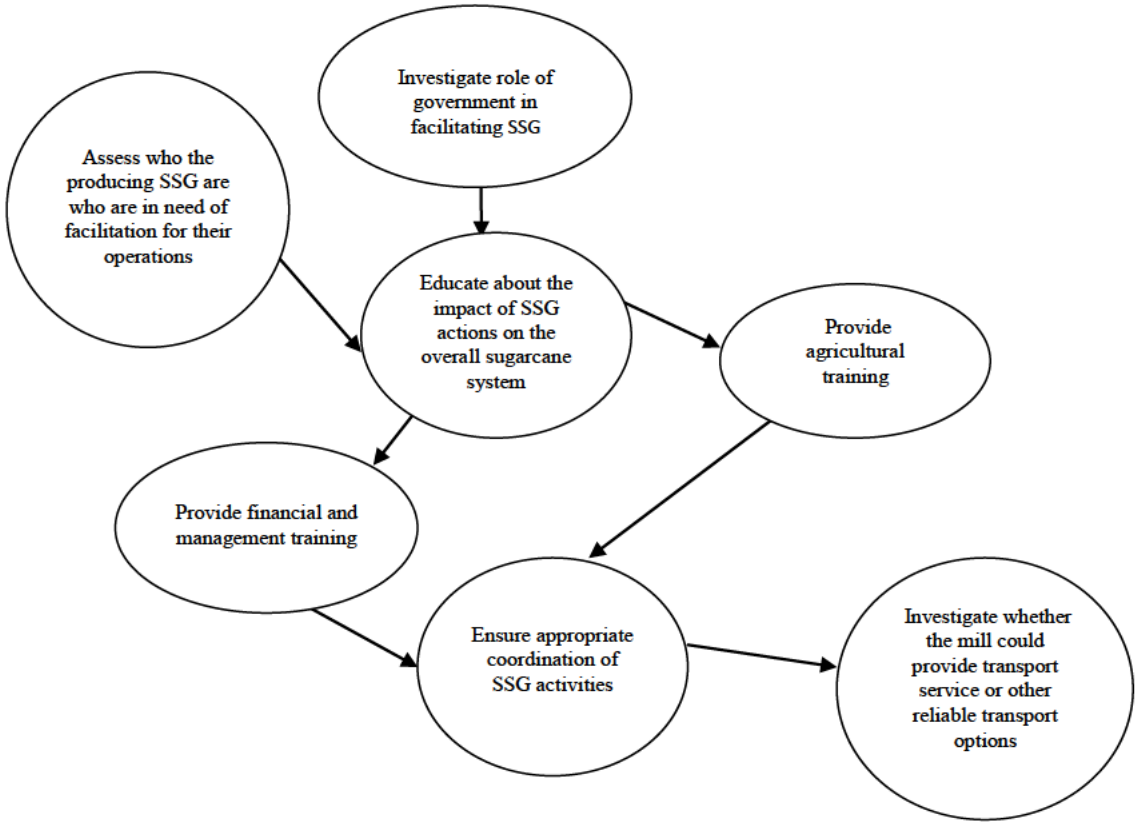


Root Definition 2 – Improve SSG sustainability

A SSG and transporter owned system operated by SSG and transporters, but facilitated by millers and government, to improve the SSG sustainability and operations by addressing their deficiencies in order to increase cane supply, within the constraints of weather, infrastructure, lack of knowledge and finances.

C	SSG, mill
A	SSG, facilitated by mill and / or government, reliable transporters
T	Improve the SSG sustainability and operations
W	SSG sustainability will increase cane-supply / Addressing their deficiencies improves the SSG sustainability and operations
O	SSG, reliable transporters
E	Weather, infrastructure, lack of knowledge and finances

