Implementation of Soft System Methodology: Lesson Learned from Case Studies

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Abstract This paper looks into three (3) different organizations where (SSM) was used to solve some issues, the aim of this paper is to introduce the case studies from three (3) different organizations that applied Soft System Methodology (SSM). This paper, also describes the unstructured ill-structured problematic situations in the organizations which often involve behavioral variables and, thus, cannot be addressed by the hard methodologies. The paper also studied how the application of SSM to organizations requires consensus among the stakeholders. Different perspectives were identified in the methodology, in which the conceptual models of human activities were achieved. Also, analyzes how the concept of this methodology tries to analyze, under a systemic focus of real organizational problem and how and to extract them from the analyzed actions for the improvement of the real world. Finally, the paper point out the benefit of applying SSM based on the case studies.

Keywords: Soft System Methodology, Conceptual models, Case studies.

1. INTRODUCTION
Handling real world situations may entail new strategies to overcome the difficulties of structure complexity. Soft system methodology (SSM) as a useful means for structuring problems and shows its performance of the organization. It uses system concept as a means for learning and understanding a “problem situation”. Soft System Methodology can be defined as a systemic methodology which focuses on the whole organization rather than parts of the organization (Tajino, James, & Kijima, 2005). It is used to tackle real-world problems by enabling the analyst and participants to know different view on the situation, such problems can be solved through learning rather than replacement of the present condition with supported enhanced ideal (Mehregan, Hosseinazadeh, & Kazemi, 2012). SSM was developed over 30 years ago and has since been operational and can be used in many contexts, which Greek Civil Service organization, Bridge Project and Tosan Company. SSM makes tow contributions to system approaches; viewing the system as systemic instead of systematic and using human activity systems (HAS).

2. Literature Review
Soft Systems Methodology (SSM) is a systems approach that is used for analysis and problem solving in complex and confusing situations. This methodology uses “systems thinking” in a cycle of action research, learning and reflection to help apprehending the various perceptions that exist in the minds of the different people involved in the situation. This approach is applicable to many domains; which include change management, planning for health and medical systems, information systems planning, human resource management, analysis of logistics systems, and expert systems development. Most of the areas that SSM is being used are in research associated with knowledge management, project management, and engineering and construction management.

2.1 Overview of Soft System Methodology
The Soft Systems Methodology (SSM) was born out of research conducted at Lancaster University to apply Systems Engineering approaches to solve management or business problems. In other words they attempted to apply a HARD SYSTEMS approach to fix business problems. (Burge, 2015). The approach of SSM method is used to interpret the idea of the problem in picture. The founder of this method believes that people have different idea and opinion when it comes to define and solve the problem. Even though two people watch the same movie, in the same place but doesn’t mean that they have the same conclusion of the movie. Same idea goes to defining and solving the problem. Holistically, this methodology is divided into two different view, which are Real World and System Thinking World. For the Real World view, the process talks more about defining, analyzing, and picturing the problems, so that it can be used to develop the system or to be absorb in a System Thinking World.
This methodology was more than just a process; Checkland and Wilson also developed a set of tools to help users carry out the steps. These include:

• Rich Picture
Conceptual Model
CATWOE
Formal Systems Model

Those tools are used in different stages to represent the idea and to make sure all the team can understand the same meaning and get the same idea. As mention before, SSM have two different views and have seven stages or learning cycle as well. Figure 1 shown the integrate between each stages, Real World and System Thinking World (Burge, 2015).

Research and gathering information will be done in first process. This process will define all the potential problem that may be occur in the management. The person that will involve usually the stakeholders to identify the current performance and issue. To define the problem, rich picture are used to interpret the issues and the idea. Because every situation is different and it is necessary to capture this potential variety, there are no formal Rich Picture modelling symbols (Burge, 2015). One of the reason using this rich picture tools is to identify the relevant system that can be used in a system thinking world view.

