Improving Evaluations of Military Organisations

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Abstract

DSTO's C3I Operational Analysis (C3IOA) Group is concerned with evaluating Command and Control (C2) organisations. This paper outlines the results of an investigation into the C3IOA Group's evaluation practice and proposes an approach that can be used to improve evaluation effectiveness. Although the target application area for the results of the investigation was initially C3IOA Group, the findings should be applicable to other areas within the Defence community.

Analysis is made of the results of current evaluation practices of the type carried out by C3IOA Group at selected Australian joint and single service operational level military headquarters and salient issues associated with these evaluation practices are identified. The topics investigated included the analysts, organisations, processes, tools and products.

The investigation showed that the complex socio-technical nature of modern command and control organisations makes them difficult to evaluate using traditional evaluation methods.

An approach is introduced that is better able to deal with modern organisation problems, especially those related to complexity, change, and emergence. This approach, which uses ideas from the Total Systems Intervention method (Flood and Jackson 1991) is based on the development of a multi-disciplinary intellectual framework that uses a variety of system metaphors and methodologies. The framework facilitates:

- accurate definition of the purpose and scope of evaluations;
- appropriate selection of evaluation measures to reflect the different ways of viewing an organisation.

1 Introduction

1.1 Context and Readership

This paper addresses operational analysis issues associated with the evaluation of Command and Control (C2) organisations. It is intended to assist operations analysts to improve the way they understand and evaluate military organisations.
The intended readers for this paper are:

- Operation analysts who work within a defence environment;
- Those personnel who work in military organizations who have an interest in evaluation and the impact of evaluation on military organisations.

1.2 Background

Defence organisations around the world have long recognised the value of well organised, scientifically based, operational analysis. There is considerable evidence (Quade 1966) to show that well conducted operational analysis can lead to significant improvements in efficiency and effectiveness of C2 organisations working at the tactical, operational, and strategic levels. There are also many historical accounts of situations where a poor analysis, or failure to scientifically analyse, has led to unsatisfactory military outcomes (Cohen and Gooch 1990).
Analysts within the C3I Operational Analysis (C3IOA) Group in the Information Technology Division (ITD) of the Australian Defence Science and Technology Organisation (DSTO) provide operational analysis support to the Australian Defence Force (ADF). The support is provided through the conduct of evaluations of C2 organisations and their associated information support systems. Traditionally, the evaluations have been focused at the tactical level and C3IOA Group has developed a considerable expertise in this area. However, more recently, the focus of the work has shifted towards the operational level with studies at a range of operational level Headquarters. These studies have involved investigations into issues associated with internal processes, information flows during military operations, and command post exercises (CPX). Operational areas that have been analysed during these operations and exercises include those related to situational awareness, planning, and decision making. The impact of technology on these operations has also been evaluated.
New information technology can increase military capability but it can significantly impact on the traditional C2 architectural components, such as organisational structures, processes, and work practices. Centralised C2 architectures are now being replaced by those that support the distributed decision making requirements associated with modern network centric warfare. As a result of the ADF change towards this more distributed information environment, the focus of C3IOA Group work has steadily shifted towards that of analysis of those elements that support the management and use of information and knowledge within military command HQ.
The migration of the ADF to an information intensive distributed decision making paradigm has resulted in the introduction of greater amounts of computing equipment. As a result, the military organisations and the systems that support commanders have become significantly more complex, making the task of evaluation more difficult. The traditional approach to organisation evaluation, that considered an organisation as being like a machine and the people within the organisation as being like the mechanised parts, can only provide a partial understanding of distributed

organisations. The traditional approach does not take account of social, cultural, political, and, at the personal level, the psychological issues, that can influence the way people and groups behave. A more complete understanding of complex socio-technical systems is required and a new method that adopts the use of a multiple perspective approach is proposed in this paper.

1.3 Purpose and Approach

The purpose of this paper is to argue the need for greater variety in the approach used to evaluate modern C2 organisations. To support this argument the salient results of an investigation into C3IOA Group evaluation practice are presented. The method used during the investigation, along with a more detailed analysis of the results, is addressed in a separate report (Yates and Burke 2000). The issues arising from the results of the investigation are discussed here and used to provide the motivation for the multi-disciplinary approach described in the remaining sections of the paper. This proposed approach embodies systems concepts as they are applied to C2 organisations and explores how organisation models, along with the idea of using a selection of metaphors and methodologies, can provide some practical guidance in identifying measures that can assist analysts.

