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UNDERSTANDING LARGE SYSTEMS

Large systems are notoriously difficult to analyse. This paper explores how a combination of three proven systemic tools can be combined to provide a suitable framework for such analysis. It uses the Gulf Cooperation Council as a case study.

Keywords: Large Systems, SSM, Viable Models, Causal loop Diagrams.

1. Introduction

In the context of this paper, it is important to define what is meant by a "large system". The term will be used to cover large political systems (such as the United States of America, The Swiss Federation, the European Union and the Gulf Cooperation Council), large economics systems (such free market systems, planned economies or socialist systems) and large business systems. (such as members of the FAANG group – Facebook, Amazon, Apple, Netflix and Google – which are extremely powerful especially in the Western hemisphere).

The word "system" is important as the authors are cyberneticians who use system thinking to view human organisations as complex adaptive systems rather than composites of individual parts. This is the definition of a system adopted by the authors. A system is a synthesis of interconnected parts which cannot be considered individually. All the examples quoted above can be considered as complex systems, in the sense that it is not possible to divide them into independent parts. It is not possible to completely and precisely predict their behaviour over time and indeed such behaviour is often emergent. There may be an extra level of complexity due to geographical distribution such as in multinational companies. These factors make it impossible to analyse and difficult to understand such entities and this paper suggests a combination of several system tools to do this task. It will use the Gulf Cooperation Council as a case study as the principle author is a high-ranking official in this organisation.

It is important for the modern world to have efficient multinational institutional bodies in order to integrate strategies. A multinational institution will be defined as an institution with branches, offices or production facilities in more than one country. Our definition is that any firm that derives at least one quarter of all its business abroad can be considered a multinational corporation. According to the United Nations, the largest 100 multinational corporations' control about 40% of global trade [26].

Political institutions are a special case and their structure has been debated as long as they have existed. Two possible (and contrasting) scenarios are a centrally controlled organisation with limited autonomy for the members or a looser federation of autonomous states with a nominal controlling body. Examples are the United States of America and the European Union which is discussed in section three

2. Problems associated with Large Organisations.

Three major problems that need to be resolved to understand any large organisation are the definition of its identity or purpose, its organisational structure and the collection and accuracy of empirical evidence data.

2.1. Identity.

The identity of an organisation is determined by what it does. Beer's famous dictum is

"a system is what a system does"

This means that to understand the system, one must examine its actions. This is not as simple as it seems as often there is a collective cognitive dissonance where the organisation thinks that it is behaving in a certain manner (and indeed may have been set up to behave that way) but actually is behaving differently. (i.e. keeping the peace by waging war or creating free trade agreements that economically cripple some of the participants). Identity is very much connected with "purpose". Cyberneticians place great emphasis on the teleological aspect of systems. Organisations are composed of people who have values. Values can be described as views of what is right or wrong. From these values, come principles which are the rules and regulations that permit the values to flourish. These principles then determine behaviour and the identity of the organisation. The first stage in understanding large systems is to establish a clear purpose for the system and then to correctly define its values, principles, behaviour and thus the identity of the system.

2.2. Organisational Structure.

Because of the size and complexity of the organisations under scrutiny, it is extremely difficult to begin any investigation. Cyberneticians believe that for intended behaviour to function, the organisation has to be structured in a certain way. There needs to be a structural coupling between organisation and behaviour. The initial insight of Weiner when he formed the area of cybernetics is that there exists a science of organisation i.e. all organisations (large or small. political or economic) all follow certain common rules. There are laws of organisation just as there are laws of physics or chemistry or mathematics, Stafford Beer formed a subset of Cybernetics called Management Cybernetics and created the Viable System Methodology (VSM) which is used in this paper to model the organisational structure of systems.

2.3. Data Collection

There are two problems with data- collection and bias

Many secondary sources will exist and can be accessed by detailed research. There is a potential problem that many sources will be outdated, and cognitive dissonance could exist. Still, these sources are useful as starting or reference points. Primary data can be accessed by means of questionnaires and interviews. The problem here is that of knowledge and bias. How much of the "big picture" do the people being interviewed possess and are their views coloured by their position in

the organisation. A major contributor to data is that of the participant-observer. A participant-observer is a person who has been working in the organisation in many roles for many years. He thus possesses two important attributes – knowledge of how things are actually done and also access to high quality qualitative data, ordinarily not available to outside researchers.

