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A Soft Systems Methodology for Transforming Organisations to Product-Service Systems (Application In Defence and Construction Industry)

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Abstract

Nowadays organisations from different business sectors and with contrasting management approaches are increasingly prioritising the satisfaction of clients' needs through service provision. The transformation of a company from predominantly product only to a product and service mix is studied. The transformation will generally involve the transfer of some activities from one part of the supply chain to another and, in some cases, this involves the transfer of activities previously carried out by the client to the product-service company. This paper describes the application of SSM (Soft Systems Methodology) to this transformation such that the views of those stakeholders across the supply chain can be captured and conflicting expectations and views can be highlighted. We provide an initial model for developing a SSM in defence construction organisations to show that the general approach is relevant to this particular feature of transformation. The SSM approach will lead to identification of barriers to transformation, the understanding of implications on overall performance and – importantly – the joint consideration of these matters and solution generation by customer and supplier in a non-confrontational fashion. The overall objective is to make recommendations that alleviate identified concerns, barriers and obstacles to this transformation. The outcomes of the research will show how the SSM conceptual models can help managers in either sector to realise the necessary activities needed to perform the transformation in a successful manner.

Keywords – Product-Service Systems PSS, Defence sector, Construction sector, Soft Systems Methodology (SSM).

1 Introduction

The competitive business environment forces managers to engage in major transformations of their businesses. One such transformation is to organise the business to provide an appropriate blend of product and service, which for many organisations means a fundamental transformation from product-focused to a product-service mix. William [1] has stated that: “In today’s highly competitive markets, industrial marketing companies whose core offering is a product or a set of products often find the strong need to augment this core offering with services in order to compete effectively”. This assertion is supported throughout the literature (e.g. see [2], [3], [4] and [5]), such that the transformation to the product-service mix is critical to maintaining or gaining competitive advantage. However, not all authors agree that the shift towards services represent a significantly new model [1].

This paper provides an initial model for developing a Soft Systems Methodology (SSM) in organisations in the defence industry (as a macro level model representing the military sector) and in construction organisations (as a micro level model representing the civil engineering sector). This will show a generic approach that can be tailored easily to support different sectors facing comparable challenges. SSM is a tool to facilitate transformation in such a way that the views of those

engaged with the transformation can be captured and conflicting expectations and views can be highlighted. The audience for this paper are the management teams and systems engineers in the defence sector (both customer and suppliers) and the project managers, construction managers and systems engineers in the construction sector. It will also be of use to management and systems engineers in other disciplines who are concerned with the implications of this transformation. In the short run, the realisation of the expected benefits will encourage participation with full awareness of the positive results that this approach can bring with respect to improving overall performance and the smooth operation of the day-to-day processes of projects within organisations. In the long run, and on a higher level of application, this SSM will serve as a catalyst model and road-map approach for identifying the correct and essential activities needed to achieve the transformation of the whole organisation from product to product-service mix.

2 Product-Service Systems (PSS) Concept and Definition

2.1 PSS Concept and Definition

The Product-Service System (PSS) concept can be thought of as a market proposition that extends the traditional functionality of a product by incorporating additional services [6]. The emphasis in PSS is on the ‘sale of use’

rather than the ‘sale of product’, hence, the concept of PSS can be seen as a special case of ‘servitization’ where the client pays for using an asset, rather than its purchase, and so benefits from reorganization of risks, responsibilities, and costs traditionally associated with ownership. Similarly, the supplier/manufacturer can improve their competitiveness as these ‘solutions’ may be clearly differentiated from product-based offerings while simultaneously retaining asset ownership that can enhance utilization, reliability, design, and protection [7]. Most authors see the purpose of a PSS as a competitive proposition, and so directly refer to the need for customer satisfaction and economic viability. In addition, many link PSS with achieving sustainability e.g. [8],[9],[10] and [11], but only [11] sees this as the ultimate goal.

In recent years, different literatures have attempted to give a definition of PSS (see [6]). In its broad term and meaning: PSS are a combination of products and services needed to jointly fulfil customer needs. The definition for PSS adopted in this work is: ‘A system of products, services, networks partners and supporting infrastructure that is economically feasible, competitive and satisfies customer needs.’ [6].

2.2 PSS Elements and Integration

Mont [9] has defined the key elements of a PSS as follows: 1) Product: a tangible commodity manufactured to be sold. 2) Service: an intangible activity (work) done for others with an economic value and often done on a commercial basis. 3) System: a collection of elements including their relations. In this sense, the integration of product and service means that a supplier integrates products and/or services to deliver an especially useful outcome. For example, IBM puts together hardware, software, and services to create turnkey trading floors for its banking clients [13]. To meet this requirement to build an efficient PSS, company managers must shift to a more holistic approach; they must consider both the internal capability for production and product lifecycle as well as the client need for immediate delivery of a needed service.

