Managerial Effectiveness from a System Theoretical Point of View

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Managerial Effectiveness from a System Theoretical Point of View[1]

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Abstract: The effectiveness of a decision maker is not demonstrated through access to better or more information; effectiveness is demonstrated in an ability to use, more resourcefully, whatever limited information is available, and to portray its implications more usefully. This paper demonstrates how decision makers can make systemic decisions in situations characterized by extremely limited information and, furthermore, what form such decisions take.

The Contemporary Challenge

In his classic work on system dynamics, Jay Forrester (1961:117) writes:

> The power of system dynamics models does not come from access to better information than the manager has. Their power lies in their ability to use more of the same information and to portray more usefully its implications.

This is a claim concerning the effectiveness of system dynamics models as decision support systems. Forrester contends that system dynamics models enable the decision maker to use, with greater effectiveness, whatever limited information is available in a problematic situation, and in addition they help portray the implications of this limited information more usefully. Given that this minimizes the costly need to gather additional information, system dynamics models are simultaneously presented as efficient decision support systems.

Implicit in this claim is that the effectiveness of a decision maker is not demonstrated through access to better or more information: the effectiveness of a decision maker is demonstrated in an ability to use, more resourcefully, whatever limited information is available, and to portray its implications more usefully. In Forrester's case, system dynamics is offered as an approach which can assist a decision maker to realize such effectiveness.

Consider, however, a decision maker who can demonstrate effectiveness *purely* on these terms, that is, irrespective of whether system dynamics is used or not. Since the acquisition of more information can be costly, such a decision maker may well be in high demand. Furthermore, given that data collection, or information gathering, is time-consuming in a world where 'the ability to learn *faster* than competitors may be the only sustainable competitive advantage' (de Geus, 1988), such a decision maker may likely be the key to the survival of any organized entity (corporate or otherwise). These very real possibilities are supported by Bennis and O'Toole's (2005) insight that:

> Executive decision makers are not fact collectors; they are fact users and integrators. Thus, what they need from educators is help in understanding how to interpret facts and guidance from experienced teachers in *making decisions in the absence of clear facts.* (italics added)

What is at issue here is the versatile use and portrayal of limited data, or information, with a view to construct knowledge, enable learning, and inform action. Knowledge

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management, concerned with practicable 'ways of disseminating and leveraging knowledge in order to enhance organizational performance' (Easterby-Smith and Lyles, 2003: 3), is the field which should address this challenge. An effective decision maker, in other words, should be one who can *do* knowledge management resourcefully in the absence of complete information. The field of knowledge management, however, appears insufficiently prepared to tackle the challenge, as evidenced by Kawalek's (2004) disturbing conclusion:

> [W]hen investigating the conceptual literature on knowledge management it seems that it is burgeoning with viewpoints that overlap, and commonly contradict each other… the literature has not provided *methodological* guidance for *doing* knowledge management (i.e. managing knowledge), without which knowledge management is fated to remain ill-defined, open to misinterpretation and sometimes abuse by unscrupulous practitioners… there are quite significant differences between the writers on knowledge management, and following each will lead to quite different approaches to knowledge management practice… While the knowledge management literature presents many insightful points, definitions and analyses, none inspire confidence that successful management of knowledge will result (or is even possible) as a result of a process of selecting from these insights.

Moreover, the challenge is compounded by the growing demand for decisions to address the holistic or *systemic* nature of problem situations. Consider a few examples of this emerging demand. In an interview given by the UK Liberal Democrats' leader Charles Kennedy to the BBC's Peter Sissons on 4 June 2001 Kennedy states:

> Now these things can't all be isolated one from the other. I think it's part of the *holistic* approach to government which is longer-term and I think more far-seeing than the short-term which has tended to plague successive British administrations.[3]

The Inquiry into the 1997 Southall rail disaster in the United Kingdom found that:

> it would be wrong to concentrate on the failings of the driver when there is compelling evidence of serious *systemic* failings within Great Western [Trains].[4]

Following the killing of a black youth by a police officer in Cincinnati, Ohio in May 2001, the head of the National Association for the Advancement of Colored People said that he believed:

> the problems in [the police] department are *systemic* and they span the last two decades.[5]

In the autumn of 2000, the Hungarian newspaper *Nepszava* reported its concern over the methods of the country's right-wing government by writing:

> The unrestrained and vulgar hatred-speeches against political rivals now common in parliament [...] degrade and threaten the peaceful *systemic* change based on social consensus.[6]

[3] As reported on the BBC Internet site on 4 June 2001 at the following URL: http://news.bbc.co.uk/vote2001/hi/english/programmes/specials/election_call/newsid_1369000/1369845.stm

[4] As reported on the BBC Internet site on 21 December 1999 in a report entitled *Rail Managers Rebuked Over 'Catalogue of Errors* at the following URL: http://news.bbc.co.uk/hi/english/uk/newsid_573000/573740.stm

[5] As reported on the BBC Internet site on 8 May 2001 in a report entitled *Officer Charged Over Cincinnati Killing* at the following URL: http://news.bbc.co.uk/hi/english/world/americas/newsid_1318000/1318269.stm

[6] As reported on the BBC's European Press Review on the BBC Internet site on 3 October 2000 at the following URL: http://news.bbc.co.uk/hi/english/world/europe/newsid_953000/953674.stm

In 2001, in the UK, the formation of a think-tank was announced charged with finding a 'holistic' way of improving UK flood defences to prevent a repeat of the 2000/2001 damaging floods which swept the UK[7]. The holistic approach was, in this case, embodied in the inclusion of a wide range of actors such as the Chartered Institution of Water and Environmental Management, water engineers, house builders, insurers, the Environment Agency and flood victims.

Setting up an alert on the Google News Internet site for the keyword *systemic* yields, on average, three to four alerts per week. Addressing systemicity is obviously *dans l'aire du temps.* There is no need to explore here the variety of interpretations of the systemic approach to which the above citations hint (for example, a long-term approach, a synchronic-diachronic analysis, a consensus-building tool), nor to examine the management thinking regarding the inclusion evident in systemic practice (Churchman, 1979; Ulrich 1988; Yolles, 1999; Midgley, 2000). What is clear is that, in the words of Ludwig von Bertalanffy (1968: 3),

> if someone were to analyze current notions and fashionable catchwords, he would find 'systems' high on the list.

Such a statement rings more true today than in the 1960s when it was first written. The contemporary context, however, is more complex than before. For if effectiveness is measured by more resourceful use of *limited* information, a decision maker who can simply plan or solve systemically is not enough. What is required is a decision maker who can meet the challenge of the paradoxical demand for useful and practical *systemic* results in the face of *partial* information, or equally, for implementable wholes in the face of informational incompleteness.

This paper proposes to demonstrate how a well-established systemic approach provides a way of thinking which helps extract knowledge from limited information, enables the construction of a systemic plan based upon such knowledge, and hence realizes effective and efficient *systemic* use of available knowledge. As a result, the paradoxical demand for useful and practical *systemic* results in the face of *partial* information is met. Ultimately, the paper demonstrates how decision makers can make systemic decisions in the absence of clear facts and, furthermore, what form such decisions can take.

Contextual Background

In 1999, the author was teaching a post-graduate executive course in operations management in a reputable business school of a British university. Operations management appears as a relatively clear-cut organizational area where the problems and their solution are reasonably identifiable (Heizer and Render, 2001). Nevertheless, more than most, students on executive programs maintain a critical eye on the relevance of the course curriculum to the real world or, more specifically, to *their* world. One such student, significantly an operations manager, communicated, in a brief written piece of correspondence, how the field of operations management, as taught and as purporting to provide avenues for resolving operational issues, was failing him and his particular operational situation and concerns. The body of the correspondence is reproduced in Box 1, with certain identifiable details omitted.

INSERT BOX 1 ABOUT HERE

[7] As reported on the BBC Internet site on 10 May 2001in a report entitled *Plans for 'Holistic' Flood Defence* at the following URL: http://news.bbc.co.uk/hi/english/uk/newsid_1322000/1322493.stm

The uncertainty stipulated in the final paragraph in Box 1 refers directly to the course curriculum which included many of the traditional subjects in operations management such as production management, material requirements planning, capacity planning, operations strategy, inventory management, distribution, layout, as well as forecasting, computer simulation, some linear programming and network modeling. Despite this wealth of relevant topics, the student was still left lacking the proper instruments with which to tackle his operational problem.

The description he provided of his real-world problem certainly seems to indicate that something more is required. It is evident, from the first line in Box 1 for instance, that the student/manager runs a *service* operation. Traditional teaching of operations management is minimally attentive to the service context (a context which refers less to production, material requirements and capacity planning and more to customer service, human relations and related quality processes). One conclusion, therefore, may be drawn straight away: a greater emphasis, in the curriculum, on service operations would resolve the student's dilemma.

Still, even the minimal description provided indicates that this switch in focus might not be quite enough. Issues regarding system design and development, organizational theory, human resource management, and negotiation all seem to impact upon this particular operational problem. These are all distinct fields in themselves and one operations management course cannot conceivably do them any justice. And yet, being an operations manager, the student cannot expect to be told to seek those other courses next semester. He has an operational problem now and his current course in operations management should at least speak to his problem situation, if not provide some means toward resolving it. Furthermore, a problem situation will not wait for next semester's enrollment process, and might even deepen by then, resulting in a far more serious deterioration of the situation and a far more helpless student/manager.

Even a cynical interpretation does not absolve the failure of the operations management course to address the student's needs. He happened, say, to choose this particular course to voice a complaint which was actually only a symptom of wider dissatisfaction with his studies. Why should the operations management course fall victim and attempt to redress the alleged failures of other courses, of the entire degree course, or of the university's handling of curriculum development? This attitude, however, does little to address or redress any alleged failings of the education system, and arguably contributes only failure.

Given the above thoughts, it appeared at the time that there was only one ethical and viable course of pedagogic action which could simultaneously ensure real-world relevance and respectability: provide the student, as well as the rest of the class (for it would be naïve to believe that other students/managers were not experiencing similar sentiments), with the means for dealing with the situation or other similar situations. The aim, in other words, was to teach decision making effectiveness in situations characterized by limited information, where time and resources are no longer available to collect more information, yet where a resolution is nevertheless required based upon the information available. The correspondence in Box 1 was to be used as a case study around which such learning would develop.

Undoubtedly, the sparseness of the case may be viewed as too extreme to result in any observable decision making effectiveness, let alone pedagogic value. The management literature, however, is beginning to address the pervasiveness of extreme situations, indicating that actors might be lacking at least conceptual training in order to deal with

them (Jackson, 2005). Over thirty years ago, moreover, Belasco *et al* (1973) designed and implemented what may be seen as extreme classroom experiential exercises in that they simulated four forces which, commonly, simultaneously impact upon managers:

- the task is ambiguous;
- the structure through which the task might be accomplished is loosely defined;
- the standard against which success is to be measured remains unstable; and,
- knowledge of the organizational and wider environments remains uncertain.

All four of these characteristics are evident in the situation as presented in Box 1, and together they may be understood as characterizing extreme situations in general. Rosenhead (1989) and, later, Rosenhead and Mingers (2001a) present approaches which have been especially designed to deal with irreducible levels of uncertainty, complexity, conflict and the risks inherent in such variables. Across the general literature, in other words, there is evidence which supports the idea that decision making in extreme situations is a required skill.