2 Evaluation Concepts

2.1 Evaluation

The Australian Concise Oxford Dictionary (Turner 1987) defines the word 'evaluate' as:

> *"Ascertain the amount of; find numerical expression for; appraise; assess."*

The words 'assess' and 'appraise' are used to help define the meaning of the word 'evaluation'. These words, 'assess' and 'appraise', are words that are often associated with the determination of the value of something. Flower (Flower 1993) makes use of the word 'value', but also adds the ideas of 'measure' and 'standard'. She defines 'evaluate' as:

> *"Judge the worth of something by measuring (comparing and contrasting) its key features against a standard; the standard may be either what is named or what is ideal."*

The main difficulties for analysts in using this definition are: knowing what reference standard to use for comparison; and identifying suitable measures. The definition of evaluation given by Owen (Owen 1993) is more practical. Owen defines evaluation as:

> *"The process of providing information designed to assist decision making about the object being evaluated."*

This definition, although slightly self-referencing, captures more of the essence of the way the word evaluation is understood within C3IOA Group. It describes evaluation as a process that has as its purpose the provision of information (e.g. advice, opinions, the results of trade studies, etc.) to help decision-making. The object (or thing) about which the decision is to be made is the

subject of the evaluation and in the context of C3IOA Group work is usually a C2 organisation or associated information support system.

2.2 Evaluation Process

Owen's definition leads directly to the consultative model of evaluation used by C3IOA Group. Figure 1 illustrates this C3IOA Group Consultative Model and shows the relationships between the ADF C3I Domain and C3IOA Group evaluation tasks.