The most critical and important are in step 3 which is root definition of relevant systems. If the problem is clearly identified in rich picture it would be easily to define the relevant system. The tool that was used is the CATWOE, this will ensure that the root definition is acceptable. Checkland and Smyth (1976), developed the mnemonic CATWOE where:

- **C** = The Customer: The individual(s) who receive the output from the transformation (in recent times it has been recognized that the out of the transformation may be “negative” for some customers and “positive” others.
- **A** = The Actors: Those individuals who would DO the activities of the transformation if the system were made real
- **T** = The Transformation: The purposeful activity expressed as a transformation of input to output
- **W** = Weltanschauung: It’s a German word that literally means “world view”. It is the belief that makes sense of the root definition
- **O** = Owner: the wider system decision maker who is concerned with the performance of the system
- **E** = Environmental Constraints: the key constrains outside the system boundary that are significant to the system

To transform the idea from root definition to relevant system, SSM use defensible logic that call Conceptual Model. This model will picture the output of the system. Again not standard practice but something very useful when constructing conceptual models is to make simple notes (on sticky notes) about the rationale behind a particular activity in the model (Burge, 2015).

Checkland (1981) points out some applications of SSM, which are listed below to elucidate the use of this methodology. SSM can be applied, among others:

- To systems design, such as for information systems;
- To the improvement of conditional problems that not well are defined;
- To the analysis of past events;
- To the structuring of evaluations (survey) in a certain operating field;
- To the elucidation of concepts.

2.2 Characteristics of SSM

i. SSM improves a problematic real world situation.

Soft Systems Methodology (SSM) may be used to analyze any problem or situation but it is most appropriate where the problem “cannot be formulated as a search for an efficient means of achieving a defined end; a problem in which ends, goals, purposes are themselves problematic” (Checkland, 1999, p. 316).

ii. SSM has the approach of structured thinking based on systems ideas.

Soft System Methodology serves as an important tool for knowledge elicitation in such circumstances as it aims at understanding the context in which the whole system functions (Fingan, 1994, 1995).

iii. SSM has no automatic assumption

Soft system methodology works in the boundaries of the study wherein there is no automatic assumption that the real world is systemic and a distinction between the real world and systems thinking about the real world.

iv. Conscious thinking

SSM has a conscious thinking about how to adapt the methodology to a given situation.

v. Reflection about the real world

Soft system methodology enables reflection of what methodological lesson can be learn from the experience using SSM.

3. Methodology

This paper followed the principle of Systematic Literature Review (SLR), whereby examining the case studies of organizations that applied soft system methodology. This study has reviewed the case studies from the organizations that had unstructured or ill-
problematic situation, and analyzes the methodological impact of applying the soft system methodology.

4. Using Soft Systems Methodology as a systemic approach to safety performance evaluation

(Greek Civil Service organization)

This case study shows how Soft Systems Methodology (SSM) may be used for the systemic evaluation of occupational safety and health (OSH) performance and support decision making for safety improvement programs. SSM was applied in a Greek Civil Service organization which is concerned with policy formulation, organization, operation and control of one of the country's major transport sectors. The proposed participatory approach for this development is the implementation of the well-established Soft System Methodology (Sgourou, Katsakiori, Papaioannou, Goutsos, & Adamides, 2012).

Here are the four activities model that described the process of implementing SSM in Greek Civil Service organization:
- Finding out about the problem situation
- Building conceptual models
- Comparing models with reality and proposing for change
- Taking action in the situation to bring improvement

5.1 Finding out about the problem situation

This initial stage necessitated the development of a 'rich picture' of the existing situation, based on all information that was considered relevant to the problem situation (safety management), including cultural and political analysis of the situation. Safety data for the past ten years were collected, including incident data, risk assessment reports, safety recommendations for corrective and preventive actions and safety procedures. Information with regard to existing occupational health and safety management practices, and views on the various social norms, roles, values and power relationships was also recorded based on the accounts of members of all organization hierarchy levels, union members and employees of the external consultant offering occupational health and safety services. During this stage, it became apparent that there was no formal safety management system, however several activities related with the control of occupational health and safety risks were taking place by different organizational units. These activities were mainly addressing minimum legal requirements, while improvement of working conditions and developing a positive safety culture were receiving less attention. Monitoring and evaluation of the outcome of these activities was seldom (Sgourou et al., 2012).