Conceptual Model

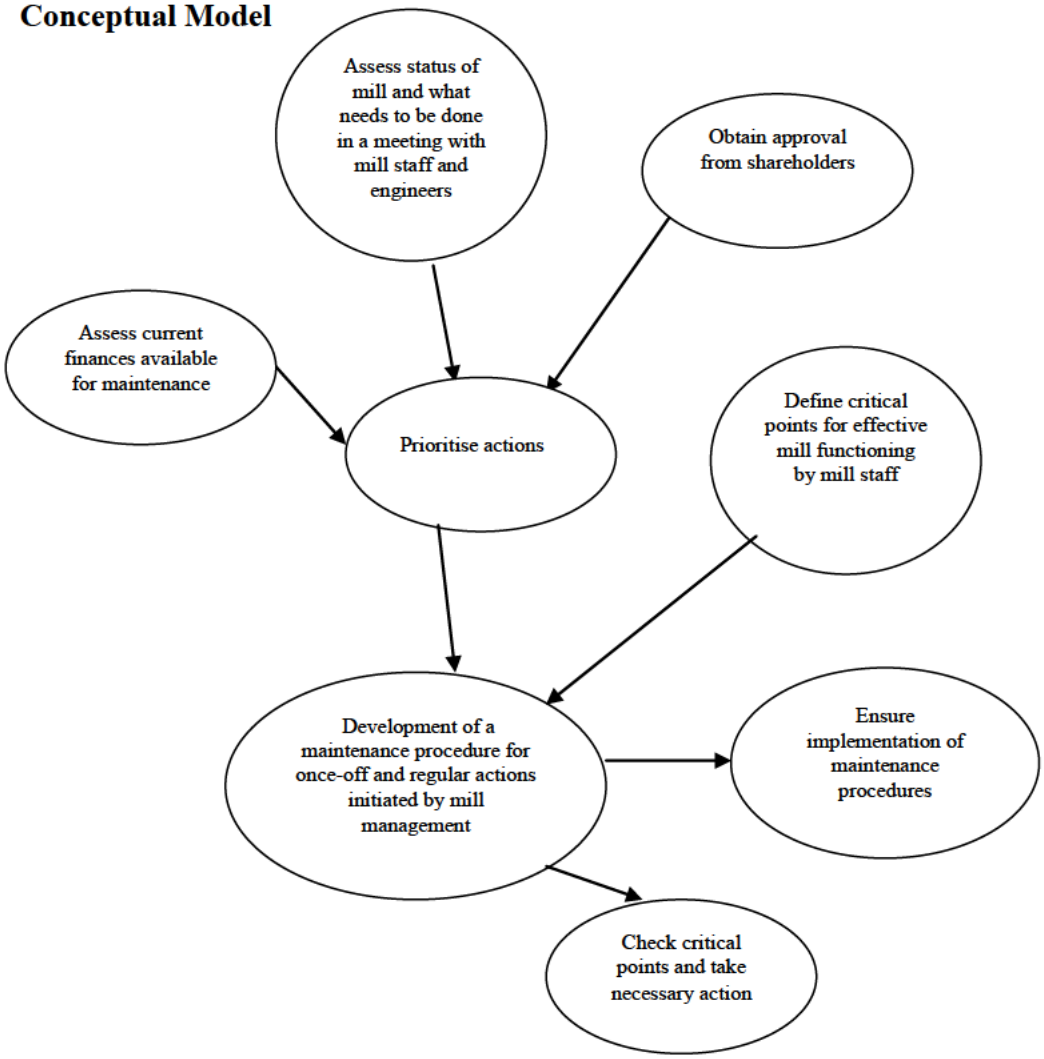


Root Definition 3 – Mill efficiency improvement

A mill management and shareholder owned system, operated by engineers and mill staff to improve mill efficiency by ensuring proper maintenance in order to reduce slow crush and mill stops, within the constraints of what is financially feasible.

C	Growers, mill
A	Engineers, mill staff
T	Improve mill efficiency
W	Ensuring mill maintenance improves mill efficiency / Improved mill efficiency reduces slow crush and mill stops
O	Mill management and shareholders
E	Finances

Conceptual Model

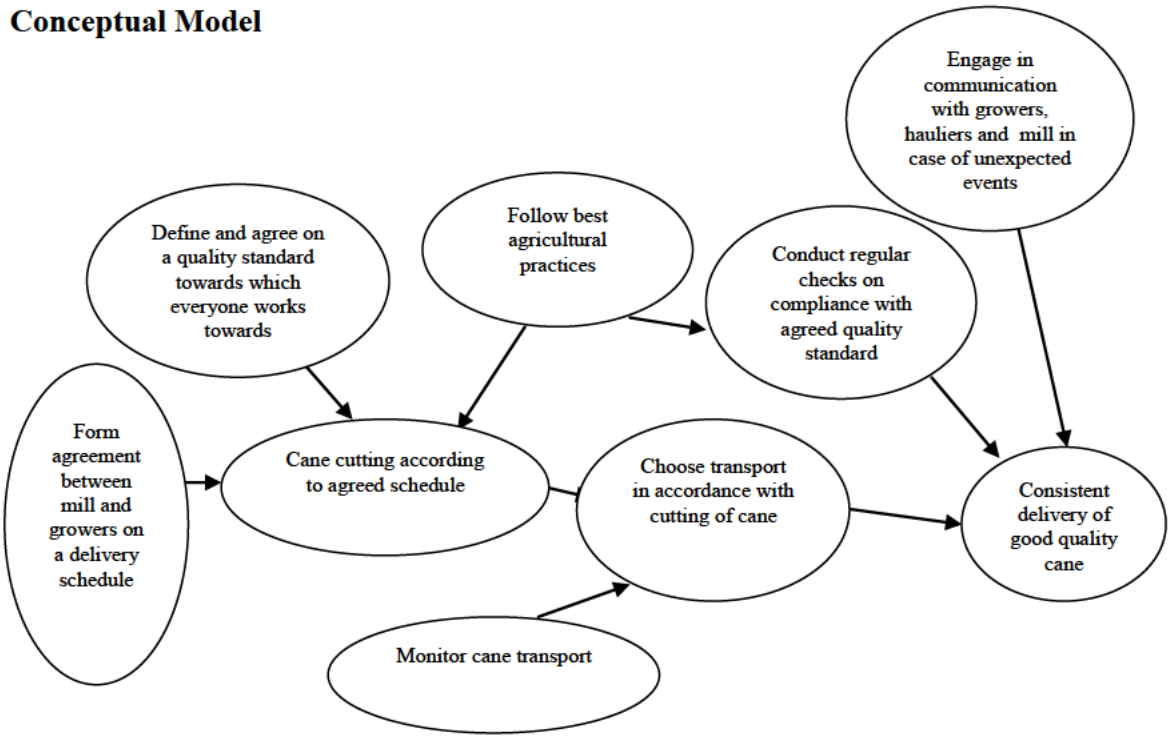


Root Definition 4 – Consistent delivery of quality cane

A grower and haulier owned system, operated by hauliers, growers, mill, to enable consistent delivery of quality cane according to the defined rateable daily deliverables, by following good agricultural practices and ensuring efficient transport to the mill to enable the consistent delivery of quality cane, within the constraints of the availability of input resources and weather.

