

Applying SSM to explore the complexity in a multi-stakeholder setting

S HILDBRAND (University of KwaZulu-Natal)
S BODHANYA (University of KwaZulu-Natal)

Abstract

This paper highlights the benefit of using Soft Systems Methodology (SSM) to facilitate a thorough understanding of the complexity in multi-stakeholder settings. This is demonstrated by means of applying SSM to a sugarcane production and supply system. The methodological approach featured a combination of SSM with qualitative research methods. SSM has not been applied in the sugar industry context and the amount of research that explores sugarcane supply chains holistically is limited.

The SSM application revealed pertinent issues, such as the transition from a corporate-owned sugar mill to a largely grower-owned mill, the presence of an insular view, resistance to change and deficient systemic commitment, the quality, quantity and consistency of cane supply and mill-related topics. The paper further reflects on some of the challenges that were encountered while applying SSM, like the inability to implement tangible improvements.

Despite these challenges, the paper concludes by highlighting the merit of SSM for today's managers, given its vast potential to facilitate a holistic insight.

Key phrases

complexity, management, Soft Systems Methodology, sugar industry, systems thinking

1. INTRODUCTION

Sugarcane production and supply systems are complex. The complexity arises from the interaction and interdependency of multiple stakeholders with diverse perspectives and partially conflicting aims (Bezuidenhout, Bodhanya & Brenchley 2012:881; Bodhanya 2011:71; Le Gal, Lyne, Meyer & Soler 2008:46).

1.1 Complexity of sugarcane production and supply systems

FIGURE 1 provides an overview of an exemplary sugarcane production and supply system. It outlines the key stakeholder groups (grower, miller, haulier), regulative boards, challenges

impacting on the system and conflict points. The Mill Group Board operates at the local milling area level and the Sugar Association deals with matters affecting the sugar industry as a whole. Government regulations and decisions, cogeneration from sugarcane, environmental conditions, increasing production input cost and the surroundings of the sugarcane milling affect the system and add to its complexity.

As indicated in Figure 1 the complexity of a sugarcane production and supply system implies hard issues, such as mill efficiency, transport, sugarcane supply, and soft issues like trust, communication, goals and perceptions, and compromises the efficiency of the system.

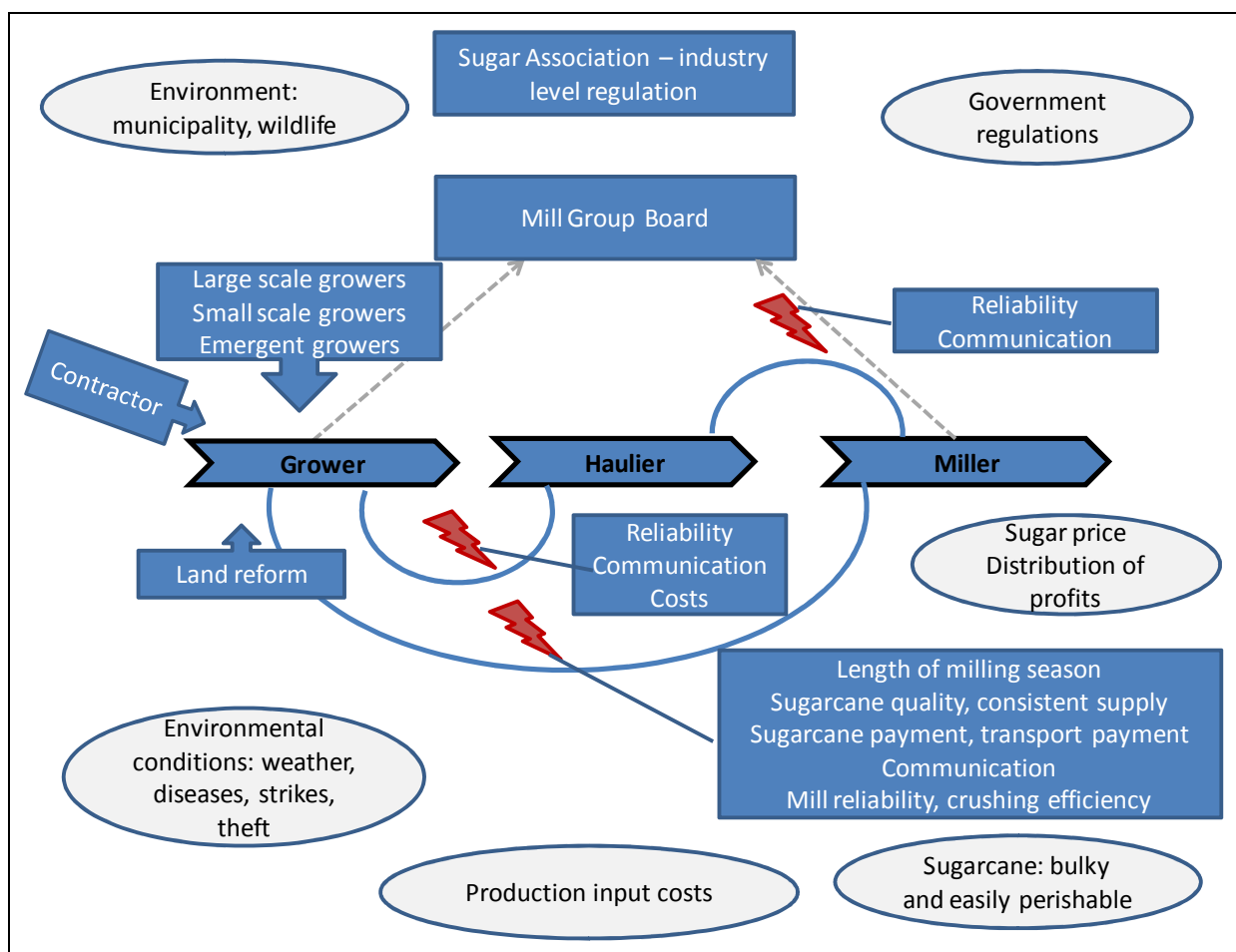


FIGURE 1: Rich picture of a sugarcane production and supply system – showing key stakeholders, regulative boards, impact factors and conflict points

Source: Own creation

Growers argue for example that they deliver their sugarcane consistently, but are negatively impacted by mill stops or poor crushing efficiency. The miller on the other side states that mill stops are the result of inconsistent sugarcane supply. The length of the milling season is a

constant discussion point between millers and growers and unreliable sugarcane transport leads to tension between growers and hauliers and hauliers and millers. These issues impair stakeholder relationships, increase opportunity costs and add to the poor implementation of beneficial innovations (Giles, Lyne, Venter, Van Niekerk & Dines 2009:151; Lejars, Le Gal & Auzoux 2008:239; Wynne 2009:89).

Given these circumstances, a systemic approach is needed to holistically explore and better understand the complexity of a sugarcane production and supply system and to possibly facilitate some improvements (Higgins, Thorburn, Archer & Jakku 2007:611). In this study, hard and soft issues were investigated.

1.2 Applying Soft Systems Methodology

Following Jackson's (2000) system of systems methodologies Soft Systems Methodology (SSM) was chosen from the range of systemic approaches, such as systems engineering, system dynamics, organisational cybernetics, and critical system heuristics. SSM comprises an action oriented 4-stage never-ending learning cycle which enquires problem situations and seeks to facilitate improvement. The problem situations are characterised by their messy, unstructured, complex and ill-defined nature.