5.2 Building conceptual models

Four human activity systems were identified as relevant to the ideal safety management system, as this was perceived by the working group. The transformation processes related to these systems refer to: (a) identification of and compliance with occupational safety and health (OSH) legislation, (b) risk assessment and control, (c) incident reporting and investigating and (d) development of a positive safety culture (Sgourou et al., 2012).

5.3 Comparing models with reality and proposing for change

The models resulting from the previous stage were used as a means for a debate on the improvements considered desirable and feasible, in order to move towards the ideal situation expressed in the models. Different views were accommodated and a list of several changes was finally drafted by the workgroup, in order to discuss their desirability and feasibility with top management who would take the final decisions. Among the various improvements discussed, evaluation criteria and safety performance indicators were selected by the working group. The three general criteria of efficacy, efficiency and effectiveness, were specifically defined for each relevant system, together with their respective levels of achievement. One or more safety performance indicators were selected for each criterion (Sgourou et al., 2012).

5.4 Taking action in the situation to bring improvement

All information collected through the three stages was included in the final report prepared by the researchers. A wide range of issues relevant to the wider issue of safety management were included in the report. Proposals for changes which would lead to the ideal safety management practices and their evaluation, as well as the implementation of changes included in the final report prepared by the researchers, were also included (Sgourou et al., 2012).

5.5 OSH Conceptual Models

The table below shows the building of conceptual models in OSH

<table>
<thead>
<tr>
<th>S/N</th>
<th>Conceptual Models of relevant systems</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Identification of and compliance with OSH legislation</td>
<td>Root definition: A system to ensure that occupational health and safety (OSH) legal requirements are continuously identified by the Organization's OSH Experts and are met by the Top Management in a prompt and organized manner.</td>
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CATWOE ELEMENTS:
Customer: Top Management
Actors: OSH Experts, Safety Unit.
Transformation: OSH Legislation not always identified and met >> OSH Legislation identified and met.
Worldview: OSH legislation

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2 Identification and control of risks

Root definition: A system to ensure that hazards to occupational health and safety (OSH) are identified, relevant risks are assessed and risk control actions are planned and implemented by the Top Management.

**CATWOE ELEMENTS:**
- **Customer:** Top Management
- **Actors:** OSH Experts, Safety Unit
- **Transformation:** OSH Risks not always assessed and controlled >> OSH Risks assessed and controlled.
- **Worldview:** OSH Risks to employees’ health and safety should be assessed, through a participatory approach, and adequately controlled.
- **Owner:** Top Management
- **Environmental constraints:** Lack of risk knowledge, Lack of resources (specialized personnel, safety budget)

3 Investigating and reporting of incidents in OSH

Root definition: A system to ensure that incidents related to occupational health and safety (OSH) are reported by all employees, investigated by the responsible units and remedial action is planned and implemented by the Top Management.

**CATWOE ELEMENTS:**
- **Customer:** Top Management
- **Actors:** OSH Experts, Safety Unit

4 Development of a positive safety culture

Root definition: A system to ensure that a positive safety culture is developed and supported by the Top Management throughout the organization.

**CATWOE ELEMENTS:**
- **Customer:** Top Management
- **Actors:** Top Management
- **Transformation:** Negative Safety Culture >> Positive Safety Culture.
- **Worldview:** A positive safety culture starts from the demonstration of top management’s commitment to safety and results in safe behaviors and motivation for action for all employees.
- **Owner:** Top Management
- **Environmental constraints:** Blaming culture in civil service, External influences to strategic decisions including occupational health and safety policy and programs.
Fig. 1 Shows the identification of and compliance with OSH legislation

Fig. 2 Shows the identification and control of risks

Fig. 3 Shows the reporting and investigating of incidents relevant system.