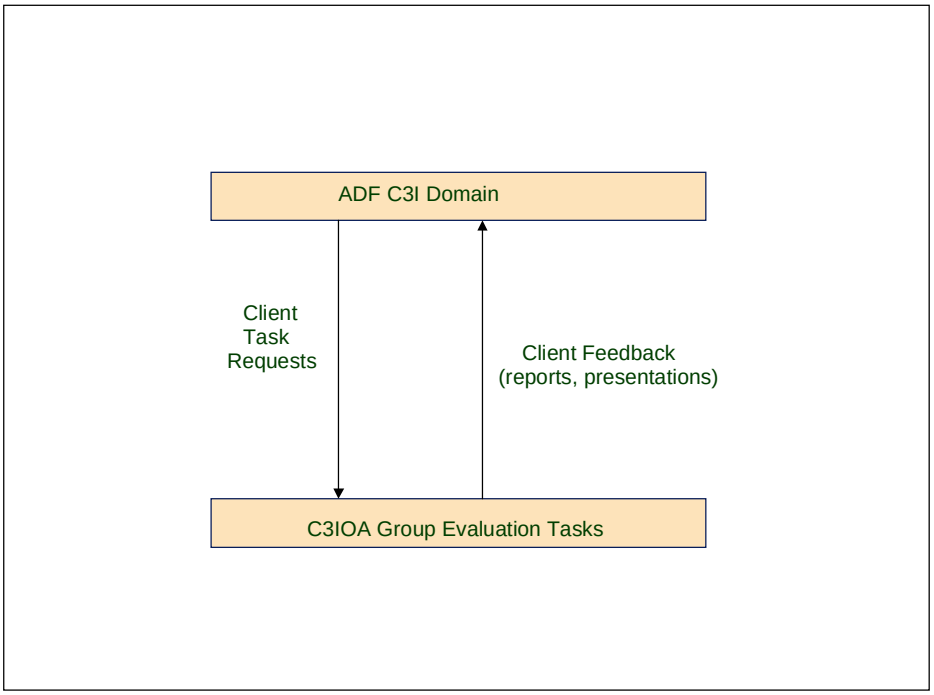

Figure 1: C3IOA Group Consultative Model

Analysts within C3IOA Group are requested by ADF clients to conduct evaluations. The results of evaluations are presented to the clients, users, evaluation sponsors, and other interested stakeholders, in the form of reports and presentations. A typical evaluation process consists of the following stages: planning what to do; collecting and analysing data about an organisation; identifying areas for improvement; reporting the findings; and some monitoring of the implementation of the recommendations. The evaluation findings should reflect an accurate and fair assessment of the issue(s) being investigated and the evaluation results should be in a form that assists the decision making process. It is not the job of the analyst to make the decisions for the client, but rather to supply findings and recommendations to the client to fully support his or her future decision making process. It is the role of the analysts to indicate to the clients the implications of any course of action the clients may choose to take.

An advantage of Owen's definition of evaluation is that it does not restrict the specific purpose of the evaluation, other than to assist the client and other stakeholders with their future decision making. However, the common reason for carrying out most evaluations is to help to identify program risks. The main program risks addressed by the work done by C3IOA Group being

those that relate to cost, schedule and quality issues associated with C2 operations. Typical quality issues of interest are: organisation effectiveness; performance; and efficiency. If a program is not yet in place, an evaluation of the relevant issues can help guide decisions regarding future implementations. If the program is already established, an evaluation can provide information to support decisions regarding changes that can improve program efficiency or effectiveness. However, an evaluation can be less focused and be used purely for the purpose of enlightening stakeholders about an organisation or system, without any reference to, or recommendation regarding, specific types of improvements. In this case, the understanding gained can help to provide an objective context for future decision making.

2.3 Evaluation System

The evaluation process introduces additional elements that together with the organisation being evaluated make up the evaluation system. These additional elements are the analysts, evaluation processes, tools, and products. The evaluation system is illustrated in Figure 2. The illustration explicitly identifies those elements that are external to the organisation but are important to the evaluation. The influence of these types of characteristics needs to be taken into account during evaluations.

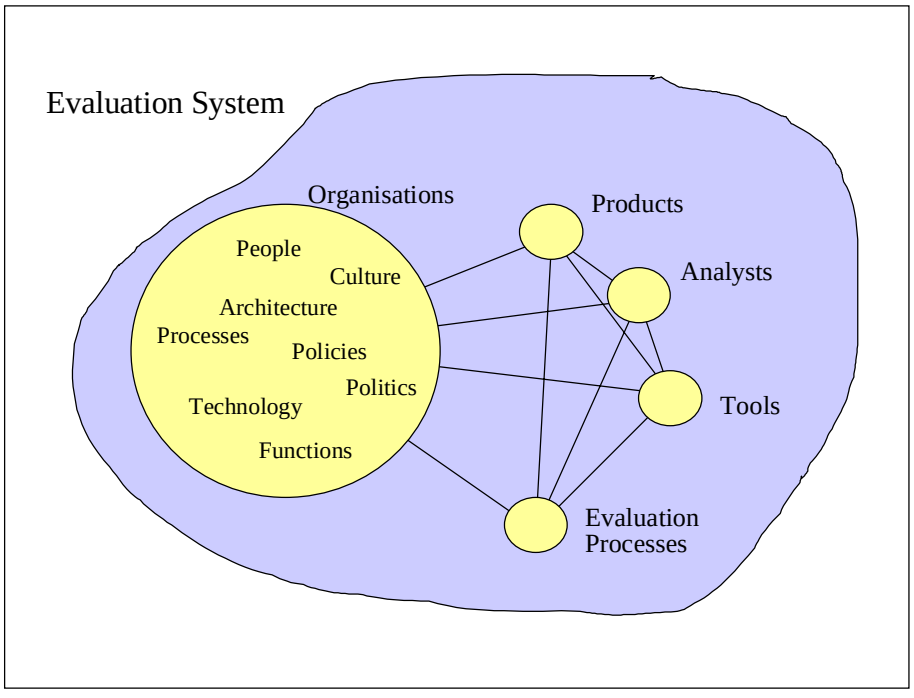

Figure 2: Evaluation System

3 Investigation Findings

An investigation into C3IOA Group's evaluation practices was conducted and several general issues that can impact on the effectiveness of an evaluation were identified:

- Military C2 organisations are complex socio-technical systems. As such, they are inherently difficult to evaluate using conventional operational analysis approaches.
- The influence of hard science (e.g. physics, engineering, and mathemetics) can introduce bias and taint evaluation results. Analysts need to guard against their own preconceived ideas of the world and how these ideas can influence or alter evaluation findings. Judgements based on past experiences instead of the facts at hand need to be avoided.
- Organisation culture, politics and social issues can influence military operations. The influence is often subtle, not easily recognised and difficult to measure. Ignoring, or only giving limited consideration to, these influences reduces the effectiveness of an evaluation.
- An intellectual framework, upon which evaluation practice is based, needs to be established. Without this framework, clear, definite, testable, and repeatable evaluation results will be difficult to achieve.
- Defining the scope of an evaluation is one of the most difficult tasks facing an analyst. Knowing what to measure is critical to evaluation success and many factors can influence the analyst in determining appropriate measures. These influences on the analyst can be self-imposed or external. The scope can be influenced as a result of customer bias, posturing, or strongly stated positions.
- The terms of reference for an evaluation agreed between the customer and the analysts can be broadly based and not contain a clearly defined purpose or premise. This makes the job of deciding what data to collect and analyse more difficult. Collecting too much data can make the analysis labour intensive, while collecting too little can make the analysis incomplete.
- There is a need for automated tools to improve the effectiveness and efficiency of data collection, analysis, and modelling activities, and some way needs to be found to overcome the security restrictions which limit the use of electronic data collection tools in some work areas.
- Many evaluations are a “snapshot” of an organisation and the full impact on the organisation is only partially known. At best, the evaluation findings are limited in time and scope to one part of the organisation. Although customers may agree with recommendations, the recommendations may not always be fully implemented. More needs to be done by analysts to develop mechanisms for feeding back information about the extent of the take up of recommendations by customers and the total impact that evaluations have on C2 organisations.
- Traditionally, the military customers have judged the quality of evaluation products. Although they are capable of determining relevance and timeliness, they are not always in the best position to judge accuracy, impartiality and completeness.

The issues relating to analyst training, analyst bias and influences, evaluation purpose, security restrictions, and customer feedback, can be satisfactorily addressed through ongoing review and correction during the planning and conduct of evaluations. However, the issues associated with the limited variety of evaluation approaches being used and the need for an intellectual framework upon which to base the evaluation work, need more than changes to the planning and conduct of evaluations if they are to be satisfactorily addressed in the long term.

The limited variety in the approaches by C3IOA Group to evaluation is evident from an examination of the issues arising from the investigation. C2 organisation complexity, the frames of

reference of the analysts and ADF customers, as well as organisation culture, politics, and social issues, all need to be better understood in order to be adequately addressed during evaluations. To improve this understanding a multi-disciplinary approach to evaluation practice is advocated. An Evaluation Research Model (ERM), which uses ideas from the Total Systems Intervention (TSI) approach (Flood and Jackson 1991) and supports the use of a variety of views from a range of different background disciplines, metaphors, and methodologies, is proposed. With a more comprehensive picture of C2 organisations, evaluations can be made more effective. The purpose and scope of evaluations will be more accurately defined, and more appropriate measures, ones that reflect the different ways of viewing an organisation, can be chosen.

4 Improving Evaluations

4.1 Approach

The concept of "model" is introduced and the difficulties associated with the use of traditional models are discussed. An alternative approach based on the TSI approach is developed and used as a basis for developing an ERM. The ERM that is developed is to be used to help in producing a variety of views that are suitable for use in the evaluation and analysis of military organisations.

4.2 Purpose

The purpose of the proposed approach is to improve the effectiveness of the evaluations of C2 organisations. The approach described will benefit evaluation practice by increasing the knowledge of analysts about themselves and the organisations that they evaluate. For the ADF customer, the quality of the product will be enhanced, the analysis will be more rigorous, and the credibility and impartiality of the recommendations will be improved. For the DSTO customers, it will increase the DSTO knowledge of evaluation methodologies and organisational concepts.