3 Shifting toward PSS: From Situation A: Product Only Focus to Situation B: Product and Service mix Focus (Servitisation)

The product and service mix must be supported by infrastructures and networks [12] to bring the product and services to customers when they are required. For decades UK manufacturers have trusted their superior technology and innovative capacities as their best competitive strategy. Traditionally there has been a clear division between UK manufacturers (focused on R&D, design and production activities) and pure service providers (focused on service delivery). However, innovative manufacturing firms could adopt a PSS approach to gain competitive advantage. To achieve this, company managers need to change their. This

research considers the practicality of the shift from product delivery to service provision in the UK. Usually companies do not move suddenly to PSS applications but rather gradually. Basically this move may be done in two different ways: productisation or servicisation. Figure 1 as given by [6] represents both of them. Although the gradual approaches (servicisation and productisation) are the most common path toward PSS, there are examples of companies that embrace PSS from its start-up [6].

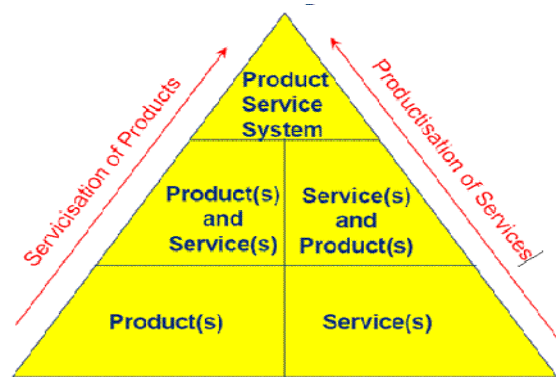


Figure 1: Moving Towards PSS Business Model (Source: [6])

3.1 Situation A: Product only Focus

In this situation the focus is on improving the functionality of the products, applying the up to date technological processes in producing them, as well as refining their features to achieve high quality products. In defence, the products are aircraft, tanks, warships, guns, radar systems, etc. In the construction industry the products include hospital buildings, hotels, schools, etc. Quality is marked by good architecting of all of these to ensure appropriate functionality and appearance. It is only the entity that is provided, its use and maintenance are dealt with separately. Thus, a five star hotel in a luxurious resort might have all the functionality architected in, but the experience of users will also rely on the service provided by another organisation from that which provided the product.

3.2 Situation B: Product and Service Mix Focus (Servitisation)

In this situation the focus is on adding complementary services to product in order to make them more attractive. The classic examples are maintenance and overhaul of cars (manufacturing sector), aircraft (aerospace and defence), roads (transportation). Between the two gradual possibilities to move toward PSS applications, servitization is the most common. Gradually the producer increases the number of these services. However not every company walks the entire path toward PSS. The organisational transformation process and its requirement for making the shift successful is discussed below.

4 Organisational Transformation

'The transformation of a traditional industrial enterprise into a service oriented organisation is not a simple challenge with easy solutions' [14] and as, mentioned by [1]: 'Enterprise transformation concerns change, not just routine change but fundamental change that substantially alters an organisation's relationships with one or more key constituencies, e.g., customers, employees, suppliers, and investors'. Thus transformation can involve new value propositions in terms of products and services, how these offerings are delivered and supported, and/or how the enterprise is organised to provide these offerings. Transformation can also involve old value propositions provided in fundamentally new ways.

The possibilities for the transformation are defined by the relationships between the enterprise and the external context with its internal strengths and weaknesses, and external opportunities and threats [1]. William argues that transformation of the enterprise occurs and operates within this broader external context and in his work for modelling enterprise [1] also presented the organisation in an input-transformation-output model. The inputs are the demands, competition, investments, people, technology, required revenues with constrained rules and regulations. The outputs present products, services, market share, innovation, jobs and revenues. The transformation is divided into two components; the enterprise state and the work process. William [1] argues that the inputs affect both work processes and enterprise state. For example, input resources (e.g. people, technology, and investment) affect both how work is done and how well it is done. [1] claims that: 'the concept of "state" is central to the theory of enterprise transformation'. He defined the state of a system as the set of variables and their values that enable the system to be assessed in terms of its current positioning or state and where it intends to go in the future state.

Following this conceptual thinking, it is required to see if the outcomes of the transformation will develop more added values to the clients. From this perspective, state variables such as revenues, costs, quality and price determine value. These variables are themselves determined by both work processes and architectural relationships among processes. Inputs such as investments of resources affect work processes.

To sum up, the value of projected outputs influences how input resources are attracted and allocated. This is an important concern for the transformation to happen and dictates the choice of the appropriate model or techniques for fulfilling this transformation.

4.1 The Transformation Processes

How does transformation happen? Transformation processes would involve constructs such as double-loop learning and organisational learning [15] and [16]. Thus, transformation might become integral to normal business

practices, perhaps even routine as mentioned by [1]. The focus is no longer on products, but on solutions and on utility resulting from the use of products [17]. It is assumed, of course, that consumers of PSS are more interested in the service than the product itself, but it should be noted that there are examples where ownership delivers the service of status, which is an important social factor [18].

4.2 Transformation Requirement

The transformation from products to PSS requires changes in the company's structure, organisation, marketing strategies, relation to stakeholders. Furthermore, the development and implementation of PSS is not just a little change or innovation, but requires a different way of thinking. PSS may be due to, or create, many different goals (e.g. new market opportunities, sustainable lifestyles, new jobs, etc.); it is not a trivial task to reach these goals as they influence each other in different ways that can be positive or negative.

