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*Representing and approaching complex management issues:*
*Part 1 - Role and definition*

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# Contents

## Acknowledgements

## Abstract

The complex issues faced by management researchers can be described in many ways. However, this richness and variety can lead to a confusion of language. The paper confronts this issue by discussing the manner in which complex management concepts can be represented and approached. It proposes definitions for various related terms: paradigm, system, framework, map, model, process, procedure, technique, and tool. These definitions are presented from the perspective of manufacturing systems management, although they may be widely applicable in other fields. Dimensions for classifying and relating these definitions are identified based on a number of key characteristics. The forthcoming second part of this paper focuses on the development and validation of frameworks, as they play a central role in the research of management issues.

# Glossary

The following 'representations' are concerned with the conceptualisation of management issues.

| Representations | Definitions |
| --- | --- |
| System | A system defines a set of bounded interrelated elements with emergent properties and represents it within the context of a paradigm. |
| Framework | A framework supports understanding and communication of structure and relationship within a system for a defined purpose. |
| Map | A map supports understanding of the static relationship between elements of a system. It is a representation of discrete features and not averages. |
| Model | A model supports the understanding of the dynamic interaction between the elements of a system. |

The following 'approaches' are concerned with practical (applied) problem solving in the management context.

| Approaches | Definitions |
| --- | --- |
| Process | A process is an approach to achieving a managerial objective, through the transformation of inputs into outputs. |
| Procedure | A procedure is a series of steps for operationalising a process. |
| Technique | A technique is a structured way of completing part of a procedure. |
| Tool | A tool facilitates the practical application of a technique. |

# 1.0 Introduction

## 1.1 Background to paper

Management researchers make use of frameworks as a means of representing complex issues. There is, however, no universal agreement as to what constitutes a framework. This is further complicated by the use of such terms as models, paradigms, tools, and techniques without clear definition. Another source of confusion is that frameworks are used within various disciplines, often with differing purposes and styles of presentation.

A considerable proportion of management research within the Institute for Manufacturing centres on the development and testing of frameworks, involving the use of practical cases. A working group was set up within the Institute to explore the various issues surrounding the development and testing of frameworks, and to define a collective view of the terminology and approach.

This paper integrates the outputs of the group and additional insights from the literature dealing with frameworks, which is scarce. This paper reviews literature on research methodology, general management philosophy and skills, systems thinking, and methods for graphical representation.

## 1.2 Purpose and structure of paper

This paper aims to give the reader an insight into a variety of issues surrounding management 'representations' and 'approaches', with a particular emphasis on frameworks. Management representations are ways of depicting management issues or problems. Management applications are ways of implementing concepts contained in management representations. Various forms of representations and applications are classified based on two dimensions: applied-conceptual and static-dynamic, defined as follows (See Fig. 1):

- Conceptual: concerned with the abstraction or understanding of a situation

- Applied: concerned with concrete action in a practical environment

- Static: Concerned with the structure and position of elements within the a system

- Dynamic: Concerned with causality and interaction between the elements of a system

The dimensions can be used to structure and understand the meaning of key terms: system, framework, map, model, process, procedure, technique, and tool (See Fig. 2), which will be discussed in more detail in the following sections. Representations are governed by paradigms. Paradigms describe the established assumptions, and conventions which underpin a particular perspective on a management issue, and may be best described as schools of thought. In order to present a logical development of the definitions, the paper begins by reviewing the role of paradigms.