4.3 Models

A model is a representation that can be used to aid understanding and communicate ideas about a system (data flow models and entity relationship models are examples). A useful model includes those parts of the system that are important to understanding while leaving out the unnecessary details (Kaposi and Myers 1994). Deciding which parts of a system should be represented in a model requires knowledge of the intended purpose of the model.

A model can be viewed in different ways in order to gain particular insights into the system that it represents. For example, mechanical engineering drawings often use first angle and third angle projections to depict the different views of a system. The different views help to break down the complexity and give a richer picture. The larger the number of views, the richer the picture.

Figure 3 illustrates a system model derived from two views. The circles represent the system elements and the lines represent the relationships that exist between the elements. Relationships that exist between the system and the external environment are not shown. In the Figure, the elements A, B, and C are common to both views of the system model. The different views do not have to be consistent with each other, except where they overlap. However, those parts of the system model that are common to each of the views have an important significance. They

facilitate the language of communication and the development of shared understanding between the different views.

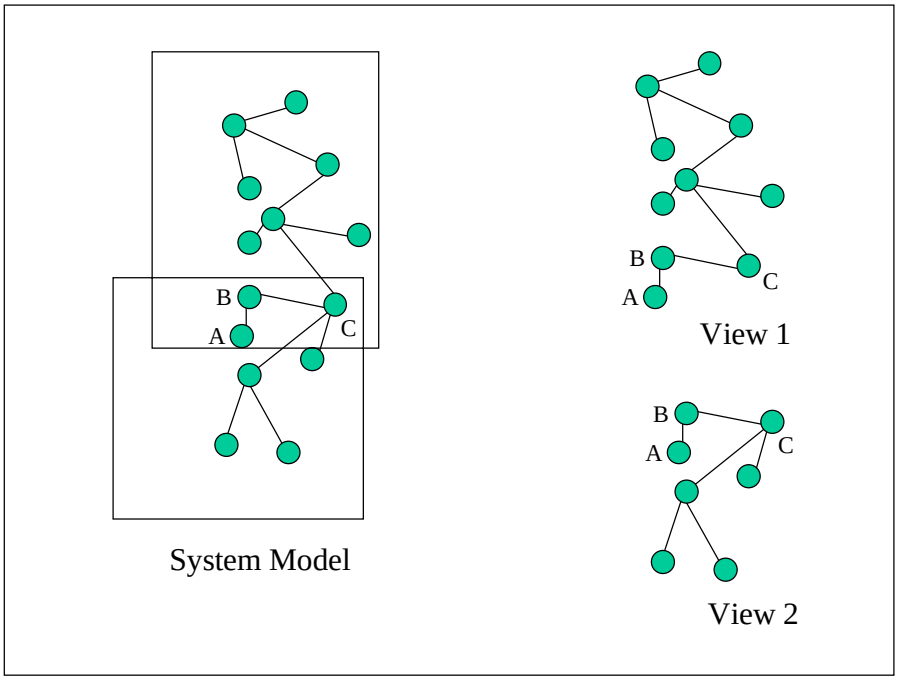

Figure 3: System Model with Two Views

4.4 C2 Organisation Models

C2 organisations are complex socio-technical systems. This complexity is due in part to the large number of heterogeneous elements and interrelationships that can exist within these systems. Modelling can assist analysts in understanding organisations by helping them to simplify and deal with C2 organisation complexity. Many different views are usually required (Kline 1995). As organisations are usually modelled using representative sets of elements and relationships, the choice of elements and relationships that are used will depend upon the purpose for which the model is intended. Typical organisation elements that are represented in organisation models are people, architectures, policies, procedures, processes, technologies, and functions. Simple organisation models (e.g. MIT 90, C4ISR) make use of some of these elements and these types of models go part of the way towards improving the understanding of organisations. However, they usually do not capture enough of the socio-technical details like culture, politics, and other social issues, to fully describe C2 organisations (Cook, Kasser et al. 2000). If these simple types of models were to be expanded to include more detail, they generally would become too complex and difficult to use, and their utility in aiding understanding would be reduced.