C	Mill, growers
A	Hauliers, growers, mill
T	Enable consistent delivery of quality cane according to the defined rateable daily deliverables
W	Following good agricultural practices and ensuring efficient transport to the mill enables consistent delivery of quality cane
O	Growers, hauliers
E	Available input resources, weather

Conceptual Model

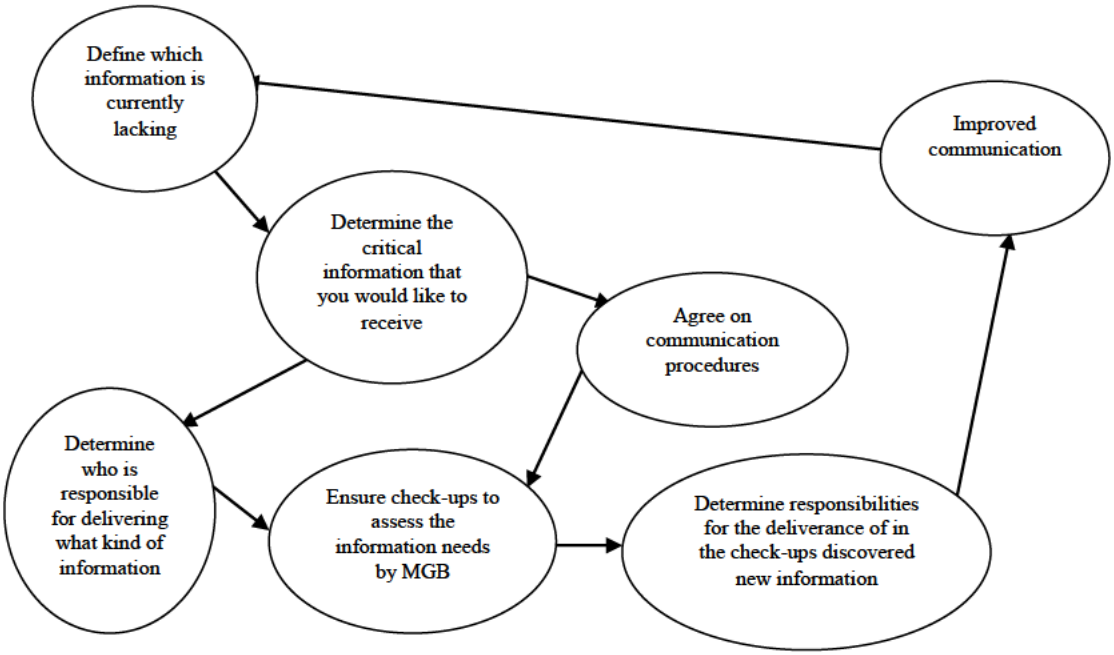


Root Definition 5 – Improvement of communication

A system to improve communication between the three main stakeholder groups by defining the information needs and communication responsibilities and procedures in order to increase transparency in operations in the sugarcane production and processing system.

C	Growers, hauliers, mill
A	Growers, hauliers, mill
T	Improve communication between the three main stakeholder groups
W	Improving communication between the three main stakeholder groups increases transparency in operations in the sugarcane production and processing system / Defining the information needs and communication responsibilities and procedures improves communication between the three main stakeholder groups
O	Growers, hauliers, mill
E	Access to communication modes, behaviours of withholding information, lacking the ability to see the benefits

Conceptual Model

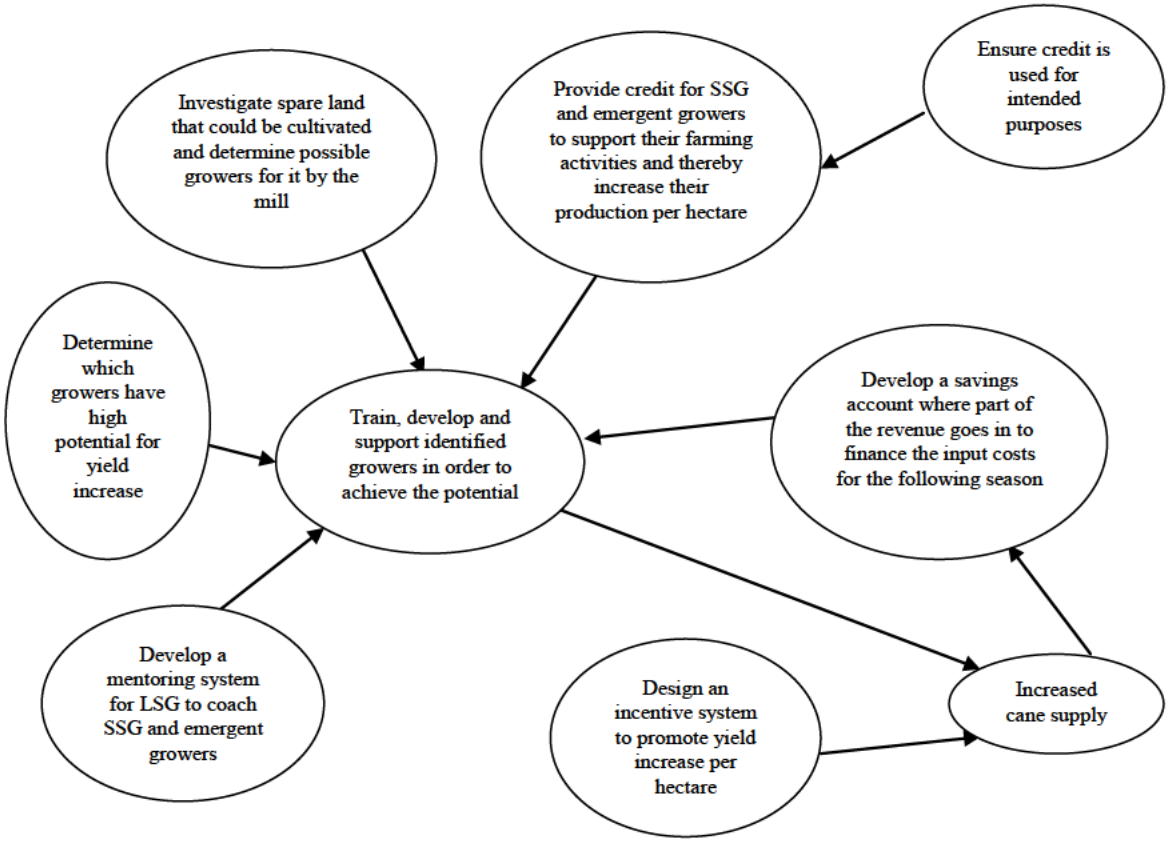


Root Definition 6 – The increase of cane supply

A mill owned system, operated by growers and mill, to increase cane supply by evaluating yield increase potential and spare land potential by supporting SSG and emergent growers and implement a yield increase incentive system in order to make the local sugar production area more sustainable, within the constraints of weather, soil fertility, land, and the availability of input resources.