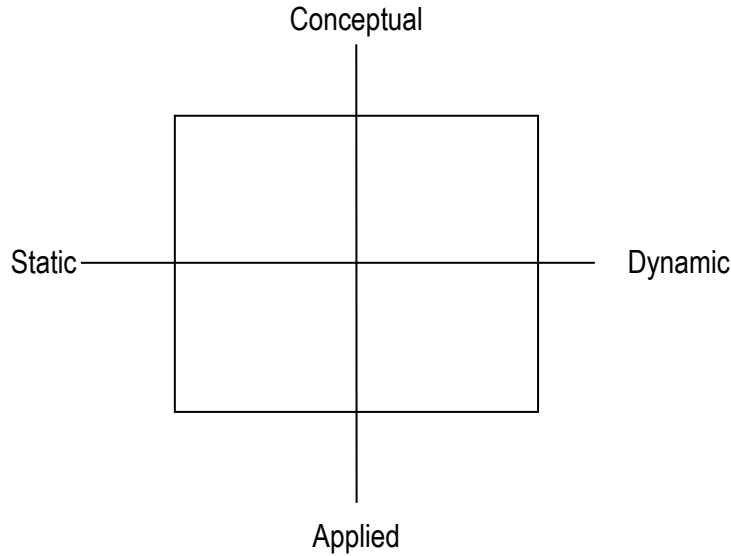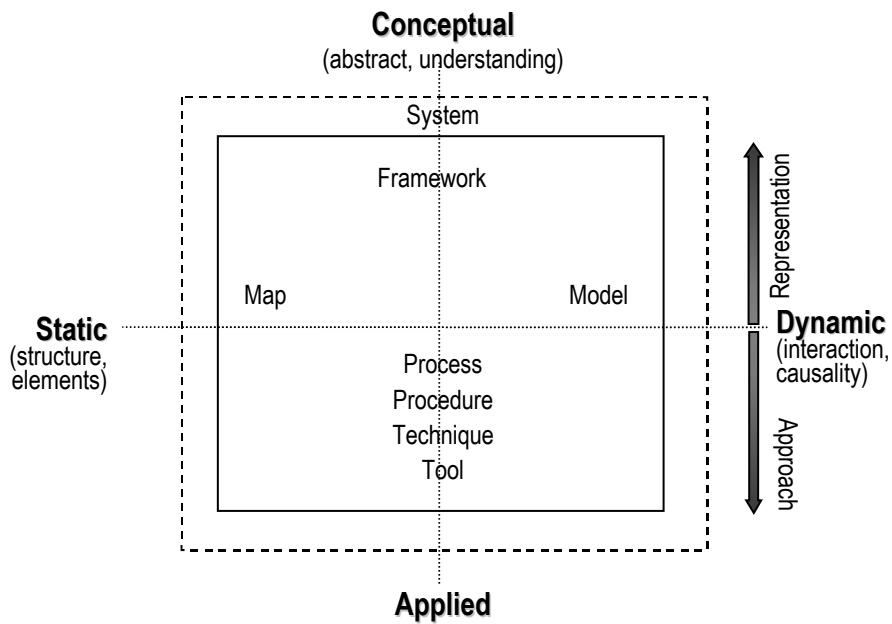*Fig 1: Dimensions for categorising management representations and management applications*



*Fig. 2: Management representations and approaches in context*

The application of these ideas is illuminated by the use of an example on manufacturing strategy formulation work by Platts and Gregory (1990)[1].

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[1] A more detailed explanation can be obtained in their practical workbook 'Competitive Manufacturing' (ISBN 1-85423-010-7)

## 2.0 Paradigm as a school of thought

Paradigms are commonly used to define, at a highly abstract level, the conceptual foundations that underpin understanding of an issue. The degree of abstraction of a paradigm can be observed in Guba's (1990) broad description: 'a basic set of beliefs that guides action, whether of the everyday garden variety or action taken in connection with a disciplined inquiry'. A paradigm is a way of thinking or cognition based on a particular context. The type of context may be influenced by 'a basic set of beliefs'.

The term has been used to form such phrases as the macro-economic paradigm, the socialist paradigm, and the change paradigm. Thomas Kuhn (one of the first people to discuss the idea paradigms), regards paradigms as patterns of scientific knowledge which evolve over time (Kuhn, 1962). The key term, 'pattern', appears to be used to describe presumptions which have withstood scrutiny or testing and therefore have emerged as established concepts (Arbnor *et al.,* 1997). The evolution or shift in the pattern is commonly referred to as a paradigm shift.

Paradigms are a collection of perceptions that form a conceptual guide, and can be used as a source of reference for further action (Choi, 1993). These perceptions define the boundaries and the context of the situation under study.

