

THE UNIVERSITY OF HULL

**The Application of Organisational Cybernetics to the
Design and Diagnosis of Financial Performance
Management Systems**

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by

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Abbreviations

Abbreviation	Term
A&P	Advertising and Promotions
BB	Beyond Budgeting
BSC	Balanced Scorecard
BT	Business Team
CAS	Complex Adaptive Systems
CFO	Chief Financial Officer
CS	Complexity Science
CSS	Cybernetically Sound System
CT	Contingency Theory
DPM	Dynamic Performance Management
FLT	Foods Leadership Team
FPMS	Financial Performance Management Control System
GST	General Systems Theory
LOC	Levers of Control
LORV	Law of Requisite Variety
MCS	Management Control System
PCT	Perceptual Control Theory
PPBS	Planning, Programming and Budgeting System
PTP	Pre Tax Profits
RAPM	Reliance on Performance Management
ROE	Return On Equity
SD	System Dynamics
SFI	Sante Fe Institute
SSM	Soft Systems Methodology
SvH	Svenska Handelsbanken
S&OP	Sales and Operations Planning
TC	Transaction Cost economic theory
TQM	Total Quality Management
TS	Team Syntegrity
UPF	Unilever Poland
VSM	Viable Systems Model

The Application of Organisational Cybernetics to the Design and Diagnosis of Financial Performance Management Systems

1 Background

1.1 Introduction

The object of this study is the processes that govern the flow of financial resources around an organisation. This is addressed in the context of the need for organisations to survive and prosper in an uncertain and dynamic world. Specifically, interest is focussed upon the mechanisms responsible for its ability to respond in an appropriate way to environmental disturbances in the short term and adapt to changes in the pattern of environmental disturbances over the longer term. The aim is to identify how this process is carried out and what implications this might have for the efficient and effective design of an organisations and practices and procedures.

These are fundamental issues for any sort of social organisations. However, over the last fifty years a body of knowledge has accumulated – often described as systems theory¹ – which seeks to identify and codify the principles that underpin all forms of organisation, whether it is sociological, biological or psychological. Advocates of systems theory claim that invariant principles can be applied, and knowledge transferred, across phenomenological domains.

¹ In this thesis, the term 'systems theory' is used to describe the corpus of rigorously defined knowledge about systems: the output of 'systems scientists' working in the field of 'systems science'. 'Systems thinking' describes all approaches which adopt an explicitly holistic perspective, in contrast to the reductionism of classical science. This includes system science, but also other approaches that do apply the same degree of 'hard' scientific rigour. System thinking should not be confused with the use of the word 'system' in a loose descriptive way, e.g. 'Management Control System'.

In academia, the study of the mechanisms that govern the flow of financial resources has received considerable attention. The study of Management Control Systems (MCS) in general and budgeting in particular is one of the most densely populated fields of accounting academic research. There has, however, been a surprisingly limited amount published on the application of systems theory to financial control processes.

The broad issues that this thesis seeks to address are therefore:

- What principles and concepts from systems theory can be applied to study of the management of financial resources in organisations?
- How might they contribute to knowledge and understanding of such systems?
- How can they be used to design and operate systems in practice?

1.2 Rationale

Virtually all social organisations, other than those that rely exclusively on volunteers time and effort, need a process to manage and direct the flow of financial resources in order to survive and help achieve their objectives. This applies whether the stated objective of the organisation is explicitly that of economic gain, as in the case of a publicly quoted company, or some other purpose, in the case of an educational establishment or charity, for instance. If an organisation runs out of money it will perish in the short term. If money is used inappropriately or ineffectively it will not achieve what it sets out to achieve and is likely to perish in the longer term. In other words, the existence of an adequate process for directing the flow of financial resources is a necessary but not sufficient condition of survival and effective operation for most social organisations.

For most of the last century the most common approach used by organisations in developed countries to regulate the flow of financial resources has been the process of budgeting. The introduction of budgeting into management practice is usually credited to the General Motors Corporation in the early 1920's (Johnson and Kaplan, 1987), and its spread to the adoption of the divisional form of organisation and the

work of business schools and management consulting firms in the years after the end of the Second World War. Today, for many large organisations, budgeting and its related practices are one of their most important business processes.

Despite the scale of change in the world in general, and business in particular, the set of practices used has changed very little since the early years of the 20th century. The arrival of computers, for instance, does not seem to have had a significant impact on the nature of the procedures used (Hope and Fraser, 2003), (Neely et al., 2001). The extensive use of information technology has mainly impacted the scale, speed and cost of operating budgeting processes rather than their form.

There have been attempts to reform and improve budgeting practices (Amey, 1979, Maciariello, 1984), (Kaplan and Norton, 1992), (Simons, 1995) but they have largely been directed at supplementing or improving the effectiveness of the conventional process rather than changing the approach altogether. Few of these innovations have been extensively incorporated into standard practice. Only in recent years has there been a serious challenge to some of the principles on which budgeting is founded, such as fixed annual targets (Hope and Fraser, 2003), but it is too early to say whether this innovation will be any more successful in changing management practice than its predecessors.

Notwithstanding its ubiquity, and its resilience in the face of a changing world, the practice of budgeting has been subject to criticism virtually ever since it first appeared in the management repertoire. In the 1950's Agyris (1952) reported on problems of employee dissatisfaction associated with budgeting, and related behavioural problems have been extensively researched over the intervening 50 years (Hartmann, 2000, Hopwood, 1973, Otley and Fakiolis, 2000).

Problems with the dysfunctional behaviour engendered by budgeting practices are also recognised by the practitioner community. Also of concern, however, is the level of bureaucracy and cost associated with the administration of budget based planning systems and their inflexibility in the context of a world that is changing rapidly, and where the ability to respond quickly is at a premium. Neely et al. (2001) cite a long

list of problems commonly associated with budgeting, and these findings have been corroborated by other surveys of the practitioner community (Answerthink, 2003).

Given the pivotal role of budgeting in the management and control of organisations, and the scale and nature of the dissatisfaction with current practice, budgeting and related topics have, unsurprisingly, been amongst most extensively researched fields in management accounting. Around 70% of all articles published in relevant journals are on the subject of control (Hesford et al., 2007). Despite this, many authorities argue that little progress has been made in building a body of knowledge (Briers and Hurst, 1990, Otley, 1980). In particular, despite a continued stream of research aimed at providing a framework for study (Hesford et al., 2007), it lacks the solid body of theory needed to direct research and help explain its findings (Chapman, 1997, Ferreira and Otley, 2009, Fisher, 1995, Malmi and Brown, 2008, Zimmerman, 2001). According to Schwaninger (2001,1213) the existence of a jungle of alternative theories is an indicator of the immaturity of a science. Puxty concludes that “accounting still has a long road to travel in its search for truth and method” (Puxty, 1993,133). There has also been little association with, and contribution to, management practice on the ground (Berry et al., 2009, Covaleski et al., 2003, Hartmann, 2000, Hopper et al., 2001, Hopwood, 1978a, 1978b, Kaplan, 1984, Spicer, 1992).

Following the approach suggested by Hopper and Powell (1995), rather than attempting to create a new theory, the goal of this thesis is to determine whether theories derived from related disciplines can profitably be applied to the study of regulating financial flows in organisations and, if so, whether they can help develop a framework for organising and integrating the corpus of existing findings, stimulate and direct new research work and inform the development of new management practices. Specifically it will focus on systems science as a potential source of theory.

Systems science is a transdisciplinary field of inquiry that was explicitly acknowledged as a subject of study in the years after the Second World War, stimulated in particular by the work of von Bertalanffy in promoting General Systems Theory (Von Bertalanffy, 1972, 1968) and the Macy Conferences held between 1943

and 1953 that promoted and explored Cybernetic ideas and concepts (Heims, 1991). While systems science has not become established as an independent academic discipline, as many of its founders and early enthusiasts had hoped, many of its ideas have been assimilated into, and have enriched, existing disciplines (Heylighen and Joslyn, 2001). The need for serious transdisciplinary academic research into problems of complex organisations has not gone away, however. It is currently undergoing something of a renaissance in the guise of complexity science (Gribben, 2002, Holland, 1995a, Prigogine, 1985, Waldrop, 1992, Watts, 2003). This new endeavour has been stimulated by the development of research methodologies using cheap and plentiful computing power, which has made it possible to investigate and simulate the behaviour of large complex systems made up of individual agents. In addition, there is a recognition that reductionist science - conducted within tight disciplinary boundaries - as successful as it has been, cannot answer many of the more profound and pressing questions of our time (Meadows, 2009). This is evident, for example, in the soul searching following the systemic failings of the western capitalist system exposed by the credit crunch (Haldane and May, 2011) debate.

Management accounting is not one of those fields that have successfully assimilated systems ideas. A few academics (Amey, 1986, Amey, 1979, Maciariello, 1984, Schoderbeck, 1967, Schoderbeck and Kafelas, 1975) worked with systems concepts in the late 1970's and early 1980's but their work, while influential at the time (Hopper et al., 2001) made little lasting impact, despite the fact that management accounting in general and budgeting in particular are potentially very appropriate fields for the application of systems. Cybernetics (a discipline defined as the science of communication and control) in particular has been identified as a potentially useful source of insights (Lowe and Puxty, 1989, Otley et al., 1995, Puxty, 1993, Vickers, 1967a). It will be argued that one reason for its failure to make an impact on the field is that cybernetic ideas and concepts were either misapplied or misunderstood. In addition, the potential scope and power of the cybernetic approach has not been recognised by many authorities who have, unwittingly, advanced cybernetic solutions in MCS studies (Anthony and Dearden, 1980, Berry et al., 1995b, Dermer, 1988, Dermer and Lucas, 1986, Emmanuel and Otley, 1985, Hedberg and Jonsson, 1978, 1978, Hofstede, 1981).

The premise on which this thesis is based is that the budget based practices of budgeting are social artefacts developed pragmatically by a small number of specific enterprises within a particular economic and societal context, and subsequently institutionalised and promulgated by educational and advisory agencies. They are not an optimally evolved response to the environments in which organisations currently sit, and that dysfunctional patterns of behaviour are in part a result of the mismatch between the two. The conjecture is that a better, theoretically grounded model would benefit both academic research and management practice.

1.3 Research objectives

The research objectives are threefold:

1. To review the gaps in the current understanding of the operation of control systems for the management of the flow of financial resources and re-interpret them from an appropriate systems perspective.
2. To develop a reference model for the management of financial resources, based on systems theoretic principles and produce a methodology and tools to aid the application of this model to the diagnosis, design, implementation and operation of financial control systems in organisations.
3. To review the application of these in the field in order to determine the nature of the impact that they may make in practice and the potential benefits for the understanding and design of control systems.

In essence, the aim is to create a new theoretical framework for the understanding, study and practice of financial performance management. In order to determine the extent to which this goal has been successfully achieved, reference will be made to the correspondence principle (Umpleby, 1989, 2001), which sets out the criteria that must be fulfilled for any new theoretical framework to be accepted as superior to those that it purports to replace. Specifically these are that it must explain existing empirical evidence in a coherent and parsimonious fashion and make additional predictions out of sample, by generating new, testable hypotheses. Thus, this thesis

therefore needs (inter alia) to be able to answer the following eight questions in the affirmative:

- a) Have we developed a framework for the management of financial resources that is new to the field, comprehensive, coherent and consistent with established systems theories?
- b) Are we confident that criticisms of systems theory and its application in this domain do not undermine the legitimacy of the framework?
- c) Do we have a methodology that will allow the theoretical framework to be applied to the understanding and study of practice in real life organisations?
- d) Are the predictions of the theoretical model consistent with the findings of extant research in the field?
- e) Does the framework allow us to develop new hypotheses that are capable of being tested?
- f) Does empirical observation (fieldwork) confirm the ability to test the hypotheses and their plausibility as explanations for real world phenomenon?
- g) Are there well-defined ways in which new insights can be applied to the design and operation of procedures and processes for use by practitioners?
- h) Are there well-defined opportunities for further research into the field?

The scope of the work is necessarily limited in a number of respects:

- Certain phenomena sometimes considered to be important to the exercise of control have been excluded, most notably consideration of motivation has been excluded from the scope of this study.
- Empirical testing of hypotheses is constrained by the scale and scope of the enquiry and the size limitations placed on a thesis of this kind. Thus the fieldwork aims to test the credibility of hypotheses; more rigorous testing must be the subject of subsequent research. This approach is thus consistent with the approach Keating (1995) describes as theory illustration, as opposed to theory discovery, specification or refutation.

Mindful of these potential deficiencies, fieldwork will be structured and analysed in such a way that their potential impact on the findings is, as far as possible, mitigated.

The proposed research aims to make general statements that can be used to improve the operation of processes, and makes no *a priori* assumptions about the existence or otherwise of social injustice and the distribution of power. It therefore has more in common with a functionalist stance than an interpretative or critical position (Hopper and Powell, 1995). On the other hand, the starting premise is that the status quo is suboptimal, thus the exclusion of phenomenological and critical perspectives is a consequence of how the scope has been defined, rather than an expression of a philosophical position.

1.4 Contribution

This thesis seeks to address a recognised need for a well-grounded theory for organisational control systems as an aid to understanding and to guide research. If successful in doing so, it will be original in a number of respects:

1. It will be the first attempt to apply a systems critique to financial management practices and the academic study of them. There has also been no previous attempt to develop and apply a cybernetic model in this domain.
2. The research will consolidate existing empirical knowledge in the MCS research field in a way not attempted before, and develop new research hypotheses, which will require the development of novel empirical measures to test them.
3. It will propose new management practices based on the insight this approach provides thereby seeking to address the gap that has arisen between the worlds of academia and practice.

In summary, this thesis aims to make a contribution, in roughly equal measure, to theory development and to empirical knowledge; with the latter involving fieldwork

that tests the plausibility of hypotheses generated by the theory. The fieldwork will give equal weight to a cross sectional study that makes extensive use of quantitative analysis and a longitudinal study that uses more qualitative case study methods.

1.5 Overview of the research process

The various steps in the research process, with their associated inputs and anticipated outputs are outlined in Figure 1 below.