Fig. 4 Shows the development of a positive safety culture relevant system.
6. Using Soft Systems Methodology as a systemic approach to safety performance evaluation

(A Case Study of Tonsan Company)

Tosan and existing performance management systems.
Tosan is a private Chinese high-tech enterprise specializing in R&D, production, sales and service of engineering adhesives. It has 400–500 employees and around 50 managers (Sgourou et al., 2012).
Tosan employed a very simple performance management system until 2006. In 2007 they introduced a balanced scorecard (BSC) based performance management system. The balanced scorecard works successfully in terms of growth and high demand. However, with the world downturn they suddenly found that their current system was not able to cope with the demands placed on it. The authors were called in and decided to design a new, strategic performance management system to overhaul all the key business processes.
Tosan runs its organization with informal, personal and reactive. Often a manager would simply set up his or her staff targets, wait for results and then react, which often led to late or wrong decisions in operations and marketing. In the past, the explosively increasing demand put operational efficiency and quality issues to the side so that, although the top executives realized the weakness of its management and operations, there was no strong call for any real change. The Managers started to find themselves fighting and firing staffs from many directions and felt increasingly unable to cope; and top management realized that they had to significantly improve their management and operations to survive in this new environment.
This was because we found that many problems were due to lack of coordination and communication, lack of planning, and panic reactions. The economic crisis changed many things: the market suddenly shrunk and became very competitive in cost and quality.
Tosan proposed to design and implement a full strategic performance management system with built-in functions to re-examine key business processes which could, among other things, bridge the two ways communication between its managers and the staff so that they could anticipate the future business and management issues together, and greatly increase managerial agility.
The approach taken to develop the PM system was based around Soft Systems Methodology (SSM). The system that was introduced and implemented was a performance management approach based on Soft Systems Methodology (SSM) that includes strategy deployment, a performance assessment framework, a performance plan, and feedback and review processes. The new performance management system put much higher demands on managerial skills and there was much for everyone to learn.

6.1 Importance SSM in Performance Management

Soft System Methodology is essentially participative, because it provides the models that will build a process of open debate and discussion, based on constructive feedback.
SSM identifies three elements for successful performance (the “3E’s”) (Checkland et al., 1990):
Efficiency, i.e. the system successfully produces the outputs that it is supposed to do (this relates to the “what” of the root definition).
Effectiveness: meaning the system does not use resources extravagantly (relates to the “how” of the RD).
Effectiveness: refers to what the system does meets the goals and aspirations of the owner (relates to the “why” of the RD).
The overall approach is to construct, after debate and discussion, a top-level root definition and conceptual model for the primary activities of the organization. This is then decomposed into successive levels of detail down towards the lower level activities. At each level, the 3Es lead to the construction of key performance indicators which are developed with managers at each level. This produces a logical, coherent and consistent performance measurement system based on the specific objectives and activities of the organization.

6.2 How Tosan Developed a New System by Applying Soft System Methodology

We, as the commissioned external consultants, tried to collect much information and data for a clear picture of Tosan, and helped to establish the performance management promotion team, which consisted of us and Tosan’s key stakeholders. We interviewed Tosan’s decision-makers, discussing Tosan’s mission, its main long-term targets, and its development strategies in full detail. These core values were developed explicitly within the SSM models, we edited and depicted Tosan’s development strategies after achieving a consensus with Tosan’s top and middle-level executives.
The objectives listed above also served us as the basis for the formulation of Tosan’s strategy map, and were used to guide SSM decomposition in the next phase. The process of interviewing the top and the middle-level executives also served as a training for them in modern performance management concepts. We also had communications with some blue-collar employees in functional units and the production frontline in order to obtain different views and to confirm what had been learnt from the managers (Liu, Meng, Mingers, Tang, & Wang, 2012).
Conceptual models were constructed as a result of the discussions of the promotion team and the top and middle-level executives after reaching the consensus with the stakeholders.
It is necessary to emphasize the importance of discussion and feedback in developing these decomposed models. This is important both to generate ideas and inputs from all levels, and to generate a much greater commitment to the final results. The conceptual model is shown below:
7. Australian construction contractor company (Bridge Project)

As soft system methodology is helpful for knowledge elicitation in complex and poorly defined areas (Finegan, 1994), a particular organizational process was chosen which was less formal, rather complex and poorly defined. The process selected was “Pre-tendering” - the process by which this organization makes an early decision to continue, or not, further venturing in a specific project.