C	Growers, hauliers, mill
A	Growers, mill
T	Increase cane supply
W	Increase cane supply makes the local sugar production area more sustainable / Supporting SSG and emergent growers and implement a yield increase incentive system increases cane supply
O	Mill
E	Weather, soil fertility, land, availability of input resources

Conceptual Model

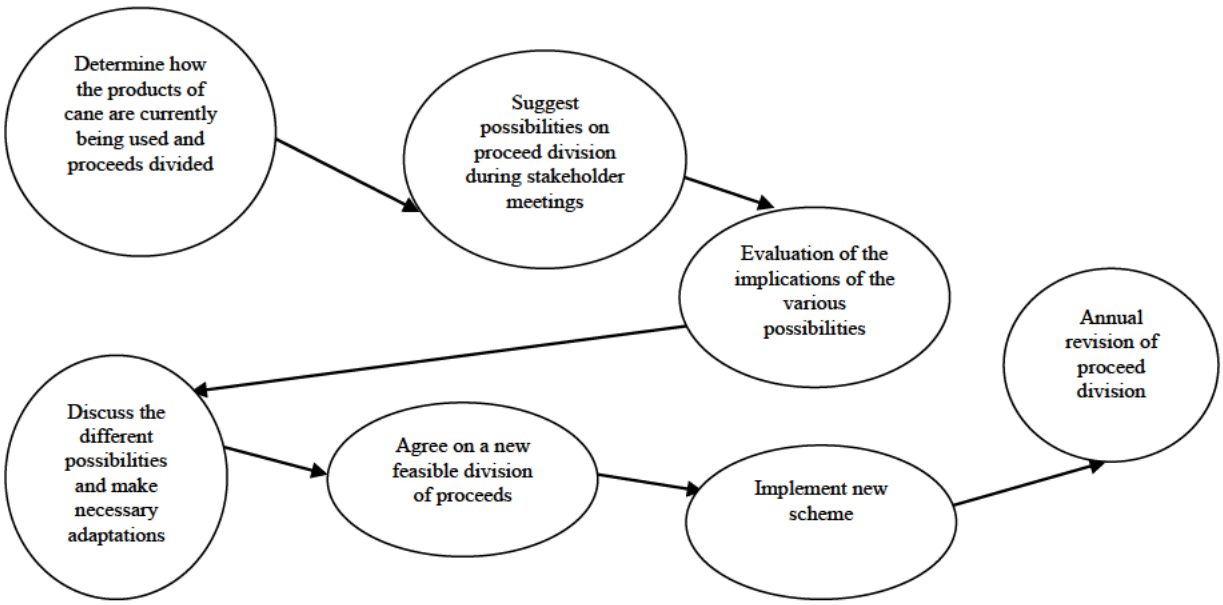


Root Definition 7 – Better division of proceeds

A THS HQ owned system, operated by mill management and enabled by shareholders and growers, to design a fairer payment scheme by enhancing discussions about the division of proceeds that arise from the various products from cane, and investigations into the possibilities of better division of proceeds, in order to improve the miller-grower relationship, within the constraints of the Sugar Act, an entrenched way of doing things, and a potential unwillingness from mill headquarters to lose part of their share.

C	Growers, mill
A	Mill management enabled by shareholders, growers
T	To design a fairer payment scheme
W	Design a fairer payment scheme improves the miller-grower relationship / Enhancing discussions about the division of proceeds that arise from the various products from cane, and investigations into the possibilities of better division of proceeds designs a fairer payment scheme
O	THS HQ
E	Sugar Act, entrenched way of doing things, a potential unwillingness from mill headquarters to lose part of their share