Pedagogically, it was impossible at the outset to be confident of success. Although arguments in favor of what was proposed were perceived as undeniable, the possibility of useful empirical results was a mere dream. No less due to lack of explicit, step-by-step pedagogical guidance in the literature, the risks in terms of pedagogic value, of personal reputation, and, in the wider scheme of things, of academia meeting the demands of the real world, were uncomfortably high. The lack and especially the risks, however, were analogous to those facing a decision maker with incomplete information and the demand for a systemic solution. This in itself was appreciated as yet another argument in favor of an attempt.

As it happened, this initial attempt proved to be successful in helping decision makers structure understanding and plan actions given limited information. Four more attempts were undertaken between the years 2000 and 2005, in three very different geographical and cultural regions (Britain, Russia and Brazil) and across three degree levels (undergraduate, postgraduate, and MBA). Each used the same problematic situation. This enabled fine tuning of the teaching approach and increasingly satisfactory results across all experiences. What follows is a summary of the major theoretical insights and practical results stemming from these applications. What they indicate is that it is possible to make systemic and significantly informed decisions in the absence of clear facts. What has been learnt, moreover, is a manner in which such decisions can be made and what form they take. Ultimately, a particular outcome has been realized: the design of useful, practical and implementable *systemic* results in the face of *partial* information.

Instructional Methodology

There are two general types of cases available for instructional use, *demonstration* cases and *problem* cases (Böcker, 1987), and the case in question must be defined accordingly in order to outline the most appropriate instructional methodology for its solution. Demonstration cases act as illustrative devices of the practical application of concepts, theories and processes. They belong to an instructional approach which oscillates between conceptual focus and practical illustration, an approach referred to as *deductive* (Böcker, 1987; Corner and Corner, 2003). The case in Box 1 is clearly not a

demonstration case. On the other hand, some deductive instruction is necessary in order to impart concepts which might be used toward some resolution.

Problem cases offer a problematic situation which needs resolving. The learner is thrust into a world (simulated or not) which requires his active involvement, and through which activity he learns a number of general problem-solving rules, techniques and/or approaches simultaneously. Instead of absorbing theory, the tendency is for the learner to learn from practice. Such an instructional approach is referred to as *inductive.* The case in Box 1 is clearly a problem case. In a controlled training environment, such as a classroom, the objective with such cases is not so much to *solve* them but to *plan* for the immediate future (Bell and von Lanzenauer, 2000; Cochran, 2000). Planning as decision making, or 'as learning' (de Geus, 1988), becomes the overarching educational aim, and the relevance of this point will be revisited later.

The above hints that the instructional methodology will require deductive *and* inductive learning linked to a problem case. This is in line with Kolb (1984: 21) who favors 'a holistic integrative perspective on learning' which systemically links both instructional approaches. His resultant *experiential learning* approach is illustrated in Figure 1.

INSERT FIGURE 1 ABOUT HERE

In essence, Kolb identifies *concrete experience* and *abstract conceptualization* as respectively empiricist and rationalist foci of learning. These two learning modes relate to each other, on the one hand, by means of *reflective observation* of the concrete experience resulting in abstract conceptualization and, on the other, by means of *active experimentation* of the abstract conceptualization resulting in concrete experience. In other words, reflective observation of empirically acquired knowledge enables rationalist development of such knowledge. In turn, active experimentation of ideas enables the acquisition of empirical knowledge. The learner is thus involved in a two-way, mutually informative, and complete learning/epistemological process or *system*. When a problem case and a controlled learning context are added to Kolb's experiential learning methodology – a combination recommended by Mu and Gnyawali (2000) - the result may be termed *case-based classroom experiential learning.* Its instructional methodology is illustrated in Figure 2.

INSERT FIGURE 2 ABOUT HERE

In this systemic instructional methodology, deductive instruction provides an initial platform, for example in the form of a lecture explicating certain concepts, which leads to an initial degree of deductive learning. This initial deductive learning serves to inform the tackling of a problem case. Upon setting to work on the problem case, a certain degree of inductive learning takes place. Indeed, there is natural learning feedback between the problem case and inductive learning, thus constituting a sub-system of the wider instructional/learning system. The learning incurred within this sub-system may, and usually will, serve to inform the initial deductive learning – hence the feedback to deductive learning. Such feedback may not only reinforce the initial deductive learning but serve to question it, leading to further deductive and, consequently, inductive understanding. Further conceptual material is introduced through additional deductive instruction and, with each new set of concepts, inductive learning begins to practically appreciate their interrelations and their systemic use. Consequently, after the initial iteration, the parts of the system begin to act less as distinct stops within a learning route and more as systemic interrelations which inform and question each other in the interests of advancing learning and its applications. As such, experiential learning begins to emerge and is strengthened with each opportunity

to learn deductively, inductively and through a problem case, simultaneously. When learning can no longer be distinctly recognized as either deductive or inductive, the students may be said to have internalized it or 'thought it in' (Bell and Margolis, 1978). At this point, the emergent property 'classroom experiential learning' signifies knowledge which forms part of the learner's conceptual apparatus for not only perceiving, but also for dealing with, reality. An underlying instructional objective is to contribute to this apparatus, for in this way the transition from apprentice to expert begins.

The advantage of this systemic instructional methodology is that it promotes a learning balance between general/theoretical principles and experiential influence or, in other words, a didactic-experiential blend (Bell and Margolis, 1978). This combats one of the dangers of experiential learning whereby excessive experiential influence could leave learners without reference points from which to derive meaning and relevance from the experience. Indeed, the methodology points toward the realization of some key objectives for experiential learning (Certo, 1976; Kayes, 2002): to facilitate learning via theory *and* experience; to *apply* theory (through an experiential exercise) in such a way which can raise questions about the theory itself and thus serve to clarify or elaborate conceptual (deductive) learning; to enable learner engagement in a dialectical inquiry process; and to provide for a holistic and integrative learning experience. Promoting this balance is recognized as a demanding objective, requiring time, effort, and a high degree of instructional effectiveness (Shuman and Hornaday, 1975; Certo, 1976).

Determining the Instructional Utility of the Case

There is obviously the possibility to include demonstration cases as illustrative devices in the above instructional methodology. A problem case, however, remains an integral tool for the furtherance of classroom experiential learning and remains closely integrated to the constituent inductive instruction which contributes, along with the deductive approach, to the emergence of such learning. Indeed, given the contextual limitations of the classroom, the problem case is of crucial importance for it provides the experiential catalyst. In this respect, the problem case is the part without which the instructional system could not give rise to the emergent property *experiential learning*.

Given its importance, the instructional utility of the case must be determined. The criteria have already been outlined: what is required is a demonstration that it is possible, given the sparse problem description, to extract, structure, and methodically use information which can, in turn, be helpful toward the development of an implementable systemic plan. With such a confirmation in hand, all that would be required would be to identify the content of deductive instruction which would provide learners with the conceptual tools for their subsequent inductive, practical learning.

A first sweep through the case yields more or less the following. The operations manager clearly visualizes that any solution to his dilemma must not sacrifice certain key variables in favor of others. *Quality*, for example, cannot be traded-off against *customer care* or *capacity*, and *operational strategy* seems not to enjoy any privileged, governing position high above the other 'relevant concepts'. There is, in other words, no single objective but multiple and simultaneous objectives measurable on respectively separate dimensions. The case is also constituted by multiple stakeholders, not necessarily hierarchically related and not necessarily in consensus with one another, whose respective decisions impact, in varying degrees, upon the situation: for example the *manager* himself, the *team* he manages, his organization's *customers* who are

explicitly identified as having businesses, his organization's *clients* who are explicitly identified as having expectations, and the *external specialist organizations* (ESOs) which seem to have a say in staff role allocation and target markets. The fact that some 'negotiation' (with the ESOs) has been deemed as required also signifies that qualitative or social judgments are of some importance to the situation, calling for their integration with any quantitatively based decisions.

This brief, still limited, understanding has underlined situational characteristics for which Rosenhead's (1989) 'alternative paradigm', and the problem structuring methods (PSMs) it underpins, was designed. Interestingly, in line with the aforementioned overarching objective to plan, the essential practice of PSMs is to enable *structured exploration of solution spaces* in order to help actors draw up equally structured *plans* for future action (Rosenhead, 1996). *Planning,* especially, is an essential methodological part of PSMs as can be appreciated by consulting a recent review (Mingers and Rosenhead, 2004) where the term appears no less than fifty times. In addition, PSMs are also beginning to be explicitly presented as support systems for organizational learning and knowledge management (Rosenhead and Mingers, 2001a: 315-334).

Still, demonstrating the relevance of PSMs to the case resolution would at least require, in accordance with their mission (Rosenhead, 1989), the demonstration that they (or any one of them) can identify and structure whatever uncertainty, complexity and conflict there is in the case. Furthermore, even if this is possible from the case as given, one would still need to decide, and justify, which of the PSMs address more directly than others decision making effectiveness in conditions of (extremely) limited information. Since the situation at least indicates the use of PSMs, it is worth exploring these two issues.

Identifying Uncertainty, Complexity and Conflict

Decision making effectiveness will emerge in proportion to the deduction of significant information which respects the degrees of allowable interpretative freedom relevant to the situation. *Significant information,* in turn, may be understood not only as information which is interpretatively sound, but as information which effectively serves the interests of the management of uncertainty, as well as information which ultimately renders the decision maker tangibly better informed and better equipped to deal with the situation.

The uncertainty evident in the case stems, in line with Rosenhead (2001a), from the unavailability, doubtful solidity, or unobtainability *of information.* Whatever understanding is possible should be structured in some way so as to enable the ability to use it more resourcefully. If, on the one hand, an imperfectly known situation opens the doors to wide interpretations, ambiguity, on the other, constrains the degrees of freedom allowed in interpretation. Care should be taken not to introduce assumptions which do not fall within the framework of the situation as given. A certain degree of mental discipline, or interpretative rigor, is called for when conceptually framing the situation, avoiding any suggestions or conclusions which are not clearly within the bounds of what is given. The risks of not adhering to this are tantamount to resolving an irrelevant, imaginary/nonexistent, or wrong problem.

Friend (2001), in explicating his Strategic Choice Approach (SCA), adds that uncertainty also arises in proportion to the level of intuitive effort required of the actors who have to deal with limited information. In order to orientate such an effort, Friend

provides three neat categories which can assist in defining uncertainty in problem situations. The advantage of so categorizing uncertainty is that once a judgment has been made on its contextual impact, the process of dealing with it is rendered more focused.

The first such categorization – stated as *uncertainties pertaining to the working environment* - is labeled *UE* and refers to that uncertainty which demands more accurate information. Friend provides some examples of the manner in which such information may be sought: through surveys, research investigations, attempts at forecasting, and requests for detailed estimations. He qualifies his examples, however, by noting that the process of information gathering may be as informal as a conversation and as technical and elaborate as an exercise in mathematical programming. In other words, the *process* of information gathering is secondary to the *quality* of the information gathered, although the former *may* influence the latter. This view underpins all three of Friend's uncertainty categorizations. *UE,* however, is the most general of Friend's three categorizations and therefore, of all of them, is identifiable as the type most prevalent in the case. Table 1 presents some results in this respect.