Incorporating these views, this paper defines a paradigm as follows:

> A paradigm describes the established assumptions, and conventions which underpin a particular perspective on a management issue.

**Example:**

*The paradigm in the manufacturing strategy formulation work is typified by the rational, normative view of strategy making. It embraces the view of strategic planning based on rational analysis.*

# 3.0 Means of Representing Management Issues

## 3.1 Understanding 'systems'

A system is a holistic representation of a situation (Starr, 1996). It is a 'collection of elements that represent the relatively fixed parts of the situation, at the finest level of analysis that we want to go to' (Carter *et al.*, 1984). Arbnor *et al.* (1997) define a system as 'a set of components and the relations among them'. Similarly, Checkland (1993) asserts that a system is comprised of elements which are connected to form a whole. A key characteristic of a system is that it exhibits emergent properties[2]. A system is only meaningful when it is viewed in the context of the 'whole' rather than its constituent parts.

A system is a representation of how a particular situation functions rather than how it should function. It could represent the key features of the situation and how they are related. The interpretation of a problem or a particular feature within the situation may depend on the perception of the individual analysing the system (Jennings and Wattam, 1994).

Building on these definitions, this paper defines a system as follows:

> A system defines a set of bounded interrelated elements with emergent properties and represents it within the context of a paradigm.

**Example:**

*In the strategy formulation work, the system under consideration is the manufacturing business. The identification of a focus (i.e. manufacturing business) helps to establish the associated boundaries, elements and relationships.*

## 3.2 Understanding 'frameworks'

### 3.2.1 What is a framework?

Miles and Huberman (1994) provide the following description of a conceptual framework: 'A conceptual framework explains, either graphically or in narrative form, the main things to be studied – the key factors, constructs or variables – and the presumed relationships among them. Frameworks can be rudimentary or elaborate, theory–driven or commonsensical, descriptive or causal'.

The Longman Dictionary of Contemporary English (1995) provides a related description of a framework: 'a set of facts, ideas etc. from which more ideas are developed, or on which decisions are based'. It is interesting to note that five business and management dictionaries were referred to, but none had a definition for a framework.

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[2] The principle that whole entities exhibit properties which are meaningful only when attributed to the whole, not to its parts (Checkland, 1993).

The above descriptions are not mutually exclusive, and appear to match with the characteristics of most existing management frameworks. However, a standard definition does not exist. A broad review of literature reveals that authors report their own frameworks without clearly defining what they mean by a framework.

The following common themes have been extracted from the discussions that have taken place within the Institute for Manufacturing concerning frameworks. A framework may:

- represent an issue for a defined purpose

- link various elements to show a relationship

- enable a holistic view of a situation to be captured

- demonstrate a situation or provide a basis for solving a problem

- provide a structured approach to dealing with a particular issue

The form of framework depends on particular purpose, and clear articulation of purpose supports framework development. Therefore, many frameworks may exit within the domain of a system.

This paper incorporates the key themes from literature, and defines a framework as follows:

A framework supports understanding and communication of structure and relationship within a system for a defined purpose.

**Example:**

*The manufacturing strategy framework links manufacturing decision areas to performance criteria. The defined purpose in this example is to support the formulation of manufacturing strategy, by structuring the links between decisions and performance. It provides a structure for identifying the areas of strategic choice, and a categorisation of manufacturing performance.*

It is important to note the major themes in the definitions as they are useful references for identifying a framework. One should not to be too pedantic about precise definitions.   It is hoped that the definition adopted in this paper will provide a common understanding of frameworks.

### 3.2.2 Types of frameworks

Frameworks differ in their purpose, and style of presentation. It is possible to classify frameworks by positioning them on a two dimensional axis representing the two key areas of variation.

The purpose of a framework can be to:

- describe how a particular objective can be achieved (Know-How), or

- depict what a particular situation is (Know-What)

The style of presentation of frameworks differs widely. A key variation is that some frameworks present a single-layer of analysis (e.g. a strategic layer), whilst others present multiple-layers of analysis (e.g. strategic and operational layers).