The key question is whether in such a situation, the results obtained can be classified as reliable in the sense of free from bias. Anthropological and sociological studies have been using participant-observation for over a century [9]. The term "ethnographic methods" has been coined to include qualitative methods of data collection such as observation, document analysis and interviewing. Observation methods are useful to researchers in a variety of ways. They provide researchers with ways to check for nonverbal expression of feelings, determine who interacts with whom, grasp how participants communicate with each other, and check for how much time is spent on various activities [21]. Polanyi described this as "tacit knowledge" which he defines as skills, ideas and experiences that people have but are not codified and may not necessarily be easily expressed [18]. With tacit knowledge, people are not often aware of the knowledge they possess or how it can be valuable to others. Effective transfer of tacit knowledge generally requires extensive personal contact, regular interaction and trust. Also, researchers who are participant-observers can be aware of the tensions in the system and elicit responses amongst interviewees which they would not share with an outsider. They would also know when opinions are just not true and be aware of distortions or inaccuracies in the responses.

DeWalt and DeWalt believe that "the goal for design of research using participant observation as a method is to develop a holistic understanding of the phenomena under study that is as objective and accurate as possible given the limitations of the method" [9]. They suggest that participant observation be used as a way to increase the validity of the study, as observations may help the researcher have a better understanding of the context and phenomenon under study. Validity is stronger with the use of additional strategies used with observation, such as interviewing, document analysis, or surveys, questionnaires, or other more quantitative methods. Participant observation can be used to help answer descriptive research questions, to build theory, or to generate or test hypotheses [9].

To summarise, a triangulation approach is recommended, combining multiple observers, theories, methods, and empirical materials. By this it is hoped to overcome any weaknesses or intrinsic biases and the problems that come from single method, single-observer, and single-theory studies. The contents of the case study are mainly based on practitioner-observer analysis of both tacit and explicit knowledge but are thoroughly grounded in primary and secondary data

3. Methodology.

Nowadays, the traditional organisational chart is considered a rather weak and unsatisfactory model of an organization [1]. This paper aims to show how a new combination of three well-established systemic methodologies can be used to diagnose and understand large organisations. The proposed methodology could be described as using a "mixed methods" research design which normally means that a combination of quantitative and qualitative methods is used. In this case, the mixed methods design uses a combination of the three received methodologies which are self-reinforcing on data generation, of the implications of the research question,

diagnostics and the final conclusion. Data can also be described as qualitative i.e. open-ended in the sense that responses cannot be predicted) or quantitative (where the responses fall under a prescribed range such as the Likert scale used in questionnaires).

The three major systemic tools in the new methodology are the Soft Systems methodology (SSM), the Viable System Model (VSM) and System Dynamics (SD). The details of these methodologies cannot be covered in this paper but interested readers can access the following [5, 6, 7, 13, 2,3,4, 11, 12, 20, 25]

The SSM can be described as a qualitative approach and is useful in taking a holistic view of the problem. [17, 23, 14] But, SSM can also use quantitative tools to elicit information such as questionnaires which it does in this research. The results from SSM will often provide a basis for a quantitative analysis to take place. In this research, the analysis will be provided by the VSM which again uses both qualitative and quantitative tools. There is considerable debate amongst managerial cyberneticians about the overall nature of the VSM. The diagnostic stage is subjective and can be argued to be qualitative, but the variety engineering is quantitative. System Dynamics uses both qualitative and quantitative approaches. The causal loop modelling is certainly qualitative and is intended to show the interconnections of the system and identify any counter-intuitive behaviour. Wolstenholme [25], and Pollack [19] System dynamics principles are highly useful in identifying and modelling complex management problems especially in predicting the impacts of decisions over time. Causal models show the dynamic interdependencies and causal relationships of the system. In constructing the SD model, the qualitative paradigm, as advocated by Wolstenholme and Pollack which uses flowcharts, interpretive epistemology, inductive reasoning, and exploratory, qualitative techniques as bases for building the SD model, was employed by this researcher. [25,19]

The effectiveness of the use of SSM as a guiding methodology in combination with other approaches such as cybernetics and system dynamics in identifying problematical situations in organisations and developing more viable models has been documented in recent empirical studies such as those conducted by [8, 15, 22, 21]. In particular, the present study drew salient methodological insight from the contribution of White [24] which enhanced SSM with cybernetic principles and applied the resulting methods to a case study of the London Ambulance Service (LAS).