INSERT TABLE 1 ABOUT HERE

The second categorization of uncertainty – stated as *uncertainties pertaining to guiding values* - is labeled *UV*. It refers to that uncertainty which emerges from politically charged contexts, where the term *politics* is understood broadly to include issues of policy, hierarchy, authority, declared objectives or values, strategy, and general orientation as well as guidance. In addition, this type of uncertainty refers to affected interests and the expectations stemming from respective, and possibly conflicting, agendas, calling for the practice of negotiation and perhaps the management of threats. Two areas of the case appear to be marked by *UV*, as can be appreciated from the results of the analysis in Table 1.

The third categorization of uncertainty is labeled *UR* and refers to the structural links between respective decision points or spaces. Friend has alternately titled this categorization as *uncertainties about choices on related agendas* (2001) and as *uncertainties pertaining to related decision fields* (1989). Based upon his descriptions (Friend and Hickling, 2005), however, the categorization itself may more succinctly be expressed as *uncertainties pertaining to structural relations between decision junctures* (or decision events). Thus, *UR* refers to that uncertainty which emerges from systemic complexity, in particular to the complex interrelations between those junctures at which decisions are required. *UR*, then, is uncertainty about how decisions in one area may affect decisions in other areas. As such, it is an uncertainty closely related to complexity. Indeed, Friend's SCA is not only geared toward dealing with uncertainties: it is distinctly focused upon complexity, the one area deemed as requiring structuring in order to subsequently inform uncertainty (Mingers and Rosenhead, 2001a). This is evidenced in Friend's intricate four-part methodology for shaping, designing, comparing and choosing. Complexity is evident in the case, and will be discussed below.

Table 1 provides a summary of the analysis of uncertainty based upon Friend's three categories. The results are based on a distinct effort to remain within the boundaries of what is knowable. As may be appreciated, what begun as a situation lacking information appears to be generating some degree of useful and relevant understanding.

As to complexity itself, it is basically understood as emerging from densely interconnected networks in which decisions undertaken in one part have wider

ramifications within, and perhaps outside, such networks (Rosenhead and Mingers, 2001b). More succinctly, complexity is understood as emerging from dynamic situations constituted by interacting systems of changing problems (Ackoff, 1979). That is, the degree of complexity is not only proportional to the level of dynamism exhibited in situations, but also to the level of interaction between constitutive systems/elemental arrangements, and, further, to the degree to which system parts themselves change. If a soft systems interpretation is brought to bear upon this idea, complexity is viewed as emerging from dynamic human situations constituted by interacting systems of changing perceptions (Checkland, 1999). In general terms, the greater the number of states or behaviors that a system can exhibit, the greater the evident complexity (Mingers and Rosenhead, 2001b). When projecting such views of complexity onto the strategic level, complexity is deemed to arise less from the sheer number of options available than from the interactions between different decision makers (Mingers and Rosenhead, 2001a).

INSERT TABLE 2 ABOUT HERE

Table 2 presents the results of an analysis of complexity in the case. Interestingly, Segments 11 and 12 (denoted as S11 and S12) now betray a densely interconnected network of elements, in which decisions undertaken in one part have wider ramifications within and outside the organization. The identification of complexity, in other words, has already highlighted an area of the case which will require systemic treatment (its basic infrastructure is illustrated in Figure 3). This further supports the idea of applying PSMs to the case in attempting to realize *systemic* decision making effectiveness.

INSERT FIGURE 3 ABOUT HERE

It is upon human interactions that conflict, finally, is focused. PSM theory broadly contrasts conflict with cooperation (Rosenhead, 2001b). That is, the underlying expectation of PSMs is that conflict be addressed in the service of potential cooperation. The management of conflict requires, at best knowledge or, at least inferences, of the positions of each of the decision makers, as well as of their respective fallback options (Bennett *et al,* 2001). However, the management of conflict need not singularly aim toward cooperation. Bennett *et al.* emphasize that conflict may be managed through deterrence, inducement and threat. Deterrence need not refer directly to the opposing party but also to attempts to subjugate existent systemic designs by *redesigning* the system in which the parties have become embroiled. An arms race, for example, need not only exhibit deterrent activities which focus upon the potential defeat of the other country; it may also exhibit activities aimed at deterring the possible continuation of the system which promotes the build-up of arms. At base, in comparison with uncertainty and complexity, conflict is more directly associated with the distinctly human influence upon situations, for it is understood as arising from pre-existing interpersonal relations, incompatible personal styles, but also from the diversity of interests represented (Mingers and Rosenhead, 2001a). As such, an underlying aim is to promote a degree of dialogue or negotiation which can act as the basis for addressing conflict.

There are two apparent areas in the case where conflict might be an issue, and comments on them are found in Table 2 which summarizes the identification of complexity and conflict. Along with Table 1 and Figure 3, it would seem that PSM applicability is relevant: uncertainty, complexity and conflict have been identified, defined, structured and situated within the case. The analysis has generated a rich set of insights which, arguably, seemed impossible upon first contact with the case. Given this

first positive result for knowledge management effectiveness, it is worth considering whether any one of the PSMs (or mixture thereof) can facilitate decision making effectiveness given the informational limitations of the case in question.

Delineating the Choice of Applicable PSMs

Uncertainty, complexity and conflict are all represented in the case. In principle, therefore, the application of PSMs arises as a relevant option here. Table 2 shows that uncertainty is a major factor, while the evidence of complexity indicates that an underlying systemicity has a governing role in seemingly crucial areas: demand, the non-existence of the system, and impact of the ESOs, for example (also see Figure 1). It is not clear whether the systemicity is objectively real or whether it is interpreted by the manager. In either case, however, what is required of PSMs is their particular ability to permit further analysis through conceptual structuring without jeopardising any inherent systemic integrity. As such, even though the inherent uncertainty and complexity invite PSMs, and even though a small part of Friend's SCA has proved useful thus far, the PSM(s) particularly applicable to this case study need(s) to be identified.

It is noteworthy of the case that, aside from exhibiting uncertainty, complexity and conflict, it also allows for relatively few structural assumptions about the situation. No prioritization among seemingly important factors is given, for instance, and key aspects appear to be equally necessary, though treatable on respectively different dimensions. As such, the most relevant of PSMs will be those which reflect the rather open-ended nature of the case as given, allowing for variations of interpretations about what is going on, whilst simultaneously promising to provide guidance for future action based on what is given.

Since signs of conflict in the case offer little room for deeper analysis, the focus must remain upon the management of uncertainty and complexity. Of the mainstream PSMs (Rosenhead, 1989; Rosenhead and Mingers, 2001a), four deal with uncertainty *and* complexity in relatively greater depth: Strategic Options Development and Analysis (SODA), Soft Systems Methodology (SSM), Strategic Choice Approach (SCA), and Robustness Analysis. Of the four, SODA and SSM are better equipped to tackle high levels of variability in interpretations.

SODA would require for the case study to be mapped and, additionally, cognitive mapping could be used by the learners on themselves with a view to structuring each other's understanding. However, basic structural assumptions are required in order to design the layout of cognitive maps (Eden and Ackerman, 2001), and it is not clear whether the limited data of the case allow for such assumptions. Furthermore, unlike SCA or (as will be seen) SSM, SODA does not produce a clear-cut route to planning or commitment. It may, in other words, enable profound understanding and problem structuring, but it has no in-built tools which can help actors move toward decisions. Experienced practitioners might easily overcome this. In order for apprentices to attain the same level of expertise, however, the exercise could easily revert to teaching SODA methodology with little time left to tackle the problem case. Where the aim is to equip learners with distinct tools to convert a problem case into a systemic plan under some time pressure, SODA might be judged unworkable.

SSM (Checkland, 1999) begins by requiring decision makers to focus upon certain aspects of a situation. It is possible to thus generate and structure a significant amount of information. Consider, for instance, the student results in Tables 3, 4 and 5 from using Analyses 1, 2 and 3 of the methodology. It is encouraging to find how much

information has been gleaned and structured from (what is essentially) an elementary exercise in focused thinking which results in three lists: the actors in the situation, their power, and the perceived socio-cultural dynamics of the problematic situation and its organizational context. Unhindered by methodological concepts or rules, students go on to produce quite elaborate rich pictures (Lewis, 1992; Monk and Howard, 1998) in a low-pressure atmosphere of fun and creativity. Some, for example, pick up on the *urgency* implied in the case and base their pictures on the theme of time and clocks. Others are more classical in their approach, placing the operation at the centre of the page surrounded by the remaining factors in the case. Others are more technical, translating the details of the case into flow diagrams. The design of rich pictures yields new insights and more profound understanding of the case in question, thus building confidence that some sort of progress is possible, even if what this progress entails cannot yet be envisaged.

INSERT TABLE 3 ABOUT HERE

INSERT TABLE 4 ABOUT HERE

INSERT TABLE 5 ABOUT HERE

The evidence points to the use of SSM as especially effective in extracting information from limited data. Fortunately, SSM also facilitates the design of wholes or systems in what it calls *human activity systems* (also termed *conceptual models*) (Checkland and Tsouvalis, 1997), an understanding of which is discussed below. SSM, in other words, appears well-equipped to meet the paradoxical demand for useful and practical *systemic* results in the face of *partial* information. Decision making effectiveness is furthermore enhanced because SSM is simultaneously flexible to use and rigorous in its management of the subjective (Checkland, 1999: A43; Rose and Haynes, 1999). Bolton and Gold (1994) go so far as to claim that,

> Soft Systems Methodology offers a rigour and discipline which automatically forces systemic thinking over and above received "textbook" wisdom or entrenched custom and practice.

Rigor such as this has already been noted as especially important to maintain in extreme situations. In SSM it is exemplified, for instance, in the manner in which (1) certain rules guide the stipulation of transformations (Checkland, 1989); (2) the three Analyses act as an information source for the contextualization of transformations based upon the mnemonic CATWOE (Smyth and Checkland, 1976); (3) the CATWOE mnemonic itself imposes particular issues upon which to focus, with subjectivity receiving especial attention (Checkland and Davies, 1983) since different perspectives on the same transformation produce strikingly different models of how the transformation should be dealt with; and (4) conceptual models must have accompanying and specific control criteria (Checkland, 2001).

As such, departing from a relatively obscure problematic situation with seemingly little information to work on, learners can end up with quite elaborate systemic models *qua* plans which at the very least serve to guide any potential future action. In brief, under repeated classroom tests ever since 1999, and across all degree levels, it is SSM which has proved to empower decision makers to make decisions in the absence of clear facts. This result is in line with the literature which indicates that SSM 'can be exploited to produce information superior to that obtained through using conventional methods' (Brocklesby, 1995). Furthermore, as will be demonstrated below, SSM can be exploited to produce detailed and coherent systemic plans in the face of extremely limited

information, thus providing decision makers with structured means through which to navigate inherent uncertainty, complexity and risk.

Understanding SSM

Teaching SSM as a tool for information-poor contexts has afforded a reconfiguration of the methodology which complements the established configurations delineated, for instance, by Rose (1997) and Checkland (1999, 2000). Some would argue that this reconfiguration does not reflect the methodology's purpose or design (Holwell, 2000). In particular, critique could be directed to steps 'one' and 'three' of the reconfiguration described below – the former for including an analysis of uncertainty, complexity, and conflict which technically does not belong to SSM, and the latter for using a modeling technique as an action plan. Given, however, that SSM has always been offered as a methodology and not a method, there is arguably no defense for purists. SSM is available to be used in part (Ormerod, 1995; Mingers and Gill, 1997, Horlick-Jones *et al,* 2001), in whole (Checkland, 1985), or in form which suits a particular objective (Bolton and Gold, 1994; Brocklesby, 1995). Indeed, that SSM can be used so advantageously strengthens its relevance to decision making. The objective here is not to explain SSM, since detailed explanations are available in the literature (Checkland, 1989, 1999, 2001). The objective is to indicate how it has been, and can be, used to yield systemic understanding and action plans in the face of incomplete information. If, on occasion, the discussion focuses upon methodological points, it is because they are pertinent to this objective.