It must be noted that some frameworks may not fit neatly into some of the above categories. For example, a framework may be developed with the purpose of partially describing know-how, and partly describing know-what. These frameworks may be termed hybrid-frameworks.

### *3.2.3 Uses of frameworks*

Frameworks are increasingly used within the management discipline as a way of translating complex issues into a simple and analysable format. In particular, their use has been to:

- Communicate ideas or findings to the wider community, from academic to academic, or from academic to industrialist

- Make comparisons between different situations/approaches

- Define the domain or boundaries of a situation

- Describe context or argue validity of a finding

- Support development of procedures/techniques/methods and tools (see definition in section 4.2)

Popper (1996) opposes the idea that a common framework is a prerequisite for facilitating communication and discussion between people with different viewpoints. However, he accepts that if there is a common framework, the discussion will be easier and better understanding between the participants is likely. His contention is that a discussion between participants who share basic assumptions or fundamental principles is less likely be fruitful, than when viewpoints differ. Thus, in Popper's terminology, 'framework' is used to reflect the underlying assumptions (i.e. paradigm). In terms of management frameworks, as defined in this paper, the focus is on facilitating communication and understanding between participants who may have different perspectives. As Popper asserts, different perspectives do not preclude fruitful communication and understanding; it is important to acknowledge that these different perspectives exist.

Most management frameworks are displayed in graphical or diagrammatic form. This is a highly effective means of communicating ideas. It is difficult to explain a concept or reason without having a visual understanding its constructs (Rodgers, 2000). As Rodgers (2000) puts it 'the first step in solving most problems…is to visualise the various components of the problem and their relation to each other'.   He explains how a simple diagram that can be seen with the eye can focus the thinking and stimulate the development of a mental image of the problem. This is indeed what a framework facilitates, i.e. abstraction and conceptualisation of a problem or situation.   This notion is further supported by Gardner (1958) who discussed the benefits of logic diagrams as a valuable means for clarifying and solving logical problems. In 1958 he predicted the contribution that such diagrams make in supporting problem solving. The truth of this prediction is now evident in the field of management where diagrammatic representation often used as an important means of communication.

Some would argue that a diagrammatic form of representation, such as that of a framework, is not rigorous enough for communicating in-depth concepts nor supporting formal arguments. Balbiani

and Cerro (1999) dismisses this proposition and suggest that diagrams can be used for formal arguments so long as their purpose is clearly defined and semantics clearly understood. Rodgers (2000) explain that whilst diagrams support the understanding of words, words are necessary to describe the foundations of the diagram. In practice, most management frameworks are accompanied by some form explanatory text.

Holyoak (1990) identify 'perception', 'language', 'categorisation' and 'sequencing of actions' or relationships, 'memory', 'judgement', and 'choice' as key ingredients for problem solving. A framework clearly represents categories and relationships, and is based on a particular perception or paradigm. The language of most management frameworks is in the form of symbols. The user of the framework applies memory, judgement, and choice, perhaps by the utilisation of a particular approach (see discussion on approaches in section 4.0).

### 3.3 Understanding 'maps'

Maps are commonly used as a means of representing a snapshot of the relationship between various elements of a system. Unlike some frameworks, maps do not show the causal relationships between the elements. Maps also tend to be less conceptual than frameworks.

Maps show the spatial or positional relationships between the elements. For example, a world atlas does not show how to travel from one place to another, it merely shows the location of different places in relation to each other. Another key feature is that, maps represent discrete features but not averages. For example, hills are not averaged with valleys to represent sea level in a geographical map.

Mathematicians use 'mapping' to relate a single variable to a second single variable. For example, $y = f(x)$, can be written as f maps x$\longrightarrow$ y. The element that is to be related is called 'the domain' (i.e. x) and the element to which it is to be related is called 'the range' (i.e. y). It is important not to confuse the difference between 'map' and 'mapping'. The concept of mapping is related to causality, i.e. x$\longrightarrow$ y. However, the existence of a map does not imply existence of an inverse mapping, i.e. x$\longleftarrow$ y.

Maps enable management researchers to link various elements of a situation in terms of position and structure, and present it in a holistic (systems) way. An example of this use of mapping can be found in research into technology roadmapping (Probert and Shehabuddeen, 1999).