The four stages can be summarised as a) finding out about a perceived problem situation, b) generating models of purposeful activity systems that potentially assist in dealing with the problem situation, c) comparing these models with the problem situation to reach accommodation on changes and d) implementing agreed changes. However, SSM is far from a recipe like method. Its core conceptual framing and features and its intended use is elaborated in the following sections.

The pluralistic context with stakeholders holding diverse views and motives, the presence of disagreement and conflict and the need to facilitate accommodation lend itself to SSM. SSM reportedly encourages understanding and improvement in a multiple stakeholder setting and a complex environment with diverse and partly conflicting views and objectives, interrelated issues and ambiguous problems (Checkland 2000a:804; Gregory & Midgley 2000:289).

In addition SSM pays attention to underlying soft issues (Cordoba & Farquharson 2008:81), which appear insufficiently explored in the sugar industry. The participative nature of SSM described a further reason for its usage. Moreover, Gencoglu, Altmann, Smith and Mackay (2002:49) and Soares, Navarro and Lima (2008:63) propose SSM's relevance for supply chain management.

1.3 Paper outline

This paper aims to show SSM's merit in providing a comprehensive understanding of complex multi-stakeholder settings using a sugarcane production and supply system as an exemplary case. SSM had not been applied in this context before. The paper further seeks to introduce SSM to managers who challenged by the complexity of multi-stakeholder settings and requiring methodologies that facilitate a holistic insight into problem situations.

The core characteristic of SSM, its tools and the SSM process, are outlined in a brief literature review and the methodological approach of applying SSM to a sugarcane production and supply system is described. The paper presents some of the findings of the SSM application, discusses the challenges that were encountered while applying SSM and proposes managerial implications. It concludes that SSM has vast exploratory power and is of great merit for today's managers.

The word 'system' mostly refers to the sugarcane production and supply system of the milling area in this study.

2. LITERATURE REVIEW

2.1 Theoretical underpinnings and core features of SSM

Soft Systems Methodology (SSM) emerged during 30 years of action research. Its theoretical concepts developed parallel to their practical application and the four-stage never-ending learning cycle is the outcome of this developmental process (Checkland 1985:757).

SSM facilitates a holistic understanding of problem situations and supports learning and improvements. It empowers people to discover their own ways of handling problem situations through an organised process of thinking about and interrogating these situations (Checkland & Poulter 2006:22). SSM is embedded in an interpretive framework and focuses on improvement rather than solutions, and emphasises accommodation, instead of consensus (Jackson 2000:247; Winter 2000:382).

The following further features of SSM were derived from an extensive literature review (for examples, see Checkland 2000b:11; Checkland 2010:130; Checkland & Winter 2006:1435; Molineux & Haslett 2007:483; Rose 1997:251; Wilson & van Haperen 2010:209):

- SSM assumes that different individuals have diverse worldviews that influence their behaviour; these worldviews can change with time.

- SSM assumes that human beings always act deliberately, based on their rational, and thus proposes the development of models of purposeful human activity systems, based on a specific worldview, to interrogate an issue.
- SSM stresses the relevance of considering the human aspect in any situation and highlights the importance of stakeholder involvement.
- SSM is a methodology comprising principles rather than a prescriptive method. It is flexible in its usage and can be adapted to situation-specific needs. It encourages light-footedness, which means being flexible, creative and at ease when using SSM, instead of feeling limited to a rigidly defined procedure.

SSM is a well-established methodology which is successfully applied around the world in public and private sectors on various topics and in diverse fields, such as:

- Health services (Checkland 2000b:22; Connell 2001:150; Kreher 1994:1294)
- Agricultural and ecological contexts (Kayaga 2008:273; Sørensen, Fountas, Nash, Pesonen, Bochtis, Pedersen, Basso & Blackmore 2010: 37)
- Education and educational development (Fougner & Habib 2008:488)
- Communication and information technology, and development of information management systems (Connell 2001:150; Sørensen *et al.* 2010:37)
- Development of knowledge management systems (Shankar, Acharia & Baveja 2009:135)
- Performance evaluation and challenges with performance measurements (Kayaga 2008:273; Paucar-Caceres 2009:445; Wilson & van Haperen 2010:210)
- Strategy and strategic reviews (Kreher 1994:1294)
- Change and reorganisation (Platt & Warwick 1995:21)
- Individualist (Brocklesby 2007:167) and group creativity and collaboration (Molineux & Haslett 2007:477)

2.2 The SSM process

Today, the SSM process is typically characterised by a four-stage, never-ending learning cycle, which is outlined in Figure 2. There is no obligation to follow these stages rigidly. The user can execute them simultaneously, proceed iteratively or move backwards and forwards between them (Checkland 2010:131; Checkland & Poulter 2006:14).

Stage 1 explores a perceived, real-world problem situation and is ongoing (Checkland & Poulter 2006:14). It finds out about crucial stakeholders, present issues, perceptions, relationships and interactions and seeks to determine critical issues (Reid, Gray, Kelly & Kemp 1999:342; Sørensen *et al.* 2010:41).