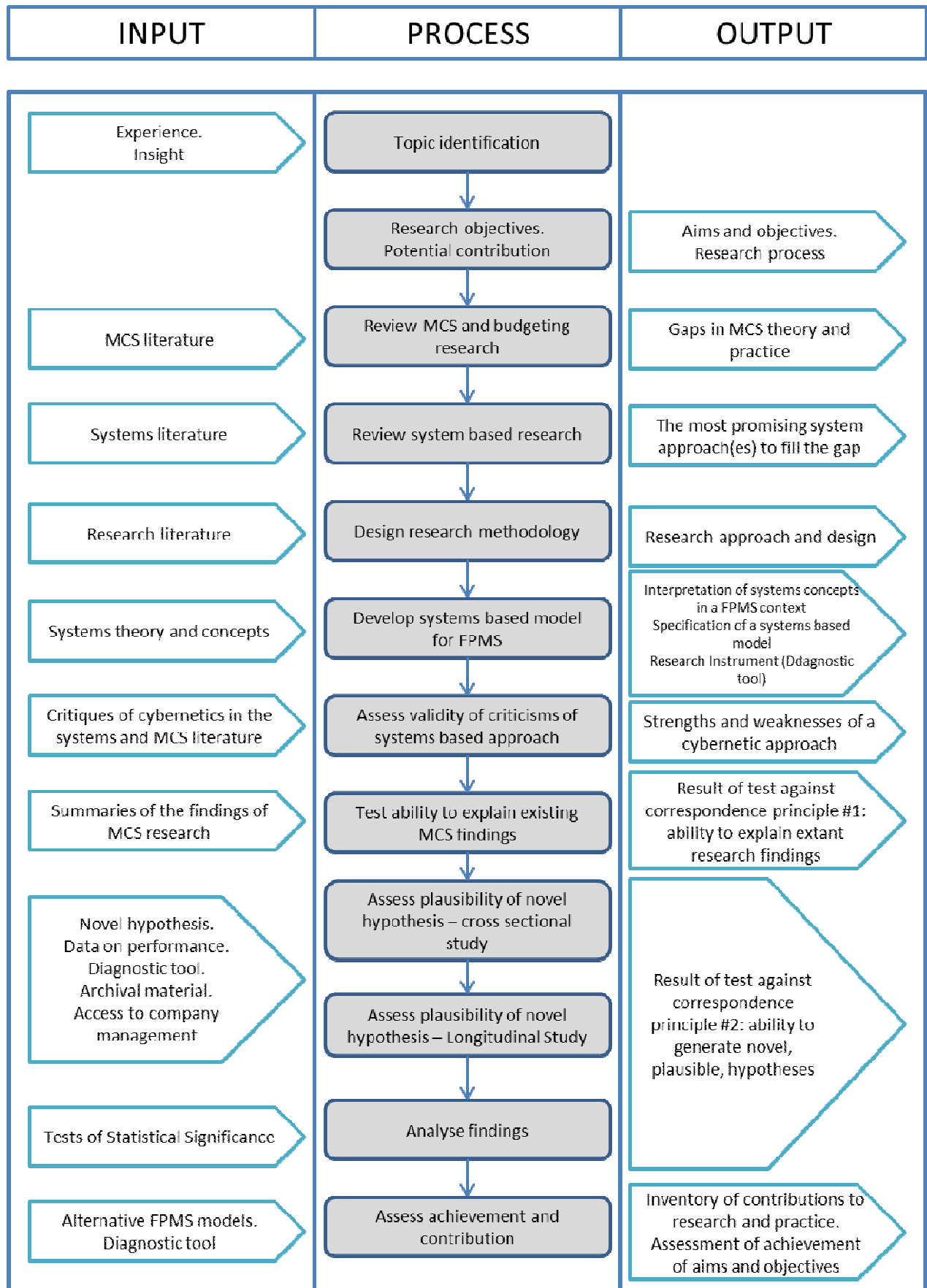


Figure 1 The research process

1.6 Structure of the thesis

The thesis is organised into ten chapters each of which addresses a series of key questions, as follows:

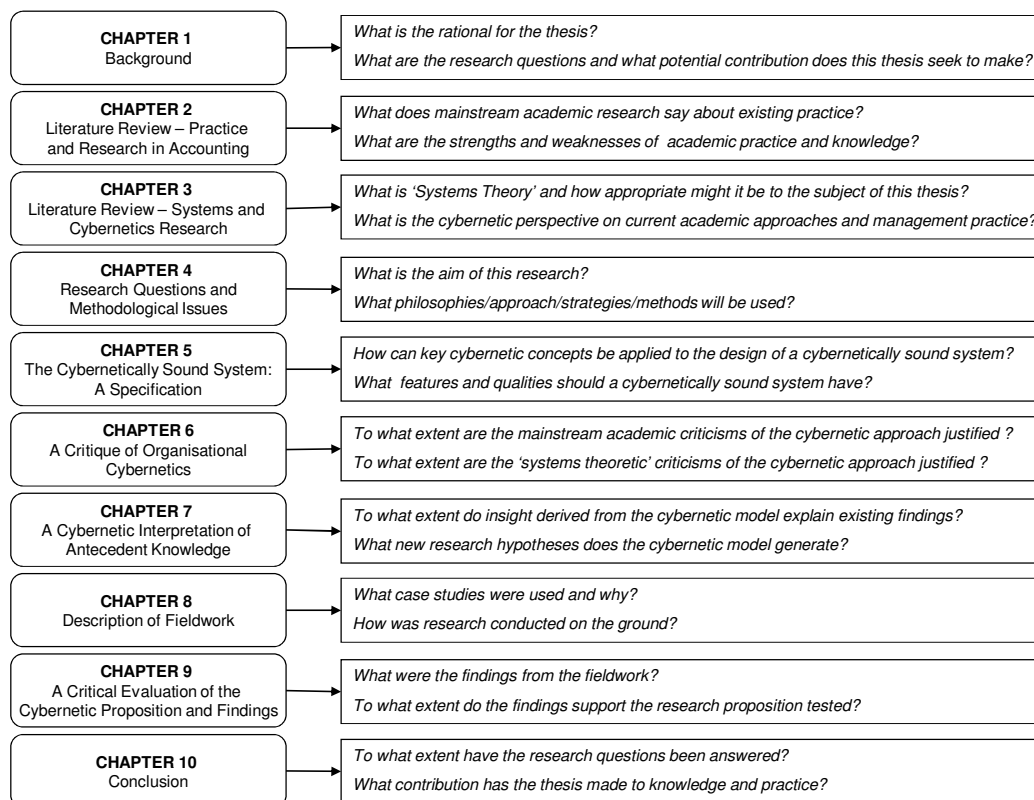


Figure 2 Structure of the thesis

After this brief introductory chapter, two chapters are devoted to a review of relevant literature. After a chapter devoted to outlining the research approach adopted, Chapter 5 develops a reference model, from cybernetic first principles. This is followed by a chapter in which the cybernetic approach to organisational design and control is subject to critical challenge. Chapters 7 to 9 seek to determine to what extent the cybernetic model exhibits the qualities expected of a credible new theoretical approach: the ability to explain existing knowledge, and the ability to generate new testable hypotheses. The final section assesses to what extent the thesis has answered the research questions posed in the introductory chapters and the nature of the contribution made to practice and academia. At the beginning of

each chapter, there will be a visual reminder of this structure to help orientate the reader.

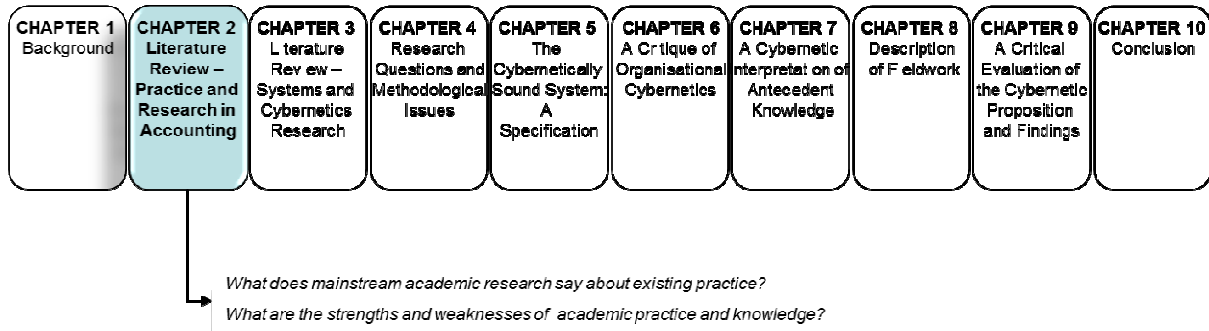
In addition to the main body of the thesis, there are six appendices. Appendices 1 to 4 deal with important detailed theoretical issues or background information that would otherwise clutter and confuse the main text. Appendix 5 houses a copy of the research instrument used in the fieldwork and Appendix 6 details the organisational performance data used to test the research hypothesis.

1.7 Conclusion

This chapter has alluded to recognised weaknesses in the processes used by organisations to regulate the flow of financial resources in practice and in the theoretical underpinnings of the academic discipline that researches the phenomena. Ideas from systems and cybernetics potentially may provide a source of ideas that could benefit both research and practice, and it is the objective of this thesis to identify how they might do this.

The next chapter starts the process by reviewing the current state of practice and literature in the field in order to identify weaknesses that this research needs to address, and potential sources of insight that might be exploited.

2 Literature Review – Practice and Research in Accounting



2.1 Introduction

The objective of this chapter is to review the state of practice and research in the field of financial performance management, particularly in relation to the development or testing of practical methodologies and theory.

Firstly, the scope of the enquiry is established and key definitions established. Next practice developments are reviewed. These have been dominated by the process of budgeting, which took hold in businesses in the decade that followed the Second World War, in a time of relative economic stability. Also, problems associated with the practice of budgeting are described. Academic research is then explored under five headings, each relating to the theoretical provenance of the research stream, or the ideas and philosophical stance underpinning them. The output from the academic research community is then critically evaluated. The criticisms are considered under two headings: the perceived lack of theory and methodological failings.

2.2 Scope and definitions

Given the volume of literature in this field it is important to clearly and tightly define the scope of enquiry and ensure that key terms and concepts are properly defined.

The scope is the study of Financial Performance Management Systems (FPMS), a field that includes budgeting but also all other processes involved in the regulation of the flow of financial resources in economic enterprises over the short, medium and long term. This explicitly includes informal mechanisms, as well as formal ones like budgeting.

In this context an economic enterprise is taken to be a social organisation where the regulation of financial resources is essential to its survival. This definition therefore includes Not For Profit (NFP) organisations (such as charities and public sector bodies) as well as those set up specifically for the purposes of making an economic return. Whilst NFP organisations do not aim to make economic gain, most, if not all of them, require financial resources in order to discharge their purpose, and in the final analysis, survive.

This thesis addresses certain questions about the processes that regulate the flow of financial resources around an organisation. In this context what is meant by organisation, financial resources and processes?

2.2.1 Organisation

The term organisation is taken to mean a group of people who come together in pursuit of a purpose (Berry et al., 1995b). The purpose may be explicitly stated but it could simply be implied by the collective actions of the group. The organisations that are the object of this study will usually be recognised in some form of a legal construct.

An organisation is taken to be a socio technical system, open to the exchange of information, energy and matter with the environment (Emery, 1969). The process of regulating or managing the organisation involves, amongst other things, designing, operating and overseeing the relationships between elements of the system in order to achieve desired outcomes, or avoid undesirable outcomes, in the face of unpredictable changes in the environment.

In simple terms this can be modelled as:

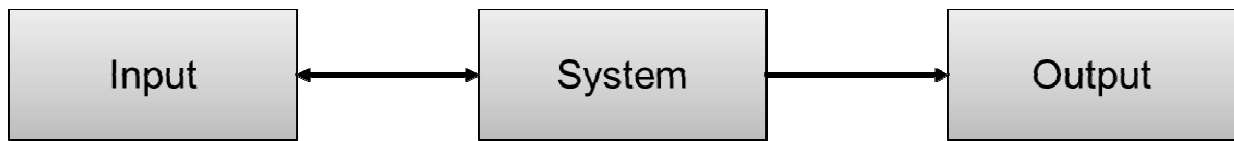


Figure 3 Simple system model

which translates as follows:

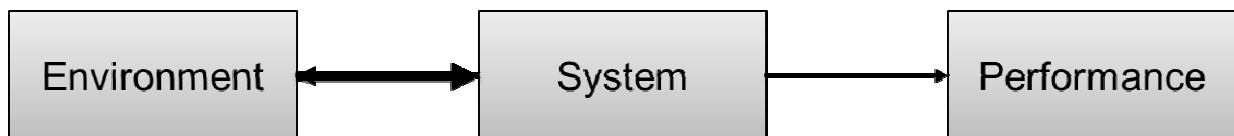


Figure 4 System model in organisational context

The environment with which social organisations interact will vary, but would typically be characterised as complex and probabilistic, as are the organisations themselves. Complexity is a concept that has proven to be difficult to define with precision (Flood and Carson, 1988, Klir, 1985). Some see complexity as a property of a systems per se (Weaver, 1948); a consequence of there being a large number of parts or interactions, non-linear or asymmetrical behaviour (Yates, 1978), hierarchical structure (Ahl and Allen, 1998) or emergent properties (Checkland, 1981). Alternatively, complexity has been characterised as a consequence of the nature of the observer (Ashby, 1973), specifically their inability to make sense of the richness of its behaviour. Probabilistic means that relationships between elements of the environment and the organisation are not deterministic in nature. In practice, taken together, these properties mean that it is very difficult to measure and to make precise predictions about the environment or the organisations response to it. The model above shows a two-way relationship between the organisation and the

environment, however, in practice the impact of the environment on the organisation is likely to be greater than the other way round (Ashby, 1952)

Performance is defined as those attributes of an organisation's behaviour that are deemed to be relevant to the purpose of the organisation. Performance might be an organisational variable, e.g. growth, cash generation, or it could be represented by an environmental variable e.g. share price, street children found a foster home.

Organisations may have an explicitly stated purpose, though, as noted by many authorities, in practice observed behaviour in the organisation (its performance) may not be completely consistent with the stated purpose (Berry et al., 1995b, Dermer, 1988). The espoused purpose may be a historic, or simplistic or incomplete representation of the purpose but it is also likely to be modified through the interaction of individuals who are likely to have their own interpretations of the purpose and their own aspirations and goals, which they act out through the organisation.

Whatever form these purposes take, the organisation has to survive, to be viable, to be able to carry them out. Viability requires that the organisation be at least minimally effective and efficient in responding to its existing environment and in adapting to future environments (Beer, 1981). For economic enterprises, a necessary but not sufficient condition of survival is the existence of an adequate level of financial resources.

2.2.2 Financial resources

Money plays a key role in the management of any social organisation whether or not its stated or manifest purpose is the pursuit of economic gain. In the first instance money is necessary in order to remain solvent. Secondly money is necessary to do work. The work in question could be philanthropic, in doing good, or it could involve the mobilisation of resources in order to make more money, or pursue the purposes of a profit making organisation in other ways. Whatever the objective, except where goods and services are donated or bartered, money plays a role as a medium of exchange. It follows from this that the processes and procedures used to regulate

the flow of money are fundamental to the survival and health of virtually any organisation.

2.2.3 Financial Performance Management Systems

For the purposes of this thesis, the term Financial Performance Management Systems (FPMS) describes all those processes, procedures and routines that are used to control or influence the flow of money around an organisation. In common usage, the word control has at least two meanings (though Rathe claims to have identified 57 different definitions in the literature (Otley, 2001)). It is sometimes used to describe the exercise of power, carrying with it connotations of coercion and domination (Emmanuel et al., 1990). When the word control is used here it carries a second meaning; that of regulation or direction. Specifically, it means the process of modifying patterns of behaviour to influence the performance of an organisation.

Many of the mechanisms used to control the flow of money are formal and explicit in nature, manifest in reports, computerised routines and documented processes and policies. Simons describes these as “the formalised procedures and controls that use information to maintain or alter patterns in organisational activity” (Simons, 1987a, 338). In practice, however, it is widely recognised (Margison, 1999, Merchant, 1985, 1986, Ouchi and Price, 1978, Ouchi, 1979) that control can be exercised through informal, perhaps even intangible, mechanisms (Argyris, 1990, Daft and Macintosh, 1984, Hopwood, 1978b). Behavioural norms, value systems and so on all play an important role in channelling, prescribing and proscribing the actions of individuals. Indeed, the way that formal controls are interpreted and applied (informally) has the effect of changing the impact of a formal process, sometimes in a way that is at variance with the aims of the designer of the formal process (Hopwood, 1976, Simons, 1987b). Overall control of the resources of an organisation is therefore the result of the interplay of formal and informal controls.

The processes in question regulate the flow of money within the boundaries of the system that is the organisation. Excluded from this study are those processes that regulate the flow of money across organisational boundaries, for instance those that manage the financing of the business, the payment of creditors or the management

of debtors, though clearly all these affect the health of the business. The scope is therefore restricted to the operation of the financial control system of the business; what, in systems terms, would be called the regulator.