Decisions about trade-offs between the goals might be necessary and barriers resulting from the organisational conditions exist. The change in mindset needed to achieve this transformation is supported by methods and techniques that support a *co-value focused thinking approach*. Development of such techniques must be investigated in order to make a successful transformation.

4.3 Company Co-value Focused Systems Thinking

The product to PSS transformation requires recognition of the co-creation of value by supplier and client; this represents a major change in mindset that implies the need to embrace different management and decision-making approaches in the leadership style. Moreover, the change in mindset must be ubiquitous throughout the organisation, hence a constructive approach towards full organisation transformation is required.

Managers must select the appropriate methods and models to effect the transformation. This paper proposes using the Soft Systems Methodology (SSM), as one of these tools, to contribute to the understanding of the current problem situation and analyse the situation using its technique of the root definitions and conceptual models to identify the necessary activities required to achieve transformation.

Figure 2 illustrates the transformation; the company has a front office (facing the client), back office (developing company capability) and the central leadership function (organising, monitoring and regulating the work between both offices). The central function uses SSM as one of the transformation models to drive the whole train (i.e. the organisation) to the proposed destination. The details of this SSM are explained below.

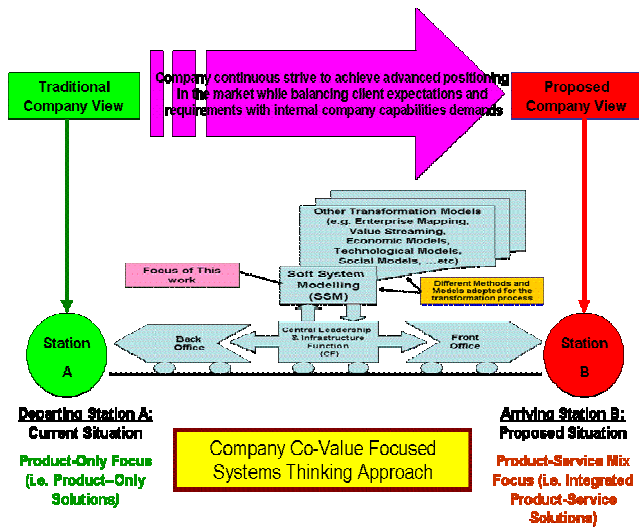


Figure 2: Proposed SSM Contribution to The Organisational Transformation From Situation A to B (A Co-value Focused Systems Thinking Approach)

5 Understanding Complex Matters

The real world is complex and messy. Many different factors may contribute to an issue, and there may be many different perspectives to consider while resolving it. This means that it is often difficult to understand the real problem or find the root cause. With so much confusion often surrounding problems, determination of an appropriate solution can sometimes seem almost impossible. To deal with issues like these, a problem-solving approach is needed that first lets stakeholders see clearly what is happening – and then helps them think about how the situation could be improved. SSM is just such an approach.

5.1 The Soft Systems Methodology (SSM) and Its Development

Soft Systems Methodology grew out of General Systems Theory founded by Bertalanffy [19], which views everything in the world as part of an open, dynamic, and interconnected system. The various parts of this system interact with one another, often in a nonlinear way, to produce a result.

The Soft Systems Methodology (SSM) was developed by Peter Checkland [20] and colleagues such as Brian Wilson [21] at the University of Lancaster. It is based upon systems theory, which provides a complement to conventional, reductionist scientific enquiry - with its tendency to reduce phenomena into smaller and smaller components in order to study and understand them [19]. SSM helps formulate and structure thinking about problems in complex, soft situations. Its core premise is the construction of conceptual models of purposeful human activity structured by systems theory, and the comparison of those models with unstructured perceptions of the real world [22]. Conceptual models are theoretical constructs which embody potential real world systems but, more importantly, follow rigorously systems principles, and their own well-defined internal

logic. They are neither descriptive nor normative, though they may carry elements of both. SSM is not, therefore, about analysing systems found in the world, but about applying systems principles to structure thinking about things that happen in the world.

5.2 What is SSM?

SSM is an approach to the modelling of human activity systems that enables problem situations to be modelled, understood and then helps potential solutions to be identified. The solutions can be tested for desirability and feasibility. Because SSM enables learning and understanding, the method is a part of the process of transformation (change) to a new desirable system state. SSM has emerged over a period of 30 years to help deal with what Ackoff [14] terms ‘messes’, i.e. complex social and dynamic situations.

Checkland and Poulter (2006) describe SSM as “an organized way of tackling perceived problematical (social) situations. It is action-oriented. It organizes thinking about such situations so that action to bring about improvements can be taken.” SSM is generally applied to situations where there are conflicts among stakeholders or where the goals of a system are debatable (Venable 1999).

During this period of evolution, the process model of SSM has emerged and the main stages of the process are described in Table 1. Generally, SSM is applied to situations where there are conflicts among stakeholders or where the goals of a system are debatable [23].