Essentially, SSM can be reconfigured into a three-step process as illustrated in Figure 4. A perspective on decision making is implicit in the figure. Decision makers have three main objectives: to produce knowledge concerning the context of a problematic situation from whatever limited or limiting sources are available, to apply it in the service of problem definition, and ultimately to plan systemically for action. The realization of each of these objectives produces, as a matter of course, respective outputs: contextual knowledge, the problem definition, and the systemic plans. They are housed in respective repositories. The term *database* is adopted in the figure to indicate such repositories. It is used in the broadest sense as opposed to the limited technological meaning it has come to acquire. In essence, the three-step model serves as a solid conceptual foundation which can inform practice and, as discussed below, provides a systematic process which yields systemic plans.

INSERT FIGURE 4 ABOUT HERE

Step One: Building a Knowledge Database

To begin with, there are tools for extracting contextual information and building what may be termed a *knowledge database* of a situation. This is done through Analyses 1, 2, and 3, and rich pictures. Other tools external to SSM – such as Friend's earlier categorization of uncertainties – provide useful contributions. Tables 1 through 5 are examples of some items constitutive of a knowledge database, as discussed in some detail earlier. The development of this first database is required in order to help define the problem in specific terms in step two.

Step Two: Building an Application Database

Due to the ambiguity surrounding the term *problem* (Mitchell, 1993: 49-58; Ho and Sculli, 1994), defining a problem more specifically requires particular conceptual tools.

Fortunately SSM provides a logic which allows users to stipulate problems in a fairly exact manner. In essence the logic says: (1) a problematic situation implies an undesirable state which needs to be *transformed* into a desirable state; (2) identify, therefore, the transformations which need to be undertaken in order to achieve the desirable state; (3) taken together, these transformations simultaneously define the problem and the desirable state.

By providing rigorous, yet almost commonsensical, rules for identifying and dealing with transformations (Checkland, 1989), SSM bypasses the difficulty of articulating desirable, but often ambiguously conceptualized, states and, instead, helps to plan relatively clearly conceptualized transformations. The focal reduction from states to transformations, and the clear conceptualization this yields, is crucial for lucid decision making and effective problem solving. The transformation rules are given in Box 2.

INSERT BOX 2 ABOUT HERE

Dealing with transformations, then, is constitutive of the second step of the three-step SSM reconfiguration. A list of possible transformations is first deduced from a problematic situation. This list simultaneously defines the constitution of the problem as well as indicates what action is required.

For example, T6 in Table 6 defines part of the problem as being poor quality of service. It simultaneously indicates, however, that the action required is to elevate quality to a specific level, one which does not detrimentally affect customers' businesses. This is different from deciding, say, on indefinite improvement or to go for 'total quality'. A specific criterion has been set, perhaps a relatively more realistic one than the standard 'higher quality' response. The criterion has been drawn from the problematic situation itself: the consequence of poor quality is detrimental effects to customers' businesses (see S4, Table 6). Quality must, therefore, attain a level which minimizes such effects. Beyond that level, the net benefits might be negative – more rigorously: there is nothing in the limited information which could found an interpretation that there is a desire to go beyond that level. Rigorous interpretation of the limited information thus yields a firm idea of what planning for this transformation will entail.

In accordance with the heuristic principle of subgoal-reduction (Grünig and Kühn, 2005: 78), it is recommended that all identifiable transformations be graded according to their degree of immediacy, concreteness and perceived possibility for dealing with them. Thus T2 in Table 6 would in effect be a product of dealing with more concrete transformations such as those evident in S4: deal with the latter and the former emerges as a matter of course (*emerges* being a key word here, since T2 appears as meaningful only in light of a complex of lower-level transformations conceptualized together). Higher-level and lower-level transformations may thus be identified, with those on lower levels generally being more amenable to accurate planning.

INSERT TABLE 6 ABOUT HERE

Any transformation does not occur in isolation. It is situated in an environment comprised of numerous factors and including other transformations. This might sound obvious but it is often an ignored fact. For example, most initial thoughts as to what *poorer quality* (T6 in Table 6) should be transformed are 'higher quality' or 'better quality' or even 'total quality'. Such responses say more about students' educational indoctrination and less about their intellectual capabilities. Education usually focuses upon what a solution should be to the detriment of how a solution can be developed. The social construction of TQM for instance (Zbaracki, 1998), has learners commonly

turn to this as *the* unquestioned expected solution to a quality problem. It was demonstrated above, however, that attention to context provides for a more specific, and perhaps much more relevant, path toward resolution. What is required, therefore, is a conceptual tool for effectively contextualizing transformations.

SSM provides this conceptual tool in its mnemonic CATWOE (Checkland 1999: 225-227). Essentially, the mnemonic incorporates the identified transformation and subsequently forces five questions, answers to which are deemed necessary if a transformation is to begin to be understood contextually. Box 3 highlights these questions. They ask for the identification of the various players involved in the transformation, according to their roles. Also asked is a reason which justifies the transformation – termed *Weltanschauung* from the German for (roughly) world-view or perspective. In addition, information is requested regarding environmental restrictions directly impacting upon the transformation – that is to say, proximate restrictions and not general, overarching ones which might be seen as impacting upon the problematic situation as a whole.

INSERT BOX 3 ABOUT HERE

Box 3 also highlights some elements of the *knowledge database* which help inform the CATWOE. It is worth noting that Analysis 2 also helps choose which transformations are more implementable than others by contributing information which helps decide on their operational/systemic desirability and cultural feasibility – two practical issues emphasized by Checkland (1985; 1999: 180-183; Yolles, 1999: 323-324). In effect, step two of the three-step SSM model *applies* the knowledge stored in the first database to transformation identification and contextualization, thus the term *application database* for the repository in this step.

It is helpful to appreciate the structure of a CATWOE. At its core lie T and W. Once T has been identified, it may usually be considered a constant. W, however, is changeable. Many perspectives can be brought to bear upon any particular T, and any one of them could serve as a justification of T. More significantly, each W will imply a different way of realizing T and, consequently, different results which T could yield. One T, in other words, can be matched with many Ws.

Consider a simple example of a transformation which might be considered by a university professor when contemplating the manner in which he organizes his research materials: *card-index research database – computerized research database*. One possible *Weltanschauung* here could be that a computerized database speeds up research work, and in general renders it more efficient. Another equally viable *Weltanschauung*, however, could be that a computerized database makes it easier to take on trips to, say, conferences because it can be saved and used in a laptop computer.

In both cases, the transformation is the same. In one case, however, the transformation will be designed especially against criteria of speed and efficiency of use. A transformation designed according to this *Weltanschauung*, in other words, will be considered a success if it surpasses the card-index system on these criteria. The other *Weltanschauung* focuses upon portability. This in no way implies the inclusion of speed and efficiency in the computerized design. It merely asks for the card-index to be translated into a basic computer program which allows for the database to be used on a computer instead of a card-index. Whether this renders the database faster or more efficient is neither here nor there. The fact that any computerized creation of a manual system will require various reconfigurations of the latter when translated into digital form is, also, secondary.

In brief, *Weltanschauung* governs the design, realization and outputs of the eventual system which will undertake the transformation – *show me your Weltanschauung and I'll show you your world,* so to speak. As such, W is the heart of the CATWOE, from which stem decisions as to who will be C, A and O, and what sort of environmental restrictions will actually be acknowledged as relevant.

Addressing the CATWOE renders a list of contextualizing elements. One such list is included in Figure 7 (which figure will be addressed in full shortly). Although lists are useful, they make it difficult to gain an integrated understanding of their members. SSM, therefore, requires such integration in the form of one sentence. This sentence, known as a *root definition*, may essentially be understood as a planning statement. It thus acts as the overarching description of the system which will realize the respective transformation. SSM provides quite detailed guidelines for the drafting of such statements (Checkland, 1999: 221-228; Checkland and Tsouvalis, 1997), ensuring as far as possible a description which can guide systemic planning. An example is included in Figure 7.

Step Three: Building a Systems Database

Realizing any particular transformation requires planning a system for effecting that transformation. This occurs in the third and final step, whose aim is a plan of action which can minimize unforeseen systemicity. The development of such a plan of action constitutes the *systems database*.

This step involves the design of what SSM terms *conceptual models,* or better, *human activity systems* - for a conceptual model is a systemic model of human action, comprised of specified interlinked activities, to be taken in order to realize a particular transformation. A human activity system can thus be seen as a decision making plan. Checkland (2000) stresses that human activity systems should be used to structure debate about change. No doubt this is true. Given, however, that debate is based upon versions of a human activity system, there results, once debate reaches a level of agreement or accommodation, a final human activity system as a plan of what needs to be done. Ultimately, therefore, human activity systems provide in themselves useful systemic action plans.

By the time decision making has reached the systemic planning stage, all analysis has been based on what can be gathered about the present situation. Systemic planning, by contrast, is about planning for the future. It thus involves using the knowledge gathered in the first two databases to make an informed leap into that future. With only incomplete information to begin with, the shorter the leap the more solid the plan. Thus, short-term planning is recommended. As will be shown, however, short-term *systemic* planning can yield more profound insights than expected of the short-term focus.

There are two general aspects to systemic planning. First, individual human activity systems are constructed for each of the contextualized transformations in the application database. Figure 5 provides an abstract illustration of two such individual systems, each composed of particular activities and associated with respective transformations.

INSERT FIGURE 5 ABOUT HERE

Second, common activities in different human activity systems are identified. For each set of commonalities, all but one are erased. Links are drawn to and from the one remaining, as required. This practice may be termed *analytical linking*. It allows for holistic appreciation of multiple transformations and activities by making explicit inter-

transformational dependence. The practice automatically renders an integrated systems plan, or what may be termed a *supersystem*.

Supersystems are necessarily constituted by two or more interlinked human activity systems. Figure 6 provides an illustration based upon Figure 5. Moving from Figure 5 to Figure 6, for example, analytical linking not only highlights that two transformations are related, but it also helps to identify how they are related. In the illustration, Activities 2 *and* 7 will inform Activity 3, and this latter cannot be undertaken effectively unless *both* of the other two activities are taken into account. In effect, analytical linking adds structural relationships *between* individual human activity systems and changes structural relationships *within* each of them.

INSERT FIGURE 6 ABOUT HERE

The design of the supersystem may, however, also invite what may be termed *conceptual links*, that is, those which arise due to interpretation. Since these links have interpretative foundations, however, care must be taken that they fall within the rigorous understanding of the situation which has been maintained thus far. The fact that systemic planning already requires a leap into the future means that this leap must not be needlessly energized through daring interpretations. The more logically argued the conceptual links, the stronger the case to draw them. The temptation to link everything with everything else must be avoided. Even though the world might indeed be interconnected, its connections are not capricious but specifically routed.