Figure 1 shows a diagrammatic portrayal of the conceptual framework of the methodology (which is strongly related to the seven-stage approach of a SSM analysis) The application of SSM will provide a clearer picture of the purpose and identity of the organisation. The VSM will be used to construct an organisation structure. It can then use its diagnostic ability to identify organizational deficiencies and suggest organizational changes to correct these deficiencies. The qualitative aspect of SD using causal diagrams will provide a means of identifying the consequences of various actions discussing "what-if" scenarios.

The first stage involves the identification of the problematical situation in the organisation by using information gathered from formal data and qualitative methods. The second stage involves the expression of the problem situation as a *rich picture* in order to facilitate a more in-depth understanding of the problematical situation by the researcher The third stage involves developing succinct statements about the purpose of the various systems or processes, called 'root definitions' which can be formulated through a particular mnemonic – the CATWOE

mnemonic, which stands for *customers, actors, transformation, Weltanschauung, owners, and environment.*

The fourth stage involves the creation of a VSM of the GCC. The boundary separating stages 1 and 2 from stages 3 and 4 is drawn to indicate that the researcher has transposed from the 'real world' to a 'systems thinking world' The fifth stage which is the evaluation of the conceptual models, involves the comparison of the conceptual model(s)

with the real world Results of the evaluation of the conceptual models is envisaged to help facilitate the identification of the desirable changes that must be made to the models in order to take into account, the interests of the actors In this paper, this stage consists of suggesting how various "organisational gaps " which were identified by the VSM can be filled. The sixth stage will use the Causal loops of System Dynamics to explore what -if scenarios.

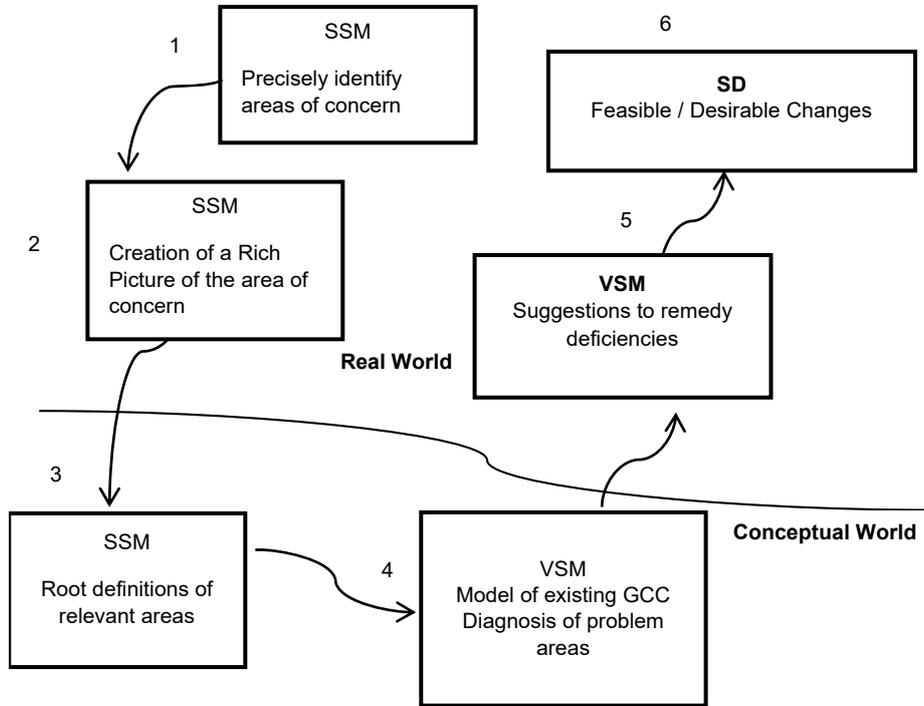


Fig.1. The Conceptual Framework

3.1. GCC as a Case Study.

The GCC was chosen as a suitable case study as the principal author has been there since its inception. Has had many roles and is now in a senior position. He is thus able to do the data triangularisation that is mentioned in section 2.3.