In making the distinction from frameworks, this paper defines a map as the following:

> A map supports understanding of the static relationship between elements of a system. It is a representation of discrete features and not averages.

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**Example:**

*Maps could be used at various stages in the strategy formulation work, for example, to describe a product portfolio.*

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## 3.4 Understanding 'models'

Models are widely used by both management, and pure and applied science researchers for simulation purposes. Their use in the management discipline has been apparent in the field of management science, chiefly for the purposes of estimation, forecasting, and decision making. Anderson *et al.* (1991) state that 'Models are representations of real objects or situations. These representations, or models can be presented in various forms'. He categories three types of models: 'iconic' models that represent 'physical replicas of real objects'; 'analog' models that are 'physical in form', but 'do not have the same physical appearance as the object being modelled' (e.g. 'a thermometer ….. representing temperature'); 'mathematical' models that 'represent a problem by a system of symbols and mathematical relationships or expressions'. Their definitions identify 'representation' as the key characteristic of a model. However, frameworks also 'represent' particular issues, so how do models differ from frameworks? The following definitions contain some useful indicators for answering this question.

A key feature of a management science model is that it represents an abstraction of a situation, and may be displayed in graphical form or may contain mathematical relationships (Taylor, 1996). In other words, a model is a dynamic representation of a system under study, and therefore does not in itself explain how a system should operate (Jennings and Wattam, 1994). It can be used to determine how a system would operate if an element of the system was to change. For example, a computerised journey planner (e.g. AA Route Finder) can be used to calculate the time it would take to travel from one location to another by taking the 'shortest route' (i.e. shortest distance). If the user changed the option from 'shortest route' to 'fastest route' then the travel time will change.

A model may be viewed as an abstraction of reality (Eppen *et al.*, 1987). Modelling is undertaken because the real world is too complex to understand. Therefore several variables and the dimensions are ignored. Only a subset that are significant are retained. It is necessary to simplify complexities if representations are to be clear and comprehensible (Chernoff, 1978). de Bono (1998) explains that it is desirable to simplify rather than cope with complexity provided that 'the unity of the overall purpose is not lost'.

Harding and Long (1998) include the following themes in their description of models:

- 'A model is a *dynamic representation* of reality'
- It 'aim to clarify a *relationship* between different elements indicating causal and effective interaction'

It is clear from these definitions that models, in addition to 'representation', are dynamic in nature, depict reality, show relationships, and enable the prediction of the impact that a change in a variable element of the model may bring. It is clear that the characteristics of a model form part of the characteristics of a framework, although the reverse is not necessarily true. It would be reasonable to conclude that a model is a particular type of framework.

It is true that researchers have used the term 'model' to imply static representation (e.g. model of an aeroplane) but this paper proposes that a model should only be used for dynamic representations as maps are used for static representations.

This paper incorporates the key themes from literature, and defines a model as following:

A model supports the understanding of the dynamic interaction between the elements of a system.

**Example:**

*A model was not developed in this example. However, a typical model could depict the major impacts on decision area(s) if one or more performance criteria were to change.*

# 4.0 Means of approaching management issues

This section attempts to identify the commonly used management approaches for applying management concepts. These are positioned within a wider context, improving understanding of how they relate to each other.

It should perhaps be noted at this point, that the term 'methodology' is frequently misused to mean a composite of process, technique, tool, etc. However its true meaning is the study of method, where 'method' encompass the approaches described in this paper.

## 4.1 Understanding 'process'

Gregory (1995) in his work on technology management processes, asserts that 'management processes are the explicit or implicit routines that determine how key decisions are made within a business. Typically such decisions will require an input of data and perceptions from various parts of the business and will not normally be amenable to straight-forward mathematical modelling'. He identifies a business process as being distinct from the conventional functional grouping of a firm.

Platts (1993), in his work on manufacturing strategy formulation, uses 'process' to describe the way of achieving a particular objective - formulation of manufacturing strategy in this instance.