In order to determine what the process of regulation involves, the simple input-system-output model introduced earlier is extended as follows:

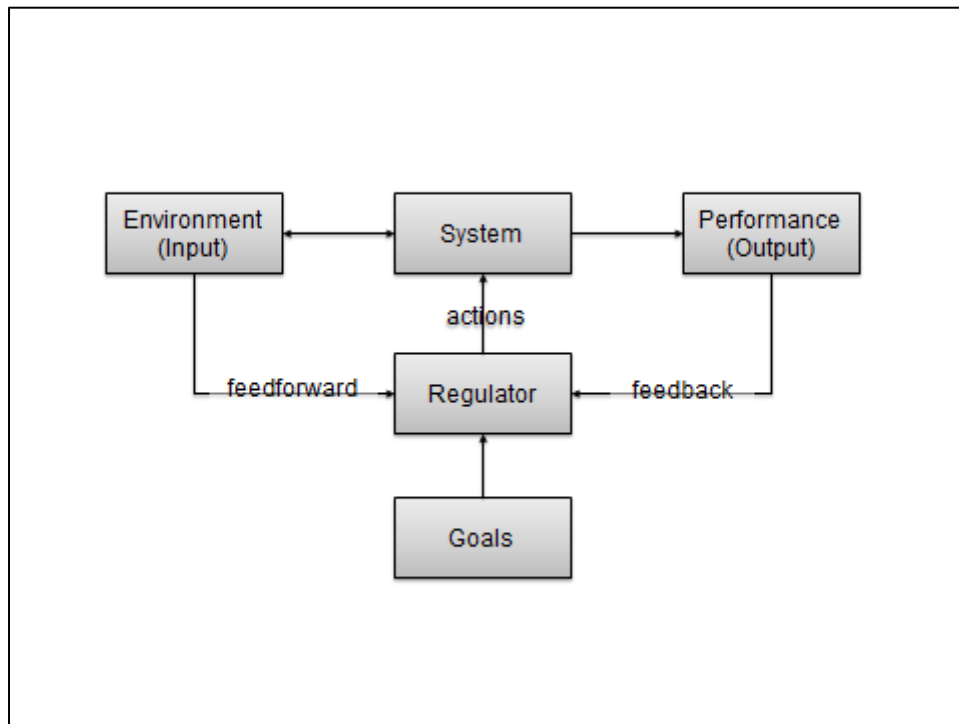


Figure 5 System model with control features

In the model shown above, we see that the regulator acts upon the system, changing the disposition of resources in the business in order to achieve the assumed goal. The activity of resource (re) allocation is informed by measurement; information about what has happened in the past, and by forecasts; information that anticipates what is likely to happen in the future, given certain assumptions about the future value of inputs and the existing plans.

For the purposes of this research we will focus on the following elements of FPMS:

1. Goal – a description of the desired output (level of performance) of the system. In the case of a FPMS, this is likely to be expressed in quantitative terms, and could

represent a performance aspiration (e.g. x% growth), or a financial constraint (e.g. no more than £x). In practice, financial goals may be explicitly or implicitly balanced off against other goals that may not be explicitly expressed (e.g. retention of skilled staff). In common usage, the two classes of goal are often treated as if they represented different phenomena (e.g. Targets versus Budgets) but in reality, as Simon (Simon, 1964) observes, they are both a form of constraint imposed on the regulator of a system. The term budget will be used to refer to constraints on inputs to regulatory action (e.g. by limiting resources) and target to constraints upon regulatory goals (output).

2. Measurement – the output of the system. In common usage this is often referred to as Reporting, but we will use this term to refer to any standardised measurement process conducted in a routine fashion, which is only one form that measurement can take. What is measured may be expressed in financial or non-financial terms and may or may not be quantified. In systems terms this is referred to as feedback – the process whereby information about the state of the system is returned to the system in order to be used (potentially) to change the state of the system (von Foerster, 1995,33). In engineering control systems, this information return often takes the form of negative feedback (information on the gap between performance and the goal that is used by the regulator to reduce the gap) but it could also be manifest as positive feedback, which results in amplifying the deviation between the output and goal. This is often associated with learning and can lead to the creation of new, more desirable, goal states.
3. Forecasting – the anticipated output of a system. In organisations, the term planning is often used to describe this activity but here we will use the term planning to cover the activity involved in constructing action plans – what the organisation (regulator) intends to do. When these plans are quantified and combined with assumptions about the future state of the environment and its impact on the organisation, they constitute a forecast. The term Plan is also often used to mean a detailed, valued set of actions prepared on a regular (often annual) cycle and which is subsequently used to align activities across an organisation and as a reference point (for reporting). The term forecasting as used here includes, but is not restricted to, such planning. In systems terms, forecasting is termed feedforward – the process of supplying information about likely future state of the system to the system, to be used (potentially) to change

the future state of the system. Like feedback, feedforward can be positive or negative in nature and expressed in financial or non-financial terms.

4. Resource Allocation – this term is used to describe the process whereby financial resources are allocated, and may be expressed as an intent (spend “x”) or as a constraint (spend no more than ‘y” see point 1 above). Resource allocation is usually the outcome of some form of decision making process. This involves making a choice from a potentially infinite set of possible actions, taking into account information about past and potential future outcomes (measurement and forecasts) and goals. Whilst the result of the process will involve a conscious act to deploy financial resources, the information used to make a decision may be of a non-financial nature. In systems terms, the process of resource allocation is a regulatory act; one that is designed to affect the future state of the system.

The model described above is a functional model. It does not imply that the entities described exist, at least in the form expressed; simply that these functions need to be carried out in some way. Whatever form they take in practice, most organisations will require control systems that are much more complex than the one described above. They can, however, be conceived of as a network of interconnected control systems with essentially the same basic structure. This leads us to the final element of the FPMS model relevant to the research objective:

5. Co-ordination – a term used to describe the process whereby the activities of semi-autonomous organisational units are aligned to ensure that they adequately serve the purpose (explicit or implied) of the organisation of which they are part. This might involve the redefinition of goals or the involvement in resource allocation by another higher (meta) level of the organisation.

This last element alludes to the fact that the operation of control systems cannot be considered in isolation from the structure of the organisation (Birnberg et al., 1983, Horngren, 1972). Many organisations are of a scale and nature that decision making that impacts the allocation of resources takes place in many different places in the organisation and at many different times. Effective management of financial resources therefore requires consideration of how these acts are co-ordinated, which

in turn requires attention to be paid to where the regulatory centres sit i.e. how the organisation is constructed (Beer, 1981).

The model shown in Figure 5 has been characterised as cybernetic by some authorities (Berry et al., 1995a, Hofstede, 1978, Willmer, 1983) who have argued that it represents an impoverished theory of management control. If that is the case, it could be argued that by defining FPMS in this way the scope of this enquiry is defined such that the outcome has been predetermined. It is, however, difficult to conceive of a system for managing the flow of money within an organisation that does not in some way involve creating a sense of what constitutes a set of acceptable or unacceptable outcomes, the recognition of actual and potential future outcomes and the exercise of choice about actions informed by this knowledge. The model does not imply that control processes are necessarily explicit, formal or mathematical in nature. It will be argued that the model described above represents a generic form of control process, which, at some level and in some way, must exist if an organisation behaves in what can be characterised as a purposeful way, even if that is only to continue to exist (remain solvent).

This position is supported by Berry and Otley (1980), who state that there are 4 necessary conditions for any sort of control to be said to exist: 1) an objective, 2) a means of measuring results, 3) a predictive model, 4) a choice of relevant actions. Both Green and Welsh (1988) and Reeves and Woodward (1970) argue that such a control system must therefore have cybernetic properties. In this thesis we will, however, draw a distinction between control systems in general and a cybernetic system. In this thesis systems terms like cybernetic will be used in a more precise way than that adopted by Hofstede (1978) to describe control systems and philosophies with specific properties rather than any form of closed loop control process.

In the literature, most of the work in this area falls either under the description of Management Control Systems (MCS), or budgeting. FPMS, as defined here is, however, not synonymous with either MCS or budgeting. An overview of the relationship between the three concepts is shown schematically in figure 6 below.

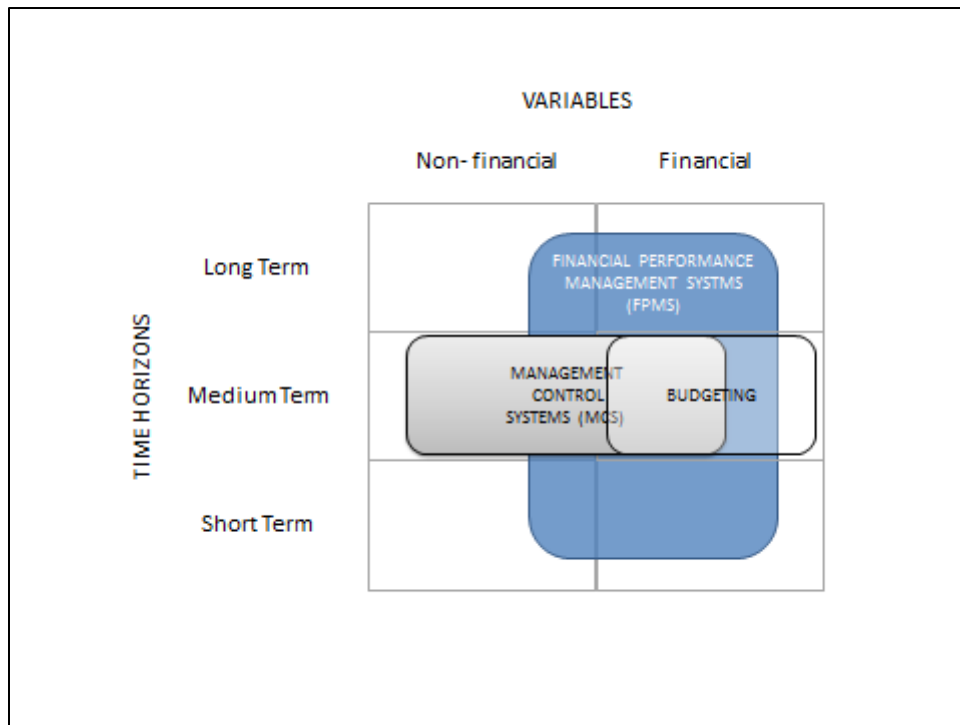


Figure 6 Relationship between FPMS, MCS and Budgeting

Management Control Systems

The term MCS was first introduced by Anthony in his book of that name (Anthony, 1965). There is no single universally accepted definition of MCS. Hofstede (1978,450) uses Anthony's definition: "the process by which managers ensure that resources are obtained and used effectively and efficiently in the accomplishments of an organisations objectives". Others (Emmanuel et al., 1990,2) call it "the process by which managers attempt to ensure that their organisation adapts successfully to its changing environment". Whilst the words used may be different, most definitions have the following characteristics:

- It is a set of processes owned by managers
- The processes are deployed in order to help meet some definition of an organisation's goals or welfare in an effective manner
- That it involves, inter alia, response or adaptation to the environment.

On the face of it, this definition would appear to be the similar to that adopted to define FPMS. The definition of FPMS, however, differs in the following respects:

1. MCS includes all control procedures involved in steering an organisation to its goals, and therefore, in this respect, it has a broader scope than that of FPMS, which focuses on the processes regulating the flow of financial resources (although Anthony identified Budgeting as the most important process in MCS, see below).
2. For Anthony, MCS described activities that fell in between short term Operational Control which is largely fixed or programmed in nature, and longer term Strategic Planning which, he argued, is a creative activity and thus not a control process at all (1965). In the way it was originally defined, MCS was the province of middle managers and operated on an annual cycle. FPMS as defined can operate at any level of the organisation and over any time scale, although it is anticipated that the way in which control will be exercised may well differ over these dimensions. Recently the term Performance Management has been used to describe a combination of management and strategic control (Otley, 1999). This is closer in scope to the definition used here, but not identical.
3. Anthony described the operation of MCS as rooted in the domain of social psychology. Considerations of the motivation of the actors in the control process are explicitly excluded from this thesis for reasons that will be outlined in the next section.

Budgeting

Budgeting is another concept closely related to the scope of FPMS and MCS. Much of what is termed MCS research is, in fact, the study of the practice of budgeting.

Budgeting is described by Anthony and Govindarajam (1995,370) as a process involving:

- an estimate of the profit potential of a unit,
- stated in financial terms,

- generally covering the period of a year,
- representing a management commitment (to delivering the objectives expressed in the budget),
- subject to review and approval by an authority higher than the budgetee,
- which, once reviewed, can only be changed under specified conditions,
- and periodically is compared to actual financial performance for analysis and explanation.

A budget (which is one of the outputs of budgeting) has been defined as a plan showing how resources are to be acquired and used over a period of time (Emmanuel et al., 1990). Whilst sharing a focus on the management of financial resources with budgeting, the scope of FPMS is not restricted to the timeframe of a year, and does not carry with it the requirement that it be approved or that it form a management commitment, which cannot be easily changed, and for which managers are held to account. It is also open to the notion that informal controls are part of the system, whereas budgeting is explicitly a formal administrative process. Budgets and budgeting should therefore be seen as one particular manifestation of FPMS.

2.2.4 The human element

Horngren (1995) has observed that MCS have two roles; firstly the provision of information that can be used to manage an organisation and secondly a tool for motivation. Some authorities have chosen to emphasise the motivation element over that of information provision (regulation). For example, as mentioned above, Anthony (1965) saw MCS as an artefact of social psychology. Presumably, this view is based on the assumption that once the goal of the organisation has been fixed and plans approved by senior management the role of MCS is to motivate middle management to deliver against these.

A consequence of the assumption that MCS is primarily a tool for social control and motivation is that the associated FPMS (i.e. budgets and budgeting) should be structured around organisational units (Responsibility Centres). The managers of these units are then required to commit to delivering the numbers and explain any

deviations from plan. Finally, changes to goals and plans should be made only in exceptional circumstances. This approach provides the logic for tying incentives to the achievement of budgets, a common practice in business. Indeed, a strand of thinking about control in organisations derived from Economics (Agency Theory see (Demski and Feltham, 1978)) regards incentive systems as the pivot point. Agency Theory states that incentive systems should be designed such that they align the economic interests of agents (employees) with principles (employers), based on certain assumptions about rationality and the availability of information.

The stance taken in this thesis is that informal controls are complementary to the control exercised through formal processes and procedures. Also, even though the currency of FPMS is financial, decisions about the allocation of financial resources are made by taking into account non-financial and even intangible information. Clearly then, the distinctions and value judgements made by human agents are relevant to this study. It is also acknowledged that, in practice, the design and operation of any FPMS is critically dependant for its success on the nature of the commitment of the people who operate and are impacted by it. However, this thesis explicitly excludes the topic of motivation from its scope, for the following reasons:

1. The term has multiple meanings and the issue of motivation is therefore open to misinterpretation. Deci (1975) states that from a psychologist's perspective motivation is concerned with three fundamental questions related to behaviour regulation:
 - a. what energises action
 - b. how it is directed
 - c. to what extent it is under voluntary control.

The direction of behaviour under voluntary control is one component of regulation and therefore something that this thesis sets out to address. Motivation as energising action, however, is a psychological phenomenon and therefore outside the scope of this thesis as defined. Moreover, there is little prospect of constructing a systems-based theoretical framework in the near future, given the shortage of published literature upon which to draw

2. The nature of motivation in the sense of energising action is an elusive and complex topic. There are many theories of motivation (Birnberg et al., 2007, Latham and Ernst, 2006). Klein (1989,152) argues that the field is characterised by “a splintered and perplexing array of theories, few with overwhelming empirical support and most with unresolved theoretical ambiguities and inadequacies”. It is also highly probable that motivation is, in part, context and personality specific.
3. When used in this context of MCS, however, it is often implicitly assumed that motivation is extrinsic rather than intrinsic in nature, comprising a system of rewards and punishments administered by employers and directed at employees who are often driven by personal economic considerations and which operates in a mechanistic, behaviouralist, manner. It cannot be assumed *a priori* that employers and employees are two distinct classes who necessarily have a conflicting set of concerns. As a result, we argue that it is not appropriate to conceive of control systems as procedures designed by employers primarily to motivate employees.
4. Specifically, the assumption behind the Agency Theory stream of research is that employees are rational utility maximising agents whose interests are therefore in conflict with those of shareholders unless they are realigned through the application of scientifically designed reward structures. This assumption is in conflict with our assumption that organisations are made up of interdependent elements sharing a common, or at least a mutually acceptable, set of outcomes or purpose, which as we have seen is a questionable assumption.
5. It is conceivable that a control system might succeed as a motivational device – as energising action but fail in its primary objective of steering an organisation towards its goals. There is plentiful evidence that individuals can, and often are, motivated to do the wrong thing either because they are supplied with the wrong information, or the control systems is configured such that it rewards inappropriate behaviour (Jensen, 2001a, Jensen, 2001b, Kaplan, 1984, Merchant, 1990, Ordonez et al., 2009). Motivation should not, therefore be the primary criteria on which FPMS are judged.

