

The Application of System Thinking for Firm Supply Chain Sustainability: The Conceptual Study of the Development of the Iceberg Problem Solving Tool (IPST)

Hussein A. Al-Homery^{#1}, Hasbullah Ashari^{*2}, Azizah Ahmad^{#3}

[#]*School of Technology Management and Logistic, College of Business – Institute for Advanced and Smart Digital Opportunities, School of Computing*

Universiti Utara Malaysia, 06010 UUM Sintok – Kedah Darulaman, Malaysia

**Universiti Teknologi Petronas, Malaysia*

¹homeryh65@yahoo.com

³azie@uum.edu.my

²hasbullah.asfari@utp.edu.my

Abstract— Purpose: the purpose of this paper is to provide academics and practitioners theoretical, and conceptual framework of the Iceberg Problem Solving Tool “IPST” as a generic problem solving tool for an effective supply chain management process. This leverages Organizational learning, organizational culture and corporate knowledge in implementing changes. The “IPST” is the moderator between the supply chain business process re-engineering of the process changes and systems thinking approach for improvement.

Design/Methodology/approach: A theoretical framework is developed from the systems thinking literature; linking integrated system thinking to firm supply chain sustainability. Theoretical versus practical integrated thinking approaches are applied to contrast the rigid management of sustainability with a model that focuses on relationships and broader indicators of societal supply chain business dynamic issues. Illustrations of the conceptualized framework are presented for discussion and for further empirical research.

Findings: The (IPST) the Iceberg Problem Solving Tools is a practical tool for the current repetitive events in complex business environments of the supply chain. The tool helps the business management, in seeing the entire effects of the pining emerging events within the firm's supply chain business process; where small changes in the leverage points of the chain business processes or system process lead to tremendous results in the performance of the firm's supply chain.

Practical implication: Potential firms supply chain crises can arise if the daily business events are not well analysed this will impact the root causes; by taking the right actions for the right causes of the business events to avoid management quick win failures. The implemented action taken will occur by placing the triggers of the supply chain events in its

original form; within the main workflow process; this will have the effect of implementing the best results of the “IPST” in any supply chain business scenarios. Routines and practices will be based on cross-function process analysis through the whole system flow chart diagram of the supply chain to avoid the pain points of the business events.

Originality/value: Within theoretical roots in systems thinking, this paper contributes to the relatively unexplored area of the iceberg model of the system thinking tools as a practical business problem-solving tool; for the complexity of the supply chain business events.

Keywords— System thinking, Iceberg model, Flow Chart, Macro Cross functions, Critical Thinking, Supply Chain events, business process reengineering, business problem solving.

1. Introduction

The firms' supply chain is established targeting the profits and expansion for the organizations. While the supply chain is dynamic, not static, the internal and external surrounding constitute a substantial part of the supply chain business success or failure. Thus, complexity characterizes the supply chain endeavours. The competitive challenges facing the supply chain of today are complex in nature, involving decision makers, policymakers and various other stakeholders. Such complexity and challenges of the problems cannot be addressed and solved in isolation from other participatory parts. Therefore, collaborative, systemic, and integrated approaches are vital to provide viable desired results. It has become significantly imperative for decision-makers and managers involved in the management of any system or organization to be furnished with knowledge of competencies and specialized

required skills to make good policy and management decisions.

In other words, the supply chain nature is the change. The change causes are varied in its origins as it could be a system, a process, a management, a business environment, or a technology issues. The change volume differs from time to time or from one process to another, as the change disseminates pressures on the firm's supply chain business. The challenges of the changes or the pressures, mostly, require adopting the changes / pressures through policies, procedures, processes, systems and so on, to avoid threats of the supply chain business discontinuity.

The supply chain continuity disruption challenges cannot be addressed and solved with a single dimensional mindset and tools of the past. It requires collaboration, systematic, and integrated approaches to deliver the sustainable desired results. The firm supply chain management or key decision makers' close involvement is significantly important for the seamless continuity and sustainability of the organization goals achievements.