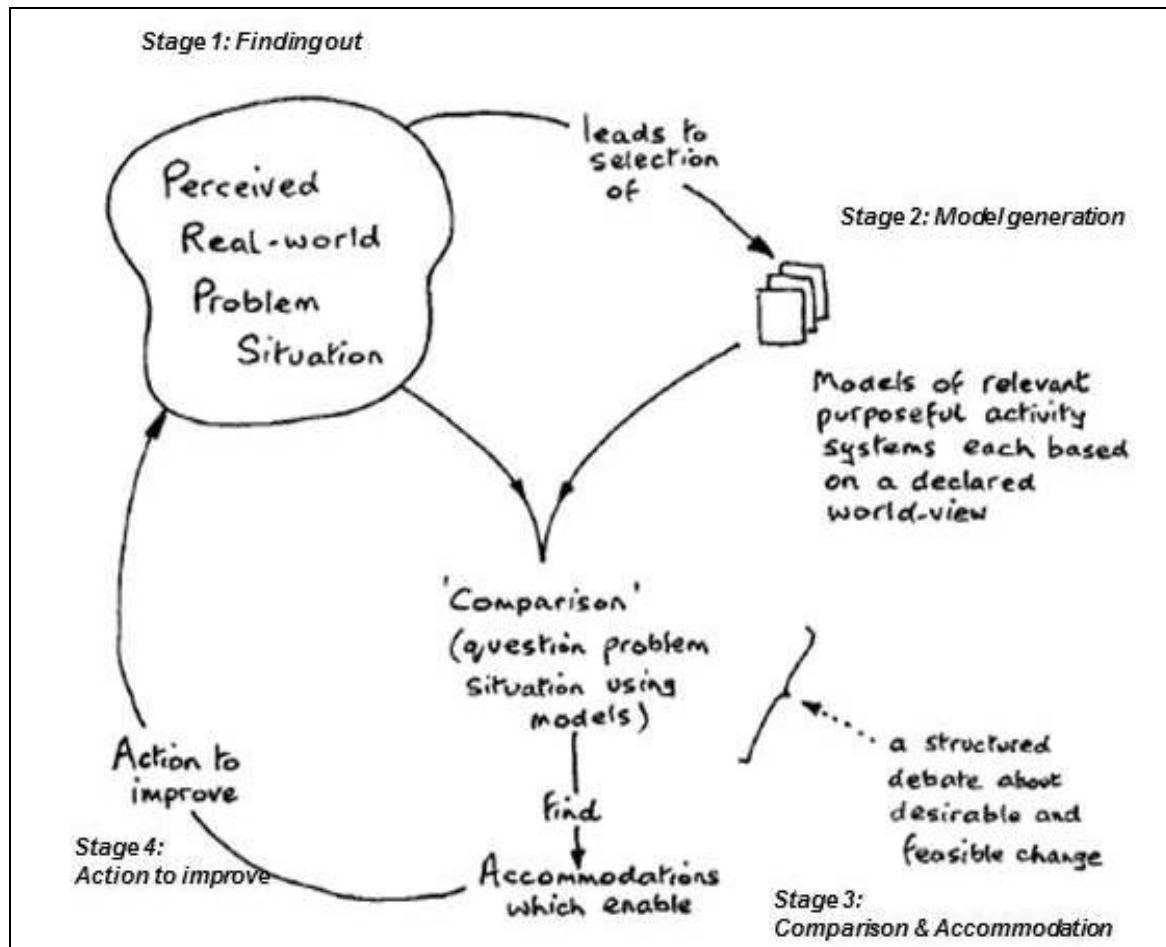


FIGURE 2: The four-stage continuous learning cycle of SSM

Source: Adapted from Checkland 2000b:16

[Note: The hand drawn part of this figure was done by the founder of SSM, Peter Checkland. He usually used these types of hand drawn figures in his publications. To maintain its originality and core feature, the hand-drawn part is reproduced here in the original format.]

Typically, Analysis One, Two and Three and Rich Pictures facilitate finding out. Analysis One reveals the three critical stakeholder groups, namely the issue owners, clients and practitioners (Checkland & Winter 2006:1435).

Analysis Two investigates the culture, history and social reality of a situation, whereas Analysis Three explores its politics and inquires how power is evinced, executed, distributed and controlled (Checkland & Poulter 2006:32). A Rich Picture constitutes an expressive illustration of a situation. It shows, for example, the relevant stakeholders, structures, issues and opinions, as well as their interrelationships in a situation, to facilitate a common understanding and encourage discussions (Monk & Howard 1998:22-25).

In **stage 2**, conceptual models of purposeful human activity systems are developed for those issues that were defined as critical in **stage 1** (Checkland & Poulter 2006:13). It is important to note that these models serve to further explore a situation and structure a discussion about it rather than to model the real world. (Checkland 2000b:S26).

The activity system is clearly defined by a, so called, root definition, which states the system's purpose, its emergent properties, implicit assumptions and the transformation that emerges from the implementation of this system (Checkland 2000b:S27).

From the root definitions, conceptual models that define the essential activities to realise the system, as described in the root definition, are generated (Checkland & Poulter 2006:44). For illustration purposes, the reader is referred to the root definitions and conceptual models that are described in the sub-section, Model generation.

The PQR-formula and CATWOE support the generation of root definitions and models (Checkland & Scholes 1990:35). CATWOE names the key stakeholders and aspects that need to be included in the root definition, as shown in Figure 3. The PQR-formula states what a purposeful activity system needs to do (P), how it can accomplish this (Q), and why it should do it (R); in short 'do P by Q in order to achieve R' (Christis 2005:17).

- C Customers: beneficiaries or victims affected by the system's activities.
- A Actors: agents who carry out, or cause to be carried out, the main activities of the system, especially its transformation.
- T Transformation: the means by which defined inputs are transformed into defined outputs.
- W Worldview or Weltanschauung: an outlook, framework or image that makes this particular root definition meaningful.
- O Owners: some agency having a prime concern for the system and the ultimate power to cause the system to cease to exist.
- E Environmental Constraints: features of the system's environment and / or wider system which it has to take as 'given'.

FIGURE 3: The meaning of the Catwoe elements

Source: Adapted from Checkland 1981:224-225

Stage 3 seeks to reach accommodation on changes that are practically relevant and culturally feasible through facilitating structured debates (Checkland 2000b:S21). During the debates, the generated conceptual models are compared with the present problem situation to explore, for example, which of the model activities are already performed, how, by whom

and why (Checkland & Poulter 2006:50). This will result in the determination of appropriate activities to improve the problem situations that are implemented in **stage 4**. In other words, **stage 4** translates a relevant human activity system into action.

3. METHODOLOGY

The four-stage SSM learning cycle guided the empirical work. Qualitative research methods were combined with SSM in an interactive manner. This led to an intensive stakeholder engagement and a comprehensive insight into the studied system, as qualitative methods as well as SSM are participatory in nature and seek a holistic understanding (Fougner & Habib 2008:490; Hannabuss 1996:22).

Data collection comprised forty-one in-depth, open-ended interviews with critical stakeholders, such as millers, growers, hauliers and representatives of the statutory body in the milling area. In addition, three workshops were conducted where participatory tools, mainly from SSM, were applied to facilitate the SSM process. Secondary data was consulted as well. Data collection was spread over three fieldwork phases, with each phase being composed of a round of interviews and an SSM-based workshop.

All data were analysed by means of thematic analysis, which surfaces relevant issues, perceptions and underlying patterns (Attride-Stirling 2001:387; Ryan 2003:85). This qualitative approach particularly enabled finding out. In addition, the 1st workshop was drafted to support finding out. Stakeholders were asked to draw a rich picture of their milling area. Afterwards, the most relevant issues in the milling area were determined through an adapted version of the world café (Lewis, Passmore & Cantore 2008:113).

A root definition, CATWOE, and a conceptual model were created for each of these preliminary findings that emerged after the first fieldwork phase. These artefacts formed the basis for the 2nd SSM-based workshop. Both the 2nd and the 3rd SSM-based workshops were designed to support **Stage 3** of the SSM process, namely the agreement on some improvements that can be taken forward. Participants selected artefacts, which were discussed and compared with the perceived problem situation and the main discussion points were recorded. In the 3rd workshop, participants were tasked to prepare precise improvement suggestions that feature high ownership and high impact.

This was meant to result in an accommodation on desirable and feasible changes that could be implemented in **stage 4** of the SSM process. In addition, the last workshop served to validate the present findings. The 3rd round of qualitative interviews, which focused on

improvement suggestions, further contributed to **stage 3** and **4** as these interviews resulted in additional improvement recommendations.

Action to improve was not realised in this study, due to the nature of the engagement, as will be discussed later. In all three workshops, participation was lower than intended, despite an extensive invitation procedure, and one stakeholder group was always missing.

In the following section, some of the outcomes of the four stages of the SSM process are presented.

4. RESULTS

Stage 1 is slightly emphasised to provide a better understanding of some of the complex issues that were revealed through the SSM application.

4.1 Finding out

Finding out surfaced the following issues that need to be addressed:

- becoming a real shareholder – a transition process
- insular view and deficient systemic commitment
- comfort zone and resistance to change
- cane supply – quality, quantity and consistency
- mill efficiency
- trust and communication.

Growers, at least indirectly through their grower structure, hold a great share in the mill. However, while some growers have begun to see themselves as mill owners and thus are committed to improve the mill's performance and to maximise the farming and the milling profits, several growers do not consider themselves to be growers and millers.

They perceive the mill purely as a place to deliver sugarcane to and get upset when asked to consider the impact of their behaviour on the mill. This causes tension, frustration and mistrust. It further prevents miller and grower representatives from jointly discussing opportunities to handle pertinent issues, such as mill efficiency or cane supply, and thus prevents efficiency improvements. Becoming a real shareholder entails a transition process that, according to many stakeholders, should be fostered. It implies the opportunity to realise the full potential of the milling area by optimising the system as a whole and thus creating a competitive advantage over other milling areas.