Finally, the stipulation of control criteria is an ever-present issue which must be dealt with throughout the construction of human activity systems. Any system without control criteria cannot be monitored. The pervasiveness of this issue is made evident once individual human activity systems, each with their own control criteria, are linked systemically to form a supersystem requiring its own control criteria. The resulting structural changes and new influences require the revision, or at least reconsideration, of all control criteria. Figure 4, therefore, highlights that the stipulation of control criteria is a continuous task throughout systemic planning. Checkland (1999: A25-A26, A37; Yolles, 1999: 327) subscribes to five key issues which serve to control systems when using SSM for their design. Like in the CATWOE, what is at stake is essentially answering five questions. They are given in Box 4, which also highlights an understanding of the organizational focus of each control.

INSERT BOX 4 ABOUT HERE

From Systematic Process to Systemic Understanding

In essence, the three-step model of SSM offers a series of tasks, arranged and known in advance for their ability to produce, when followed accordingly, a particular product. In short, what is offered is a systematic process which ultimately enables the production of systemic plans. *This in itself is deemed of the utmost relevance*. For, in the popular mind, systemic thinking is the simultaneous grasping of the whole – a quaint but impossible idea. Systematic thinking, on the other hand, is more than possible – it underpins the basic problem solving approach (Mitchell, 1993: 75-86; Grünig and Kühn, 2005). If, therefore, the demand for systemic planning can be met through systematic thinking, this imposes few psychological barriers and simultaneously fulfills a contemporary and growing need. That the three-step SSM model, discussed here, provides this is evidenced by the systemic plans rendered possible by following the process.

Consider briefly, as an example, only one small part of a wider supersystem of the case in question. Figure 7 provides a human activity system for the transformation *unacceptable time lag in dealing with urgent demand – acceptable time lag* – one possible manner, that is, in which this transformation could be systemically planned. Next, however, when planning for the transformation *uncoordinated approach to service provision – coordinated approach,* it was found that this second human activity system had much in common with the one for *unacceptable time lag*. Linking the two produced the beginnings of a supersystem as in Figure 8. There are two immediate insights here.

INSERT FIGURE 7 ABOUT HERE

INSERT FIGURE 8 ABOUT HERE

First, although the planning of a coordinated approach will require (for coordination to be realized) the rates of all three demands, the designers considered the planning of a coordinated approach as secondary to, and furthermore requiring, the resolution of the time lag situation impacting upon urgent demand. Use of the rate of this demand, therefore, can only be made indirectly, that is, once the acceptable time lag for urgent demand has been set. The dotted-line link was used to indicate indirect usage and thus reflect the designers' considerations.

The second insight is the formation of a feedback loop which has been highlighted in thicker arrows in Figure 8 and reconstructed, for clarity, in Figure 9. What this feedback indicates is that the time-lag level of acceptance will be incorporated into the coordination planning. The coordinated plan, however, must subsequently be communicated to the organization. This requirement to communicate was interpreted from the hierarchical socio-cultural dynamics of the organization, as identified in Analysis 2 of Table 4. The link, in this case, is therefore conceptual.

INSERT FIGURE 9 ABOUT HERE

Communicating the coordinated plan in this way might, due to the subsequent links already established, influence expectations and lead to changes in the acceptable time lag level and operational strategy. These changes could, in turn, affect coordination planning. The merging of human activity systems, therefore, begins to betray interrelated factors which at first may not have been perceptible.

There results, in other words, systemic information which appeared to be not available in the raw data of the case, and yet which makes perfect sense following a systematic process. Furthermore, this systemic information is conceivably relevant beyond the short-term for it portrays underlying structural dynamics. As such, by focusing only on the short term, an insight has been provided which will need to be taken into account in any medium-to-long-term plan, decision or action.

The example of the two transformations briefly considered here implies something very powerful in a methodology which can yield such rich insights from very limited information. Far from being invented and going beyond the boundaries of the case given in Box 1, information has been extracted, used and portrayed in a resourceful manner. The result has been knowledge which is interpretatively sound, which effectively serves the interests of the management of uncertainty, and which ultimately renders the decision maker tangibly better informed and better equipped to deal with the situation. Systemic understanding and implementable systemic plans have resulted from applying a systematic process to partial information. The thought processes formalized in the methodology indicate that the decision maker who thinks in terms of SSM might well

be *the* decision maker who can meet the contemporary paradoxical demand for effective systemic results from incomplete information.

Conclusion

The reality which decision makers confront can frequently be constituted by ambiguous tasks, structures, standards and information. In having to make decisions in such circumstances, decision makers face a difficult challenge. This paper has demonstrated how the use of a slightly reconfigured systemic approach – Soft Systems Methodology (SSM) - appears to be able to meet this challenge. It has been shown how SSM can be exploited to construct knowledge, enable learning, and inform action by resourcefully using whatever limited information is available, and portraying its implications for decision making advantage. Quite elaborate, internally coherent and well-grounded systemic planning is possible given limited information. 'Planning as learning' (de Geus, 1988) is, in effect, realized and comprises the decisions required. The final product itself may additionally be appreciated as a decision map, warning of potential systemic effects, and hence risks, when any one of the activities of the plan is actioned. In this way, uncertainty compounded by complexity is brought under some control and dealing with informational incompleteness becomes manageable.

Instructing decision makers in the use of SSM for information-poor contexts has required its reconfiguration into a three-stage process. This reconfiguration meets Grünig and Kühn's (2005) criteria for a systematic decision making process. In particular, the reconfiguration can be appreciated as a goal-oriented decision process (the goal being systemic understanding and systemic action plans), whose deliberations may be evaluated as objectively as possible (due to interpretative rigor, sets of rules and guidelines), and which follows a structured procedure of action using clear methodical rules (manifested in the proposed three-step reconfiguration). It is a process whose steps invariably lead to systemically structured action plans.

In the university classroom, three one-hour lectures, corresponding to the three stages, are all that is required for providing the conceptual material (i.e. the deductive learning). When interspersed with practical application of the concepts through a problem case, classroom experiential learning emerges. During the learning process, decision makers learn less *what* to think and more *how* to think. For what they learn is essentially a thinking methodology, that is, a manner of approaching problematic situations. This runs counter to many management degrees (from Bachelors through to MBA) which trade on substantive factual material and tend to disregard teaching *how to think* in problematic situations (Checkland, 2000; Bennis and O'Toole, 2005). Real dilemmas, however, arise from limited information compounded by the need to act on it. Under such circumstances, no amount of factual material can help if the decision maker is not equipped with an equally substantive, yet flexible, methodological approach which enables him to design his resolution on the firmest ground possible given the informational limitations.

Tackling complexity and its related uncertainty essentially amounts to effective knowledge management. Soft Systems Methodology as an approach, way of thinking, and way of constructing knowledge, appears to be able to provide such effectiveness. As such, it is a major contributor to forging the link between systems thinking and knowledge management/organizational learning. In demonstrating how useful and practical systemic results are possible in the face of partial information, the paper has indicated how instructors can guide decision makers to make decisions in the absence of

clear facts. In this respect, and in response to Bennis and O'Toole (2005), here is a distinct contribution toward the manner in which business schools might, once again, find their way.

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I manage a team of people providing a specific service.

I want to look at improving this specific operation.

We are currently lacking an effective system to deal with new and urgent demand including a system to deal with urgent local demand which must be met between 9 and 5pm.

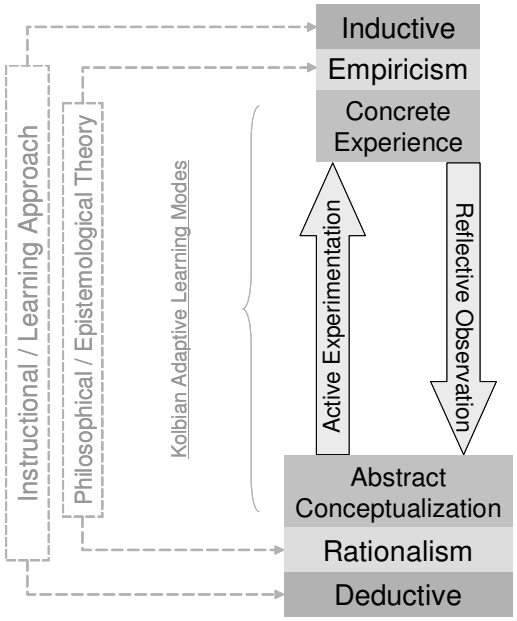
As this system does not exist currently, the result is an unacceptable time lag in dealing with urgent demand, an uncoordinated approach to service provision - leading to poorer quality of the service with consequent detrimental effects to our customers' businesses.

The need to rectify this is particularly significant given the expectations of both, our organization and our clients.

I would like to look at establishing such a system. This will raise issues about the roles of staff within the team and who we will provide a service for. This will require negotiation with various external specialist organisations we work with.

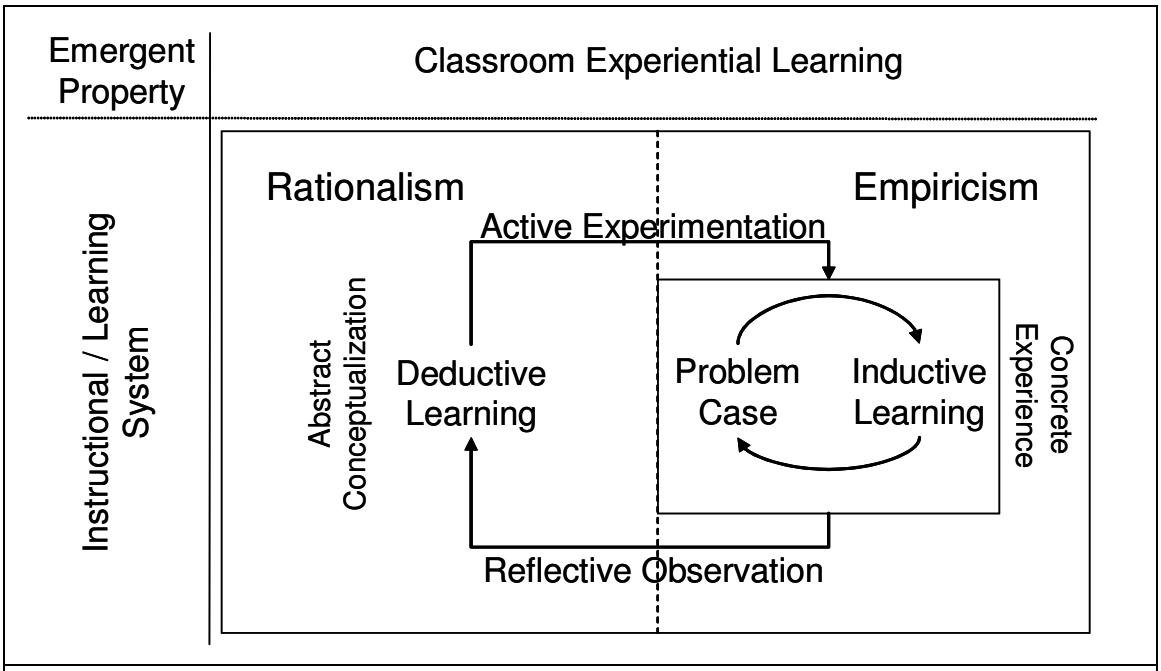
Relevant concepts will include quality and customer care, capacity and operational strategy. However, I am somewhat uncertain as to how I would apply forecasting, inventory management or computer simulation.