Conceptual Model

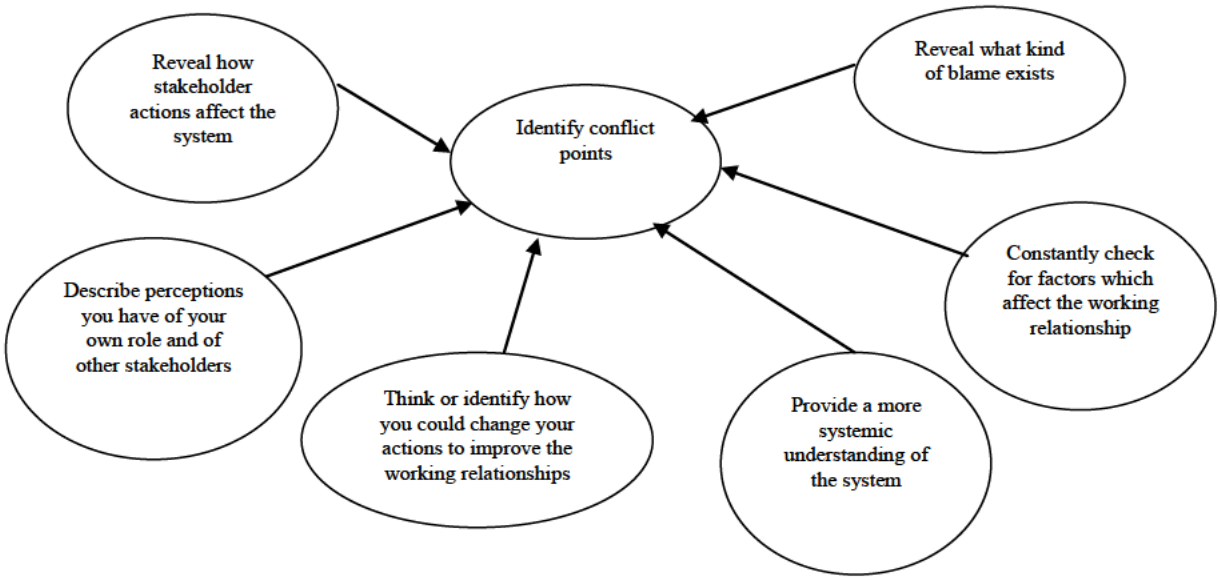


Root Definition 8 - Improve working relationships

A mill, grower and haulier owned and operated system, to improve the working relationship between the various stakeholders by identifying the sources of conflict and blame, revealing existing perceptions and providing a more systemic perspective in order to bring about a mindset change through an understanding of how stakeholders' actions affect the whole system, within the constraints of history, an entrenched way of doing things, a lack of a holistic system view, and egoism.

C	Mill, growers, hauliers
A	Growers, hauliers, mill
T	Improve the working relationship between the various stakeholders / Bring about a mindset change through an understanding of how stakeholders' actions affect the whole system
W	Identifying the sources of conflict and blame, revealing existing perceptions and providing a more systemic perspective brings about a mindset change through an understanding of how stakeholders' actions affects the whole system and improves the working relationship between the various stakeholders
O	Mill, growers, hauliers
E	History, entrenched way of doing things, lack of a holistic system view, egoism

Conceptual Model



APPENDIX 11: EVALUATION OF SSM WORKSHOP 2

Thank you for taking the time to participate in the exercise. Please complete the following questions regarding your participation in the exercise.

- How would you describe your experience in the exercise? Was it difficult to discuss the issues and compare them with the current situation at your mill?

- How did you feel in this exercise? Did you feel heard or is there anything you want to add now?

- Has your participation in the exercise made you think differently about your real world, life, or work? Please describe.

- What could have been done better in the exercise?

- What are the lessons that were learnt from the exercise, regarding the sugar industry? What do you think about the suggestions or next steps forward that you discussed at your table – are they feasible?

- What are the ideas or suggestions that came up in the exercise that you would like to take forward?

- What are your suggestions – based on this experience – for how the following groups in the sugar industry can do things differently, in order to move forward as a collective whole?

Growers / farmers:
Millers:
Hauliers:
Other stakeholders:

- Is there anything else that you wish to add that was not covered in the workshop process or any other opinions that you have?

- In order to assist us in planning our future workshops, please indicate which days in a week / week of the month is most suitable for you to attend?

Thank you!

APPENDIX 12: OCTOBER 2010 INTERVIEW QUESTIONS

- How do you feel in general about soft issues in your milling area?
    - Particularly around leadership, and power relations?

- How would you describe the working relationship between the different stakeholders?
    - Can you explain whether they appreciate and understand each other? Describe?
    - How is your working relationship influenced by soft issues, i.e. communication, trust, value, norms and behaviours?

- How would you describe the transparency of the interactions between the different stakeholders happening in your mill area?
    - How is it influenced by issues around power relations?
    - How would you describe the behaviour of your colleagues and other stakeholders in this respect?
    - Which kind of communication would be required to address issues of transparency?

- What are the soft issues around cane quality and cane supply?
    - How is it influenced by existing values, norms and roles or behaviour?
    - How would you describe issues around leadership and management in this respect?
    - What can be done by individuals to ensure the long-term sustainability?

- Tell us about the payment system; is it equitable, how do you experience it?
    - What can be done by the various stakeholders to enable the development of a fairer payment system?

- Tell us about your thoughts on mill efficiency and what the soft aspects are around it?

- What are management and behavioural actions that can be done by you or other stakeholders in order to address the issue of SSG sustainability?

- How would you describe the existing norms, values, roles and power relations in your milling area?

APPENDIX 13: EVALUATION OF FELIXTON LOCAL GROWER COUNCIL PRESENTATION

Thank you for taking the time to participate in the exercise. Please give us your input regarding the findings and recommendations.

- Do you generally agree with the findings? What stood out for you?

- If there are any findings that you disagree with or do not find valid, please mention them and state why.

- What are the ideas or suggestions that came up that can be taken forward?

Thank you!

APPENDIX 14: SSM WORKSHOP 3 PRESENTATION

Felixton workshop 3

Cecile Gerwel

22 March 2011

Objectives of today & the presentation

- Presentation of findings to add value to your area and address the critical issues
- Confirm and probe findings
- Where the energy should be placed and where you are interested in moving forward
- Check if we missed something

Overview

- Carel – replanting project presentation
- Sylva – CTS data
- What we have done so far
- Tentative findings
  - Some briefly
  - Some in more detail
- Discussing the findings and working towards a way forward
- Evaluation

What we did in previous workshop

Reflections on previous Felixton workshop

- Did you think about things differently after the last workshop?
- Did you gain a new perspective?
- Did you have any ideas as to why the same issues reappear?
- Were there any obvious or discreet changes?
  - Have relationships improved?
  - Are there different approaches to existing issues?