The approach adopted in this thesis is that, since FPMS regulates human behaviour, and human beings design FPMS, we do need to take account of factors such as limitations on human capabilities and the natural desire to avoid stressful or unpleasant situations. No assumption is made, however, about what energises action. This will be addressed later in the thesis.

2.3 The practice of budgeting

2.3.1 Genesis

Early accounting practice was based on the need to inventorise assets and liabilities. Accounting in the sense of a process for the control and management of the internal affairs of an organisation is, however, a relatively recent affair. Budgeting is the most common mechanism used to manage the internal finances of the firm but it did not acquire its modern form until the early part of the twentieth century (Johnson and Kaplan, 1987). It subsequently evolved quickly so that by the start of the Second World War, according to Kaplan (1984) management practices were recognisably modern.

The development of FPMS practices is well documented in Johnson and Kaplan's book *Management Accounting; Relevance Lost* (Johnson and Kaplan, 1987). They trace the history of Management accounting - the use of financial information for decision making and control - back to the development of cost accounting practices developed in the mill and railroad industries of the 19th century. According to Johnson and Kaplan, the catalyst for the development of modern FPMS, was the creation of large multi-divisional business, of a size and nature that made it difficult for owner-entrepreneurs to control directly. The practices that we have come to call budgeting were developed in the United States initially by the Dupont Company and subsequently in General Motors (GM).

In 1903 the Dupont family started the rationalisation of the American explosives industry and in response to the new managerial challenges this threw up, developed and perfected a new set of techniques for organising and managing a large interdependent (in this case vertically integrated) business. According to Hofstede,

this development is a tangible manifestation of the Fayol's organisational thinking and an extension of Taylorism (Hofstede, 1981). Whatever the genesis of the concepts, according to Chandler (Kaplan, 1984), by 1910 the Dupont Company was employing nearly all the basic methods that are currently used to manage big businesses.

After the First War, GM was plunged into a financial crisis, as a result of the chaotic management style of its founder coupled with the rapid growth and then collapse of the market for cars (Sloan, 1967). Subsequently, the Dupont family, who were major shareholders in GM, took an active role in managing the company, with Pierre Dupont assuming the role of President. The management practices developed by Dupont were introduced into GM, along with a number of personnel, amongst them Donaldson Brown who had helped develop the Dupont system. Over the next decade, working with Alfred Sloan, Donaldson Brown effectively created the blueprint on which the US corporate world was modelled in the post war period. It is noteworthy that organisational structure and processes co-evolved. The interdependence between the two has been remarked on by subsequent authorities (Horngren, 1972).

Kaplan concludes that "it is clear that the organisational form and reporting and evaluation system for virtually all modern enterprises had evolved in General Motors by 1923" (Kaplan, 1984,597) but goes on to note that, whilst the form of organisation and the processes used to manage it have remained largely unchanged, the way in which they have been used has changed. So, for instance, in the 1930's the goal of GM were to earn a satisfactory Return on Investment over an economic cycle, not, as is the norm now, to achieve annual increases in earnings. The critical distinction between the disembodied form of control and how it is interpreted and applied in practice is a recurrent theme through the literature, most notably by Hopwood (1973) and others working in the RAPM (Reliance on Accounting Performance Measures) field.

The GM model of FPMS spread throughout the rest of US industry after the Second World War, stimulated by the growth in Business Schools (Maher, 2001), management consultants and accounting textbooks. Also at this time, many

economies such as those under Communist control and the war economies of Europe were, apparently, being successfully run using a command model, which probably contributed to the relatively swift adoption of this form of managed internal economy in industry. By 1940 around 50% of US companies were using budgeting, but by 1958 the figure was up to 95% (Hofstede, 1967). Hofstede estimates that Europe lagged the US by around 15 years in adopting the budgeting model.

2.3.2 Problems with budgeting

The set of practices based on budgeting were adopted very quickly despite the fact that both academics and researchers recognised very early on that many problems were associated with them.

Soon after World War 2 Agyris was sponsored by the American Controllers Foundation to investigate why the use of budgets were associated with dysfunctional behaviour and job related stress, and to propose remedial measures (Agyris, 1952). The negative psychological by-products of budgeting issues are to this day a major source of concern for industry and a focus of research in the academic community (Covaleski et al., 2003, Dermer, 1988, Dermer and Lucas, 1986, Dunk and Nouri, 1998, Hofstede, 1967, 1978, 1981, Kaplan, 1984, Onsi, 1973). Academics also realise that budgets often fail in their primary purpose (Hayes, 1977), since “limitations caused by the lack of variety in the accounting systems in no way matches the complexity of the organisation being controlled” (Berry and Otley, 1980,242) or the complexity of the environment (Berry et al., 1995c). Emmanuel and his co-authors (1990) argue that the multiple, conflicting, roles of budgeting makes it incapable of being effective management tools. Indeed, Ackoff believes that most organisations survive only because managers have learned how to cheat the budgeting system (Ackoff, 1991).

Amongst practitioners, the sense of dissatisfaction is echoed, if anything with greater vehemence (Hope and Fraser, 2003) . For example, a report by Neely et al. (2001) drawn from the practitioner literature list 12 commonly cited problems:

1. Budgets are time consuming to put together.
2. Budgets constrain responsiveness and are often a barrier to change.
3. Budgets are rarely strategically focussed and are often contradictory.
4. Budgets add little value.
5. Budgets concentrate on cost reduction and not value creation.
6. Budgets strengthen vertical command and control.
7. Budgets do not reflect the emerging network structures that organisations are adopting.
8. Budgets encourage gaming and perverse behaviours.
9. Budgets are developed and updated too infrequently, usually annually.
10. Budgets are based on unsupported assumptions and guesswork.
11. Budgets reinforce departmental barriers rather than encourage knowledge sharing.
12. Budgets make people feel undervalued.

Many other surveys play variations on these themes (Hansen et al., 2003, Libby and Murray Lindsay, 2010). One piece of practitioner based research (Answerthink, 2003), based on a survey of 70 major European companies (80% of which had turnover in excess of E2 billion), helps give a sense of the scale and critical nature of the concerns held by the practitioner community:

1. Time (cited by 71% of respondents) – the process takes too long; results are often obsolete the day that they are published.
2. Quality (38%) – that quality of budget data is compromised by cautious behaviour and fosters political agitation instead of entrepreneurship.
3. Cost (29%) – it requires a high investment in time and resources and many resources are wasted during the exercise while the benefits are dubious.
4. Flexibility (29%) – it is an annual event that obstructs responsiveness to change.
5. Focus (6%) – promotes centralisation of decisions, reinforces hierarchical structures instead of a value chain perspective.

In this context it is surprising that the practice of budgeting has persisted. The resistance to change has been recognised by a number of academics has has variously been attributed to:

1. A failure to transfer knowledge from academia into practice (Hopwood, 1979, Kaplan, 1994)
2. The fact that the process of change in management practice is complex and not necessarily rational (Scapens and Roberts, 1993)
3. The observation that much change is driven by fashion (Granlund and Lukka, 1998) or the agenda of the management consulting community (Ittner and Larcker, 2003)
4. The length of time needed to affect major structural change: in excess of ten years (Luft and Shields, 2003a)

A particular feature of the practice of budgeting, however, is that it is holistic in nature, which means that it is difficult to change in a piecemeal fashion (Hope and Fraser, 2003). Finally, perhaps, budgeting has persisted because of the lack of a coherent and comprehensive alternative; something that this thesis aims to remedy.

2.4 Academic research

Management Control Systems in general, and budgeting in particular, are probably the most extensively researched topics in the field of management accounting, with a history that can be traced back over 50 years. Between 1980 and 2000, for instance, 70% of articles published in a range of management accounting journals related to the topic of control (Hesford et al., 2007).

Since the objective of this thesis is to determine whether and in what way aspects of systems theory can be applied to the understanding and design of FPMS, it is appropriate to organise the literature review around to the theoretical traditions from which the work arose. This survey is conducted at a macro level; the specific findings of any stream of research are not described in detail in this section

Following the taxonomy and approach adopted by Covaleski et al. (2003), the literature is summarised under four broad headings; Descriptive, Economic, Psychological and Sociological, to which a fifth has been added for the purposes of

this thesis: Systems. Although they are described as research traditions they are not necessarily founded explicitly upon theories drawn from other disciplines, rather it is that the research questions, unit of analysis and assumptions about the world are characteristic of work in a particular domain.

2.4.1 Descriptive

According to Covaleski et al. (2003), work in this tradition is founded on the description, classification and analysis of the operation of control practices in organisations. The primary research question asked is “what are the characteristics of effective control practices?” Research is inductive in nature, and is not explicitly based on any theoretical construct drawn from other fields, although critics have labelled it cybernetic (Hofstede, 1978). It is usually based on observation or field work and it is assumed that the practices observed, because they are used in organisations that have survived and prospered, approximate an equilibril optimum. It also usually universalist in that it implicitly assumes that there is one right way, irrespective of organisational context. The level of analysis are the control mechanisms at an organisation and subunit level and in Hopper’s (1995) classification would be categorised as functionalist. This research tradition represents the mainstream paradigm of management control and budgeting.

According to Giglioni and Bedeian (1974), research in this tradition can be traced back to Fayol, but they argue that the first text devoted entirely to the subject of management control was written in 1920 by Lawson. He declared his purpose to “set out before those who are engaged in organization work the true fundamental laws governing all direction and control” (Lawson, 1920,v).

The explicit focus of the early texts was control, described as: “verifying whether everything occurs in conformity with the plan adopted, the instructions issued and principles established” (Fayol in (Giglioni and Bedeian, 1974,295)). Initially, work focussed primarily on operational control; the control of the costs of low level programmed activities, and financial control. The first attempt to broaden the scope of enquiry to explore corporate control emerged in 1941 with the work of Holden, Fish and Smith (1941).

In the 1950s the first principles of management textbooks emerged. They built on earlier management thought and articulated the established consensus of what constituted good practice.

Probably the most significant piece of work in this tradition is Anthony's work *Planning and Control Systems: A Framework for Analysis* that first appeared in 1965 (Anthony, 1965). It was in this work that Anthony first set out the concept of Management Control Systems (MCS).

Anthony (1965) positioned MCS between Operational Control Systems and Strategic Control Systems. The former were comprised of programmed activities, which are generally well defined and repetitive in nature with consequently relatively little scope for discretion on the part of (it is assumed) low level employees. Strategic Planning on the other hand, was conceived of as a creative process in which the high level objectives, goals and strategies of an organisation are formulated. This is the preserve of senior management. Unlike Operational Controls, which are seen as being very short term, the scope of Strategic Planning covers a multiyear horizon Anthony (1965).

In Anthony's (1965) scheme, management control is based on an annual horizon and cycle and is characterised as the responsibility of middle management. If Strategic Planning is about deciding what to do and setting goals based on this, MCS is made up of the processes that determine how these goals should be achieved. The backbone of MCS is budgeting since it is simultaneously the common denominator for all activities of an organisation, a major constraint on what can be done and the language in which many of the goals are expressed. The objective of MCS is to facilitate goal congruence and to allocate resources most effectively to this end. Anthony (1965) believes that goals originate with senior management, and the role of MCS is secure congruence with their wishes. "An organisation is in control when it is behaving in accordance with pre-set standards. They are determined by top management, and top management wants all operating managers to work so as to achieve these goals" (Anthony and Dearden, 1980,35). According to Anthony, the starting point for MCS design is "how do we motivate people" to this end. He goes on to assert that activities such as communicating, persuading, exhorting, inspiring and

criticising are an important part of the process. As a result, he argues that management control is a practice primarily informed by social psychology.

Although Anthony's work (1965) was not explicitly based on any theoretical tradition, others have characterised his work as emanating from a systems viewpoint (Gigliani and Bedeian, 1974). However, whilst Anthony (1965) did recognise that the science of cybernetics should be able to make a contribution to this field, he did not make any claim for his own work in this regard. The majority of his writings simply codify and catalogue existing good practices and should not be seen as an attempt to set out a theoretically grounded model of the way in which the affairs of organisations ought to be managed.

Although his focus is on processes and procedures, Anthony (1965) does recognise that control is not exercised exclusively through formal practices. Informal controls play an important role in helping to ensure that an organisation meets its goals, but Anthony does not develop this line of thought. Other authors have been more explicit in this regard, and the importance of soft controls and the interplay between different control mechanisms has been a feature of much research in recent times. Merchant (1985) made distinctions between action controls, result controls and personal/cultural controls and makes some conjectures as to how each of these types of controls might be appropriate. Ouchi (1979) identified three forms of control: behaviour control, outcome control and clan control. Hopwood (1976) distinguishes between action, results and personal control. Another significant contribution to the object of control strand of thinking is Simons 1995 work in which he proposed 4 Levers of Control (Simons, 1995) based on a decade of case based research. They comprise: Belief Systems, Boundary Systems, Diagnostic Controls and Interactive Control.

Object of control research is relevant to the study of Management Control System but not to FPMS, since the traditional form of FPMS (namely budgeting) is by its nature a formal control system. If, however, it is acknowledged that the flow of financial resources around an organisation can be guided, and therefore regulated, by processes that are unstructured, social or cultural in nature, and that financial constraints or goals need to be balanced with non-financial considerations, then

such mechanisms should be included in the scope of research that seeks to understand, analyse and design FPMS.

An interesting contribution to the debate about objects of control was made by Hedburg and Jonsson (1978). They argue that the way in which organisational controls are exercised and studied tends to stress the need to eliminate ambiguity and facilitate the maintenance or restoration of order and stability. They argue that in order to survive, an organisation needs to learn and adapt. A conventional system, in filtering out confusing signals, can deprive an organisation of the stimulus to question and learn, and so can contribute to freezing an organisation and robbing it of the capacity to change.

Otley (1999) supports the view that a holistic view of control systems should be preserved and points out that different control system configurations are likely to be required in different circumstances and different configurations could be equally successful in any single environment. More recently, others have also advanced intellectual frameworks in the holistic, descriptive tradition of management control (Ferreira and Otley, 2009, Malmi and Brown, 2008).

2.4.2 Economic

According to Covaleski et al. (2003), work in the economics tradition began in the late 1970s influenced by developments in information economic theory. It sets out to answer the question “what is the economic value of budgeting practices for owners and for employees?” Much of the work in this area is based upon agency theory, which is founded on the assumption that the optimum arrangement for control exists where the utility of employees (agents) and owners is in equilibrium. The focus of analysis is the economic contract between the employee and employer, who are both assumed to act in a perfectly rational way, maximising their personal utility, although information asymmetries are explicitly acknowledged. Research is characterised by high levels of theoretical modelling and empirical (laboratory) experiments in controlled settings.

According to Covaleski et al. (2003), Agency Theory assumes that individuals are perfectly rational and that the world is typically in a state of equilibrium. Therefore, goes the logic, the fact that budgeting exists, rather than markets, must be a consequence of information not being perfect. The seminal studies in this area were those conducted by Demski and Feltham (1978). They argue that budgets played two key roles; decision facilitation, in that they help co-ordination and the flow of information around the organisation, and decision influencing as incentive contracts are often based on budgets.

In subsequent years, this approach has been extended to investigate other budgeting phenomena such as participative budgeting (Baiman and Evans, 1983), capital budgeting (Antle and Fellingham, 1995) and the analysis of variances (Baiman and Demski, 1980). The trend has been to increase the number of endogenous variables (that is those that the analysis seeks to explain rather than assume), the result of which has been an increase in the complexity of modelling. In addition to analytical modelling, Agency Theory research relies heavily on experimental research, which involves testing of hypotheses using actors who respond to signals supplied by the researchers under experimentally controlled conditions.