This case study documents the commonly observed scenario while tendering, where multiple parties try hard to bid on a certain project and only one with the lowest bid achieves success. This case study documents a tendering process on a Bridge Project where the bidder lost their bid by a very small margin. It was claimed by the bidder that with a little more expense, the client was going to get a lot more value out of the design. However, by disregarding value analysis and resorting to competitive bidding, the bid with the lowest price (with less value) was selected (Maqsood, Finegan, & Walker, 2009).

In this case, client had undertaken an investigation of the site in the previous 3 to 4 years, but had not completed a final design. It then became a task of the bidder to develop a realistic design in addition to the cost and time estimate that would form a bid within the short time span of 12 weeks. The routine method of bridge design and the typical construction method could not be used because of the nature of soil (clay) that was very difficult to compact. Also, the presence of wild life sanctuary in the vicinity of the bridge made the design and construction environmentally sensitive and subject to community interest. The project team shared the experience gained in developing this bid, adding to their tacit knowledge. By applying SSM, this experience has been made explicit and is documented in the Rich Picture, Root Definition and Conceptual Model in Figure below (Maqsood et al., 2009):

7.1 ROOT DEFINITION – Bridge Project

A system owned by the Bidding Contractor, who together with the Design Engineer, use knowledge, skills and experience to prepare competitive bids for the design and construction of bridge projects. This is undertaken with the understanding that while the client wants a low price, there is also a desire to obtain the best value in a bid. These bids must also take into consideration the competitive market and community expectations for the design and construction of a major project.

7.2 CATWOE

Customer: The client and the community
Actors: Bidding contractor, competitors, design engineer, design team, client.
Transformation: To use knowledge, skills and experience to prepare competitive bids for the design and construction of bridge projects.
Weltanschauung (why Bother?): While the client wants a low price, there is also a desire to obtain the best value in a bid.
Owner: Bidding Contractor
Environment: Competitive, quality, cost and time critical, and community expectations.

Conceptual Model
Lesson learned from the three case studies in implementing SSM

i. The application of SSM and its outcomes proved that it can be used as a tool to address the evaluation of safety management activities in complex organizational settings. SSM contributes as a problem-solving method tool emphasizing on system thinking idea in complex problem involving human affairs.

ii. Soft System Methodology provides valuable insights into the different stakeholders’ perspectives regarding the way occupational health and safety should be managed and evaluated throughout the organization. The concept of SSM employs system thinking approach as an alternative to the reductionist approach of breaking the system into smaller subsystem.

iii. Soft System Methodology is can be considered as an approach that helps in solving organizational chaos that must do with perspective view from different individuals, by proving a cleared and open room for discussion until the desired consensus is met. SSM can be considered as an interpretive approach which expose researchers to a wider scope to address the issues of cultural, political and human that will shape social environment related to the problem situation.

iv. Applying SSM in a company could fight with the economic downturn by overhauling its performance management and operation system in a short time. SSM approach is always trying to find improvement for a problematic situation rather than finding a solid solution to that problem.

v. SSM helps managers and staff all plan pro-actively how to achieve their targets, and to anticipate the possible problems in a constructive way.

vi. SSM is recommended where an organization is seeking to achieve changes in workplace culture and transformation into a learning organization.

Conclusion and Recommendation

This paper introduces the impact of applying soft system methodology by using three case studies that have successfully applied the processes taking while dealing with a complex and confusing situation in an organization dilemma. The paper considered SSM methodology as an approach that helps in solving organizational problems that must do with perspective view from different individuals by proving a cleared and open room for discussion until the desired consensus is met.

We strongly recommend on the organization to be applying the practices of SSM in order to increase the decision making with the help of internal and external stakeholders.

References


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