The background to the GCC is as follows. Six Gulf states make up the GCC (see figure 2). They have many features

in common. They are all follow the same religion and share a common culture and language. They all have large hydrocarbon reserves which forms the basis of a carbon intensive production industry. They all have a harsh, dry and humid climate and scarce water resources. There are however differences as demonstrated by the current blockade of Qatar by Saudi Arabia and the UAE.



Fig. 2. The geography of the GCC

The founding charter of the GCC (The Cooperation Council for the Arab States of the Gulf, 1981) stipulates that the objectives of the GCC are to facilitate "coordination, cooperation and integration between" member states "in all fields." Specifically, the founding charter enumerates the following objectives of the GCC:

1. To effect coordination, integration and inter-connection between Member States in all fields in order to achieve unity between them.

2. To deepen and strengthen relations, links and areas of cooperation now prevailing between their peoples in various fields.

3. To formulate similar regulations in various fields including the following:

- a. Economic and financial affairs
- b. Commerce, customs and communications
- c. Education and culture

4. To stimulate scientific and technological progress in the fields of industry, mining, agriculture, water and animal resources; to establish scientific research; to establish joint ventures and encourage cooperation by the private sector for the good of their peoples. (The Cooperation Council for the Arab States of the Gulf, 1981).

The data collection methods included the following:

- Participant-Observer knowledge
- Using the Literature reviews
- Existing Documentation (Archival)
- Questionnaires, Interviews.

3.2. Use of the SSM.

The research process lasted the five years. The researcher's firsthand experience with the GCC, his background in management and his interests served as precursors for adopting SSM as the guiding or dominant methodology. A series of interviews together with selected reading and personal experience formed the basis for stages 1 – 3. A root definition was constructed as:

The GCC is a political, economic, social, regional cooperation organisation owned by the leaders of the GCC member states established to "effect coordination, integration, and interconnection among members states in all fields in order to achieve unity among them" by formulating and implementing relevant policies, resolutions and agreements in accordance with the legal instruments and limits set by its Charter.

From this the Rich Picture shown in figure 3 was constructed. This shows several problem areas that need to be addressed in stage 4.

3.3. Use of the VSM.

The VSM was used in three ways:

- To build an organisational model of the GCC,
- To identify deficiencies in the present structure and
- To suggest improvements.

Building a Viable System Model has been thoroughly described by Beer especially in his book "Diagnosing the System" Beer solves the problem of the inter-connectiveness by concentrating on roles not people and he also uses the principle of recursion. In Beer's view one must first identify five sub-systems in the organisation (termed system 1,2,3,4

and 5). Each of these sub-systems has certain roles and is connected recursively to the other subsystems. The greatest problem is in identifying the System Ones. These are the systems that actually do the work i.e. define the identity and purpose of the organisation. A complex organisation can be split in many ways – it is a subjective process, but the guideline is always – what is the system doing? The final model for the GCC is shown in Figure 4 Once the subsystems and the level of recursion are identified, Beer quotes four laws of organisation. These control the flow of information between the subsystems and follow Ashby's law where the variety of the controller must at least equal the variety of that which is being controlled. By examining the variety passing between the systems, suggestions can be made how to correct deficiencies.

3.4. Use of SD.

In any action there are always unintended consequences and the improvements suggested by the VSM are not exempt. Here the power of System Dynamics can be fully revealed. At this stage, causal diagrams were constructed, and unexpected feedbacks were examined. The combination of these three systems methodologies contributed to a greater understanding of the GCC and form a powerful tool with which to understand complex and large systems.

4. Results.

The VSM diagnosis of the GCC revealed many instances where the subsystems did not follow the four Laws of Organisation laid down by Beer. This allowed the researchers to suggest changes in the organisational structure that addressed the problem areas revealed in the Rich Picture. As an illustration of these suggestions, let us consider one area that was identified as a major problem in the SSM stage. This is the question "can the GCC act as a supranational body". This is an interesting question because it can be raised with regard to the three political examples quoted in the introduction. It reflects the basic issue of the balance between control and autonomy. To sue VSM terminology, it reflects on the roles of the System Ones and System Five and the levels of recursion in the System.