4.5 C2 Organisation Characteristics and Measures

The characteristics of a C2 organisation can be described in terms of its elements, internal relationships between the elements, and external relationships between the elements and the

environment. (Yates, Vernik et al. 1999). Each C2 organisation element has associated with it a set of attributes, or properties, that can be used to describe it. The attributes can often be measured by quantitative and/or qualitative means, although choosing which to use is not always a simple matter. These measures, or indicators, can be used to assess the value of attributes ascribed to particular C2 organisational elements and can help analysts to characterise and understand C2 organisations. The TSI approach can be used to assist with the selection of measures. The views derived from the different metaphors are helpful in determining which elements, attributes, and measures are of importance. Each view has its own set of measures. The views can help analysts to focus the questions that they ask and the observations they make, and they can help to scope the type and amount of data that needs to be collected.

4.6 C2 Modelling Tools

Although models can help analysts to understand C2 organisations, the models themselves can be quite complex. C2 organisations have many interacting, and often dynamic, elements. To be comprehensive, the models of C2 organisations that are used need to include these dynamic elements. However, even with the benefit of models, humans have difficulty in reasoning about C2 organisation complexity and change (Pew and Mavor 1998). For each analysis task, many different scenarios may need to be analysed, but dealing with the complexity using manual analysis processes can be onerous and relatively slow. Computer based modelling and simulation tools can assist analysts in analysing and reasoning about the static and dynamic nature of C2 organisations.

4.7 How Conceptual Models are used to Understand Organisations

One way of trying to understand an organisation is to develop a conceptual model of the actual organisation and compare that model with the conceptual model of an ideal organisation. The process of building and validating the models, and identifying the differences and similarities between them, can help to develop the analysts' understanding of actual organisations. Unfortunately, because of the intrinsic complexity of C2 organisations, specifying their characteristics and building and validating their conceptual models is difficult. However, the idea of comparing and contrasting things, even if they are complex, has merit. Flood and Jackson in their TSI approach have referred to some useful organisation comparisons that have been made. They compare certain aspects of organisation behaviour with that of the behaviour of machines and living organisms. Their approach identifies, selects and brings together the important attributes of a variety of models. The basis for this approach is that no single model that can describe all the relevant aspects of an organisation has been developed. Currently, the best that can be done is to accommodate the different views using a selection of different models. An approach for developing a single model that adequately describes organisations could be the subject of further operational analysis research.

4.8 Metaphors

The TSI approach expands on the idea of comparison through the use of metaphors. Metaphors describe the systemic properties of the system under study by evoking the systemic properties of other well-known systems. Well chosen metaphors can help analysts to use the knowledge gained

from the analysis of other types of systems (from various fields) to help them in analysing organisations. Flood and Jackson have identified five metaphors that support a large number of organisational concepts: machine; organic; neurocybernetic; cultural; and political. This list covers many of the aspects of modern organisations, but is not exhaustive, and other metaphors can be used. The TSI approach makes recommendations regarding the suitability and application of each of these different metaphors. There is no restriction on the number of metaphors that can be used to describe an organisation, however, according to Flood and Jackson, most organisations can be described adequately with one or two predominant metaphors. In their description, a model of an organisation that provides a more systemic view of the organisation can be created using the views built with the aid of the different metaphors. This model, built from several views, will provide a much richer picture than is available using only one view.

4.9 Methodologies

Although metaphors can help in identifying the different views that can be used to help to characterise an organisation, these metaphors still need to be applied to the organisational situation under investigation. The TSI approach is a meta-methodology that can be used to help analysts to select from a range of methodologies that can be used in conjunction with the metaphors. Some better known methodologies that can be used are:

- Operations research.
- Systems analysis.
- Systems engineering.
- Systems dynamics.
- General system theory.
- Social systems design.
- Soft systems methodology.
- Interactive planning.
- Organisational cybernetics.
- Strategic assumption surfacing and testing.
- Critical systems heuristics.
- Contingency theory.

There are several factors that need to be considered before choosing an appropriate methodology(s) if the process of selection is not to be ad-hoc. The TSI approach provides some advice on how to select and apply the methodologies.