Approach to this workshop

- While listening to the presentation
- Please consider the following:
  - What perceptions are bringing down the system?
  - What are specific projects or ideas that we can jointly take forward?
  - Who (individuals or stakeholder groups) can do what?
- Jot down key ideas
- Areas where you strongly agree/disagree to raise questions at end of presentation

Tentative findings

Grower concerns

- Main goal of grower to grow and harvest cane at lowest cost
  - What is the long-term cost?
  - What is the expected quality at which cane must be grown? (from miller and from grower)?
- Some growers want equity in mill
- Perceived difference btw Umfolozi and Felixton
  - Milling and growing is one – growers send in quality cane
  - Possible in Felixton?
- Love of cane disappearing but also exciting time for sugar and downstream involvement
- Some growers need professionals to help with finances, negotiations (general business management)
- Communication of grower needs to leadership and vice versa

Tentative findings

Motives for staying in cane farming

- Historic reasons (commodity guaranteed to survive)
- Farmers only in it for the lifestyle
- Cane supply agreements only reason
  - THS would be more willing to negotiate if not for agreements
  - Cane supply agreements are anti-competitive – lack of trust
  - Ideally no agreements
  - Cane supply agreements are necessary (the mill is not a bank)

Tentative findings

Some growers in comfort zone

- Growers only forced to look for help when things go wrong
- Growers individuals and need to serve their own needs first
- Growers want initiatives that do not cost them
  - Growers need to share resources/inputs
- Some growers do everything, others are apathetic
- Need for change
  - How to get growers to think out of the box and embrace change?
  - How to get rid of the 'why should I worry attitude'?
  - How vulnerable is the system if even one grower fails?
  - How to get growers to agree on one system and speak with one voice (1) *do growers want this & (2) do millers want this?*
  - How to create incentive to change?
  - Is it necessary to know what is happening on each other's farms?
  - Should growers learn to be influential?

Tentative findings

SSG sustainability

- Contractors rule
- Economies of scale (SSG land too small) or rather share input costs (one tractor, etc.) – what is applicable in the SA context?
- Problem of lack of hands-on approach
- Social issues – theft, hunger, health
- Decrease in mill staff – field managers and extension officers
  - Are existing support structures working or as effective as could be?
- Canegrowers Association to be more proactive
- SSG out of loop due to communication difficulties
- Need to be integrated into the system and be involved in larger planting groups
- Need to speak with one voice and take initiative, too many politics involved

Tentative findings

Concerns around expectations of THS leadership

- Request for more ground level interaction
- Hierarchical challenges
- Feeling that decisions made at THS HQ beneficial to the whole business, but not necessarily Felixton
  - Can more be done at local level (and also *by* the local level)?
  - Should/can THS HQ come to (meet) grower level?
  - Is THS HQ working towards a common goal?
  - Is THS HQ not giving direction or too much?
  - Are contentious issues communicated upwards?
  - Are influential players part of the discussion?
  - Is guarded information being communicated (mill level & THS HQ)?

Tentative findings

Concerns around expectations of THS leadership

- Perception that THS HQ has not completely opened doors to growers yet
- Feeling that THS HQ fighting for own survival and not concerned about growers' wellbeing
- Argument that growers should abandon cane farming to get reaction
  - Does the grower really count? Does the grower need to count?
  - It is purely business, is communication at a different level?
- Replanting and subsidy important to growers
- Feeling that desperation for cane led to acceptance of anything
- Concern over preferential treatment for some growers, while others hit with rules

Tentative findings

Mill level leadership challenges

- Growers do not always provide information or do not send correct information
- Mill has processing, milling and transport departments
  - Cohesion
  - Staff capabilities
  - Information sharing (good and bad) between departments
- More assistance on growers' farms
- Increased mill level decision-making
- Concern about what happens to cane once it reaches mill
  - Mill vague about what happens
  - Relevance to mill efficiency

Tentative findings

Miller-grower conflict

✧ ***Historical reasons for miller-grower conflict***

- The history
  - Growers were dominant many, many years ago (families, involvement)
  - Then phase of engineers (new technologies)
  - Finally advent of external shareholder (accountants, efficiencies) – break in relationships

✧ ***Miller and grower seen as separate entities***

- Two separate power entities
  - How to get the best from each stakeholder group?
  - How to prevent conflict?
- Ask at which point is drastic action taken (time to look past resource questions)
- Without the mill, the growers would have nowhere to take their cane
- Without the growers, the mill would be of no use to anyone
- Growers and millers need to understand the complexity of the system in bulk

✧ ***Grower and miller leadership***

- Can have strong grower leadership
  - But if growers do not come to meetings or do not listen then...
- Can have strong mill level leadership
  - But if THS HQ does not come to meetings or does not listen then...

Tentative findings

Miller-grower conflict

- Miller, growers (and hauliers) have own agendas
- Miller out to get the grower
  - Mill always hiding something and more powerful
  - Mill makes huge profits while growers do not
  - Farmers are price takers
  - In anything that is produced the farmer is always at the bottom and the manufacturer at the top
- Mill only concerned about their shareholders
- Anything that the mill says viewed with caution by growers
- Mill dictates to growers (e.g. increasing policies) to get growers into state of obedience
- Mill should assist growers but mill is not a bank

Tentative findings

Haulier inefficiencies

- Biggest saving in industry could be transport (increases rift because of poor cane supply)
- Number of hauliers problematic
  - Perception that haulier is not of real consequence because there are only 2 permanents in the business
  - Growers all independent in their operations and hauliers
  - Problematic that growers must provide their own transport
  - 80% of the grower's time spent on getting cane to the mill
  - Common haulier proposal (increase in accountability by miller and grower)
  - Growers to invest
  - Bad service from Transnet and lack of action to penalise
  - Growers take the 'nonsense' because of financial saving

Tentative findings

RV and payment system

- Differences between Felixton and Midlands
- 64/36 ratio problematic
- Grower gets paid for what goes in and not what goes out
- Grower gets paid for fiber but mill benefits
  - Who does the fiber belong to?
  - Originally grower did not want to partake because they made enough money
  - Perhaps not fair to expect miller to let growers in on this without contributing
- Molasses – big driver of mistrust

Tentative findings

Means and depth of communication

- Sms, email – but perhaps not enough
- Possible creation of something else
- Role of MGB and whether it needs to be adapted
- Friday breakfast valued and other informal gatherings

Tentative findings

Technical matters: Cane quality and supply, mill efficiency

- Cane quality and supply mainly influenced by finances
  - Economics affects cane quality
  - Not enough money – no spray, fertilizer
- Rocks in cane very problematic
  - Rock spotters make difference
  - Some growers get preferential treatment
- Mill efficiency not big problem because of limited cane supply but if sudden surge, then what?