In the original USA constitution, the individual states were the system ones and they existed in a loose union where only major decisions (Such as War) were made by the System Five (the president). This is known as the Hamiltonian or Jefferson model. After the civil war, Lincoln wanted much more central control and he changed the role of the system Five to its present role where the president has much more power and the autonomy of the states are reduced. In the case of Switzerland, there are four system ones (the four cantons) and they have a more Hamiltonian structure. In the case of the European Union, the UK claims that it entered a Hamiltonian structure which has evolved over time into a Lincolnian structure which severely limits the autonomy of the UK.

With regard to the GCC, the VSM shows that it does not have the requisite variety to make supranational decisions. In fact, its present structure precludes this. To do so would require an alternative structure (shown in figure 5) where the six member states are themselves the system ones of a new structure. In this way, a supreme council would be able to influence decisions. It would depend on the will of the individual states whether this would morph into a Hamiltonian or Lincolnian version.

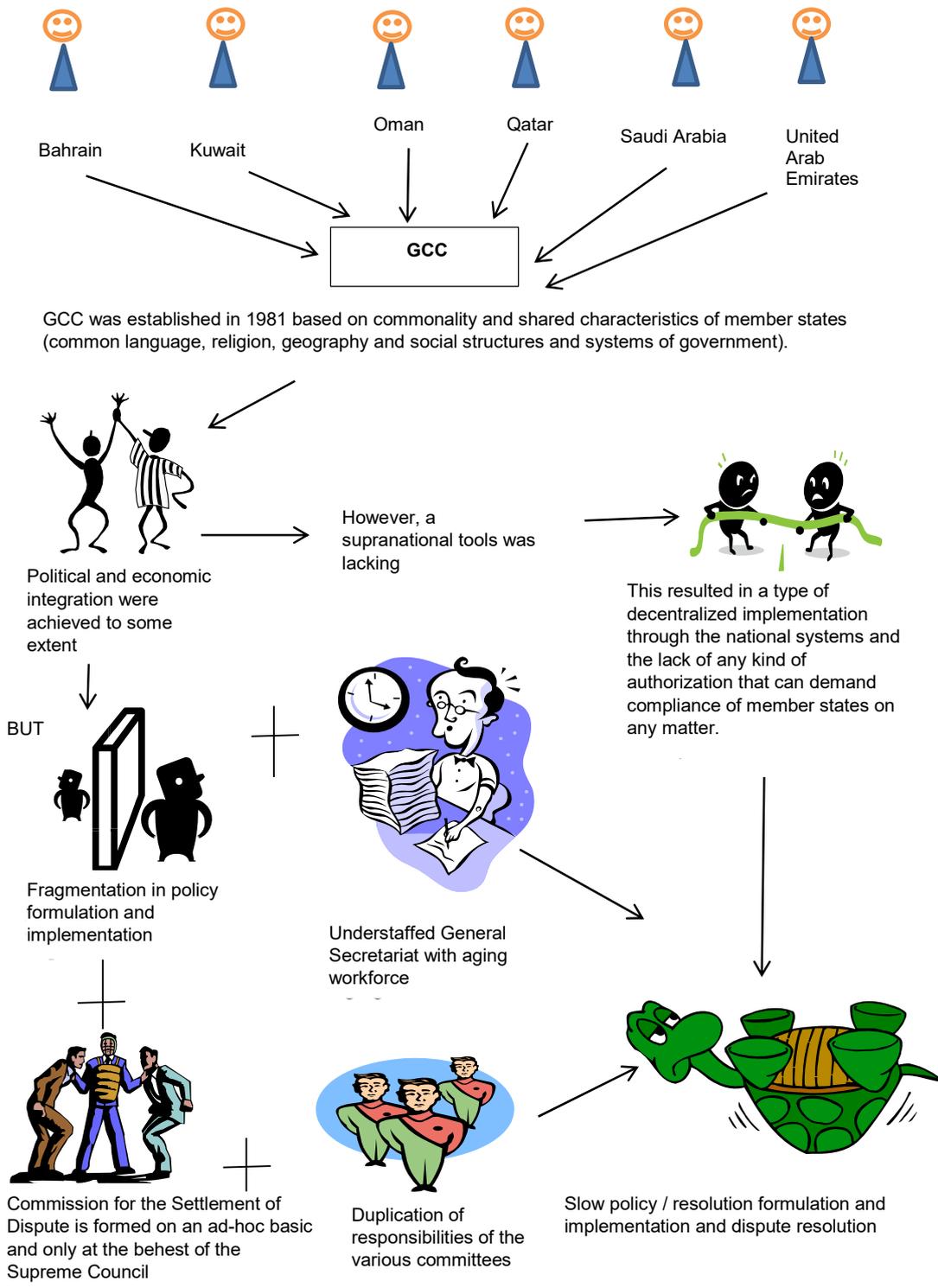


Fig. 3. Rich Picture for the GCC

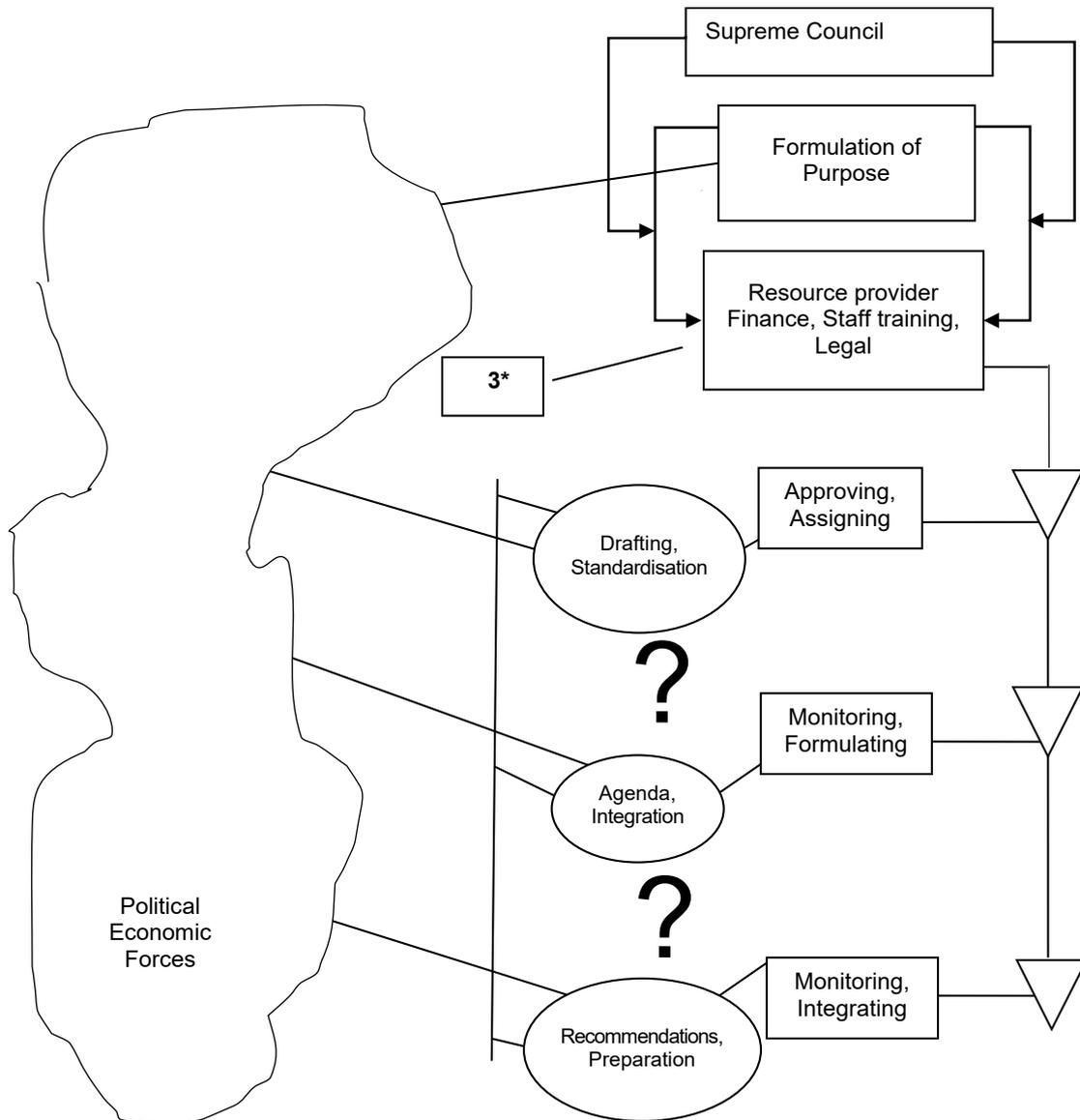


Fig. 4. Viable System Model of GCC

5. Conclusion.

This paper addresses the problems of large organisations and suggests a new methodology for doing so. The three methodologies are SSM, VSM and SD. It is assumed that the reader has previous knowledge of these methodologies, but ample references are given in the text. To illustrate the methodology, the GCC has been chosen as a case study.