Box 1



The Kolbian learning cycle with respective philosophical/epistemological theories and instructional/learning approaches

Figure 1

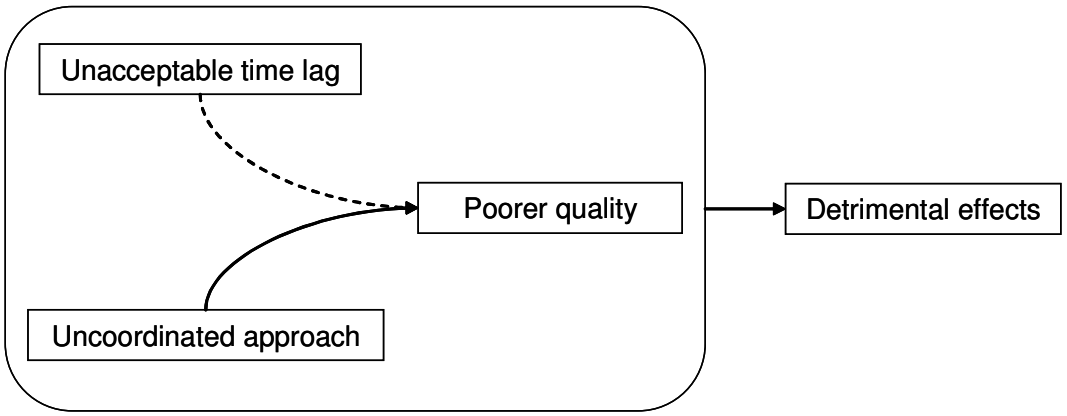


Systemic, case-based classroom experiential learning methodology

Figure 2

	Uncertainties		
Case Study Segments	**UE**	**UV**	**UR**
S1. I manage a team of people providing a specific service.			
S2. I want to look at improving this specific operation.			
S3. We are currently lacking an effective system to deal with new and urgent demand including a system to deal with urgent local demand which must be met between 9 and 5pm.	*Demand* as given in the case can be interpreted as existing in either two or three modes: either as (a) two distinct demands respectively identified as new *and* urgent on the one hand, and urgent local on the other, or as (b) three distinctly different demands respectively identified as *new*, *urgent* and *urgent local*. There is uncertainty due to lack of accurate information and, as given, the interpretations of *demand* will determine the nature of any resolution.		
S4. As this system does not exist currently, the result is an unacceptable time lag in dealing with urgent demand, an uncoordinated approach to service provision - leading to poorer quality of the service with consequent detrimental effects to our customers' businesses.	To which of the aforementioned demands does the 'urgent demand' mentioned in this Segment refer: new and urgent demand, or urgent local demand? And how does the interpretation of these latter (as noted in the UE comment above) affect the understanding here? The perceived distinction between *customers* and *clients* is also one which gives rise to uncertainty due to lack of confirmatory information. Customers are identified with having businesses whereas clients are identified as having expectations. Clients, in this case, might not be an immediate group which makes use of the service provided. After all, stockholders are a group which has expectations on a company, might not use its services, but most certainly is the group for whom the company ultimately works and, as such, is the ultimate client. As to customers, their having been identified as having business which are affected by the seeming inability of the current system to meet demand, indicates that the operation in question might be strictly commercial, that is between corporations instead of serving customers off the street.		
S5. The need to rectify this is particularly significant given the expectations of both, our organization and our clients.		There are affected interests around the (possibly conflicting) expectations of *our company* and *our clients*. Clarification of the convergences and divergences between the respective expectations might be required, serving to clarify the respective authority or importance of each, in order to ultimately provide guidance or orientation.	
S6. I would like to look at establishing such a system. This will raise issues about the roles of staff within the team and who we will provide a service for. This will require negotiation with various external specialist organisations we work with.	Perhaps the most striking example of *UE* in the case, however, and no less due to the operation already meeting some demand, is the somewhat surprising issue that *who we will provide a service for* remains an open question. This sort of question arguably points to the need for surveys, research investigations and the like which are suggested by Friend as alleviating *UE*.	It appears that an external element – the ESOs – quite directly influence or impact upon traditionally internal decisions such as *roles of staff* and target markets (*who we will provide a service for*). It is not clear whether this influence is welcome or not, or whether it constitutes normal policy. It is clear, however, that the decisions identified constitute policy issues, perhaps define hierarchy in staff roles, require negotiation and affect certain interests. As such, this area of the case exhibits uncertainty of the *UV* type.	*Uncertainty* stemming from complexity, especially from apparent *decision-making complexity*, is particularly evident in the ambiguous manner in which the following four decision areas relate: the establishment of the system, staff roles, target market, and negotiations with ESOs. Any overt *UR* in the case is arguably concentrated here.
S7. Relevant concepts will include quality and customer care, capacity and operational strategy. However, I am somewhat uncertain as to how I would apply forecasting, inventory management or computer simulation.	Require more accurate information in order to decide whether uncertainty is even relevant.		

Table 1 Identifying three types of uncertainties



Cross-sectional, partial systemic infrastructure evident in problematic situation of Box 1

Figure 3

Case Study Segments	Complexity	Conflict
S1. I manage a team of people providing a specific service.		
S2. I want to look at improving this specific operation.		
S3. We are currently lacking an effective system to deal with new and urgent demand including a system to deal with urgent local demand which must be met between 9 and 5pm.	*Demand,* in the case, appears to be riddled with complexity. On the one hand, the problem of demand is its urgency, rendering it clearly dynamic. On the other hand, the problem of demand as a whole is changing since something *new* has been introduced into it (either a new demand or a demand which is new *and* urgent, both of which interpretations remain within the bounds of what is given).	
S4. As this system does not exist currently, the result is an unacceptable time lag in dealing with urgent demand, an uncoordinated approach to service provision - leading to poorer quality of the service with consequent detrimental effects to our customers' businesses.	Complexity is evident in the manner in which the non-existence of the desired system gives rise to *an unacceptable time lag* and *an uncoordinated approach* – both or the latter of which lead to *poorer quality*, which leads to external *detrimental effects* (to the customers' businesses). The complexity here is compounded by the role of organisational and client expectations. This area of the case implies a densely interconnected network of elements, in which decisions undertaken in one part have wider ramifications within and outside the organisation.	The fact that customers' businesses suffer from detrimental effects caused by the lack of the desired system signals a point of conflict between these customers and the *specific service* in question.
S5. The need to rectify this is particularly significant given the expectations of both, our organization and our clients.		
S6. I would like to look at establishing such a system. This will raise issues about the roles of staff within the team and who we will provide a service for. This will require negotiation with various external specialist organisations we work with.	*Complexity* is particularly evident in the ambiguous manner in which the following four decision areas relate: the establishment of the system, staff roles, target market, and negotiations with ESOs.	Any negotiation deemed as *required* arguably hints at potential conflict if the negotiation is not carried through. In which case, it appears that conflict might be an issue wherever the ESOs come into play.
S7. Relevant concepts will include quality and customer care, capacity and operational strategy. However, I am somewhat uncertain as to how I would apply forecasting, inventory management or computer simulation.		

Table 2: Identifying complexity and conflict

Case Study Segments	Who	What
S1. I manage a team of people providing a specific service.	I (manager) Team of people	Specific service
S2. I want to look at improving this specific operation.		Specific operation
S3. We are currently lacking an effective system to deal with new and urgent demand including a system to deal with urgent local demand which must be met between 9 and 5pm.	We (I + team + organisation?) New and urgent demand Urgent local demand	
S4. As this system does not exist currently, the result is an unacceptable time lag in dealing with urgent demand, an uncoordinated approach to service provision - leading to poorer quality of the service with consequent detrimental effects to our customers' businesses.	Customers	Time lag Approach to service provision Quality of the service Customers' businesses
S5. The need to rectify this is particularly significant given the expectations of both, our organization and our clients.	Organization Clients	Organisational expectations Client expectations
S6. I would like to look at establishing such a system. This will raise issues about the roles of staff within the team and who we will provide a service for. This will require negotiation with various external specialist organisations we work with.	Staff (individual team members) Who the service is for / target market External specialist organizations (ESOs)	Roles of staff within the team
S7. Relevant concepts will include quality and customer care, capacity and operational strategy. However, I am somewhat uncertain as to how I would apply forecasting, inventory management or computer simulation.		Quality Customer care Capacity Operational strategy

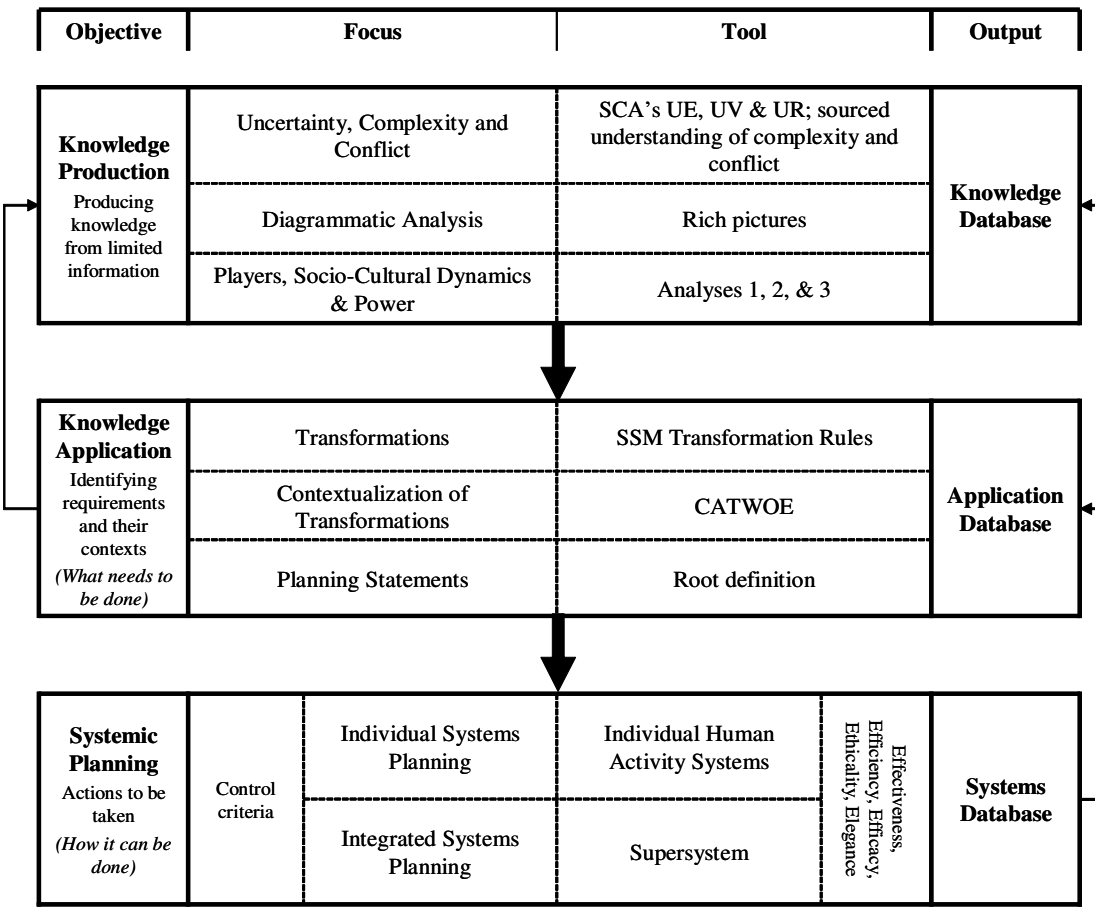
Table 3: Student results for SSM Analysis 1