Unlike agency theory, Transaction Cost (TC) economic theory does not assume perfect rationality or perfect contracts (Birnberg et al., 1983) . TC asserts that organisations exist because, in some circumstances, the cost of market based transactions are too high and, as a result, resources are allocated using administrative processes rather than market mechanisms. Because of the imperfection of contracts (not all circumstances can be anticipated in the construction of contracts) employees may act opportunistically. Although it is possible to see how a TC perspective might be applied to research in budgeting, to date it has not gained much support in the research community (Kaplan, 1994, Spicer, 1992).

2.4.3 Psychological

According to Covaleski et al. (2003), this research stream addresses the impact of budgeting and management control practices on the individual, usually those in a subordinate role. The archetypal research question asked is “what are the effects of budgeting practices on individuals’ mental states, behaviour and individual performance?” The issues addressed are similar to those in the economics tradition; incentive contracts, performance evaluation, target setting and so on, but individuals are assumed to exhibit bounded rationality (Simon, 1957). They are driven to minimise cognitive dissonance, and any failure to do so will result in job related stress and/or dysfunctional behaviour. The theoretical underpinnings of work in this stream are not always explicit. Research has largely taken the form of questionnaire based cross sectional studies, initially based on a universalist assumption, but increasingly research has sought to identify contingent or moderating variables.

If the descriptive and economics traditions address the ‘what’ of budgeting, the psychological focuses on the ‘how’. At the risk of over simplification, it is helpful to draw out three main themes running through research in this tradition. The first, and the oldest, is that which addresses the subject of the way that budgets or targets are set, often characterised as Participative Budgeting. The second investigates how budgets are used, particularly in performance evaluation. This is usually described as Reliance on Accounting Performance Measures (RAPM). The third addresses the one of the common symptoms of budgeting practices; Budgetary Slack and other dysfunctional behaviour involving manipulation of budgeting and related processes.

Participative budgeting

Research within the field of budgeting originated with Agyris who was commissioned by the Controllershship Foundation (Agyris, 1952) to investigate the reasons for some of the dysfunctional consequences of budgeting as reported by employees and as reflected in their behaviour. Agyris’ work was followed up by Stedry (1960) who, in laboratory experiments, combined the notion of imposition of budgets targets with budget difficulty.

Hofstede built on the psychological line of enquiry in *The Game of Budget Control* (Hofstede, 1967). He observed that hitherto discussion had taken place around whether the budgets was tight or loose, whether there was participation or not and on the role of the Controller's Department and the boss's attitude. In his view, these were all important factors but that the predominant variable was a contextual one related to the atmosphere around the handling of feedback. In arguing for a balance between clarity and vagueness, from the perspective of human motivation, Hofstede anticipated the arguments of Hedburg and Jonsson (1978) who see ambiguity as an important catalyst for organisational learning and adaptation. There has also been much work in Organisational Theory in a similar vein (Morgan, 1997) but little of this has found its way into the accounting literature. Hofstede's focus on the role of the staff officers (in this case Management Accountants) in enforcing a "technical theory of control" was taken up later by Argyris (1990,503), who argued that "unilateral and coercive activity will activate....individual and organisational defensive routines that are over-protective and anti-learning" and in this way frustrate the objectives of the exercise.

RAPM

The relationship between budgets and performance evaluation is touched on in the literature on participative budgeting but it is the central focus of the RAPM research, which Chapman (1997,193) describes as "the extent to which supervisors rely on, and emphasise, those performance criteria which are quantitative in accounting and financial terms and which are prespecified as budget targets".. Work in this area was initiated by Hopwood's study of supervisory styles (1973), and this spawned a large body of research that some believe represents "the only organized critical mass of empirical work in management accounting" (Lau et al., 1995,360). Others, however, have taken issue with this judgement (Chapman, 1997, Hartmann, 2000)).

Hopwood identified three supervisory styles: Budget Constrained, Profit Conscious, and Non Accounting, which vary across at least three dimensions:

- the range of criteria used for evaluation purposes
- the flexibility with which variances from standard are interpreted
- the manner in which short and long run issues are handled.

Hopwood's study was followed up by Otley (1978) who studied the effects of RAPM in a profit centre, as opposed to cost centre, environment, but he was unable to replicate Hopwood's findings. This discrepancy, proved to be a spur to further research work, no doubt facilitated by the fact that questionnaire based surveys easily lend themselves to the use of structured and rigorous statistical analysis of a scientific nature (Hopper et al., 2001)

In subsequent years researchers have introduced additional contextual variables in an attempt to expose the true nature of the relationships first postulated by Hopwood and improve replicability (see Hartmann (2000) for a good summary). The inclusion of contextual variables in RAPM studies has served to blur the distinction between RAPM studies and Contingency Theory, (Chapman, 1997, Hartmann, 2000) which is covered later under the sociological thread.

Budgetary slack

Manipulation of information is one of the commonly reported dysfunctional by-products of budgetary control; indeed it was one of the problems that instigated Agyris' pioneering study on the impact of budgets on people (Agyris, 1952). Subsequent work, starting with research into budgetary slack, has broadened to include issues such as the propensity to deliberately underestimate revenues and/or overstate costs in the budgeting process, as described below.

Early work focussed exclusively on the issue of budgetary slack alone (Otley, 1980). Onsi (1973) found that 80% of managers interviewed admitted to bargaining for slack. Schiff and Lewin (1968) estimated that 20-25% of divisional operating expenses could be related to slack. Leibenstein (1979) estimated it could be as high as 30-40%.

More recently, often prompted by corporate failures and scandals, research has tackled other types of data manipulation, and many of these studies trace the behaviour back to the way in which budgets, and specifically targets, are deployed in organisations (such as (Merchant, 1990). Birnberg et al. (1983) argue that such behaviour originates with an attempt to apply controls such as budgeting that emanate from one kind of world (where there is certainty about preferences about possible outcomes and certainty about causality) to other worlds where these conditions do not exist, a conclusion supported by Hofstede and others (Dermer, 1988, Dermer and Lucas, 1986, Hofstede, 1978, 1981).

2.4.4 Sociological

Work in the sociological stream tackles the question: “how does budgeting influence decision making and bargaining processes amongst a plurality of interests pertaining to planning and control of social and organisational structures?” Much of the work in this area is explicitly informed by Contingency Theory (Lawrence and Lorsch, 1967), which takes the view that there is no universally right way of organising. The appropriate organisational arrangements, and therefore the equilibrium position, will be determined by contingent factors most notably environmental characteristics such as the level of uncertainty. According to Covaleski et al. (2003) work underpinned by Institutional Theory also sits within this stream. This takes the assumption that budgeting and other management control procedures fulfil a symbolic and political role within an organisation. Organisations may be subject to disequilibrium and tension as the result of interplay between conflicting interests and environmental pressures. Work in this tradition is addressed at the organisational unit and sub unit and again relies heavily on cross sectional survey based research.

In recent years, much MCS research has been based on Contingency Theory (CT) (Fisher, 1995, Otley, 1980), (Chapman, 1997, Hopper and Powell, 1985). CT originated in organisation theory and explicitly adopts the contingent position rather than including contextual variables purely in order to explain inconsistent research findings. Work in this research stream started by testing some relatively simple hypotheses, but as the body of work has matured, researchers have added extra contingent variables in an attempt to develop greater explanatory power (Merchant

and Otley, 2008). Indeed, some argue that CT should be regarded less a theory than a philosophical standpoint (Otley, 1980). This holds that there is no universally applicable correct approach to organisational design because the right solution depends on contingent factors, such as environmental uncertainty, industry structure and so on. CT originated with the work of Burns and Stalker (1961) who proposed two different forms of organisation, mechanistic and organic, arguing that either could be appropriate, depending on the nature of the environment. Woodward (1965) suggested that production technology was also an important factor and in 1977 Lawrence and Lorsch extended this line of thinking and examined exactly how both environmental and task uncertainty might be reflected in organisational structure (Lawrence and Lorsch, 1967).

This contingent view of organisational structure was easily transposed to control systems and lent itself well to an empirically based (survey) research methodology that seeks to build knowledge by looking for correlations between different attributes of organisations, their control systems and their environments. The gradual accreditation of empirical evidence would, it was hoped, ultimately lead to the development of solid theory. The conceptual and methodological confluence of CT and the psychological MCS research stream led, in Otley's words (1980), to a minor avalanche of literature starting with Bruns and Waterhouse (1975) Gordon and Miller (1976), Hayes (1977) and Daft and MacIntosh (1978). As a result the lines between the sociologically based CT streams and the psychologically based work have become blurred.

Initial CT work picked on the themes of environment and technology (Hayes, 1977, Waterhouse and Tiessen, 1978), but the search for other situational factors that might affect the design and operation of MCS has broadened out considerably (see Fisher (1995) for a good summary). In his recent review of MCS research, Chenhall (2003) categorises work and analyses the findings under the headings of Environment, Technology, Size, Strategy and Culture. The inclusion of strategy in this list is relatively recent and is significant in that it acknowledges that the choice of MCS may not be purely a response to exogenous contextual factors, but that the nature of co-existing MCS routines can also influence characteristics of the organisation.

Most CT research is conducted at the level of the organisational unit and sub unit. It is usually categorised as functionalist (Chenhall, 2003). In that it is assumed that what is observed and measured represents an equilibrium position of best fit between the organisation and the environment with organisational effectiveness being the implicit guiding force or selection criterion used

Other MCS research within the sociological stream takes a significantly different position to that of CT (Baxter and Chua, 2003, Cooper and Hopper, 2007, Otley et al., 1995). Typically, they treat control structures as a manifestation of the interplay of interpersonal politics and power struggles within organisations. In other words, they serve personal needs and goals, not just the objectives of the organisation. Covalleski et al. (1996,24) argue for drawing on interpretative and critical perspectives and using pragmatic pluralism as a way of enhancing our understanding in the social sciences. To date, these alternative approaches have not gained much ground in mainstream research (Hopper and Powell, 1995) and do not help address the research questions posed in this thesis.

2.4.5 Systems and cybernetics

Covalleski et al. (2003), did not recognise a systems based approach in MCS research, but following their mode of analysis it arguably sets out to answer the question “what is the best way to configure the process/organisation in order for the system to remain viable?” and usually tackles this problem at the level of the organisation or the sub unit. Organisations are conceived as open systems, tightly coupled with environments that are assumed to be dynamic and unpredictable in nature. Control processes are informed by goals, feedback and feedforward information that is used to hold an organisation in a state of dynamic balance with current and future environments by facilitating appropriate responsive and adaptive behaviour

Although the word system is extensively used descriptively by researchers from all research traditions, and Ashby and Beer were, according to Hooper et al. (2001)

very influential in the late 1970s and early 1980s, there is little explicitly systems-based work in the literature on the subject of this research. Specifically, one might expect that cybernetics, which Wiener (1948) characterised as the science of control and communication), would provide useful insights for researchers. There is little evidence, however, of many researchers explicitly adopting cybernetic ideas, but that has not stopped a number of authorities claiming that the science had a pervasive negative influence on the entire field of MCS research.

For example, (Hofstede, 1978) characterised the mainstream paradigm (by which he means that represented by the work of Anthony (1965) and others in that genre) as being cybernetic in nature. Dermer and Lucas (1986) and Dermer (1988) took a similar line, the authors arguing that the prevailing cybernetic orthodoxy represented an impoverished philosophy of management control since it is founded on simplistic, mechanical models of organisations.

In support of his view, Hofstede (1978) cited Giglioni and Bedian's work (1974), which traced the development of management control theory between 1900 and 1972. However, most of the work covered by their survey pre-dated cybernetics as a recognised science, The word cybernetics was only coined by Weiner in 1948 to describe what he saw as a revolutionary new approach to the study of goal orientated systems and everything that could be described as cybernetic science was developed subsequent to this. In fact, the first comprehensive text on cybernetic science was not published until 1956 (Ashby, 1957). Whilst intuitively acknowledging the existence of a generic model of control, it is clear that the authors cited by Hofstede cannot have drawn explicitly on cybernetic theory in the way in which he seems to imply.

This tendency to apply the term cybernetic to the work of authors who made no such claim for themselves has been recognised by a number of researchers. Lowe and Puxty (1989), for example, referring to Anthony's 1984 edition of his book on Management Control Systems, note that he recognises that the nature of control he advocates is based on simple feedback loop concepts but because the word cybernetics does not appear in the index we must assume that the science of cybernetics is not considered relevant to the author's purposes. In the article referred

to above, Hofstede (1967) himself acknowledges that that the word cybernetic is used as a way of describing an approach to the process of control rather than the science of cybernetics itself (Hofstede, 1978,454):

“By cybernetic it is meant a process that uses the negative feedback loop represented by: setting goals, measuring achievement, comparing achievement to goals, feeding back information about unwanted variances into the process to be controlled, and correcting the process. This is a much narrower use of the term cybernetic than that advocated by Wiener who coined it to deal with the transfer of messages in the widest sense, but it corresponds more closely to its present use in practice”.

Perhaps the reason for this confusion is, Morgan argues, that researchers have failed to make a distinction between cybernetic techniques (such as error controlled feedback systems) and cybernetic epistemology. He notes that the latter often results in the design of mechanistic control routines of a sort that are inappropriate for use in complex social organisation and which consequently, paradoxically, violate the principles of cybernetic epistemology (Morgan, 1982).

It is clear that the term cybernetic is often used as a way of describing a particular sort of common sense approach to control and should not be taken to mean that the work to which it is applied is derived from cybernetic theory other than in a very trivial sense. The view taken in this thesis is that cybernetic theory includes, but is not limited to, first order negative feedback systems.

There is very little work that sets out to develop a control model explicitly based on systems or cybernetic theory, despite the obvious attraction of doing so. Ansari (1977) advocates developing an open systems model for designing control systems and later (1979) demonstrated what he believed was an open systems approach to the process of variance analysis. Others (Amigoni, 1978, Flamboltz, 1983, Lowe, 1971, Lowe and Tinker, 1977) also attempt to describe a systems framework but without any reference to acknowledged systems or cybernetic authorities. Maciarello claimed to have based his work on Management Control Systems (1984) upon cybernetic theory, but since he makes no reference to the work of Ashby, and

specifically to his Law of Requisite Variety, which Richardson (1991) regards as the defining characteristic of work in the cybernetic stream, it is doubtful that the impact of cybernetic science on his work was profound. Hooper and Powell also claim that the work of Hertog (1978) and Hedburg and Jonsson (1978) are in this tradition, and Morgan (1982) notes parallels between cybernetics and organisational theories upon which the sociological stream of MCS is based. Indeed, Puxty believes that the tendency for contingency theorists to disclaim cybernetics is one of the models chief lacunae (Puxty, 1993). Many other management accounting researchers make use of cybernetic concepts without making any explicit reference to them, including Emmanuel and Otley (1985) who refers to the concept of ultrastability, homeostasis (Hofstede, 1978), viability and survival as a goal (Berry et al., 1995b), variety (Berry and Otley, 1980, Leeuw de and Volberda, 1996), autonomous self-organised teams (Hofstede, 1978), (Dermer, 1988, Dermer and Lucas, 1986) and open systems and survival (Atkinson et al., 1997). All through this body of work, the link to cybernetic theory (if it is there at all) is superficial, implied or unconscious rather than well-grounded and explicit.

The only significant piece of work that can claim to have been founded on a deep appreciation of systems science is that of Amey (1986, 1979). His stated objective was to begin a “fundamental re-examination of the foundations of budgeting and budgetary control” based on systems and modern control theory, having been frustrated by the “unscientific nature of many of the procedures” and a recognition that “budgets do not appear to perform very effectively as planning or control devices in practice” (Amey, 1979,84). While his work is grounded in cybernetics and in control theory, he relies on concepts derived from relatively simple (mathematically tractable) mechanistic control systems; first order negative feedback mechanisms (i.e. those that rely exclusively on negative feedback to steer towards externally determined goals). He followed up his first book with a companion volume on Planning Systems (Amey, 1986), which he saw as being distinct from budgeting systems for theoretical and practical reasons.