5.3 SSM Stages

SSM comprises the following seven stages (based on [24]), as shown in Table 1 and as illustrated by Figure 3 below:

Table 1: Key stages of Soft Systems Methodology (source [24])

Stage	Objective
1	Understand the problem and its situation.
2	Attempt to build the richest possible picture of the situation.
3	Aims to describe the nature of the chosen system using Root Definition (RD) and specifying the CATWOE.
4	Produces conceptual models of the defined system that reflects this RD.
5	Compares conceptual model with actual situation in order to generated debate with the stakeholders.
6	Outline possible changes that are desirable and feasible.
7	Involves taking action based on stage 6.

5.3.1 SSM Components and Tools

After defining the problem from the client in an unstructured manner (stage 1), it is then is represented using a number of tools which are associated with SSM [25] and

[24]. Client in this case means the organisation (company) transforming to PSS.

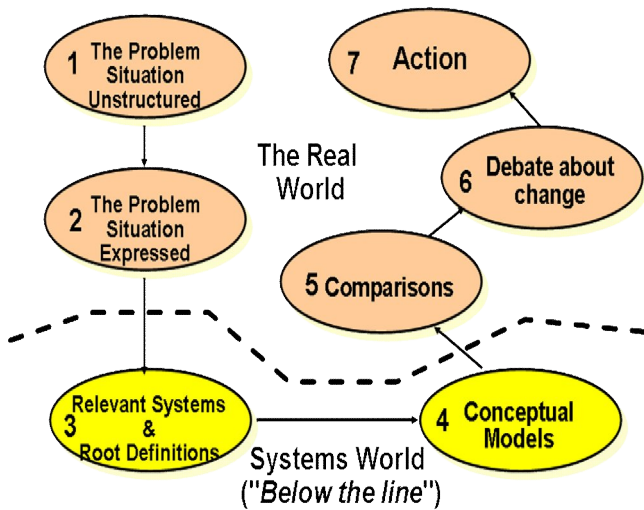


Figure 3: Illustration of the Seven Stages of Soft Systems Methodology (source [24])

These tools can be used within the two-stream process model of SSM described by [25] for identifying appropriate activity systems for the problem situation. These tools include:

1- Rich pictures (stage 2) which express the problem in diagrammatic pictures and symbols that are easy to visualise and recognise its importance by all parties involved in the analysis.

2- A root definition (stage 4) is prepared to show the purpose of the required system. The issues and key tasks extracted from the rich picture become the basis for defining what are called the ‘relevant systems’. There is no reason to restrict relevant systems to one issue or key task. Further analysis of more than one relevant system might provide valuable insights into different perspectives of the situation. The initial idea of the relevant system is then expanded into a root definition, which is also coupled with preparing:

3- The table of the mnemonic CATWOE (C – customers or clients, A – actors, T – transformation, W – worldview, O – owners, and, E – environmental constraints) as explained in Table 2:

Table 2: The Elements of The root Definition – The mnemonic CATWOE

	Component	Description
C	Customer(s) or Client(s)	Who would be the victims/beneficiaries of the purposeful activity (i.e. the transformation)?
A	Actor(s)	Who would do the activities for the transformation to happen?
T	Transformation Process	What is the purposeful activity expressed as Inputs -- Transformation----(Transformed) Outputs?

W	Weltanschauung (Worldview)	What view of the world makes this definition meaningful?
O	Owner(s)	Who could stop this transformation process?
E	Environmental Constraints	What constraints in its environment (outside the system) does this system take as given?

Finally, the activities are related in a logical relationship through what is called:

4- Conceptual Models (CM). These can be either issue-based models related to soft issues (e.g. training, contract matters, management-client relationships, client-supplier relationships and interactions,...etc) or primary-task models (e.g. improving marketing department, improving information system in a company, a production process,...etc.). The conceptual (or activity) model contains all the activities that the relevant system has to perform. The model is usually drawn as a block diagram (see examples at end of this paper).

5.3.2 The Validity of Conceptual Models

Examining the validity of models generated as part of a soft systems enquiry is difficult and [26] suggests that there are really only two aspects that can help differentiate a good model from a bad one and these relate to whether the models as developed: a) are in any sense relevant and b) are competently built. The relevance of the models is a matter for the participants to determine and is related to the extent to which the models generated improve the understanding of issues and the generation of subsequent actions. The competence relates to ensuring that the root definitions and conceptual models have been derived systematically from the rich picture and the issues identified within it and also that the conceptual models are built only from the root definition.

6 A Research Question

The aim of this research is to explore the use of SSM as a tool for helping managers to transform the organisation from pure product to product-service mix company. The overall research question that can be asked in the context of this paper is:

How can SSM be adapted as a framework for achieving organisational transformation in the UK Defence and Constructions sectors?

The answer to the above research question is not straight forward and the full transformation is beyond the scope of this paper. However, one answer would be: *using the SSM for studying, analysing and developing some conceptual models for defining the necessary activities required for solving some complex problems, issues or some difficult and conflicting matters that can hinder the transformation process in both sectors.* Hence by resolving those matters, managers can integrate or compile different models and techniques (e.g. economic, technological, social, enterprise mapping models, value streaming models etc. - refer to

Figure 2) including the SSM for achieving the overall required transformation. In the context of this paper only the SSM is explored. The process for understanding transformation is outlined, but not detailed.