Tentative findings

Future perspectives

- Other products (grass, macadamias, bananas, horses)
- Growers excited by energy, ethanol (cane plant moving into another era where sugar will be by-product)
- Positivity around downstream involvement of growers
- Would deliver if there were other opportunities
- Cane will continue migrating to other mills so long as equity issue not dealt with

Tentative findings

Strategic interventions to address inefficiencies

- Full-time professional negotiators/mediators
- Growers to influence miller boards and shareholders
  - Problem with philosophy of the board, not mill management
- Clear communication and information about the new dispensation required from the mill and industry
- Strategic plan to take to senior management on both sides
- FRED scheduling system – smoother functioning of the mill
- Strengthen role of:
  - CTS (neutral)
  - SASA council (miller and grower unity)
  - MGB (miller and grower unity)
  - Mill/THS HQ leadership (trust)
  - NCF (grower unity so as not to have division, pressure group to bring change)

APPENDIX 15: DEBATE STAGE OF SSM WORKSHOP 3

* Picture shaded to protect identity of participants

APPENDIX 16: LIST OF ACTIONS EMANATING FROM SSM INTERVENTION

Possible actions	Likelihood of achieving action and enabling factors	Factors that could impede the action
Introduction of one major haulier jointly owned by miller and growers, or two or three hauliers at most.	• This action may not be that achievable. • Miller and growers would need to meet regularly to plan and identify precisely how such action could increase competitiveness. • All growers would need to agree to such a system. • It would take time to conceptualise and implement, and a constant flow of cane supply would be critical. • Saving on transport costs could be an incentive for growers to become involved in such an initiative. • The miller and growers would have to display serious commitment and trust. • Involvement of industry	• Growers may not be prepared to lose their individuality by forming a collective. • The way in which individual growers conduct their operations could present a problem. • Growers who also act as hauliers could be reluctant to join in as they could lose from such a move. • Stakeholders may lose momentum as such a system could take time to get off the ground. • A lack of finances could derail efforts. • Drawing in small-scale and emergent growers could be challenging.

	could assist in realising this action.	
Investing in replanting and seedcane.	• This action is achievable. • Miller with executive leadership should meet with all growers regularly to discuss such initiatives to increase cane supply and to plan implementation. • Sugar Research Unit should meet miller and growers regularly to discuss problems and share research findings.	• Lack of finances. • Lack of nurseries or suppliers of seedcane. • Stakeholders could lose interest as such action could take at least two years to realise.
Improving cane quality through ripening, cutting the cane differently, publicly releasing information on quality of cane of individual growers, and through awareness forums.	• This action is achievable. • All parties could realise improved revenue. • Improved knowledge about better harvesting methods could assist labourers. • Hauliers, growers and miller should keep each other informed of delays in schedule which could negatively impact cane quality. • The miller and Sugar Research Unit could assist growers who struggle.	• The weather could present a problem. • Poor management, planning and logistics could prevent success. • Untrained or unwilling labourers who do not cut the cane properly. • Growers may not agree to a ‘name and shame’ system due to their reputation being affected.

	• On-site office at mill to develop financial, technical and management competencies of all growers.	
Mentoring for small-scale and emergent growers.	• This action may be achievable. • Sugar Research Unit and large-scale growers should be involved in mentoring. • Small-scale and emergent growers should become more involved in industry and grower forums. • Government should fund such efforts and be involved with the sugar industry to ensure success of the industry as a whole. • Small-scale growers could pool resources by forming cooperatives and engaging in negotiations with miller for transport subsidy.	• Political aspects and local customs related to small-scale and emergent growers could derail such efforts. • Lack of finances to pay mentors. • Financial mismanagement or ineffective leadership could present a challenge to running cooperatives.

APPENDIX 17: EVALUATION OF SSM WORKSHOP 3

Thank you for taking the time to participate in the workshop. Please complete the following questions regarding your participation.

- Do you generally agree with the findings? If there are any that you disagree with or do not find valid, please mention them and state why?

- How would you describe your experience in the workshop?

- How did you feel in the discussion? Did you feel heard or is there anything you want to add now?

- Is there any suggestion or proposal regarding the mentioned findings that you would like to state now – please do so.

- What are the ideas or suggestions that came up in the workshop that can be taken forward?

Thank you!