A process transforms inputs into outputs (e.g. Ellis, 1997; Smith, 1997). In a traditional manufacturing process, inputs could include raw materials, labour, and energy and outputs could be products. This idea of transformation can also be extended to other softer issues. For example, Khalil (2000) describe the process of technological innovation as ' a complex set of activities that transforms ideas and scientific knowledge into physical reality and real-world applications'. Similarly, a research process could describe how initial ideas transform into substantiated new knowledge. Other examples of 'transformation' can be found in business process re-engineering literature. Hammer *et al.* (1993) define a business process as 'a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer'. Harrington (1997) define it as 'a logical, related, sequential (connected) set of activities that takes an input …..and produces and output'.

A composite of these definitions follows:

> A process is an approach to achieving a managerial objective, through the transformation of inputs into outputs.

**Example:**

*The process to support the formulation of a manufacturing strategy takes managers through the transformation of information concerning the manufacturing business (market requirements, current performance) into an action plan (how to close the gap between required and achieved performance).*

## 4.2 Understanding 'procedure', 'technique', and 'tool'

Platts and Gregory (1990) view a procedure as the stages, or steps in a process. The term has been used synonymously in other fields, e.g. surgical procedure (steps involved in the surgical process), programming procedure (steps that a software programme will execute at run time).

The terms tools and techniques have been used interchangeably, leading to confusion about their difference in meaning (Farrukh *et al.*, 1999; Brady *et al.*, 1997). Farrukh *et al.* (1999) attempt to distinguish between tools and techniques, as follows: 'Tools tend to be aimed at carrying out a particular analytical task, whereas techniques are usually methods or procedures for achieving a particular activity'. Brady *et al.* (1997) define tools more broadly: 'a management tool could be a document, a framework, procedure, system or method which enables a company to achieve or clarify an objective'.

Dale *et al.* (1998), in their discussion on quality management techniques and tools, make the distinction that tools have a clearly defined application, whereas techniques are broader in their application and requires some conceptual and skill input for their effective utilisation. They illustrate this difference by explaining that statistical process control (SPC) is a technique and the control chart used to record the data is a tool.

One may extract from these definitions that a procedure is a series of steps, a technique is a way of accomplishing a procedure, and a tool is something that can be used to apply a technique. The following definitions reflect these views:

A procedure is a series of steps for operationalising a process.

A technique is a structured way of completing part of a procedure.

A tool facilitates the practical application of a technique.

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Example:

*The strategy formulation process comprises a number of steps, which the participants are required to follow. These series of steps represent a procedure.*

*Within one step of the procedure the participants may need to complete a particular activity or task. This will require the application of a technique.*

*The first part of the strategy process includes a technique to illustrate the need for a strategic review. This requires the plotting of market and performance profiles and overlaying them. The technique utilises a tool, a worksheet, to facilitate this. The application of the tool (the worksheet) demands a certain amount of skill for success. It is the skilful application which constitutes the technique.*

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The following diagram places the above management representations and approaches into context, demonstrating the relationship and flow of knowledge between them (see Fig. 3). Based on this contextual understanding of representations and approaches, the second part of this paper is already being prepared to explore how frameworks may be developed and validated.