6.1 SSM as Input-Transformation-Output Model

For any transformation to happen, an input-transformation-output model is recommended [1]. To apply this concept using the SSM, [27] proposed to combine the viable social system modelling described by Beer [28] with the SSM components in an input-transformation-output model. Some modifications to this model are added here. This is to serve the idea of using the SSM as one of the valid tools for transforming organisations into a co-value focused system as previously described in section 4.3. Figure 4 shows the mnemonic CATWOE of the SSM, with other components (input, output, transformed outcome and performance assessment feed-back loops) represented in an input-transformation-output model, as described in Table 3. Formal feed-back loops are also shown between the client part and the input, the transformation and the output parts for making dynamic changes to respond to changes in client demands.

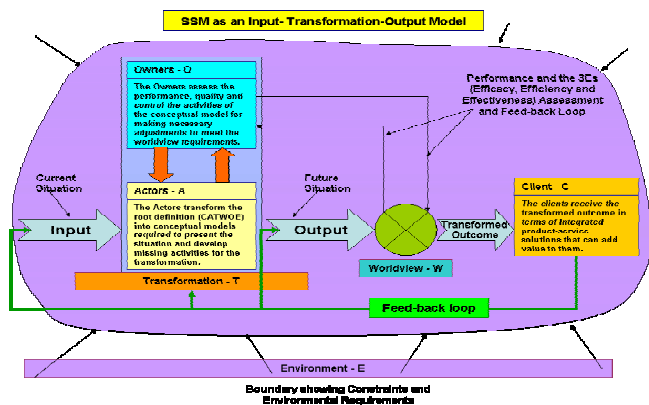


Figure 4: SSM as Input-Transformation-Output Model for Organisational Transformation From Situation A to Situation B

Table 3: SSM as Input-Transformation-Output Process

No.	Component	Description and Use
1	Input	Describes the current situation (e.g. product only).
2	Transformation (T)	Develop a system RDs, CATWOE tables and transform them to conceptual models (primary task or issue based) to define necessary activities required for the transformation. This is done by Actors and controlled and assessed by Owners of the system.
3	Actors (A)	The Actors transform the root definition (CATWOE) into conceptual models required to present the situation and develop

		missing activities for the transformation.
4	Owners (O)	The Owners assess the performance, quality and control the activities of the conceptual model for making necessary adjustments to meet the worldview requirements.
5	Output	Realise the outcomes of the conceptual models and assess their validity to meet the worldview requirement.
6	Worldview (W)	The new required organisational system that will achieve the transformation to product-service mix.
7	Transformed Outcome	The required transformation activity required to meet company and client demands.
8	Client (C)	The Clients receive the transformed outcome in terms of integrated product-service solutions that can add value to them.
9	Environment (E)	The different factors and constraints that affect the whole transformation that should be considered in the transformation process.
10	Boundary	The boundary within which the constraints are managed and beyond which the scope of the transformation will be difficult.
11	Performance Assessment	Assessing the performance of the transformation output through assessment of their expected performance using the 3Es (Efficacy, Efficiency and Effectiveness).
12	Feed-back Loops	Feed-back loops from the client and users of the newly transformed system for future enhancement to the input, modifications to the transformation or changes required in the resulting output. This makes the system dynamic rather than one static transformation.

6.2 SSM and Its Use in Organisation Transformation

Understanding the previous table and diagram with its notion of Input-Transformation-Output modelling and by referring to Figure 2, the SSM, as a proposed model contributing to organisational transformation can be represented as one of the tools to help company managers make the transformation journey feasible by departing from station A (product-only focus) to arrive at station B

(product-service mix focus) within co-value focused systems thinking approach as illustrated in Figure 5.

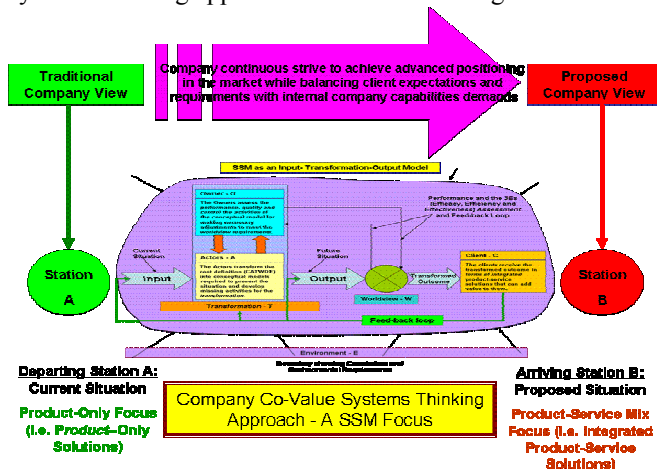


Figure 5: SSM and Its Use in Organisation Transformation

7 SSM: Application in Case Studies

As confirmed earlier, the SSM can be used to analyse and present matters encountered in complex problems. In this paper two complex case studies are considered; one is in the defence sector and the other is in the construction sector. Root definitions, with their CATWOE tables and relevant conceptual models are offered to show the usefulness of the SSM in handling some issues or conflicting managerial matters in an attempt to make a contribution to the full transformation of organisations in both sectors. The general steps of the process are summarised in the following five steps:

7.1 Steps of The SSM in Action

1. Define the problem under investigation with the help of the company/project managers (in workshops format).
2. Develop reflecting different RDs and different relevant conceptual models (Issue-based and/or Primary Tasks ones) (done by the Actors of the process).
3. Prepare data (from workshops with project managers and employees) required for completing the model from workshops results (done by the Actors of the process).
4. Refine the SSM(s) and finalise the presentation of the problem under investigation with all resolved matters (done by the Actors of the process).
5. Compile results and produce a report of the required actions to the project managers (Owners of the process) for tackling the necessary transformation actions (done by the Actors of the process).

8 SSM Applied to P to PSS Transformation in Different Sectors

The problem of P to PSS transformation is many faceted, but an area of particular difficulty that we have observed concerns the transfer of responsibility for some activities from the client organisation to the supplier organisation, whilst other activities are retained by the client. The particular situation in which this can pose tension is that in

which the client becomes simultaneously customer and sub-contractor. This situation can arise for a number of reasons, but is especially likely in the P to PSS transformation; it is possible that it may be an intermediate problem during transformation. The whole nature of the PSS condition is based on the co-creation of value; under this condition that client has a role in the creation of value which will specifically require the discharge of some (commercial) activity. Sometimes the client may wish to retain some activities for economic, commercial, security or other reason. It could be, for instance, that skills retention is only viable if the client retains the activities.

The situation is awkward because the service provider relies on the client for some part of the service. This is 'messy' in a contractual sense, but is also 'messy' in an organisational sense, which is why SSM is a useful tool through which potential tensions may be appreciated and alleviated.

8.1 SSM: Application in The Defence Sector – The ATTAC Project

8.1.1 ATTAC – A Simple Overview

ATTAC (Availability Transformation: Tornado Aircraft Contract) provides guaranteed availability of Tornado aircraft for the RAF. The contract is potentially worth in the region of £1.5 billion and will save the MOD £510 million over the initial 10 years of the programme. The contract includes on-aircraft maintenance of the GR4 fleet, spares support, technical support and training. The approach builds on availability improvements and cost reductions achieved through earlier pilot programmes. More detailed information on the ATTAC programme is provided in [29] and [30].

8.1.2 GFX in ATTAC

GFX stands for Government Furnished (various) contracts (X) and describes the situation in which the MoD (or other Government Departments) act as a subcontractor providing Government Furnished Equipment, Facilities, Information, or Services. The commercial arrangements under which GFX is carried out depends on whether the service etc. is provided to another Government department or to a prime contractor. The ATTAC programme includes some parts of the service that are delivered by the MoD and a value-chain mapping exemplified this as an area for improvement in terms of the overall maintenance and service offering. Such arrangements are becoming commonplace (i.e. the Tornado programme is not unique in this arrangement) and the dependencies thus created are in pressing need of resolution.

We observed that the dependencies created by the GFX arrangement were the subject of very different perspectives both between the client and service provider (front office) and the back office, as represented by the off-base technical and managerial staff. This leads to some judgemental and dispersed management processes that, it appears, are typical of the GFX arrangement. The different perspectives observed tended to be concerned with priority and time-criticality between the GFX service and the front office and

misunderstandings of responsibilities between the back office and front office.

SSM specifically includes different perspectives as a means of sharing appreciation of those perspectives across the stakeholders. It offers a forum for legitimate debate between the various parties concerned.

8.1.3 The SSM Steps for P-PSS Transformation as Applicable to GFX in ATTAC

A two-phase approach is suggested for representing GFX in ATTAC, as shown in Figure 6.

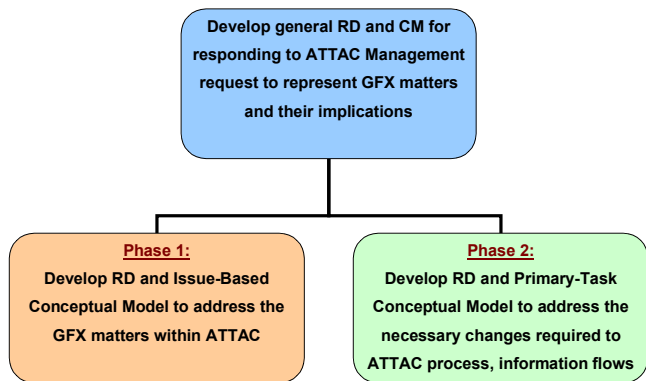


Figure 6: The GFX/ATTAC Problem-Solving Approach and Its Two Phases

Phase 1: to illustrate and present the GFX matters using SSM to support understanding of the situation by ATTAC management. This will require the construction of an *issue-based system* conceptual model (CM) from a predefined proper Root Definition (RD) and CATWOE analysis.