The deep analysis for business disruptions returns to internal and external barriers such as system, process, management, environments, policies and procedures. Many business disasters occur due to lack of common understanding and shared vision of how to address the complex issues facing the firm. The lack of cross function collaboration leads to fragmented decision making and uncoordinated actions. These are further exacerbated by cross purpose negotiations, the wasting of the firm's supply chain resources and loss of confidence in firm management. Such practices, over the time, escalate into a vicious cycle of mediocre performance and poor results for the business firm. Moreover, another vital object for the poor results is that, many of the supply chain problems being addressed are simply treated quick fixes "quick wins" or treating the symptoms. When the quick win has repeatedly occurred to the same symptoms with the same action taken. Thus, the quick win solution concept makes business losses, and threaten the business continuance. While, quick wins due to poor analysis, poor understanding of the real symptoms causes, lead to poor results. Therefore, we are in need of an innovative and effective approach for dealing with highly complex and multidimensional problems and ensuring that solutions will be found at the level of the root causes.

In addition, we form a part of the systems of management in business firms' supply chain,

divisions within firms, disciplines, and so on. Therefore, without understanding that all these different parts in the business supply chain same as in life are extremely interconnected through the cross-functional business tasks or cross communication and collaboration, the solutions that effectively address the multi-dimensional and multidisciplinary nature of complexity will remain elusive.

This paper presents the methodology of a 'new tool for problem solving' using the systems of thinking approach to enhance cross functional process of the organizational communication and supply chain collaboration, to deal with increasing complexity and to stimulate effective change of the process departmental wise as well as company supply chain performance wise.

In our next section, we will give a summary about system thinking, iceberg model, system leverage points, and problem solving, eventually the concept of Iceberg Problem Solving Tool (IPST).

2. System thinking

The system thinking looks at a group of interacting parts interactively working together instead of looking at individual pieces expecting what emerges from the interaction [1]. Looking at the whole system that produced, the discipline recognizes that behavior is caused by often invisible pressures, and that actions have consequences which often feedback into the original problem [2]. System thinking is recommended for complex system consisting of multi-interrelated parts which constitute the whole. The system thinking uses the analogy of an iceberg to illustrate the conceptual model.

3. Iceberg Model system thinking Tool

The analogy of an iceberg used to illustrate the conceptual model for levels of thinking. The levels of system thinking start from three levels till seven levels of thinking [1], [3]. The iceberg version of the tool uses five levels of thinking for different levels of analysis, figure (1).

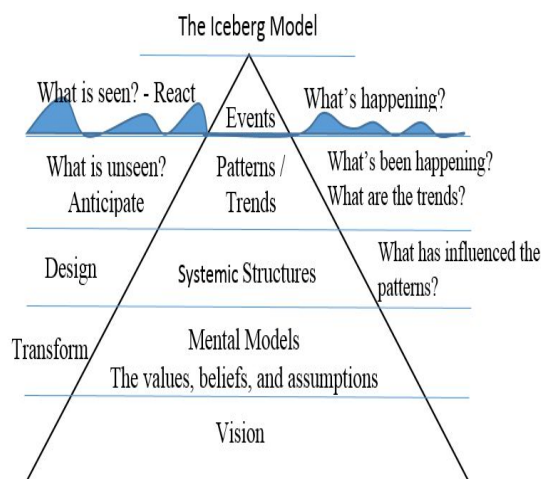


Figure 1. The Iceberg Model

Source: Adopted from Senge, Peter, *The fifth Discipline*, 1996.

In this model, the events or symptoms are the visible part of the iceberg above the water surface. Most decisions and interventions are taken at this level, as a 'quick win' (treating the symptoms) to overcome the situation as soon as possible, although they do not provide long lasting solutions. While, events frequently occurs again and again with the same reaction, of the same quick win solutions, then we are in need for another level of analysis to explore and identify the patterns or the trends which become linked with the events as a relationship among components of the triggered events. Moving deeper into the third level of thinking of the structure that reveals how the different components are interconnected and affected one another. Thus, structure unravels the complexity in ties of the relationships, how it is designed to propagate the trends of the events in the system. The building structure affected by the mental model reflection of the beliefs, Values, and assumptions of the individuals and organizations at the deeper level, the four levels of thinking analysis. Then, such mental models are built upon the vision of the business in the fifth level of thinking analysis. The systems thinking paradigm and methodology embrace five levels of thinking by moving the stakeholders from the event level into deeper levels of thinking in a systematic framework in problem solving.