Case Study Segments	Socio-cultural dynamics	Notes
S1. I manage a team of people providing a specific service.	Hierarchical	
S2. I want to look at improving this specific operation.	Open to ideas (?) Autocratic management style Bureaucracy Low team spirit	Autocratic/bureaucratic/blame culture: these dynamics arise from the language of the case. For example: *I* manage, *I* want to improve, but *we* lack. Positive aspects of the situation are attributed to *I,* whereas negative aspects of the situation are attributed to *we.* Urgency/deadlines/tension: these dynamics arise from the nature of the demand(s) acting upon the situation, as well as the *unacceptable time lag* and *detrimental effects*. Disorganised: this may be a consequence of the urgency/deadlines/tension, but is more explicit in the *uncoordinated approach.* There is no quality limit set and yet quality control requires defined limits if it is to work. Perhaps the limit is defined by the expectations of *our organisation and our clients*.
S3. We are currently lacking an effective system to deal with new and urgent demand including a system to deal with urgent local demand which must be met between 9 and 5pm.	Urgency Deadlines Tension Blame culture	
S4. As this system does not exist currently, the result is an unacceptable time lag in dealing with urgent demand, an uncoordinated approach to service provision - leading to poorer quality of the service with consequent detrimental effects to our customers' businesses.	Disorganised Desire for (previous level of?) quality or quality=expectations	
S5. The need to rectify this is particularly significant given the expectations of both, our organization and our clients.	Desire to meet expectations (not go beyond them ?) – conservative Goal-oriented Threatening culture	May be a conservative culture because there is no indication of wanting to go beyond expectations. Threatening culture: there appears to be a horizon of threats from the organisation and the clients. The autocratic style, identified above, may also contribute to this.
S6. I would like to look at establishing such a system. This will raise issues about the roles of staff within the team and who we will provide a service for. This will require negotiation with various external specialist organisations we work with.	Dependent culture Stuck in their ways	Dependent culture: depend upon ESOs for internal structuring (roles of staff) and market definition (who we will provide a service for). Stuck in their ways: system not established yet, and roles of staff has become an issue.
S7. Relevant concepts will include quality and customer care, capacity and operational strategy. However, I am somewhat uncertain as to how I would apply forecasting, inventory management or computer simulation.	Data-driven Technical Computer-literate Optimisation-culture	

Table 4: Student results for SSM Analysis 2

Case Study Segments	Who/ What	Power
S1. I manage a team of people providing a specific service.	I (manager) Team of people Specific service	Allocated and bureaucratic power – no presence (charisma) Low power stemming from little room to manoeuvre ?
S2. I want to look at improving this specific operation.	Specific operation	?
S3. We are currently lacking an effective system to deal with new and urgent demand including a system to deal with urgent local demand which must be met between 9 and 5pm.	We (I + team + organisation?) New and urgent demand Urgent local demand	? Power to force change Power to force change
S4. As this system does not exist currently, the result is an unacceptable time lag in dealing with urgent demand, an uncoordinated approach to service provision - leading to poorer quality of the service with consequent detrimental effects to our customers' businesses.	Customers Time lag Approach to service provision Quality of the service Customers' businesses	? ? ? ? ?
S5. The need to rectify this is particularly significant given the expectations of both, our organization and our clients.	Organization Clients Organisational expectations Client expectations	Power to impose expectations Power to impose expectations Power to regulate time lag, approach to service provision, and quality Power to regulate time lag, approach to service provision, and quality
S6. I would like to look at establishing such a system. This will raise issues about the roles of staff within the team and who we will provide a service for. This will require negotiation with various external specialist organisations we work with.	Staff (individual team members) Who the service is for/ target market External specialist organizations (ESOs) Roles of staff within the team	Low power stemming from little room to manoeuvre Power to force internal change Power to influence in terms of internal HR and external market definition ?
S7. Relevant concepts will include quality and customer care, capacity and operational strategy. However, I am somewhat uncertain as to how I would apply forecasting, inventory management or computer simulation.	Quality Customer care Capacity Operational strategy	? ? ? ?

Table 5: Student results for SSM Analysis 3. A Who/What plays a role in a situation. As such it has some power, if only to play the respective role. Therefore, all Who/What elements should have associated Power descriptions. If these descriptions are marked with question marks, this indicates high uncertainty given the information at hand.



A three-step reconfiguration of SSM. The reconfiguration includes the identification of uncertainty, complexity and conflict based on sources such as the Strategic Choice Approach and the general PSM literature. The thin arrows indicate information feedback between the three steps. This merely formalizes the fact that at any point in time, and especially during a particular task, new insights arise which either require to be added to previous databases or require the revision of current information therein. As for the thick arrows, they simply indicate the step-by-step logic.

Figure 4

• Consider only one input and one output
• The input must be present in the output, though most probably in a changed state
• An abstract/intangible input must yield an abstract/intangible output
• A concrete/tangible input must yield a concrete/tangible output
The four transformation rules used in SSM. Note the reduction to one-to-one relationships between inputs and outputs might appear to restrictively reduce the richness of any problematic situation. The objective at this stage, however, is not to appreciate such richness, but to grasp the essence of the problem. The reductions undertaken here enable the richness of the situation to emerge later in a structured and systemic manner.
Box 2

Case Study Segments	Transformations	Notes
S1. I manage a team of people providing a specific service.		
S2. I want to look at improving this specific operation.	T1. Specific operation in need of improvements – improvements realised	
S3. We are currently lacking an effective system to deal with new and urgent demand including a system to deal with urgent local demand which must be met between 9 and 5pm.	T2. Lack of an effective system to deal with new and urgent demand – lack met T3. Lack of a system to deal with urgent local demand which must be met between 9 and 5pm – lack met	How the lack is 'met' should be addressed by Conceptual Model activities. The abolition of the demands, which would thereby dissolve the respective lacks, does not appear to be an option. Note also that these Ts address the desire 'to look at establishing such a system' in Segment 6.
S4. As this system does not exist currently, the result is an unacceptable time lag in dealing with urgent demand, an uncoordinated approach to service provision - leading to poorer quality of the service with consequent detrimental effects to our customers' businesses.	T4. Unacceptable time lag in dealing with urgent demand – acceptable time lag in dealing with urgent demand T5. Uncoordinated approach to service provision – coordinated approach to service provision T6. Poor quality of service – quality level which does not detrimentally affect customers' businesses T7. Consequent detrimental effects to our customers' businesses – detrimental effects minimised	T6 alternative (with reference to Segment 5): Poor quality of service - quality level which meets the expectations of our organization and our clients T7 (note on causality): The consequent detrimental effects to our customers' businesses are a consequence of poor quality of service.
S5. The need to rectify this is particularly significant given the expectations of both, our organization and our clients.	T8. Unclear expectations of our organization – expectations clarified T9. Unclear expectations of our clients – expectations clarified	Note that he does not say that expectations are not being met. There is therefore no T such as: expectations not met – expectations met
S6. I would like to look at establishing such a system. This will raise issues about the roles of staff within the team and who we will provide a service for. This will require negotiation with various external specialist organisations we work with.	T10. Unaddressed issues about the roles of staff within the team – issues addressed T11. Unaddressed issues about who we will provide a service for – issues addressed T12. Negotiation required with various external specialist organisations we work with – negotiation realized	
S7. Relevant concepts will include quality and customer care, capacity and operational strategy. However, I am somewhat uncertain as to how I would apply forecasting, inventory management or computer simulation.	T13. Uncertainty as to how to apply forecasting, inventory management or computer simulation – uncertainty resolved	

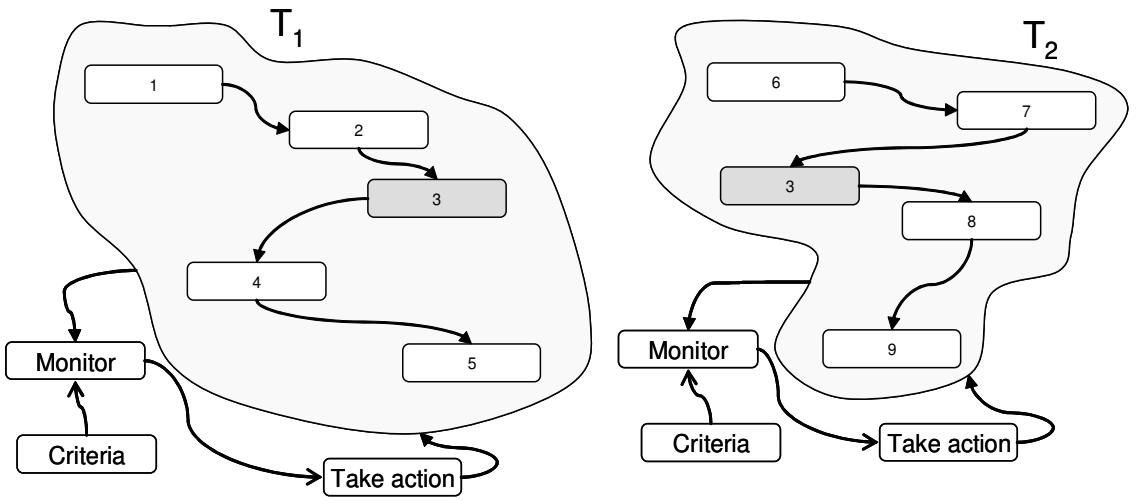
Table 6: Student listings of transformations

Mnemonic	Terms	Questions	Informed by
C	Customer(s)	Who will benefit and who will lose from this T?	Analyses 1, 3
A	Actor(s)	Who will do this T, or make it happen physically?	Analyses 1, 3
T	Transformation	The T itself	Methodological rules
W	Weltanschauung	What reason or perspective justifies doing this T?	Analysis 2
O	Owner(s)	Who can stop or change this T?	Analyses 1, 3
E	Environmental restriction(s)	What restrictions are there in the immediate surroundings of this T?	Analysis 2

Above: The elements of a CATWOE and their basic information sources. Each identified transformation requires a completed CATWOE. All CATWOE terms are technical, with respective questions highlighting exactly how such terms are to be understood. Thus, *customers* is a particular label for those who will gain and/or lose from the transformation. The term used here is not to be confused with *customers* in the case, nor with any other quotidian understanding of the term.