The results show that the aim of becoming a supranational body was defeated at the inception of the GCC in the way that it was structurally assembled. To obtain the original vision, a new structure would be needed.

In the authors opinion, a hypothesis or new idea can make a contribution to knowledge in three ways – support evidence, provide a logical and coherent explanation or be useful. Because of the complex interactions inherent in a large organisation, it is extremely difficult to use an empirical approach. Any evidence (if it exists) is not guaranteed to be reliable as it may not (indeed will not) include ALL the facts and will be coloured by vested interests. As such the results are not falsifiable (in the Popperian sense) or verifiable (in the Kuhnian sense) This is a common criticism of social

science or economic modelling but can be answered. The authors use the Abduction philosophy proposed by C.S. Peirce [16] which can be roughly summarized by "if there is no reason to disbelieve then believe" The traditional way is to use empirical observation to construct models that fit. Einstein reversed this trend and sought truth in the models and let reality catch up! In this paper we do not ignore empirical observation and indeed insist on a triangulation of empiricism, primary and secondary data. The methodology uses tried and tested tools and is logical and coherent. It is also useful as any attempt to unravel the workings of such systems or organisations adds to the general understanding of the problems and provides a debating platform for further improvement. This echoes the views of Feyerabend who states that "the most important criterion is that a theory should be useful" [10]. Science is done by people. Some of these are empiricists, some are rationalists, some are pragmatists and however "validity" is defined, there will be exceptions. The authors this submit that this new methodology is a valuable contribution to knowledge and in the particular case of the GCC has provided insights that they are now considering.