The application of systems thinking has grown extensively and incorporates works in many diverse fields and disciplines such as, to mention but a few, marketing [4], sustainable supply chain management (SSCM) [5], Ink Sales with iceberg thinking [6], laboratory learning [7], cultural metaphors [8], evolution of iceberg phenomena [9], education [10]-[12], organizational change [13], Organizational Learning [1], library and information science [14], human resource

management [15], health [16],[17], environmental conflict management [18], and food security and population policy [19].

This is a conceptual paper to demonstrate how (IPST) Iceberg Problem Solving Tool, as a comprehensive system thinking approach, embedded in a cyclic action research framework, can be used to deal effectively with complex issues of the supply chain in a variety of contexts.

4. Theorized framework and practical illustrations

The Iceberg Problem Solving tool, to be known by its acronym "IPST" is an analytic business tool to guide the search evidence for problem solving in a practical business environment. The tool helps to contribute to the broad area of enquiry towards observing the tool in practice. To examine the pain points of business events in a systematic approach of system thinking. The literature review has highlighted the importance of the system thinking in many applications as well as an iceberg model as the main model in our conceptual tool (IPST). The most important part in the tool is that, all interrelated departments processes (the preceding, the current, the successive) of any triggered pinpoint events of other processes, all of them need to be present in all the discussions and the analysis process from the beginning till the end. Above all every analysed iceberg should be agreed with all the participants groups the results for implementation, then the same group should observe the outcome, and interprets the reflections for the next cycle improvements enhancement process and so on.

5. The Iceberg Problem Solving Tools (IPST)

The (IPST) is a process, as well as a setting, in which a diverse group of participants are shared in a cyclical process of thinking, planning, action and reflection. It is a tool designed to be used in the problem identification process of the action research; analyse the identified problems of the triggered events through the five levels of analysis which will result in the new vision of the new iceberg to build upon the change in the mental model. This is constructed through the new changes of the current structure and the new trends or patterns of the propagated events on the surface levels of the supply chain.

Identifying the problems of the propagated events is a five analysis process; where we go through the iceberg five levels of analysis for each

function in the process. We start with the repeated events of the supply chain which cause losses to the business firm or the critical issues in delay the supply chain process. Then, do the reported event analysis in more details, while doing that we have to go deeper to another level of analysis to know, what are the trends or the patterns produced by these events; is it process, system, management, or human factor? To know why this pattern generated such events, we need to do the third level of analysis, which is the structure which generates the trends and accordingly triggered the events. To have the whole picture we need to have further deep analysis to the fourth level of analysis the mental model. The mental model is what the assumptions, beliefs, and what is supposed to happen as a change in the assumptions or users beliefs, as change to build upon our new vision in as our fifth level of analysis.

The analysis of the iceberg is to be implemented across function wise for one process of the supply chain from the beginning till the end to observe and judge the results, departmental wise to reach to the optimum solution of the function system wise, process wise, management wise. As we aim to improve the business firm performance.

To practice the iceberg model operation wise, we developed our (IPST) tool. It depends on the iceberg model of the system thinking. While, the business firm supply chain problems are extremely complex, have many interrelationships among the business components, and frequently, repeatedly occur regardless of the solutions, then our (IPST) tool of the system thinking can be applied.

The tool is used to identify and analyse the frequent and repeated problems in a business firm supply chain by action research as the business requirements mostly are the fast action, the high performance, unless the firm losses will be high according to the business volume size. The steps of the Iceberg Problem Solving Tool "IPST" are as follows:-

First of all, we need to study the repeated propagated business events of the supply chain within the whole system process which is going on, which means that this process affects greatly in the preceding process and the succeeding process of the main cycle process as a task by task. Therefore, the whole system of the business firm supply chain as process workflow overview is the first to be handled.

The second step, to track the process of the business events repetitively occur, from the very

start point of the system workflow process till the last task in the complete cycle of the process. For example; in an authorized automobile dealer the retail sales process starts from the customer channels contacts, where the customers meet the sales consultant for their vehicle requirements in a dealer's showroom and ends to deliver the vehicle to the customer as a complete sales process cycle. The automotive retail sales process, starts from the customer and ends with the customer by delivering the vehicle. While between the start and the end many processes are going on between different departments of the dealer's office to complete the sales process tasks.

The third step, heading firm business meetings or interviews for all the participating departments of the sales task processes. All processes to be studied carefully and indicate with question mark symbols "?????" for the irritated triggered events in the supply chain process of the system workflow chart, cross functional department wise to be able to grasp the complete dealers' pining issues. Then, look for the irritated areas in the current system to know, where the leverage points are in the system workflow diagram can be changed to enhance the firm supply chain performance.