4.10 Evaluation Research Model

An Evaluation Research Model (ERM) is proposed by the authors that uses an intellectual framework based on a range of different metaphors and methodologies that can be used in conjunction with one another. The ERM is to be used to develop models of military organisations that can be used during evaluations. The relationships between the different elements of the model are shown in Figure 4. The elements of the ERM are represented by filled in circles grouped into four categories: analysts; metaphors; methodologies; and organisations. Analysts evaluate organisations with the aid of appropriate metaphors and methodologies. The particular views that

are chosen as the basis for the intellectual framework determine the type of metaphors that are most appropriate for a given class of problem. For example, certain types of social interactions that exist in an organisation can best be captured using a cultural metaphor. The Checkland Soft Systems (Checkland 1993) approach may be an appropriate methodology that can be used to apply the ideas embodied in the cultural metaphor.

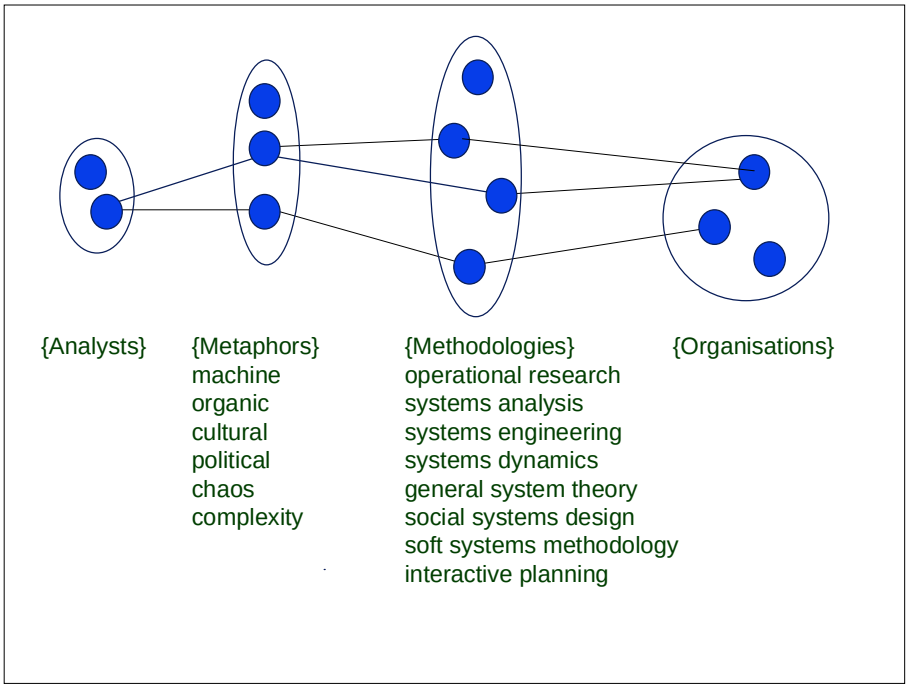

Figure 4: Evaluation Research Model (ERM) (based on TSI Approach)

The TSI approach gives some guidance on how metaphors and methodologies can be selected and applied to organisational problems. However, further work is required in order to refine the TSI approach so that it can be more readily applied to the analysis and modelling of C2 organisations.

4.11 Related Approaches

The TSI approach is a meta-methodology that is useful for selecting different views of organisational architectures. However, there are other multi-methodology approaches that have also proved to be useful and these deserve further investigation, for example, the multi-methodology approach for combining management science methodologies proposed by Mingers (Mingers and Gill 1997). Future work will need to be cognisant of the contribution made by these other authors.

5 Conclusions

This paper discusses the results of an investigation into C3IOA Group evaluation practice and it proposes an approach that can be used to improve evaluation effectiveness. The results of the investigation showed that although current evaluation practice is effective in helping the ADF decision making process it has limitations when applied to complex socio-technical systems such

as C2 organisations. The paper identified a range of issues that need to be addressed in order to improve C3IOA Group evaluation practice. Some of the issues can be addressed through the use of better evaluation task management and control techniques. Other issues, mainly related to the limited variety of the evaluation approach and the need for more analysis, modelling, and scientific rigour, require a more effective approach to be devised and adopted. The Evaluation Research Model outlined in this paper is proposed as a way of providing a path towards more effective evaluations.

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