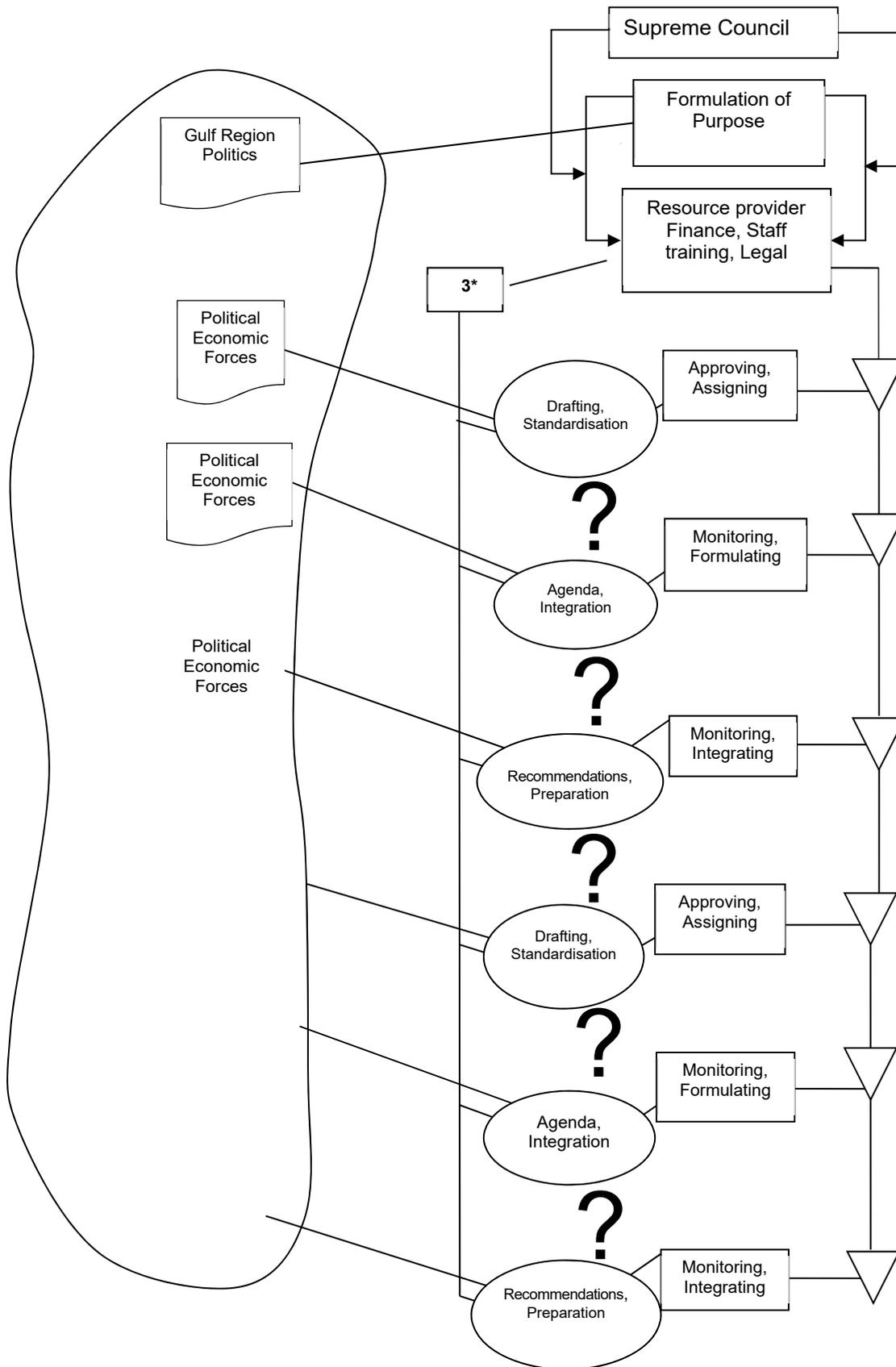


Fig. 5. Alternative structure for the GCC

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ОСЯГНЕННЯ ВЕЛИКИХ СИСТЕМ

Великі системи, як відомо, важко аналізувати. Досліджено, як комбінування трьох надійних системних інструментів може створити підходящу основу для такого аналізу. Для прикладу вивчається Рада співробітництва арабських держав Перської затоки.

Ключові слова: великі системи, методологія м'яких систем, прийнятні моделі, схеми причинно-наслідкових зв'язків.

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ПОСТИЖЕНИЕ БОЛЬШИХ СИСТЕМ

Большие системы, как известно, трудно анализировать. Данная статья исследует, как комбинирование трех надёжных системных инструментов может создать подходящую основу для подобного анализа. Для примера изучается Совет сотрудничества арабских государств Персидского залива.

Ключевые слова: большие системы, методология мягких систем, приемлемые модели, схемы причинно-следственных связей.

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ФОРМУВАННЯ ТА РОЗВИТОК КОНЦЕПЦІЇ КОРПОРАТИВНОЇ СОЦІАЛЬНОЇ ВІДПОВІДАЛЬНОСТІ

Досліджено формування та подальший розвиток концепції корпоративної соціальної відповідальності. Проаналізовано особливості трансформації цієї концепції відповідно до соціально-економічних змін, очікувань суспільства та інтересів бізнесу. На основі наявних наукових розробок систематизовано відповідний понятійно-категоріальний апарат, виокремлено основні принципи функціонування, комплексні моделі, потенційні можливості та загрози соціальної діяльності бізнесу за сучасних умов.

Ключові слова: корпоративна соціальна відповідальність; соціальна діяльність бізнесу; моделі корпоративної соціальної діяльності; принципи корпоративної соціальної відповідальності.

Постановка проблеми. Нині перед глобальним суспільством постали гострі соціально-економічні проблеми, критичними серед яких є такі: деградація й забруднення навколишнього середовища, спричинені надмірним виробництвом та споживанням; старіння населення і міграція, що підвищують економічний тиск на держав-

ний сектор, який постає перед необхідністю надавати соціальні послуги у більшому обсязі за умови обмежених податкових надходжень. Одним із напрямів вирішення зазначеної проблеми є практика корпоративної соціальної відповідальності (КСВ), що є механізмом перенесення державних соціальних функцій на приватний бізнес. Як відомо, зазначені практики в розвинених країнах