The behaviour of several stakeholders is guided by an insular view and/or a lack of commitment to the system. Both imply that stakeholders do not consider the interdependencies and interactions in the system, nor the system in its totality, but focus primarily on their own operations.

Figure 4 outlines some impacts of this behaviour. It highlights that soft issues, such as an insular view or deficient systemic commitment, compromise the sugarcane production and supply system. They limit, for example, efforts to improve the consistent supply of high quality sugar cane, collaboration and knowledge sharing, becoming real shareholders and aiming at an optimisation of the entire system for the advantage of all stakeholders in system.

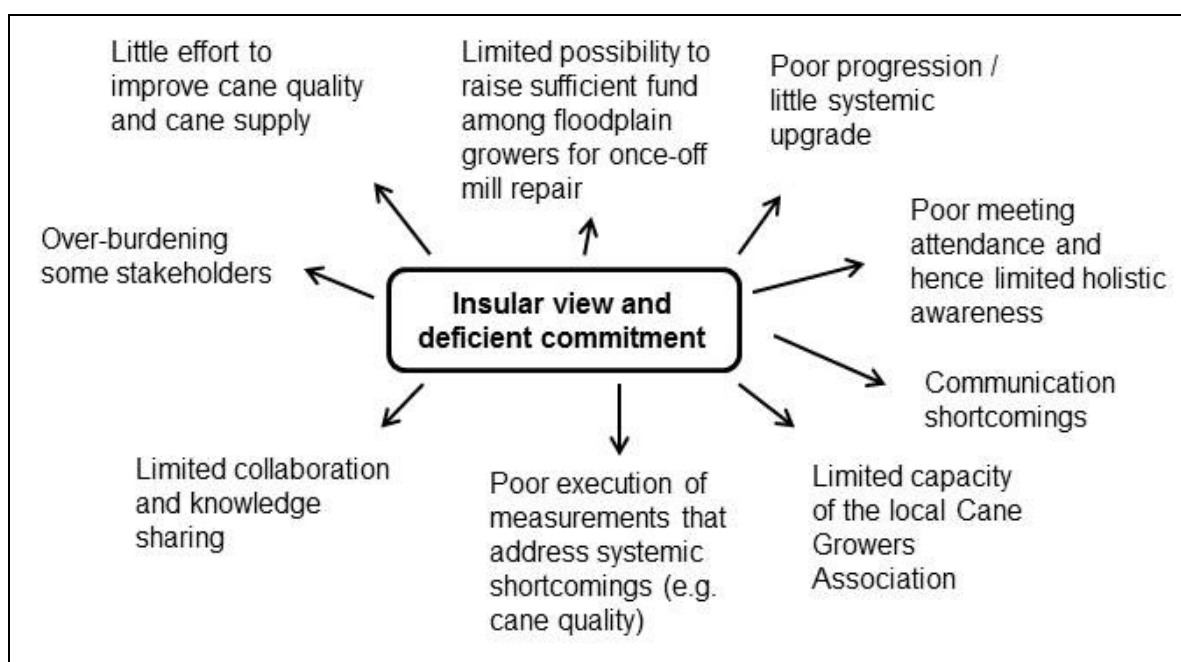


FIGURE 4: Consequences of an insular view and deficient systemic commitment

Source: Own creation

The difficulties with adopting real mill ownership, like the presence of an insular view and deficient commitment, are caused amongst others by a deeply rooted miller-grower tension, which results from the historical perception that one only wins at the cost of the other, insufficient common objectives and some stakeholders living in a comfort zone. Area-specific advantages allow for a comfortable way of living and satisfaction with the status quo and thus resist change and pro-activeness. This hampers the handling of many other issues, such as deficient systemic commitment and sugarcane quality shortcomings and it limits initiatives seeking to enhance the efficiency of the system as a whole.

As shown in Figure 5 trust and communication are interrelated with issues like deficient commitment, real mill ownership or sugarcane quality. They can either promote improvements in these issues, or be restrained by deficiencies in these issues. Although trust has already improved, an element of miller-grower mistrust still remains. Likewise, the two-way communication between millers and growers can be improved and more information on certain topics, like the repair strategy for the mill, could be provided.

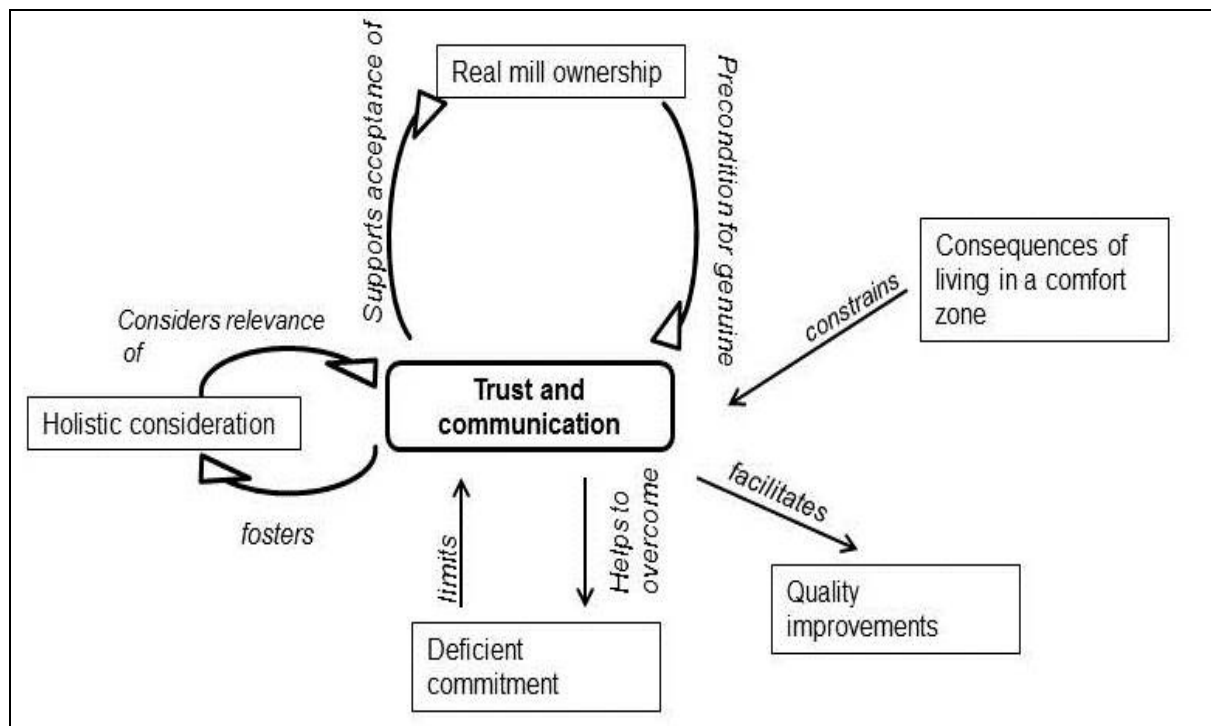


FIGURE 5: Interconnectivity of trust and communication with other relevant themes

Source: Own creation

As already indicated in Figure present soft issues are interdependent. Deficient systemic commitment, insular view, trust and communication deficits and not becoming a real shareholder enforce each other and living in a comfort zone amplifies all of them.

The interplay is displayed in Figure 6, which additionally indicates that soft issues add to hard issues, such as cane quality shortcomings. Living in a comfort zone, deficient systemic commitment and not being a real shareholder constrain, for example, the implementation of measurements that would enforce the supply of better sugarcane quality. The present interconnectedness proposes that addressing one of the issues should have a positive impact on the other issues and thus facilitate a process of incremental improvement.