Amey’s work represents a serious attempt to tackle the issue of budgeting control at a theoretical level but it has inspired little in the way of follow up research, perhaps because of the failure to translate the thinking into practical concepts and language

and also the mathematical and mechanistic bias of his work (Hopper and Powell, 1995, Otley, 1983). Whilst, in their review of 'Control, Organisation and Accounting' Otley and Berry (1980) argue that it may be appropriate to discard current accounting frameworks in favour of an integrated one synthesised form system theoretic principles, they damn Amey's work with faint praise ("a partial start"). Their conclusion is that "cybernetics has yet to demonstrate that it can provide useful insight into the design of organisational control systems". (1980,242)

A sign of the lack of impact made by systems-based work in the field is that a number of recent reviews of research into MCS and budgeting (e.g. (Berry et al., 2009, Chenhall, 2003, Chennal, 2003, Covaleski et al., 2003, Hesford et al., 2007, Laughlin, 1995) make no reference to the contribution or appropriateness of systems theory at all. According to one recent analysis the source disciplines for management accounting publications are: Economics (43%), Sociology (40%) and Psychology (15%) (Hesford et al., 2007).

2.5 Critical evaluation

2.5.1 Achievements

Fifty years of academic research into the topic of management control has not been without success. Argyris' early work on participative budgeting (Argyris, 1952) has clearly had an impact in practice as well as in stimulating a rich seam of academic research in and around the behavioural interface between people and process. The field has matured and progressed over the years (Merchant and Otley, 2008). Early approaches, which tended to be universalistic in nature and rather simplistic in their view of cause and effect (single variables, unidirectional causality), have given way to research that factors in contingent variables and recognises that causality is not necessary linear in nature, i.e. A influences but is also influenced by B. Contingency based research has now accumulated an extensive catalogue of findings (see (Chenhall, 2003) that have been broadly validated by research. In addition, an earlier exclusive focus on formal controls and a functionalist stance has given way to a view that in practice control is exercised through the interdependent operation of many controls of a formal and informal nature (Ferreira and Otley, 2009, Malmi and Brown,

2008) and a recognition that the existence and primacy of externally determined economic goals in organisation control systems cannot be assumed.

There are, however, dissenting voices. They argue that the research endeavour has not succeeded, either in terms of accumulating a body of knowledge or in terms of solving problems in the real world, often the very ones that stimulated the research work in the first place. For example, in the field of RAPM, Briers and Hurst (1990) take issue with the view expressed by Lau et al. (1995), concluding that while a body of knowledge exists it cannot claim to be organised. Increasing disillusionment of a similar nature is expressed about the state of Contingency Theory research, Chapman (1997), for example, claiming that it has fallen into a state of disrepute.

Within the management accounting research community many opinions exist as to why a coherent, generally accepted body of research knowledge has not emerged, but they can be summarised under three broad headings:

1. Issues with theory development.
2. Issues with the methodologies used.
3. Issues with links to management practice.

2.5.2 Theoretical and philosophical issues

The importance of theory to research in MCS is well recognised, not only as a prerequisite for powerful empirical studies (Anderson and Widener, 2007) but also a vehicle for understanding and communicating in qualitative research (Ahrens and Chapman, 2007, Otley and Berry, 1994). It has long been recognised as a weakness in MCS research, dating back to the critique in Geert Hofstede's influential paper (Hofstede, 1978), in which he launched a robust attack on what he perceived as the impoverished nature of management control philosophy. The inadequacy or lack of theory has been a theme that critics of research in this field have returned to on a regular basis.

The object of Hofstede's critique was what he characterised as the dominant cybernetic paradigm on which traditional MCS research was based. The thrust of his argument is that traditional forms of controls rely on: a) the establishment of a standard, b) measurement of actual accomplishment and c) the use of this to intervene in the process. This approach, he argues, appropriate to the control of only the most routine industrial-type processes. The mechanistic paradigm that this approach assumes cannot, he believes, be applied to complex social systems comprised of individuals with the capability and psychological need to choose their actions, and with their own values, norms and goals. As a result, he argues, any attempt to enforce a cybernetic model will either fail or result in at best pseudo control where the formalities of the process are observed explicitly but ignored in practice.

He develops the argument further in subsequent work (Hofstede, 1981), arguing that whilst what he characterises as Type 1 errors (the failure to apply cybernetic models to matters of routine control) do exist, the archetypical problem in management control are Type 2 errors (the inappropriate application of simplistic cybernetic control to complex control problems), an analysis supported by Birnberg et al. (1983). Berry et al. argue (1995a) that where conditions for cybernetic control exist – clear objectives, a stable environment described by a predictive model capable of easy measurement – the need often does not.

Dermer and Lucas (1986) take a similar line, arguing that to the extent that a given set of prescribed control variables cannot effectively be used due to inherent uncertainty difficulties of measurement, or lack of knowledge concerning causality (all characteristics of real life in organisations) that the application of contemporary control approaches will likely produce poor results. They then make a case for an expanded theory of control based on an alternative definition of control where the process of commitments and constraints as a two way process rather than one whereby a controller extracts compliance from a controllee. Johnson (1997) concurs with this analysis, arguing that management accounting approaches are mechanistic, directed at ends rather than means. He advocates that we pay more attention to the way that things are ordered in the natural world: nature does not mechanise, it naturalises.

Criticisms of the prevailing paradigm have continued in recent years. For example, Otley (1994) suggests that it focuses too much on accounting controls and assumes a hierarchical organisational structure, both of which he believes are becoming increasingly less prevalent in modern organisations. Gray (1990) also criticises the philosophical assumptions on which mainstream MCS research is based by criticising Simons' (1987b) work, which she argues is flawed because it assumes that strategy is a top management prerogative and the task of managers is confined to implementation.

Criticism of theoretical deficiencies is not limited to the dominant cybernetic paradigm. For instance, Kaplan (1994) and Berry and Otley have targeted work emanating from the Agency Theory stream. They believe that "there has been a tendency in the literature of management science and financial management, if not in practice, towards the development of elegant mathematical models for non-problems against the development of heuristics or crude models for real problems" (Berry and Otley, 1980,414)

Others argue that theory is not so much impoverished as incomplete, perhaps even non-existent. Chenhall (2007) argues that Contingency Theory is not a theory as such, more a variety of theories created to explain context dependant behaviour. Otley is less charitable. "Contingency Theory is not a theory at all but rather a point of view which asserts "it all depends" which has been invoked, so it seems, in order to cover up some of the embarrassing ambiguities that exist in the universalist approach" and that "tends to be used as a means of avoiding rather than addressing design implications" (Otley, 1980,414). Others argue that where theory does exist, large important gaps remain. Thus Anthony and his followers are criticised for assuming the existence (of goals) as completely unproblematic (Berry et al., 1995d) and "explaining them away by relegating them to the realm of strategic planning" (Berry and Otley, 1980,235). According to Merchant and Otley, goal setting theory has not advanced since the 1970s (Merchant and Otley, 2008).

In the absence of good theory, MCS empirical work has been poorly directed and fragmented (Malmi and Brown, 2008, Otley and Fakiolis, 2000). The inability to

generate testable hypotheses (Birnberg et al., 1983) has led to “a fragmented set of insights...many of which have a largely unknown and possibly equivocal relationship to accounting in real life” (Otley, 1989,30) and made the consolidation of theory and empirical research from case studies problematical (Hopper and Powell, 1995). Otley goes on to deplore the polarisation “between what may be disparagingly described as the armchair generation of theory at one extreme and mindless empiricism on the other”(Otley, 1989,29), which he regards as “particularly unfortunate in a discipline which has such real world aspirations”. Briers and Hurst (1990) argue that theoretical development has been subordinated to statistical analysis.

According to some, the absence of a theoretical anchor for MCS research has also left academics open to the vagaries of management fashion. Ittner and Larcker’s review of the empirical managerial accounting literature (2001,207) concludes that it is “driven by changes in practice...many papers are motivated purely by the fact that a certain topic has received considerable attention in the business press, with little effort to place the practice or study within some broader theoretical context”.

While there might be agreement that it is desirable to have a theory, not everyone believes that it is possible. Berry, for instance, argues that “context has so many relevant dimensions which often work in opposing directions that the establishment of an integrated contingency theory seems all but impossible” (Berry et al., 2009,15). Zimmerman’s (2001) strident call for a unifying theory based on economics attracted a lot of comment in the literature, much of it unfavourable. Most of the critics did not take issue with his analysis of the state of the field, but they didn’t agree with his view that it was possible to construct a unifying theory or that economics should be the source. Most critics, instead argued for a pluralist approach to research (Hopwood, 2002, Ittner and Larcker, 2003, Luft and Shields, 2003b). For others, adopting a pluralist approach is not a panacea for the lack of theory building; indeed it confuses rather than enriches debate and polarises positions, so stifling progress. Different streams of literature have tended to develop independently. They use different terms to describe similar concepts and infrequently cite works from other paradigms (Merchant and Otley, 2008) thus contributing to fragmentation rather than theoretical richness and consolidation. Writing in 1986 Chua argues that “the accounting domain is thus a) characterised by apparently

irreconcilable cross-paradigmatic discussions and b) hampered by some theories about practices that, in the main, are neither of or informed by practice” (Chua, 1986,602).

In conclusion, many, perhaps most, researchers would concur with Fisher’s view that “a theory of management control systems that explains not only how control operates but also how it relates to other mechanisms of the firm and contingent variables is clearly wanted and awaits further development” (1995,48). The trend is clearly towards adopting a more holistic perspective (Ferreira and Otley, 2009, Malmi and Brown, 2008, Otley, 1999) but thus far these have taken the form of frameworks rather than theories with explanatory power.

Back in 1980, Berry and Otley suggested that “it might be appropriate to neglect the current accounting framework as being so removed from the issue of interest as to make it inappropriate (that would) require an attempt to synthesise an integrated theory of organisational theory from cybernetics, general systems theory and organisational theory” (Berry and Otley, 1980,242). As yet, though, “the abstract nature of the core theory of systems stands as a skeleton to be completed” (Puxty, 1993,133).

2.5.3 Methodological issues

RAPM and Contingency based research in particular, has been heavily reliant on the use of questionnaire based surveys, which are subsequently submitted to statistical analysis. The attraction of this approach for researchers is that it is, on the face of it, objective and allows for the quantitative testing of precisely formulated hypotheses. It is also relatively easy to conduct and replicate studies (Hopper et al., 2001) (Hopwood, 1979) and so, it is hoped, quickly build up a body of knowledge that submits to the Popperian ideal of falsifiability. However, have argued that another reason for their popularity is that it represents the quickest route to publication and therefore the furtherance of an academic career (Hopwood, 1979, Otley, 2001). This might explain why nearly 30% of published material in the field uses this approach despite it being “the most heavily criticised research method employed by management accounting researchers” (Van der Stede et al., 2007,445). The most common criticisms made are as follows:

1. First, it is incapable of capturing the richness of real life, since the only a few variables can be analysed at the same time and the method of measurement is crude. Accounting systems are part of a whole, argues Otley (1980,445), and “in these circumstances it is unrealistic to expect purely statistical methods to unravel a complex pattern of interaction”. Hopper and Powell (1985,440) continue: “although the procedural nature of organisations is emphasised, much of the research...has tended to use questionnaires to take snapshots of temporary structural manifestations rather than observing the process unfold over time”. Thus, for example, Otley (1980) and Kaplan (1994), amongst others, have argued for an anthropological approach founded on case based fieldwork.
2. Some critical assumptions underpinning this kind of research are open to question. As Chenhall notes (2003), although it is rarely explicitly stated, the assumption upon which such cross sectional surveys is that MCS are at equilibrium; that the nature and form of control systems in use and their internal and external environment are in balance and that the current situation reflects some form of optimum. This clearly can only apply if the contextual variables are very stable or if control systems adapt quickly to changes in the environment, but in the real world practices might be very slow to change for a plethora of cultural and practical reasons (Scapens and Roberts, 1993): change is also complex and contingent. Also, most organisations take ten years to accomplish major structural change (Luft and Shields, 2003b). In addition, control systems evolve in response to a multitude of factors, one of which is the tendency to conform, as a consequence of the dissemination of the ideas of academics or the work of consultants or simply because of the faddish or fashion driven nature of the market for innovations in management (Ittner and Larcker, 2003). Granlund et al. (1998) argue that there is therefore a tendency for management practices to converge on a consensual model rather than adapt to local contextual variables. Professional training and socialisation also act to stabilise and homogenise management control practices (Tiessen and Waterhouse, 1983). Otley (1999) holds that history is important for understanding how and why MCS take any particular form, and argues for a longitudinal archaeological approach to MCS research, a view

supported by Kaplan (1994), Hopwood (1978b) and Briers and Hurst (1990) amongst others (Fisher, 1995, Malmi and Brown, 2008, Merchant and Otley, 2008).

3. The small sample sizes often used (typically involving low response rates from a small population of companies in a single geography or industry) make generalisation difficult (Hartmann, 2000, Merchant and Otley, 2008). Also, ambiguous wording in survey questionnaires (Otley and Fakiolis, 2000) and the failure to define constructs in a precise or a consistent fashion (Tiessen and Waterhouse, 1983) have been criticised. According to one source of criticism “little cognisance has been paid to how selective perception of the researcher may bias results...(and) questions of individual understanding and meaning have been taken as non-problematical” (Hopper and Powell, 1985,441) For a comprehensive analysis of the failings of survey methodology see Young (1996).
4. The relevant output variables (i.e. those representing performance) are rarely included in the scope of research. Since MCS are, by the commonly accepted definition, practices which help organisations meet their goals in an effective and efficient way this is a potentially serious omission, a point made by Lowe (1989) and Hofstede (1978) amongst others. Where output variables are not included in scope, the implicit assumption made is that, since a particular set of practices exist and persist they must be optimal with respect to the achievement of goals, since management acting rationally would not otherwise employ them. Another reason why output variables are often not included in research is more straightforward; relevant archival data is often difficult to source. Also, even where an output variable is included in the study, performance is often defined in an unsatisfactory way (Fisher, 1995). “It is not at all clear what is a good performance measure” conclude Merchant and Otley (2008,792). Apparently little has changed since Waterhouse and Thiessen concluded that “a substantial amount of work needs to be done of the linkages between organisational and managerial variables and effectiveness before policy prescriptions can be written with confidence (Waterhouse and Tiessen, 1978,74).

Given the range and nature of methodological shortcomings it is perhaps unsurprising that researchers have often been unable to replicate research findings (and see Hopwood (1973) and Otley (1978) for a classic example). A number of authorities have commented on the high incidence of contradictory research findings (Chapman, 1997) or simply hypotheses that are not validated (Hartmann, 2000, Otley, 2001) (Hopper and Powell, 1985).

Survey based methodology is the predominant methodological approach used the Psychological and Sociological research stream, but Economics based research draws heavily on analytical and experimental techniques. These approaches have their critics. While Kaplan commends the technical virtuosity of the Agency Theory researchers, he goes on to argue that “the complexity and difficulty of computing equilibrium solutions in multipurpose non co-operative game settings has limited analysis to only extremely simple organisational settings” (Kaplan, 1984,603). Such analytical work is frequently used in combination with laboratory experiments, often using undergraduate students in simulations, an approach that has been criticised as unrealistic and incapable of generating findings that can be generalised to real life organisational settings (Merchant and Otley, 2008, Ryan et al., 2002).

It has been suggested that one reason for the failure to develop a consolidated body of knowledge from empirical work in the field may be a result of what is measured rather than how it is measured. For instance Chapman (1997) and Hartmann (2000) argue that uncertainty may be the missing variable. Thus far little work has been done to develop this theme.