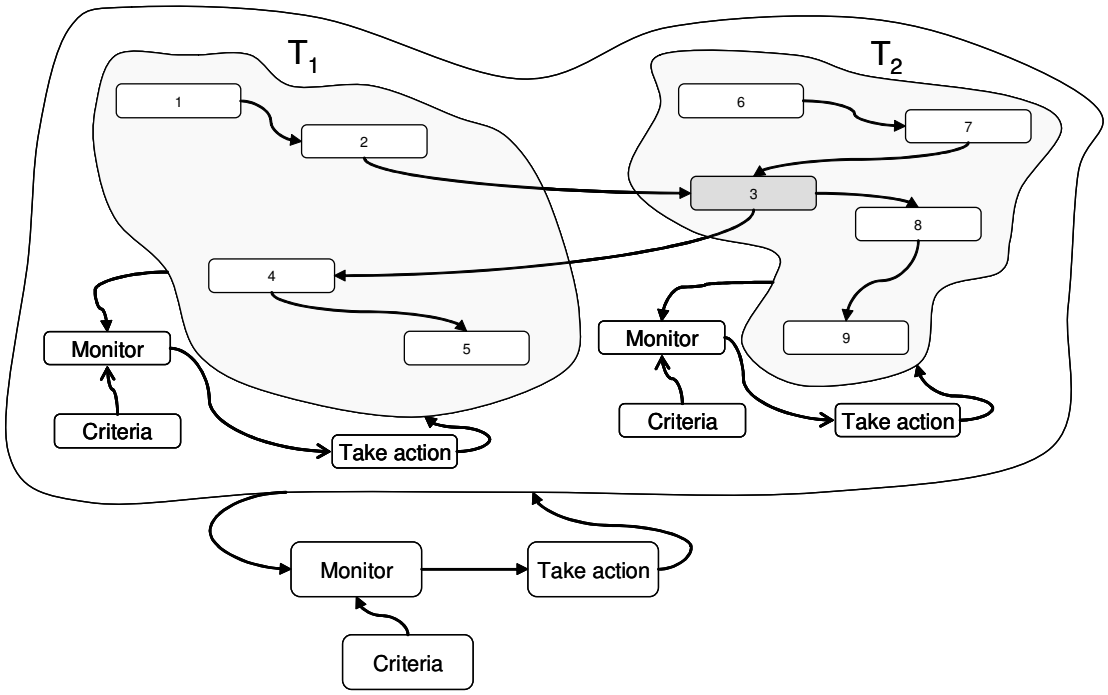
Note In essence, the CATWOE says: give me a transformation, tell me who is involved and how they are involved, tell me why this transformation should be done, and provide immediate restrictions which should be taken into account when thinking about, and planning for, this transformation.

Box 3



Abstract illustration of two individual human activity systems respectively associated with transformations T_1 and T_2. Notice that the planning of each transformation requires respectively distinct and linked activities, as well as respective monitoring subsystems which control output according to certain criteria. The two systems here make use of one activity, Activity 3, which appears in both. This indicates the need for analytical linking, as illustrated in Figure 6.

Figure 5



Supersystem that renders Activity 3 dependent on Activities 2 *and* 7 which belong to respectively different transformations. The links create antecedent and posterior relationships between the two transformations. This introduces inter-transformational dependence which, in planning, is made obvious only at the supersystem level.

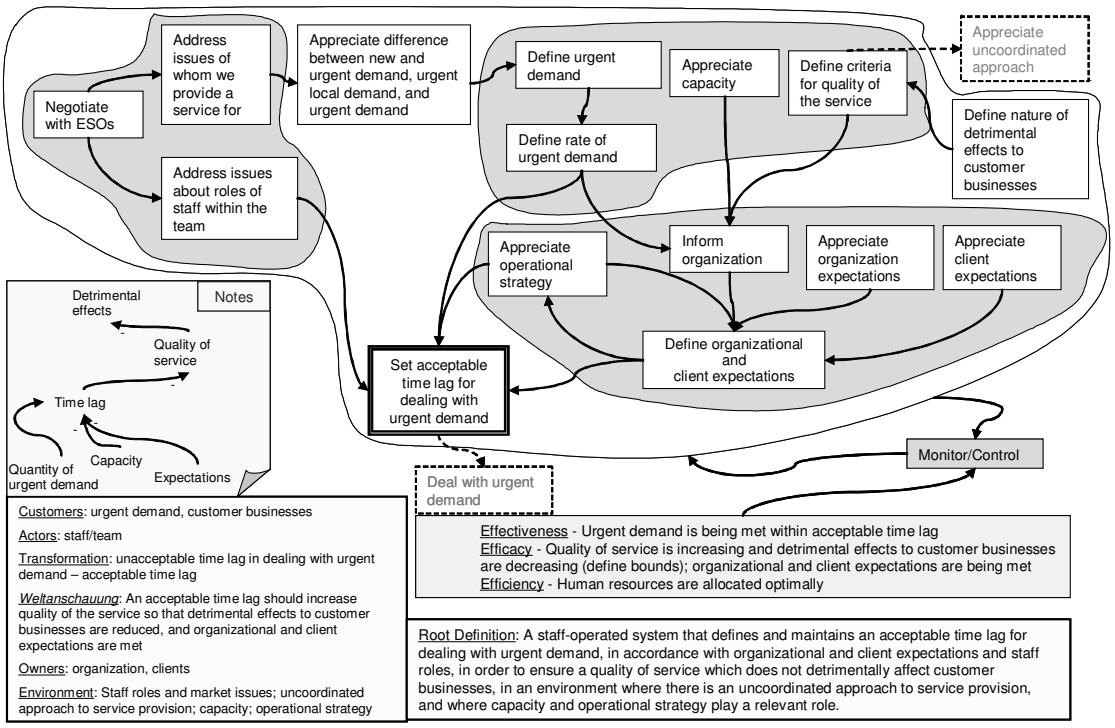
Figure 6

Control criteria	Questions	Focus
Efficacy	Do the means work?	Processes and their output
Efficiency	Are the minimum resources used?	Resource usage
Effectiveness	Does the T contribute to the attainment of owners' (O) goals and expectations	Strategy
Ethicality	Is T a moral thing to do?	Social responsibility, ethics
Elegance	Is T aesthetically pleasing?	Socio-cultural sensibility

Above: five control criteria incorporated in SSM use, the questions they ask, and the organizational focus of each.

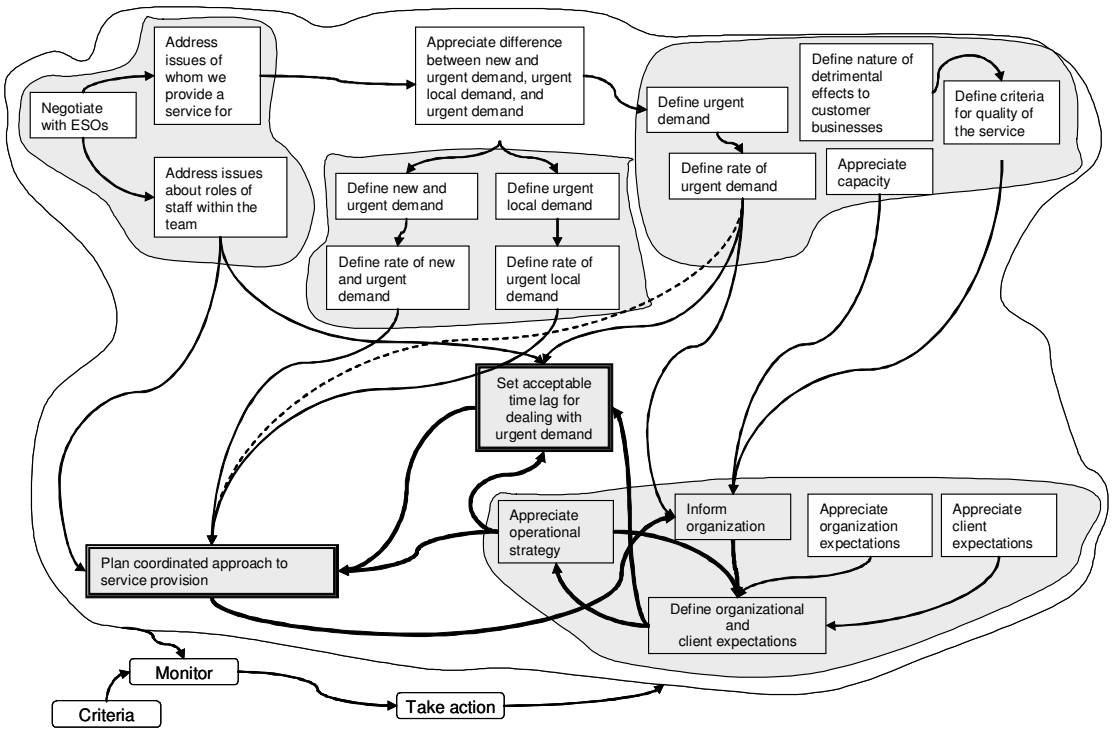
Note Answers to the five criteria will be based on particular perspectives which do not arise independently of the wider environment. To take an extreme example, efficacy might be attained through slavery or through waged labor. The fact that one is chosen over the other is based upon an underlying perspective reinforced by societal moral standards and infrastructure. Consider, also, that efficiency cannot be tackled independently of effectiveness for they are, by nature, inversely related – more weight placed on one causes the other to suffer. As such, the development of control criteria is not a simple task but one which requires a degree of systemic thinking itself.

Box 4



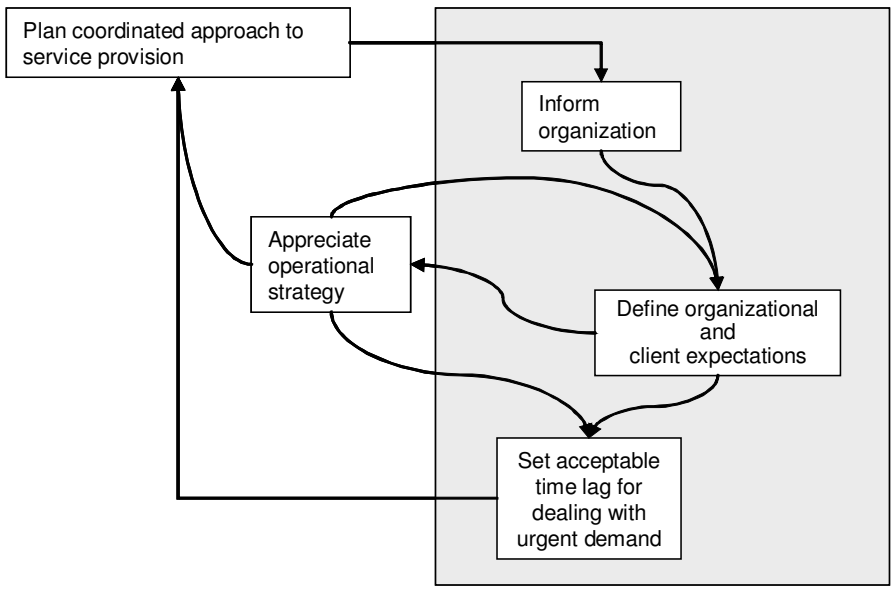
Individual systemic plan (human activity system) for the transformation *unacceptable time lag in dealing with urgent demand - acceptable time lag*. Included are the model's CATWOE, root definition, three control criteria, and an influence diagram of core issues. The designers of this particular model decided that the grouping of individual activities need not represent sub-systems within a larger system. The groupings merely highlight activities which are understood as lying within respective contexts: a context of negotiations with ESOs, a fact-gathering context, and a context of informing the organization. Due to this, the only monitoring and control system required is the one shown for the whole human activity system. Had the groupings been treated as sub-systems, then each one would require its own monitoring sub-system with control criteria.

Figure 7



The beginnings of a supersystem constituted, at this stage, by two transformations, (1) *unacceptable time lag in dealing with urgent demand – acceptable time lag*; and (2) *uncoordinated approach to service provision – coordinated approach*. The heavy arrows indicate a feedback system which is reconstructed in Figure 9.

Figure 8



A system of feedback loops evident in the supersystem of Figure 8.

Figure 9