**Conceptual**
(abstract, understanding)

System

Framework

Map

Model

Process
Procedure
Technique
Tool

Induction

Induction

Deduction

Deduction

Representation

Approach

**Static**
(structure,
elements)

**Dynamic**
(interaction,
causality)

Know-what
Know-where
Know-who

Know-why
Know-how
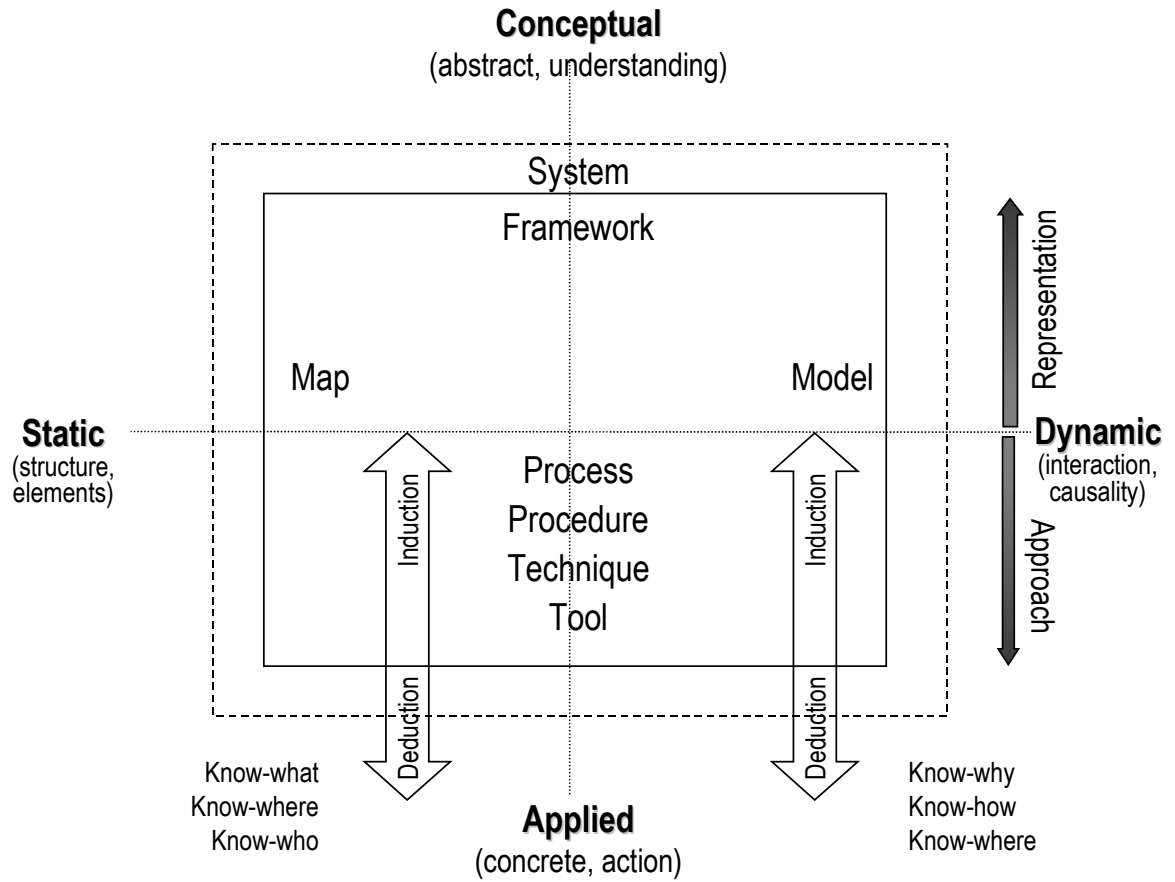Know-where

**Applied**
(concrete, action)

*Fig. 3: Management representations and approaches in context (with knowledge flows)*

## 5.0 Conclusions

This paper has explored the various ways in which management issues are conceptualised and applied. It has presented a critical discussion on how these relate to each other and proposed some coherent definitions. The complexity of management issues results in the use of a great variety of representations and approaches. They include those that define the boundary of analysis of a situation, that represent the causal or positional relationship between the elements of a situation, and that describe, with varying level of detail, how a concept might be applied.  Two key dimensions for categorising these have be identified. They are: conceptual-applied, and static-dynamic.  These dimensions are also useful for checking the completeness of the representation or approach developed.

A major contribution of the paper has been in clarifying the confusion surrounding the way in which these management representations and approaches are utilised. Some would argue that these terms are socially negotiated, i.e. their meanings evolve through their use and therefore one should not attempt to define them. However, it is clear from the discussion presented in the paper that a consistent and common understanding of these terms is crucial for effective communication.

The definitions, along with the descriptions presented in this paper, provide a basis for developing a common understanding and communication between the researchers.

The relative lack of literature concerning frameworks was noticeable. This paper provides the basis for further research and discussion of framework ideas, and the way for developing a better-shared understanding.

The definitions in this paper have provided a basis for developing a deeper understanding of how frameworks may be developed and validated.

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