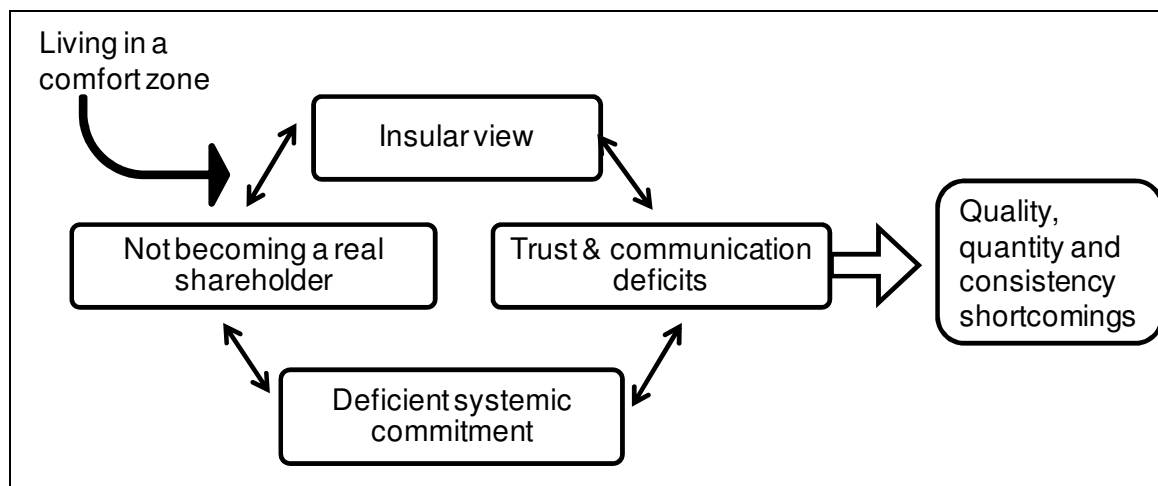


FIGURE 6: Interrelationship between issues

Source: Own creation

Technical, managerial and operational mill shortcomings compromise mill performance and thus the system as a whole, as all stakeholders depend on an efficient mill operation. The old mill state and resulting technical deficiencies in particular impair a smooth operation. Mill management blaming the poor condition of the mill and poor cane quality as reasons for mill breakdowns, instead of investigating the mill's operational and managerial deficiencies, creates frustration among growers and leads to a 'blame' culture. Stakeholders emphasised that the mill needs to demonstrate its crushing reliability, create the required stability and regain growers' confidence. Existing plans to address mill efficiency shortcomings are not known by all stakeholders, which suggests that part of the frustration results from communication shortcomings.

Supplying poor quality sugarcane *viz.* consignments with high ash and fibre contents, low purity, and possibly containing foreign matter, was described as a serious concern. It can cause mill breakdowns, which affect the entire system. A clean cane campaign was initiated to address this issue. However, some stakeholders argued that cane quality is not an issue, that the clean cane campaign is an inappropriate interference in grower affairs and that the mill should stop blaming the growers.

Consequently, sugarcane quality is a contentious issue causing some tension in the system possibly adding to the difficulties with becoming a real shareholder. Figure 7 outlines some of the reasons leading to poor cane quality and the rejection of the clean cane initiative.

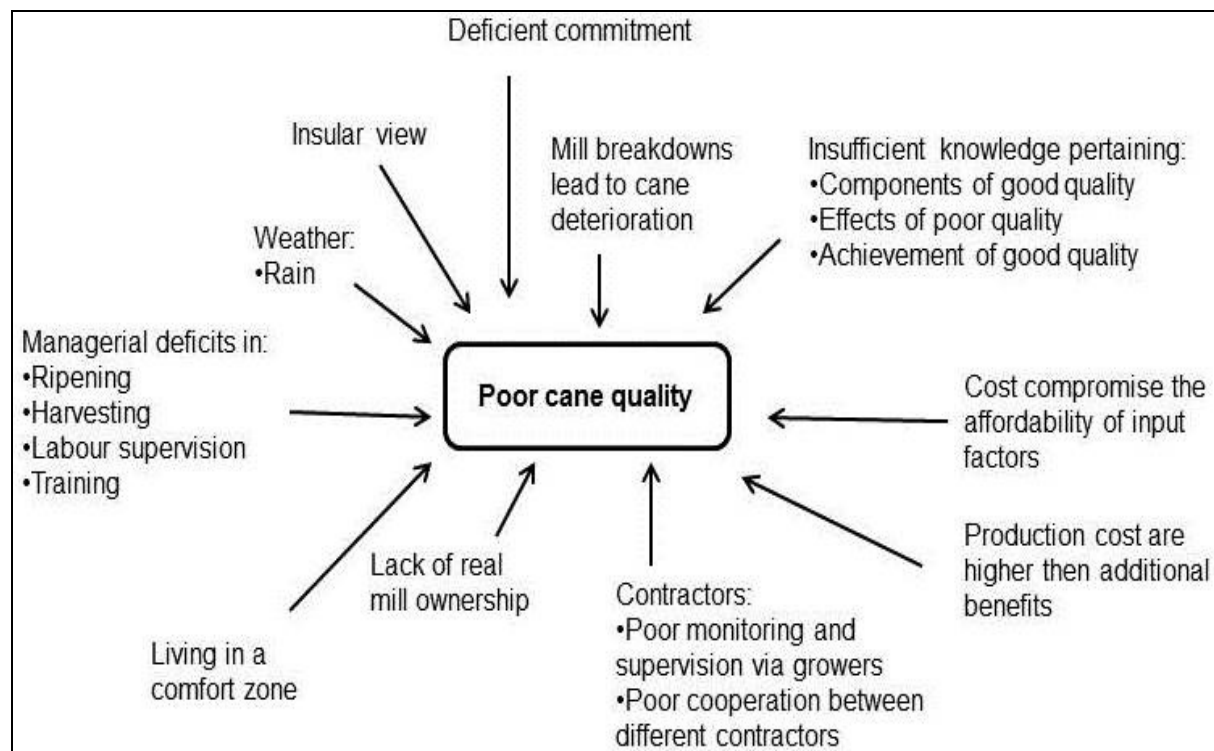


FIGURE 7: Direct and indirect factors that contribute to quality shortcomings and partially limit the effectiveness of quality improvement efforts

Source: Own creation

The necessity, benefit and feasibility of sugarcane supply increase is an equally a controversial issue. Some stakeholders stress the urgency to increase cane supply, while others stated that there is sufficient supply for the present mill capacity. Some interviewees suggested an improved efficiency of the current system as superior compared with extending mill capacity and sugarcane supply, as proposed by others.

The system depends on consistency. The mill requires sugarcane consistently and growers desire a steadily running mill. However, inconsistencies in grower deliveries, cane haulage and the mill, such as mill break downs or maintenance stops, exist, and millers and growers blame each other for such inconsistencies.

Analysis Two revealed the different roles that growers embrace. Some growers are powerful and influential and thus should direct the system. They should embrace a holistic view, have grasped the concept of mill ownership and be committed to the system as a whole, yet they do not necessarily follow this norm. The active growers in contrast have the entire system at heart and seek its improvement, but lack the power to influence it. Some growers strive for a comfortable lifestyle rather than realising the optimum.