The fourth step, is to represent the complete supply chain process of the concerned business as a macro cross function process wise through all firm participating departments. The macro level cross function workflow, gives us an idea of how is the repeated events are connected and most of the time are related to each other. In other words, the propagated event is a cause of a previous process, not done right, while its process is going on, it is propagating another event in another process ahead in the sequence of the main workflow process or parallel to and so on.

The fifth step, while doing the supply chain macro process function wise, needs to stage wise the process from the beginning till the end.

The sixth step, the previous stages wise process should be understood very well as the interrelationship of the current, the preceding and the succeeding processes, for each task in the supply chain workflow process. Then we need to write down the repeated events stages wise, event wise, and cross functional wise.

The seventh step, once we highlighted the pining areas of the repeated event stage wise, then our next step is to start doing analysis for all identified problems through the five levels of analysis of the iceberg model in our "IPST" tool, to reach our new vision for each task we analyse.

The eighth step, to do a separate complete cycle of “IPST” for each repeated event stage wise. While doing that, we need to write down all available angles as well as the hidden angels for exception to handle the exception system wise, process wise, management wise.

The ninth step, once we finished all the analysis of the identified supply chain problems by having “IPST” for each repeated event cross function wise. Then, we list inside the Iceberg Problem Solving Tool (IPST) format, the cross function supply chain process, by listing down the first column of the tool, the cross function process. Then, in the next columns, the five levels of the iceberg analysis model - Events, Patterns/trends, Structure, Mental Models, and Vision, in the same successive sequence horizontal wise. Each stage we called function, therefore, each stage will be represented as a cross function preceding by its section number in the detailed analysis of the identified problems script for solving, as in figure (2). The tool is summarizing the volume of the leverage points in the existing system, where changes are required to happen to receive a positive result affects in the performance of the existing supply chain system, such change could be a process, a system, a management, a human factor, and a technology and so on.

The tenth step, what has been analyzed and listed in the (IPST) tool, stage wise, cross function wise, process wise, is representing the complete supply chain system processes or business processes requires changing. The (IPST) is required for the planned actions to be taken. Then the implementation process as enhancement of the existing supply chain system or business process to know the reflections of the implementation of the process as well as the system for more enhancement to our next cycle of the actions to be taken and so on, till we reach the optimal solution. Upon the new vision for the implementation process enhancement, the actions and reactions of the above stages will reflect in propagating new events that were hidden before, which means that the new vision is still going to produce more events on the surface to be treated in the next cycle of the business actions that plan to guarantee the continuity of the business process and its required performance of the process. The new vision of the “IPST” tool for the complete supply chain cycle of the whole system, the invisible triggers of repeated events, will be clearer where we start the whole from the part or the components which constitute the whole. This complete analysis will be the new vision for the second run of the business actions to be taken for supply chain performance

improvements.

Cross Functional Work Flow	CYCLE - 1				Vision
	Events	Patterns	Structure	Mental Model	
Process -1		XX1- Function -1			
Process -2					
Process -3					
Process -4					
Process -1		XX2- Function -2			
Process -2					
Process -3					
Process -4					
Process -1		XX3- Function -3			
Process -2					
Process -3					
Process -1		XX4- Function -4			

Figure 2. The Iceberg Problem Solving Tool (IPST)

6. Discussion: Innovation, learning and continuous improvement

The objective of this paper is to explore our new Iceberg Problem Solving Tool (IPST), as a practical business tool. Drawing on insights from systems thinking, as a theoretical tool developed to

examine supply chain organizational events pinning issues to overcome the management disasters of the accumulated effects of events on the firm's supply chain business performance as a whole. The paper offers insights to illustrate what (IPST) might look like in practice. With each of the automobile dealer sales process examples, were grappling with different contextual sustainability impacts, and were all willing participants in helping us to showcase their capabilities. The lack of the system thinking literature in using the iceberg model as a problem solving tool has given us the advantage to offer the tool for business supply chain applications and future implications.

Moreover, the tool is a systematic framework for identifying the supply chain business problems, system processes as well as business processes. The tool could be a great help for practitioners as well as academics. Furthermore, it is a well systematic documentation tool for how the problems are identified and how the solutions are derived.

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