Phase 2: how to assess the ATTAC business (using SSM) with particular reference to improving the ATTAC performance, delivery scheduled plans and the reduction of operation costs and any risks associated with their overall maintenance and service plans. This will require the construction of a *primary-task system* conceptual model (CM) from a predefined proper Root Definition (RD) and CATWOE analysis. From the point of view of this research there is also a big possibility of more phases to be added to complete the study and to offer more practical solution(s) to eliminate or reduce the problem and improve overall performance of the ATTAC programme.

The SSM steps in detail:

A suggested general RD and conceptual model is presented showing our understanding of the GFX matter.

1- The Suggested RD for the GFX (Describes what ‘the system’ is):

A system-owned by ATTAC management (O) prepared by researchers (A) to advise the ATTAC management of GFX matters and their implications (T), within the context of ATTAC programme performance, delivery schedule plans,

reduction of operational costs and risks associated with the maintenance and service plans, by developing relevant systems conceptual models (*issue-based system - phase 1* and *primary-task system - phase 2*) and undertaking comparison against respective parts of the ATTAC programme (W), to the satisfaction of ATTAC management (C), in order to assess changes to the ATTAC process, information flows and ATTAC polices (E).

2- The CATWOE Table:

Table 4: GFX System CATWOE Table

Elements of CATWOE	Description
C: Client	ATTAC management.
A: Actor	Researchers.
T: Transformation	Advise the ATTAC management of GFX matters and their implications
W: World View - Weltanschauung	Within the context of ATTAC programme performance, delivery schedule plans, reduction of operational costs and risks associated with the maintenance and service plans, by developing relevant systems conceptual models (<i>issue-based system - phase 1</i> and <i>primary-task system - phase 2</i>) and undertaking comparison against respective parts of the ATTAC programme.
O: Owner	ATTAC management.
E: Environmental	In order to assess changes to the ATTAC process, information flows and ATTAC polices.

3- The Proposed Conceptual Model (CM) to the GFX problem with its two phases

The conceptual model built in Figure 7 will help define the necessary activities and, hence, identify any missing activities, associated with GFX management. Through the performance assessment feedback loop and the controlling activities in the CM, the appropriate capabilities for managing GFX can be identified and allocated. Joint decisions by the supplier and client members of the ATTAC management can be reached.

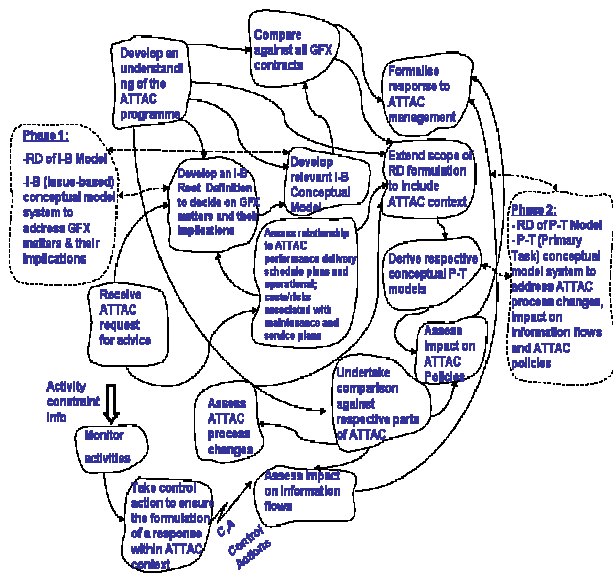


Figure 7: The Proposed Conceptual Model for the GFX Problem With Its Two Phases

8.2 SSM: Application in The Construction Sector

8.2.1 SSM for Modelling Parties Interactions and Contact Matters in Construction Projects

The importance of SSM in the construction industry has been identified in several literatures. For example see [31] and [32] where SSM worked as a data collection technique based on interviews and workshops led by researchers for alleviating discussion on some construction observations. Similarly, in a discussion of the application of soft approaches in the construction industry [33] observes and stated that: “the increasing concern amongst clients for construction professionals to understand their “business processes” before embarking on design makes SSM especially applicable in the current context. SSM potentially offers a means by which construction professionals and client representatives can derive a common understanding of the client organisation’s business processes”. SSM has been suggested by [34] as a valuable approach for defining clients’ requirements and as a tool to comprehend the underlying processes and to highlight the related issues concerning project histories during construction bidding process stage for one leading construction company in Australia [35]. This showed that project histories are poorly designed, implemented, managed and applied in the organisation studied by [35]. They argued that the reason for this deficiency is the lack of support from senior management, and proper integration of project histories into a company’s overall strategy and vision. The results of this SSM exercise highlighted to the different participants the need to carry out some important actions to improve the process the of handling project histories for future accessibility and efficient use by all stakeholders or parties involved in the bidding process.