This promotes a 'convenience' culture instead of a 'commitment' culture. Consequently, for change to be feasible a reflection on whether changes constrain stakeholders' convenient way of operating, and thus might be rejected, is needed. The presence of the 'convenience' or the aforementioned 'blame' culture compromises the implementation of improvement possibilities and the realisation of the system's full potential.

Analysis Three highlighted that the mill holds a powerful position. It is a critical part of the system and decisions can be made rapidly. Likewise, the grower body is powerful. Mill management cannot enforce a grower behaviour that would be more suitable for its own purposes. For instance, growers would have to approve stricter cane rejection rules and thus need to be involved in the development of cane quality improvement measures to ensure their feasibility. Regardless of this, not all growers perceive themselves in a powerful position in their interactions with the mill. They seem to require improved negotiation skills to strengthen their bargaining power.

4.2 Model generation

This section introduces the artefact that was generated and then discussed in the 2nd workshop to address mill efficiency shortcomings. The Root Definition, CATWOE and conceptual model of a system that supports mill efficiency improvements are outlined in Figure 8. A proper repair and maintenance strategy will increase mill efficiency and reduce times of slow crushing and mill breakdowns. Shareholders and mill management, as owners of this system, need to approve this strategy. Its realisation could be limited by financial constraints. Growers, millers and hauliers would benefit from the implementation of this system and the conceptual model identifies the required activities for its realisation. Later fieldwork revealed that several of these activities resonate with the approach taken by mill management.

4.3 Comparison and accommodation

In the 2nd workshop, two topics were chosen for further discussion, namely mill efficiency and cane supply. The discussion led to propositions for improvement, which can be seen as some kind of accommodation, yet they lacked assertiveness as stakeholders neither approved certain actions, nor specified activities that were to be pursued. This section outlines aspects that were discussed in relation to mill efficiency.

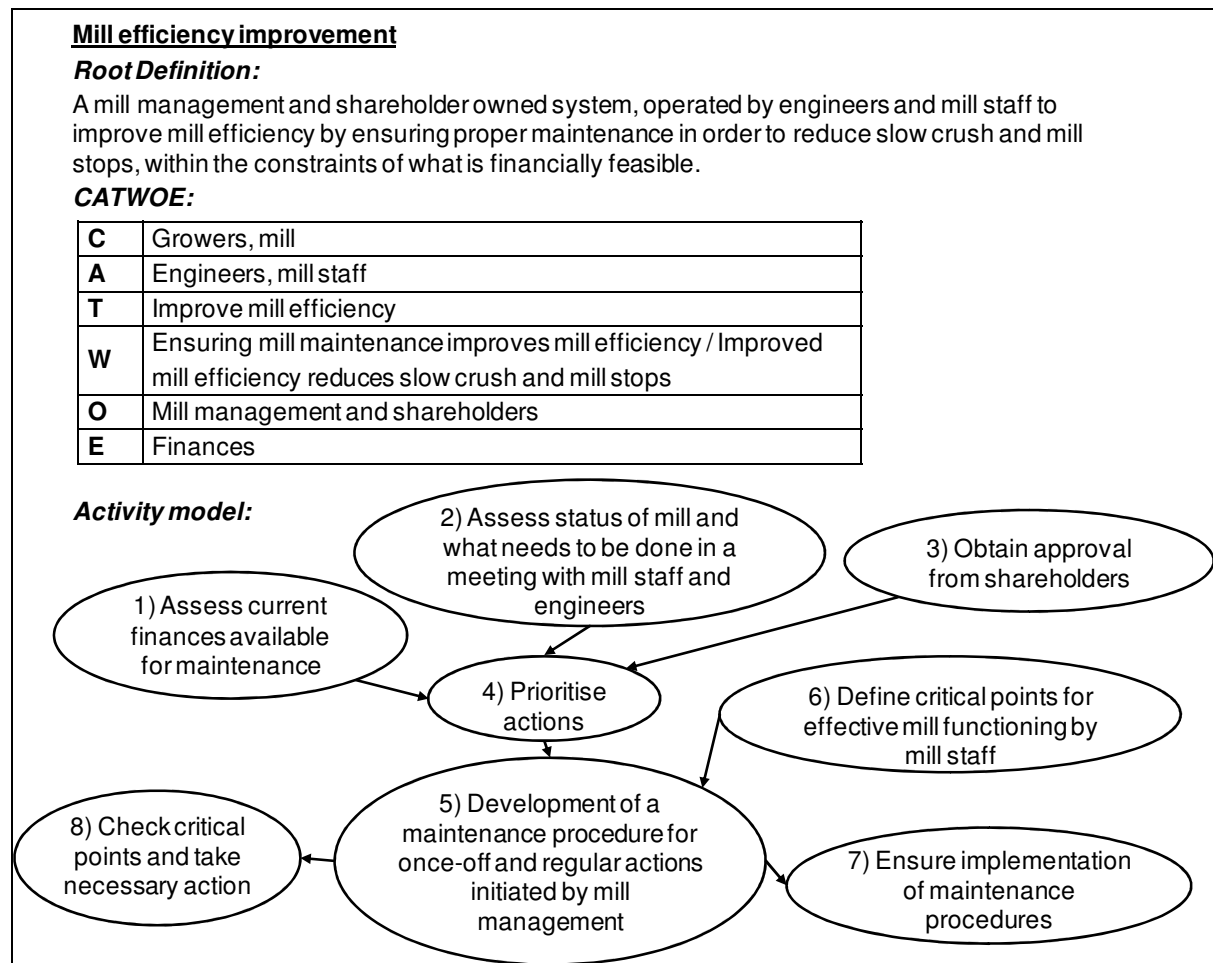


FIGURE 8: Root definition, Catwoe and activity model of a system to improve mill efficiency

Source: Own creation

[Note: The root definition, the CATWOE and the activity model were created based on the data gained during the 1st round of fieldwork. They emerged from an reflection about this data which was guided by the concept of root definition, CATWOE, PQR-formular and conceptual human activity systems, as described in section 2.3]

The presentation of Figure 8 implied a comparison between the model and the real world and rich debates, which provided further insight into the system. Although no accommodation on specific changes was reached, participants suggested that the possibility of conducting a once-off mill repair should be investigated.

Figure 9 outlines this main improvement suggestion together with respective responsibilities, preconditions and possible constraints.

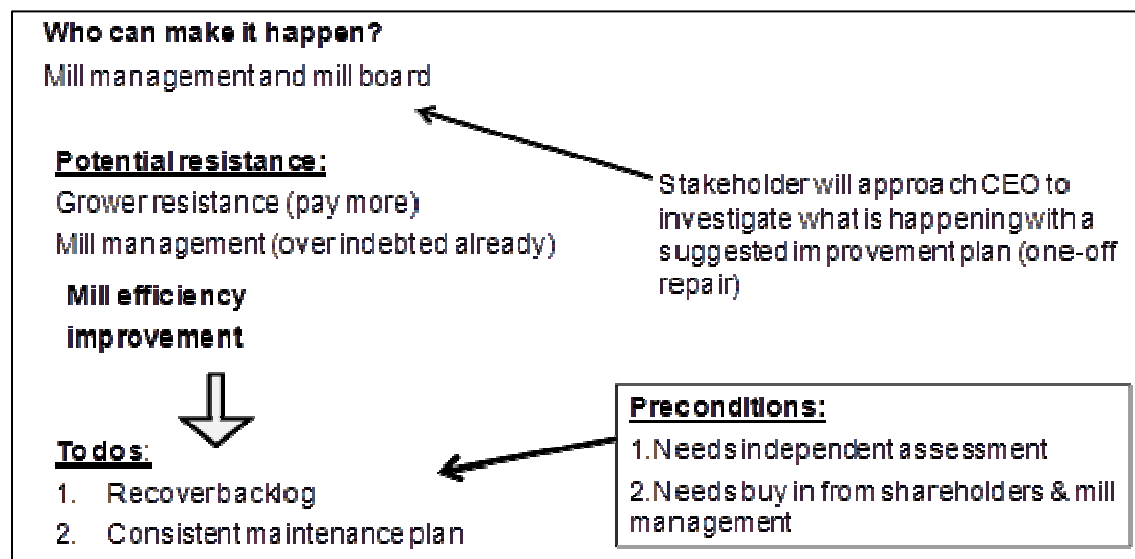


FIGURE 9: Chart on mill efficiency improvement generated by a participant in the second SSM-based workshop