APPENDIX 18: MARCH 2011 INTERVIEW QUESTIONS

1. What suggestions can you make to address grower concerns regarding equity in the mill, downstream involvement, professional assistance, growing cane at minimal costs but yet while adhering to quality concerns?
2. There is a perception that some growers are in a comfort zone and are only forced to look for help when things go wrong, or want to serve their own needs first. How do you feel about this? What is required to get them out of their comfort zone and be more active and concerned about the whole? How can better grower cohesion and increased involvement be accomplished?
    - *Are individual grower goals in conflict with the collective?*
3. SSG have problems with contractors, farm size, politics, and a lack of cohesion and active involvement. What concrete proposals or actions can be taken?
4. There is a perception that THS leadership is not as accessible and involved on the ground, make decisions that are not necessarily good for Felixton, and are not part of important discussions. Other concerns are around growers not being appreciated, and some growers getting preferential treatment. How do you feel about that, and what suggestions or actions can you make to address this or move things forward?
    - *How feasible is it for the mill to be (more) transparent?*
5. It seems that there are some issues or concerns at mill level, such as needing more accurate information from growers but also sending out more information and having growers know more about what happens to cane in the mill, having the different departments work better together, providing assistance to growers, and having more decision-making power at this level. How do you feel about this and what can be done to address these concerns?
6. Millers and growers have conflict that goes back years. They are seen as separate entities, but also as being dependent on each other. There are also perceptions that the miller is out to get the grower, hides things and dictates to growers, and is only concerned with shareholders and profit. How do you feel about this, are there any suggestions you have to address this? What actions can the grower leadership and THS leadership take?

- *What can be done to increase equity and improve relations between miller and grower, without changing the THS organisational structure?*
- *What must be undertaken by all parties to address the history?*
- *How can the profit motive and shareholder expectations be reconciled with grower demands?*
- *Is it really a joint venture? Who is the grower growing cane for and who is the mill crushing cane for?*
- *How can the separate entities be harmonised?*
- *Does the one party see the other as a customer or supplier, as in a traditional business structure? If so, is this appropriate? If not, why is this different?*

7. It seems that there are haulier inefficiencies and that a lot of time and money goes to getting cane to the mill. What actions can be taken and by whom to address this?
8. There appears to be concerns around the RV and payment system, and issues around fiber and molasses. There is a general feeling that the grower gets paid for what goes in and nor for what comes out. How do you feel about this? What actions and proposals can you suggest to address this, and who can do so?
9. What suggestions, other than sms and email, can you make to increase communication between the different stakeholders? Can existing committees be used or adapted to facilitate this?
    - *What communication forums must be created or adapted, and for which focus areas?*
10. What suggestions can you make regarding the improvement of cane quality and supply, and mill efficiency? Some say that quality is influenced by finances, and that growers require assistance from the growers.
    - *How and why should the mill assist growers financially?*
    - *Are growers prepared to spend?*
    - *Why should both spend in the short-term?*
11. There appears to be a drive for equity in the mill and involvement in downstream activities, and there is the feeling that if growers had the opportunity to deliver elsewhere and if they were not bound by supply

agreements, then they may go elsewhere. How do you feel about this, and what actions or concrete proposals can be taken to address this?

12. What do you think about strategic interventions such as having professional mediators, growers influence the philosophy of the board, and a strategic plan to senior management on both sides. And also relooking or having a stronger focus or more involvement from CTS, NCF, THS HQ and mill, SASA and MGB. Can you suggest other interventions that can move things forward, and improve leadership and relationships?
    - *How can change be facilitated in such a complex industry?*
    - *What is achievable at the local level? How can trust at the local level be improved?*
13. What is the most important thing that keeps you in business?

APPENDIX 19: NOVEMBER 2011 INTERVIEW QUESTIONS

1. What triggered the need for changes to the Sugar Act?
2. Who is involved in bringing about the changes?
3. What is the current status of negotiations and when will the Act be finalised?
4. What are the proposed changes?
5. How is vertical slicing defined?
6. How will local mill areas be affected by the changes?
7. Issues have been raised at mill area level concerning the division of proceeds and fibre, and it has been mentioned that industry matters severely impact the local relations, particularly creating tension between miller and growers, leaving a feeling of powerlessness. How do you feel about this? Provide your perspective about the division of proceeds and fibre, and future of co-generation, and how industry can intervene?
8. Cane supply was also mentioned as critical to the survival of the industry, and local mill areas. What are your suggestions on how industry can intervene?
9. What suggestions do you have to facilitate relations between miller and growers?
10. Can you provide information about how pricing in the industry works?
11. It has been mentioned that the sugar industry is a very difficult industry to bring about change? How do you feel about this? How can change be brought about?
12. Do you have any specific thoughts on the Felixton Mill area, and how industry can intervene to improve the sustainability of the areas?

APPENDIX 20: ETHICAL CLEARANCE APPROVAL

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8 SEPTEMBER 2010

Ms. C. N. Gerwel (209510447)
Leadership Centre

Dear Ms. Gerwel

PROTOCOL REFERENCE NUMBER: HSS/0953/010D
PROJECT TITLE: An Application of Systems Methodologies to Investigate Social Complexity at the Felixton Mill Area

NEED FOR ETHICAL APPROVAL WAIVED

I wish to inform you that the need for ethical review has been waived because this protocol forms part of the broader research protocol which has already received ethical clearance (HSS/0204/010).

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.
PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

[redacted]

.....
Professor Steven Collings (Chair)
HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE

cc. Supervisor – Dr. S Bodhanya
cc. Mrs. C Haddon

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

18 September 2014

Ms Cecile Gerwel Proches (209510447)
Graduate School of Business & Leadership
Westville Campus

Protocol reference number: HSS/0953/010D
Project title: An application of Systems Methodologies to investigate Social Complexity at the Felixton Mill Area

Approval – Recertification

Your request for Recertification dated 11 September 2014 was received.

This letter confirms that you have been granted Recertification Approval for a period of one year from the date of this letter: This approval is based strictly on the research protocol submitted in 2010.

Any alteration s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study must be reviewed and approved through the amendment /modification prior to its implementation. Please quote the above reference number for all queries relating to this study.

PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years

Yours faithfully

[redacted]
.....
Dr Shamila Naidoo (Deputy Chair)

/ms

cc Supervisor: Dr S Bodhanya
cc Academic Leader Research: Dr E Munapo
cc School Administrator: Ms Zarina Bullyraj

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