In a similar approach to the project history methodology of [35], this section proposes the use of SSM to address the understanding and the investigation of the issues and matters concerning construction project relationships and interactions between all parties involved in executing a construction project (i.e. contractors, designers and sub-contractors as executors with the client as customer and his project management company as client representative). The role of the project management company is very crucial in the construction business as it represents the client in terms of the technical construction relationship as well as caring for the interest of the client in terms of the legal and financial relationship matters with the executing parties. SSM can be a useful tool to regulate and properly control these delicate relationships and interactions, the especially nowadays when the construction industry is moving from the design-construct mentality to the design-construct-service mentality. Thus the interactions between the parties involved is becoming more complex with consideration of the different and conflicting interests of the diversified parties involved. This has put more pressure on the client (project owner) and their representative (the project management company) to address these complicated interactions. Hence the proposed RD to address this interaction problem is a follows:

1- The Suggested Root Definition for the Construction Project Problem: (Describes what ‘the system’ is):

A system owned by the project manager company (system owner in SSM terms) on behalf of a client (owner of the construction project) performed by the project management company and employees (actors), to control and regulate the interaction and relationships of a construction project between the executing construction parties - contractors, designers and all sub-contractors - and the client (T), by overseeing permitted contacts in terms of technical, legal and financial relationships, both inside and outside the system and acting accordingly (W), while recognising client requirements in terms of time, cost, quality and project performance and following all necessary construction management practice constraints (E).

2- The CATWOE Table:

The CATWOE table is presented as follows:

Table 4: Construction System CATWOE Table

Elements of CATWOE	Description
C: Client	Owner of a construction project (e.g. building, house, office block, school, factory, waste water, water treatment project...,etc.).
A: Actors	Project management company team and employees.
T: Transformation	To control and regulate the interaction and relationships of a construction project between

	the executing construction parties - contractors, designers and all sub-contractors - and the client.
W: World View - Weltanschauung	By overseeing permitted contacts in terms of technical, legal, and financial relationships, both inside and outside the system and acting accordingly.
O: Owner	Project Management company.
E: Environmental	while recognising client requirements in terms of time, cost, quality and project performance and following all necessary construction management practice constraints.

3- The Proposed Conceptual Model (CM) to the construction industry problem with its two phases

The proposed CM to the construction industry problem is developed as shown in Figure 8.

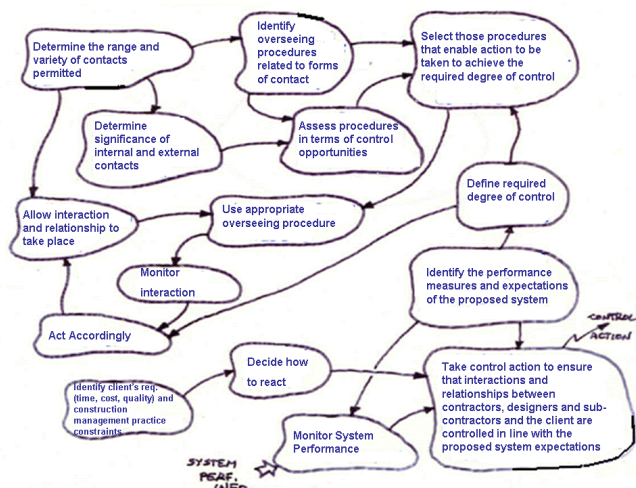


Figure 8: The Proposed Conceptual Model for the Project Construction Management System

Please note that the word 'contacts' is used in the CM in Figure 8 to refer to the type of the matter under study either: technical, legal or financial relationships between the parties executing the construction project (i.e. contractors, designers and all sub-contractors) and the client. This is used so as not to repeat drawing the CM three times.

From reviewing this CM, the SSM can be seen as a useful approach for alleviating this delegate continuous and conflicting interactions in the world of construction management between the owner of a construction project (the client) and the executing parties (contractors, designers, and sub-contractors). Additionally, this gives the project management company more authority over the

executing parties to regulate and control the activities between them for better performance of the construction project in terms of time, cost and quality to meet the client requirements and expectations while abiding by all construction management practice rules and procedures.

9 Conclusions

This paper has attempted to address the role that the SSM (Soft Systems Methodology) can play in organisational transformation from product-only to product-service mix. It has presented the SSM steps and stages to facilitate the process of this transformation.

The paper has focused on the particular case arising in the P to PSS transformation in which the client retains some activities giving rise to dependencies between service provider and client for the deliver of the service. An initial model for developing a SSM in defence and construction organisations has been expounded. The first case presented a conceptual model of GFX matters that drew on a specific case and related them to a general area of tension in PSS for defence. The model presented included our research activity and the transformation concerned the development of an action plan, rather than the plan itself.

The second case addressed the interactions and relationships contact problem between the owner of a construction project (the client) and the executing parties (contractors, designers, and sub-contractors). The activities required to be undertaken by the client representative (the project management company) are represented in another conceptual model. In both cases, the SSM approach showed a potential lead to identification of barriers to transformation, the understanding of implications on overall performance and – importantly – the joint consideration of these matters and solution generation by customer and supplier in a non-confrontational fashion.

The work presented herein is preliminary, but it points towards an effective means of capturing the views of those engaged in P to PSS transformation and enabling joint resolution of one part of the co-value creation challenge. This will support managers in achieving successful transformation.

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