2.5.4 Links with practice

A third source of discontent with research in the field is the lack of interaction with the practitioner community, both as a source of insights and understanding and as the outlet for academic knowledge and expertise. Accounting is an applied science (Ittner and Larcker, 2003) but in fact the scale of the intercourse between the two worlds is very modest. Attempts to bridge the gap between the worlds of theory and practice are notable by their rarity (Gordon and Miller, 1976, Govindarajan, 1988) .

The problem starts with a lack of understanding in the research community, according to Hopwood (1979,146). “I have recently become ever more aware of how little we know about the actual functioning of accounting systems in organisations” and “drawing on over two decades of scholarly effort, it is difficult to name more than a handful of organisationally based empirical investigations of the accounting craft”. Two further quotes support this view: “Researchers know little about accounting in actual practice, how it interacts with other organisational practices and how it contributes to organisational effectiveness and adaptability” according to Bourn (Hopper and Powell, 1985,446) .

If this critique is to be believed, academics have made little contribution to practice. Not only has there been relatively little research work grounded in the real world of industry but practical developments continue to be “a very pragmatic affair, prodded no doubt, by the recognition of the inadequacies of prevailing approaches and the possible relevance of known alternatives...guided by practical wisdom and shaped by the rules of experience and the lessons of trial and error. Certainly there is little or no evidence of any systematic research being undertaken, least of all in the academic community” (Hopwood, 1979,145). “There have been few, if any British scholars who have proselytised particular trends or converted them into applications that have received significant application in practice” says Hopper (Hopper et al., 2001,284). Kaplan makes the same criticism of American scholars (Kaplan, 1984), something from which he is exempt given his contribution to the Balanced Scorecard and other innovations in accounting craft.

This lack of contribution is not the result of a shortage of issues that would benefit from academic input. For instance, the predominant focus of research has been management control and budgeting, which sits within the medium term time frame in Anthony’s classification of control systems. Otley (Otley, 1999) notes that short term Operational Control has been neglected by the management accounting research community, and, at the other end of the scale, whilst strategy has tended to be included within the scope of MCS research in recent years (see (Langfield-Smith, 1997, Simons, 1991, 1987b, 1995)) the integration of Strategic Controls with MCS – a common problem raised by practitioners – has received little attention. Also, as

Berry et al. remark, in the context of a critique of Anthony's work (Berry et al., 1995d) researchers often tend to assume the task of goal setting away by stating that it came from strategy or ignore it altogether. Some longstanding practical issues have still not been resolved by the academic community. Commenting on the literature on participative budgeting that originated with the work of Argyris in the 1950's Covalski notes that: "fundamental questions about how resources are allocated and how information is communicated in budgeting...are still of urgent interest to practitioners" (Covalski et al., 2003,34).

It would also be very helpful if academics could help managers assess which of the remedies offered by consultants and software suppliers were solutions and which simply fads (Ittner and Larcker, 1998,234). Closer to the topic addressed by this thesis Otley laments that "the rather depressing conclusion for management accounting researchers is that having put in much work coming to a fuller understanding of how budgeting systems work in practice, and the impact of differing patterns of use of such systems, organisations are giving up budgeting as the primary means of affecting overall control and are having to resort to other techniques. It is not clear what these techniques should be. (2001,254) "

Hopwood, amongst others, argue for a more explicit design focus whilst recognising that "the foundations for a theory of accounting system design, if they do exist, currently remain within the experiential understandings of accounting practitioners and consultants" (Hopwood, 1979,10). This requires researchers move beyond technical level research and challenge authority and the status quo (Hopwood, 1978b). Kaplan argues strongly for closer links with practitioners (1994) and the need for academics to get their hands dirty, make interventions and participate; learning by doing, an approach endorsed elsewhere (Berry et al., 2009). He also advocates a design and problem solving focus and points to the revolution in theory and practice in management accounting in the 1980s as evidence of what can be achieved through closer engagement (Kaplan, 1984). In particular, there is a need for researchers to tackle what Kaplan sees as the important problems that have arisen in the 60 or so years since the Dupont system was first developed: accounting manipulation, short termism and financial entrepreneurialism.

In conclusion, while there is a strong consensus about the purpose of MCS research, and an agreement that contingent factors are important (Berry et al., 2009) – that there is no universalistic solution – research findings are fragmented and there is little confidence that integration can be achieved, at least with existing theories and approaches. This is the context in which this thesis sits.

2.6 Conclusion

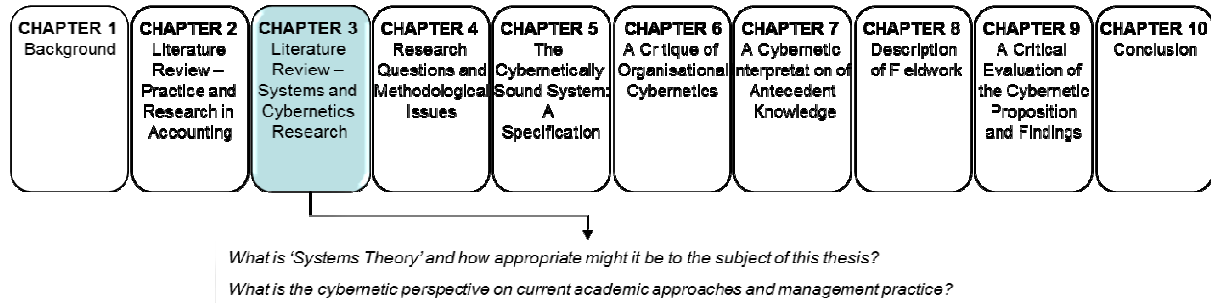
This chapter has defined the scope of this research enquiry: the mechanisms governing the flow of financial resources in organisations, and described how budgeting has come to dominate management practice in this field.

There has been a long tradition of research in this area, often carried out under the banner of Management Control System research, which over the last 50 years has spawned a number of distinct traditions. These traditions adopt different philosophical and ontological stances, often ones imported from related disciplines, and typically employ different methodological approaches. For reasons that are not clear, few workers in the field have chosen to adopt a systems-based approach to research.

The collective result of this research endeavour has failed to produce a coherent body of knowledge or to have made a significant impact on management practice, which is unfortunate, given the manifest problems associated with conventional budgeting. This has been attributed to a failure to develop a coherent theoretical framework, to shortcomings in the research methods applied and a lack of engagement between the world of academia and practice.

In the next chapter, the content and history of systems thinking and systems science will be reviewed with the aim of establishing whether, and in what way, these ideas might be relevant to the study of FPMS.

3 Literature Review – Systems and Cybernetics Research



3.1 Introduction

In this chapter, the history and content of systems thinking and systems science will be reviewed with the aim of establishing whether, and in what way, these ideas might be relevant to the study of FPMS.

It will be argued that there are many strands of systems thought, but they all share some basic assumptions about the world; one of which is that what we see around us is the result of the interaction of components that combine in complex ways to create phenomena with characteristics that cannot be inferred from the nature of the individual elements. In other words, systems have emergent properties, and such systems cannot be understood by reductionist methods. However, even though the behaviour of systems cannot be predicted (because of the nature and scale of the interactions involved), they often adopt stable forms with archetypal patterns of behaviour, and these forms also tend to become more ordered or complex over time.

In these and other ways, systems science has a distinct and different perspective on the world to that of classical science. Traditional science is based on the concepts of determinism, linear causality and reductionism, assuming that phenomena are best understood through analysis, which when conducted properly yield precise predictions. It also postulates (as enshrined in the Second Law of Thermodynamics) that the dominant tendency is for the world to become more disordered (entropy),

whereas systems science seeks to understand why, in localised parts of the universe, the tendency is toward increased order (negentropy).

An aspect of systems science that makes it of particular interest to this research is the assumption that general laws derived from the study of relationships between elements of systems in one domain can be applied wherever the same pattern of relationships exist, irrespective of the substance from which a system is constructed. It may be that such laws can be applied to the study of FPMS.

The chapter will start with a short overview of the classical Newtonian scientific paradigm, which is then compared to the Systems paradigm. The major strands of systems science and their provenance are then discussed, and the ways in which these ideas have been applied to management are outlined. Cybernetics is the branch of systems science felt to have the most potential for application to the field of FPMS, so the chapter concludes with a Cybernetic critique of FPMS. This critique will help establish whether there is a prima facie case for using it as the theoretical foundation for this thesis.

3.2 The characteristics of the systems approach

3.2.1 The classical model of science

Modern Western science is dominated by the concept of reductionism articulated by Descartes (Checkland, 1976, Jackson, 2000). This approach is based on a belief that the best way to acquire knowledge is to break down the complexity of nature into its component parts to make it more amenable to understanding. It is therefore an analytic approach, based on the assumption that an understanding of all the parts will provide an understanding of the reconstituted whole.

This approach to the acquisition of knowledge can be traced back to Aristotle. Arguably, however, the first modern scientist was Galileo, by virtue of the fact that he developed an experimental approach that enabled ideas to be tested, thereby enabling the process of knowledge accumulation through what has come to be termed the scientific method.. Other renaissance figures, such as Tycho Brahe, Copernicus

and Kepler, contributed to this process through a rigorous process of theory development and observation and but the most significant breakthrough was made by Isaac Newton, who demonstrated that many phenomena could be shown to obey natural laws that could be expressed in a relatively simple mathematical form (Capra, 1982a, 1997). Along the way he developed tools, such as differential calculus, to help him dissect nature and expose its secrets.

Over the last 400 years the scientific approach to acquiring knowledge has proved spectacularly successful. Whilst Newton's Laws have been shown to represent nature only partially, and there have been many others who have contributed to the development of knowledge and the scientific method of acquiring that knowledge; science as we know it is still essentially Newtonian in character. How might the Newtonian model of scientific enquiry be characterised? According to Guba (Guba and Lincoln, 1998) paradigms of enquiry can be summarised by their answers to three basic questions: what assumptions are made about the nature of the world (ontology), what criteria define what constitutes knowledge (epistemology) and how is knowledge acquired (methodology)? We will now address each of these in turn.

3.2.1.1 Ontology

The classical perspective on the world assumes that the objects we perceive are real and tangible; that is they exist as things in themselves, independent of the scientist, and that they can be sensed, represented and measured in an unambiguous and objective way, given the right instrumentation. Following Latour, Pickering (2010) calls this dualist ontology, where people and things are assumed to be different, modern. Big things are taken to be made up of smaller things, the assumption being (at least until quantum phenomena were discovered) that at some very small scale there exist some fundamental particles from which everything else is made up. These entities, at whatever scale we consider, are assumed to relate to each other in a deterministic fashion. That is, if initial states are known and all extraneous variables are eliminated, the behaviour of any body can be predicted, perfectly (Laplace, 1951). In those circumstances where the number of bodies is too large to make precise predictions for each one (such as in a gas or fluid), the behaviour of

the population can be understood probabilistically. In other words, the cause is both necessary and sufficient to explain the effect. The world is therefore taken to be mechanistic in character. Ackoff (1999) characterises this view of the world as representing the Machine Age; the age of industrialisation. Von Bertalanffy, one of the founders of systems science, summarises it thus: “classical science is essentially concerned with two variable problems, linear casual change, one cause and one effect or with few variables at most” (Dent and Umpleby, 1998,515).

3.2.1.2 Epistemology

The belief that the world is real as we perceive it means that the approach of classical science to acquiring knowledge is based on empiricism. Traditionally, this proceeds in a reductionist manner. This involves breaking the world up into its component parts, isolating those elements that are the object of enquiry and, through a process of experimentation, seeking to determine the nature of the (deterministic) relationship between them. Having understood the relationship between the parts, the whole can be understood by reassembling them. This approach is analytical in nature.

Over the last few centuries academic disciplines have developed within the reductionist approach to acquiring knowledge; the nature of the object being studied being studied determining the boundaries between them. As a consequence knowledge is organised around the nature of things: objects in the real world. Consequently it is often implicitly assumed that there is limited scope for knowledge to be transferred from one domain to another; at least in a way that is recognised as scientifically valid.

The criterion usually applied for what passes as scientific knowledge is falsifiability (Popper, 1959). In other words, something does not pass for scientific knowledge unless it is capable of being falsified; all scientific knowledge is therefore provisional in nature. A consequence of this is that methodological procedures need to be replicable. If they are not, the results cannot be falsified.

3.2.1.3 Methodology

The scientific approach to acquiring knowledge comprises three basic steps: decompose, explain separately and put back together (Ackoff, 1999). In the classical model, at its simplest, decomposition results in isolating two variables, A and B; one of which is deemed to be the independent variable, the other the dependant variable. The scientific method involves formulating a hypothesis about the nature of the relationship between these two variables and then constructing experiments in order to test the validity of the hypothesis (Saunders et al., 2003). In the physical sciences, this process of testing involves constructing an experiment, often in a laboratory setting, designed in such a way that the influence of all extraneous variables can be eliminated. In more complex situations (such as those found in the social sciences) it is often not possible to eliminate all other variable by experimental design, and so they are controlled for, i.e. their potential effect is identified and allowed for in the analysis of the results.

3.2.1.4 Challenges

The scientific approach, while successful, cannot be applied to every kind of natural phenomena. In his classic paper (1948), Weaver characterises the focus of Newtonian science as organised simplicity; that is, those parts of nature that can be represented by simple two body problems. The phenomena that Newton was trying to explain (the movement of celestial bodies) proved to be very tractable to this method because, while there are more than two bodies in the heavens, the level of interaction is such that they can be ignored. Thus Newton was able to predict their movements with great precision. These triumphs led some, such as Laplace (1951), to believe that if we had infinite calculating capacity, and knowledge of the starting position of every entity, we would be able to explain everything in the Universe; everything that has happened and will happen. The scale of the additional computational capacity required is not, however, trivial. For instance, although Newton's mechanics easily solved the two body problem, the three body problem is enormously more difficult to solve using conventional approaches as Poincare demonstrated (Gribben, 2002).

At around the turn of the twentieth century, it was realised that classical scientific methods could be applied to another class of multi body problem, without the need for a vast increase in computational capacity; a class of phenomenon that Weaver calls disorganised complexity. If there are a very large number of bodies, but they are disorganised (that is they behave in a completely independent fashion) it is possible to explain their behaviour in a probabilistic as opposed to a deterministic fashion. Thus, with the advent of Statistical Mechanics and the work of Boltzmann, Gibbs and others, the world of fluids and gasses submitted themselves to the scientific method.

At around the same time, however, the classical model of the world ran into difficulties. Bohr, Planck, Heisenberg and others (Capra, 1982a) demonstrated that at a very small (quantum) scale the world did not seem to be made up of objects at all, but of probability distributions, which only crystallise with the act of observation, to create the reality we perceive. What is more, it is not possible to know everything because the very act of measurement changes reality (Heisenberg's principle of uncertainty).

Quantum mechanics demonstrated that the classical approach to science begins to break down at a very small scale, and it also became increasingly clear that it was difficult to apply it at a larger scale, the scale at which most human affairs are conducted. Weaver characterised problems at this scale as those of organised complexity. In this domain, complexity involves consideration of the interactions between more than two bodies, but because the relationships between them are organised – that is they are constrained in some way, often by the circular logic of interdependence – they cannot be modelled statistically in the way that gas or fluid particles can.

Even if it were possible to identify all of the bodies, and mathematically analyse the relationship between them, the classical approach to science runs up against another problem. For computational convenience classical science assumed that most relationships between variables were linear in form; non-linear equations were usually impossible to solve with the technology available before computers. When

computers were invented it became clear that relaxing the assumption of linearity generated additional complexity, which hitherto had been hidden (Gleick, 1998). By their very nature, nonlinear equations, even though their form is strictly deterministic, are prone to produce solutions that are unpredictable, particularly if they are recursive in nature (that is the output of one pass of the equation becomes an input into the next). This is sometimes referred to as Chaos Theory (Gleick, 1998). While this mathematical process sometimes results in behaviour that is patterned in a characteristic fashion (taking the form of attractors), the equations are often highly sensitive to starting conditions, so small random perturbations can cause a shift in behaviour that cannot be anticipated. Thus, where non linearity exists (and most of the natural world is nonlinear in nature) predictions are not possible, even with deterministic systems. This is why it is not possible to forecast the weather precisely, beyond the next few days. The fact that a system is deterministic does not mean that it is predictable.