Source: Created by a participant during the second SSM-based workshop

The similarity between Figure 9 and some of the activities suggested in Figure 8 indicates the power of developing conceptual models. The interview process equally stressed the importance of rectifying the mill's technical shortcomings. It further highlighted the need to deal with internal operational and managerial weaknesses at the mill and to provide adequate information concerning the handling of this issue to address present stakeholder concerns and perceptions. In the 3rd workshop, amongst others, proposals to improve sugarcane quality were developed. Table 1 summarises these proposals.

In the interview process, it was emphasised that any measurement to improve cane quality needs to appreciate factors potentially constraining its realisation, needs to be flexible, and must involve all affected stakeholder groups in its development. Interviewees also suggested, for example, that the area leadership, namely those stakeholders holding an official role in the grower structure, being a direct shareholder in the mill or having an influential and respected position in the system need to become more committed quality drivers and lead by example. Also there should be more training and education regarding quality matters.

From the recommendations outlined in Figure 9, the introduction of a financial incentive or penalty system, or a system that assigns symbolic rewards, like smiley faces, appeared most promising to advance sugarcane quality. The realisation of these systems would require the

approval of the Mill Group Board, which seems to be the appropriate body for following up these proposals. However, although the stakeholders confirmed the appropriateness of these proposals, no specific actions were defined to facilitate their realisation. Nevertheless, the debates enhanced participants' understanding of issues.

TABLE 1: Recommendations to improve cane quality derived from participant discussion in the third SSM-based workshop

Proposal name	Proposal detail
Change cane rejection rules	Increase practicality and strictness of the MGB rules for cane rejection.
Change cane testing procedure	Test poor appearing consignment before it goes into the mill and can cause damage. Reject consignment that proves to be poor.
Financial incentive or penalty system	Financially incentivise the supply of good sugarcane quality or penalise the supply of poor sugarcane quality. Precondition: overcome potential constraints against this initiative.
Smiley faces	Allocate a smiley face on a notice board to growers delivering good quality and a sad face to growers supplying poor quality. Quality advancement is stimulated by the creation of peer pressure resulting in an intrinsic motivation for improvement (similar principle as by 'name and shame').

Source: Own creation based on participant discussion in the third workshop

4.4 Action to improve

Despite best intentions to facilitate some improvements during **stage 4**, this could not be achieved. Some proposals from the 3rd workshop, such as the introduction of a financial incentive or penalty system to advance sugarcane quality, seemed likely to lead to action to improve, yet remained in their preliminary stage. Pursuing the realisation of these proposals was outside the capabilities of this study, as it would have needed more support from stakeholders within the system.

5. DISCUSSION

SSM seeks to facilitate learning, improvement and a holistic understanding. This section discusses to which extent this was achieved. It highlights the value of SSM for managers and challenges that need to be considered. This study certainly demonstrated the merit of SSM in complex multiple stakeholder settings where stakeholders are interdependent, yet act as independent role players.

5.1 The merit of SSM in a complex setting

The SSM application facilitated an in-depth understanding of the complexity of the sugarcane supply and production system. In particular the revelation of existing soft issues, such as an insular view or the lack of a real miller-grower partnership, was critical. The SSM usage showed how these soft issues constrained improvement opportunities, like sugarcane quality advancement, and it provided a sound understanding of the interrelationship between the different issues. The SSM usage further clearly indicated that improvements of the system as a whole, beneficial to all stakeholders, require the handling of underlying soft issues. This has not been emphasised to a similar extent in the sugar industry before. By outlining the interrelationship between the issues, SSM additionally revealed potential intervention points.

As outlined in Figure 10, systemic improvement can be facilitated by an incremental process of dealing with the different soft issues. Improvement on one issue will lead to improvement in another issue, as the handling of soft issues mutually supports each other and provides the basis for dealing with more tangible aspects, such as sugarcane quality.

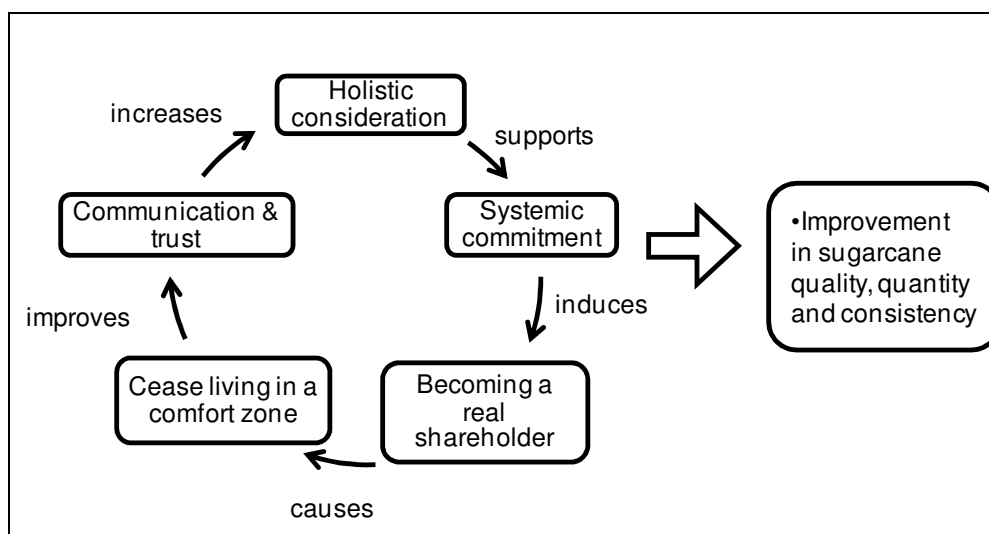


FIGURE 10: SSM reveals intervention points by showing the interdependency between issues

Source: Own creation

In addition, Analysis One, Two and Three facilitated a better understanding of the cultural and power related aspects of the system. They provided a sound understanding of the roles of different stakeholders, the present values and norms that impacted on the system and the different powers at play. Paying sufficient attention to cultural and power related issues is important if one seeks to intervene in a system, especially regarding the development and

determination of feasible improvement initiatives, as they could be hampered by these issues. Analysis Three emphasised for example that grower involvement is a necessity when dealing with sugarcane quality shortcomings. By surfacing present cultural and power related issues the SSM usage not only reveals potential change obstacles, but also indicates with which stakeholders a change driver should collaborate. This leads to good precondition for change realisation.

The SSM usage facilitated learning among those stakeholders who participated in the research. They indicated the value of the SSM process in supporting the understanding of several issues, such as mill efficiency or sugarcane supply and quality. They further highlighted that being involved in the SSM process made them aware about the importance of soft issues and the interdependencies within the system. This is a crucial achievement for an industry that generally focuses on hard issues and seeks to optimise its parts rather than the entire sugarcane production and supply chain.

5.2 Workshop versus interview data

The pertinent issues primarily emerged from the interview data. Observation, archival data and workshops supported a better appreciation of them. However, the workshop outcomes featured a different focus, such as current events or hard issues. Soft issues, like communication, trust, poor commitment or insular view were partly disregarded in the workshops, yet their significance was indirectly validated while discussing hard issues, such as cane quality or mill efficiency. This re-emphasises that soft issues underlie hard issues. In addition, the low workshop attendance suggests the relevance of the following themes:

comfort zone, deficient systemic commitment, insular view and becoming a real shareholder – a transition process. For example, if stakeholders are fully committed to the system, they would be interested in attending workshops that discuss their system and explore improvement potentials, thus ensuring a high workshop attendance. Given these realities, an interview process seems essential to support an in-depth examination of a situation under comparable circumstances.

5.3 Difficulties with change implementation

The SSM application led to suggestions about feasible and desirable changes. However, agreement on specific actions and the implementation of tangible improvements were not achieved in the course of the study. The study largely focused on finding out. This partly confirms a prime criticism questioning SSM's merit as a real change driver (Pala, Vennix &

van Mullekom 2003:711). Despite not implementing any of the developed recommendations, the authors propose a successful SSM usage. Success in the case of SSM is not only seen in the implementation of change, but especially in the facilitation of understanding and learning and the preparation for change. Many of the proposals developed in the last workshop, could be taken forward by stakeholders from within the system. The discussion of their desirability and their feasibility illustrates not only a good precondition for their implementation, but also highlighted the capability of the SSM process to facilitate these kind of crucial discussions.

Furthermore, it is proposed that outlined difficulties with change implementation were largely caused by circumstances such as inadequate stakeholder participation in the SSM workshops or the presence of certain soft issues such as deficient commitment or an insular view, rather than a failing of SSM, or inadequate SSM usage. Inadequate stakeholder participation refers to a) low stakeholder participation at workshops, b) the absence of representatives from relevant stakeholder groups and c) the lack of influential stakeholders with decision-making power and an execution mandate.

The stakeholder participation was low at all workshops. In particular more participation from sugarcane growers, mill management and the tram transport system would have been desirable for the SSM process. Representatives from these stakeholder groups were present at almost all workshops and they were involved in the interview process, but a more proactive participation in the workshops, especially from the leadership, most certainly would have been beneficial. The absence of influential stakeholders with decision making power particularly impaired the SSM process, as they were essential to finalise and approve recommendations and facilitate their implementation. This might have been the core reason for the impossibility to really facilitate stage 4 of the SSM process. Their absence might also have led to the belief amongst other participants that this study was irrelevant, which thereby decreased participation even further. Although this study was approved by influential stakeholders and had their support, their attendance most likely would have been beneficial for the progress of the study.

SSM generally deals with soft issues, yet the presence of certain soft issues, such as living in a comfort zone, resistance to change, an insular view, or deficient systemic commitment, might have limited stakeholders' readiness to learn and move forward and thus, directly impaired the SSM process. These soft issues most likely also indirectly compromised the SSM process by decreasing workshop participation and hampering accommodation. The

authors propose that the difficulties experienced in this regard most certainly could have been mitigated if the study had been driven by influential representatives from within the system. Nonetheless, SSM is most likely not the most appropriate approach to induce change, given the strong resistance to change. It cannot, and does not intend to, impose change. Under such circumstances, a more autocratic approach might be required and critical systems thinking, in particular total system intervention, should be considered (Jackson 2000: 368). This reality, however, does not justify claiming that SSM, as a methodology, is inappropriate.

In contrast the merit of an SSM application is strongly advocated. In this particular study, SSM facilitated a comprehensive insight into the system, served as a valuable sense-making tool and resulted in a more thorough understanding of existing challenges. This is a prerequisite to handling existing issues and supporting improvements. In addition, SSM usage enabled the deduction of improvement recommendations, which is advancement in itself.

Applying SSM further assisted as a means to interrogate a situation and to facilitate discussions that are aimed at seeking a way forward and at defining feasible changes. Thereby the concept worldview turned out to be particularly useful. It allowed the SSM use to investigate the system from a particular view point without blaming a specific group to embrace this view point. This assists in fruitful discussion where finger pointing is sought to be omitted. Given slightly more suitable conditions for the SSM application, the realisation of developed recommendations is expected. Consequently, it can be concluded that SSM is a suitable methodology that has relevance for managers.

5.4 Implications for managers

The following points, which are drawn from this study and the literature, highlight the benefits that SSM offers managers:

- SSM facilitates a holistic understanding of a problem situation. It reveals the different perspectives, assumptions, interrelationships and interdependencies that add to the problem situation.
- SSM is particularly sensitive towards soft issues and supports their adequate appreciation. This is important, as soft issues are critical factors in a system and often impair improvements.
- SSM focuses on achieving accommodation, despite different stakeholders' interests. This is relevant for managers who are often challenged by mediating conflicting

objectives in a multi-stakeholder setting. In addition, finding accommodation paves the way for improvement.

- SSM reveals the different roles, norms and values in a system and it surfaces power related issues. Understanding these aspects will assist managers in generating more appropriate change suggestions that are likely to be realised.

These points propose that SSM is well positioned to deal with the social complexity that emerges from multi-stakeholder settings and the implied presence of diverse and partly conflicting views, interests and objectives. Consequently, SSM can assist managers to deal with multi-stakeholder settings. Nevertheless, for managers to realise SSM's full potential, they should consider some of the methodological lessons that can be derived from this study. For instance, learning and change realisation requires rich stakeholder participation in the workshop process, stakeholders' willingness to learn and to take responsibility for change, the involvement of influential stakeholders (power holders, decision-makers) and the availability of sufficient time. Being driven from within the system certainly supports SSM application and the realisation of its full potential.

Consequently, there should be a close collaboration between the stakeholders in the system and the SSM user, and the availability of local champions to boost the SSM process. These factors should be automatically given in cases where managers apply SSM in their organisations. Either managers perform the SSM application themselves or they will employ and support an SSM facilitator. In both cases, they will be able to ensure adequate participation, for example in workshops etc. Nonetheless, future research is needed to investigate possibilities to strengthen the capacity of SSM regarding change implementation and to explore its relevance for managers in their organisations. Such research needs to include studies that explore the benefit of combining SSM with other approaches, as recommended, for example, by Bell and Warwick (2007:71) and Reisman and Oral (2005:170).

6. CONCLUSION

The paper highlighted that SSM is a highly beneficial approach to understanding the complexity of a multi-stakeholder setting. This was demonstrated by applying SSM to a complex sugarcane production and supply system, where the SSM application resulted in a thorough understanding of the challenges that this system is facing. In addition, the paper introduces managers to the SSM process on a theoretical and a practical level.

Despite the challenges encountered with change implementation, the paper argues for the merit of SSM for managers, given its outstanding capacity to approach social complexity and provide a holistic insight into a problem situation. A better understanding of social complexity will assist managers in their handling. In addition, the SSM application led to the generation of several feasible and desirable recommendations to address some of the challenges that surfaced during the study.

Furthermore, experienced challenges were largely based on situation-specific conditions, rather than a shortcoming in the methodology itself. Nevertheless, some methodological lessons should be considered to realise the full potential of SSM and to support a holistic understanding, learning and improvements. These propositions need to be verified by further research, which should also explore ways to support the SSM process in bringing about action to improve.

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