Furthermore, it is clear that not only is the behaviour of organised complex systems impossible to predict, but the qualitative nature of systems at different organisational levels can vary in ways that cannot be deduced from the qualities of the systems of which they are composed. This is the phenomenon of emergence. Thus, in a very simple example, saltiness is not a quality of either sodium or chlorine; it comes into existence when they combine to form salt. By the same token, the qualities of sodium cannot be deduced from the arrangement of electrons, neutrons and protons.

Finally, in studying the phenomenon of interest to the natural sciences, the notion of purposefulness can be completely ignored; behaviour can be assumed to be entirely the product of exogenous causes. The concept of choice as exercised by biological entities is, by its nature, at variance with classical ontology and epistemology, and undermines its methodology. In the social sciences this idea is sometimes referred to as reflexivity the idea that how we perceive the world (rightly or wrongly) may change our behaviour and in so doing change the world (Umpleby, 2007). Little wonder that Einstein is quoted as saying "one can best feel in dealing with living things how primitive physics is" (Rosen, 1979,321).

From this short review it is clear why, despite its proven success in explaining many natural phenomena, the classical scientific approach has proven to be less effective to the study of complex systems tackled by the disciplines that address problems of organisation such as biology and social sciences.

3.2.2 The systems model of science

Emergence or holism is not a new phenomenon (Dent and Umpleby, 1998). The notion that the whole is more than the sum of the parts can be traced back to Aristotle, and qualities that attach themselves to wholes have been invoked by scientists (e.g. vitalism) and mystics (e.g. the soul or spirit) over the millennia in an attempt to explain phenomena that cannot be understood analytically. What is relatively new is the scientific study of systems; one which adapts the philosophy and approach of classical science in order to reach into the world of organised complexity, resisting the temptation to cover any gap in understanding by invoking a new substance.

3.2.2.1 Definition

Klir (1991) defines a system in this way:

$$S = f(T, R)$$

In other words a system (S) is made up of things (T) and the relationships between them (R).

Ackoff (1974) provides a fuller definition. A system is said to exist when three criteria are fulfilled:

1. The behaviour of each element has an effect on the whole.
2. The behaviour of the elements and the whole are interdependent.
3. Subgroups of the elements are formed such that each has an effect on the behaviour of the whole and none has an independent effect on it.

Thus, a system is the result of an interaction of parts.

What is common to both definitions is the importance of relationships. Classical science focuses on things and tends to characterise relationships as being bilateral and unidirectional i.e. there is cause and effect: if A then B. Whilst recognising that you need to look at both things and relationships (Checkland, 1981), systems science's primary focus is on relationships; relationships that may be multilateral and bidirectional. As a result, conventional notions of cause and effect are not appropriate. Indeed, systems science contends that the nature of relationships can and does apply to multiple sets of things, and that the same type of behaviour can be observed in systems made up of very different forms of matter. This explains the many isomorphisms we observe in the world (e.g. the flow of fluids and the dynamics of traffic jams) and why it is justified and appropriate to study systems in themselves. Systems science is therefore an explicitly meta disciplinary science transcending existing academic boundaries (Forssell, 2008).

Despite being a metadisciplinary science, the systems approach has developed as a number of different streams or research traditions. According to Dent and Umpleby (1998) however, the differences are differences of emphasis rather than competing approaches. What systems scientists hold in common clearly differentiates them from those working within the conventional classical scientific paradigm, and what they share is much more significant than those things about which they differ.

3.2.2.2 Ontology

As is obvious from the definition used above, a systems scientist regards the world as a set of organised entities joined in a relationship and subject to some form of constraint. Those on the hard end of the spectrum (positivists or empiricists) work on the assumption that the set of entities are real and can be objectively measured and represented. At the other end of the scale (constructivists or phenomenologists) there are those who believe that the world as we experience it is socially or biologically constructed: it is entirely a product of the nature of the relationship of the

observer or scientist and to the phenomena concerned (Jackson, 2000). This research posits that the act of defining a system involves selection – a decision made by an observer about where to draw the boundary that differentiates the system from its environment: a property of being a systems is as much a property of the observing systems as of the observed system itself (Beer, 1959a). At this point, many of the clear cut ontological distinctions of classical science begin to break down (Heylighen and Joslyn, 2001). For instance, an observer may act on a false perception, so changing the real world (Umpleby, 2007). The process of making distinctions between the system, the observer and the environment can never be wholly objective. Ultimately there are of a whole, thus Cartesian dualism completely disappears.

Systems may be deterministic or probabilistic. Those that are studied by system scientists are usually complex; too complex for precise predictions to be made about their behaviour, even if the relationships between the elements are completely deterministic. Whilst the behaviour of systems might be indeterminate, they are not necessarily chaotic, however. Precise predictions may not be possible, but systems often demonstrate archetypal patterns of behaviour of a kind that allow us to make generalisations.

The Universe is made up of a hierarchy of systems with simple systems being synthesised over time into more complex ones (Simon, 1962). All levels of systems have novel characteristics that cannot be predicted from a study of the parts, i.e. they display emergent properties (Checkland, 1976, Downing Bowler, 1981) whether this be the result of design (a car), evolution (a human being) or accidents (vortices, the weather). In other words, as Nobel prize winning physicist Philip Anderson observed in a seminal paper: more is different (Anderson, 1972).

3.2.2.3 Epistemology

Whether systems scientists hold an empirical or constructivist position, what they do is characterised by taking a holistic rather than a reductionist approach. Instead of seeking to break nature down into smaller and smaller units they look at the whole of

which the entity is part, and seek to understand the nature of the relationships within it. They believe that the world cannot be properly understood by analysis alone, a synthetic approach is required (Ackoff, 1962).

The interdependent nature of systems means that simple statements about causality cannot be made; A is necessary but not sufficient to explain B, since C, D, E etc will also be party to the relationship. Ackoff (1999) calls this form of causal explanation product/producer (as opposed to cause and effect) since, unlike conventional casual logic that is environment free, this approach is environment full, since explanation always involves consideration of the context and the relationships that exist between entities. The emphasis on wholes and the relationships between them means that systems science is by its nature transdisciplinary in nature.

3.2.2.4 Methodology

As one might expect, the process of discovery in systems science proceeds in the opposite direction to that of classical science. Instead of decompose, explain and put back together, Ackoff (1999) argues that the process proceeds from identification the whole of which the entity is part, to explanation of the behaviour or property of the whole before explaining the behaviour or properties of the part in context of its relationship to the whole. Since isolating the system from its context is inconsistent with the whole systems idea, conventional experimentation is not appropriate. Instead, models are extensively used to simulate the relevant elements of the systems being studied. Beer (1966) gives a cogent explanation of how this way of building knowledge proceeds. He describes a process that starts with insight and leads to the construction of a simple conceptual model analogous to the thing being studied. This can be thought of as a hypothesis. Subsequently, this model is tested against the real world, refined and ultimately rigorously formulated such that it is isomorphic to the problem being studied; in other words, despite being a simplification of reality it demonstrates predictive power. In Beer's view, once this model is sufficiently generalised it constitutes a scientific model. In this approach, the use of analogues is positively encouraged, since a tenet of systems science is that similar patterns of relationships, associated with similar patterns of behaviour, are

manifest across ontological domains. Thus knowledge can be transferred across domains (Rosen, 1979).

Since conventional experiments (i.e. those that involve the elimination of irrelevant variables) cannot be conducted, what constitutes knowledge about systems fails Popper's test of falsifiability (1959). Instead, the criterion of what constitutes knowledge is the existence of academic consensus, based on the coherence of insights and their invariance over time and across domains (Heylighen and Joslyn, 2001). Ultimately, some argue (Umpleby, 2002), the real test of a systems theory is a utilitarian one, that is: is it useful?

3.2.2.5 The origins and traditions of systems science

Beginnings

There are many competing claims for the first scientific study of systems, but Maxwell was one of the first recognised scientists to apply rigour to a systemic problem. In 1868 Maxwell, using a set of differential equations, demonstrated why and how different arrangements of the governor on a steam engine (a classic example of feedback control) could result in a range of different behaviours in the systems ranging from stability to oscillation or run away behaviour, i.e. an explosion (Scrivener, 2002).

Another seminal piece of work was that of Cannon (1932) who explored how regulation takes place in the human body and coined the term homeostasis to describe its ability to maintain dynamic stability in the face of environmental variation. Whilst at the time it was not clear exactly what the mechanisms were, it was clear that they would be systemic in nature.

General Systems Theory (GST)

Arguably, the first comprehensive attempt to create a systems science was that of Bogdanov, who published his work on Tektology in Russia between 1913 and 1917,

but this went largely unrecognised in the West. Another pioneer of systems science who enjoyed more success was, like Cannon, also a biologist, Ludwig von Bertalanffy (1972). His insight was that classical science was based on closed systems, because they are closed to the transfer of matter and energy (indeed a classical experiment is designed to be a closed system). As a result of this assumption, systems (following the Second Law of Thermodynamics) will tend towards greater levels of disorganisation – greater entropy (greater simplicity) – ultimately leading to the heat death of the universe. Von Bertalanffy contended that because living organisations were open systems they were able, locally, to maintain their organisation. In fact, life demonstrates the capacity to increase its complexity, in other words it is negentropic

According to Katz and Kahn (1969) open systems are characterised by:

- The import of energy.
- Throughput i.e. a process of transformation.
- Outputs – export to the environment.
- Cycles of events.
- Negentropy.
- The selective use of information.
- The characteristic of a steady state that is maintained under a variety on environmental conditions.
- Internal differentiation (of function) i.e. subsystems have specialised roles.
- Equifinality; the capacity to achieve the same end state from a variety of starting conditions.

Based on his insights, von Bertalanffy argued that a new science was needed; one based on systems. General Systems Theory (GST) represents an attempt by von Bertalanffy and others to identify general high-level laws, expressed in very general mathematical terms, which apply to systems of all kinds. As a result, systems knowledge in GST is not directed to developing theories about the world, but about developing abstract theories about systems, devoid of real world content, which can subsequently be applied to the real world (Bunge, 1977).

Cybernetics

Around the same time as von Bertalanffy was starting his pioneering work, just after the Second World War, independently and in parallel (Von Bertalanffy, 1972) the science of cybernetics was born. It grew out of the work of a group of scientists from a range of disciplines (Mathematics, Neurology, Biology, Psychology, Anthropology) who met under the auspices of the Macy Foundation (the Macy Conferences of 1946 – 1953 see Heims (1991)) but the founding fathers of this group were Warren McCulloch and Norbert Wiener. Wiener coined the term Cybernetics in 1948 (Weiner, 1948), the full title of his book being: *Cybernetics: The Science of Communication and Control in the Animal and the Machine*. The insights that catalysed the founding of cybernetics as a discipline were the fruit of collaboration between Wiener, who as a mathematician had been studying problems to do with the control of anti-aircraft guns as part of the war effort, and Arturo Rosenblum, a neurologist. Wiener recognised that the solution to the control problem lay in the transfer of information around the system, specifically the process whereby information about the current state of the system is fed back into the system in order to change the state of the system. When they realised that the phenomena Wiener had studied mathematically in the world of engineering, were also manifest in dysfunctions of the nervous system (e.g. ataxia or purpose tremor) Rosenblum and Wiener (1948) recognised that they were dealing with concepts that were of great significance and wide application. For instance, the properties of negative feedback (whereby information about actual performance is used to steer towards a target) could be used to explain apparently teleological or purposeful behaviour.

Contemporaneous with Wiener's development of his ideas on feedback, McCulloch was working with Walter Pitts, publishing in 1943 their classic paper on the logical calculus of nervous activity (McCulloch and Pitts, 1943). This demonstrated how an array of processing elements, if appropriately coupled together, could display brain like qualities. This, along with Shannon's Information Theory (Shannon and Weaver, 1949), led to a recognition that the concepts of control and communication were closely related and that both must be present wherever organisation existed, whatever form it took, mechanical, biological, social or logical.

Sometimes cybernetics is seen as being separate from, or offering a competing philosophy to, GST. In fact, GST and cybernetics share many concepts and ideas. Cybernetics is probably best thought of as being part of GST (Aulin, 1982, Klir, 1991, Troncale, 1985), that part which is concerned solely with the behaviour of goal orientated systems, and therefore with a particular concern with the role of information in the process of regulation and adaptation. As a result, theories or laws originating in cybernetics, (such as Ashby's Law of Requisite Variety), can be regarded as a General Systems Theories (Bunge, 1977).

Cybernetics has stimulated research in many diverse fields, such as computing, artificial intelligence, robotics, biology and organisational theory (Heylighen and Joslyn, 2001, Pickering, 2010), but in many peoples' minds it has come (mistakenly) to be associated or synonymous with Control Engineering. Although cybernetics is rarely acknowledged as a valid independent academic discipline, the core ideas of cybernetics have been assimilated into the intellectual fabric of science and are periodically rediscovered (Heylighen and Joslyn, 2001) without their provenance, or the intellectual legacy bequeathed by its founders necessarily being recognised or acknowledged (Pickering, 2010).

System Dynamics

The interest in ideas surrounding complex and circular patterns of causality took another form in the early 1960's in the intellectual movement that grew up around Jay Forrester and his colleagues at MIT that ultimately led to the development of System Dynamics. Whereas cyberneticians focus on the nature of the relationship between a system and its environment and assume that the exact nature of causality, and indeed the nature of reality, is unknowable, irrelevant or both, Forrester took the opposite view (see (Forrester, 1961, Richardson, 1991) for an analysis of the similarities and differences between the two approaches). With a background in control engineering, and using some of the first commercially available computers, he set out to model the exact nature of the casual relationship within systems, usually ignoring the environment altogether or explicitly building it into his model of the system. What he was able to demonstrate is that apparently

simple systems, built on relationships based on a simple set of rules, can display complex and often counter intuitive behaviour. The work of this group was focussed on informing the design of systems and directing policy interventions, initially at the scale of companies (Industrial Dynamics (Forrester, 1968)) but subsequently at the level of entire cities (1969) and even the Globe (1971).

Complexity Science

The label Complexity Science has been applied to the work in Chaos Theory (Gleick, 1998), fractal geometry (Mandelbrot and Hudson, 2005) and Prigogine's work on the phenomena of open non-equilibrium systems in chemistry (dissipative systems) (Prigogine, 1985). Much of the current interest centres on the Santa Fe Institute (SFI); set up in 1993 to research issues in science and society that in general shared the characteristic of complexity (Waldrop, 1992). The aim of the SFI is to promote fundamental research of a transdisciplinary nature into Complex Adaptive Systems (CAS) (Buckley, 1968). In addition to its explicit commitment to working across conventional academic boundaries, the work of the SFI is characterised by the use of plentiful, cheap computing resource as a tool to experiment on systems that have hitherto been too complex to model using conventional mathematical approaches. In a sense, computer modelling has the same relationship to the new science of complexity that calculus did to Newton's physics. This form of experimentation often involves the use of agent based models to simulate the interaction of individuals, thus avoiding the need to make assumptions about the characteristics of whole populations as was necessary in the past given the constraint on computation.

The work of the SFI and others working this intellectual seam has, *inter alia*, touched upon scaling laws in nature (see (Buchanan, 2001), self-organising Bayesian networks, order for free (Kauffman, 1993), the properties of networks (Barabási, 2002, Watts, 2003) non-equilibrium economics (Arthur, 1994) near chaotic systems (Langton, 1996) and agent networks (Holland, 1995b). Whilst it is very early days in scientific terms, it appears that the work of SFI and other academics working in the same field could make a significant contribution to many areas of knowledge and to the way in which research into complex phenomena is conducted.

All complexity science shares (Gribben, 2002) the belief that many real world processes are circular and nonlinear in nature, and that these are capable of generating rich, complex forms and apparently sophisticated, often adaptive, behaviour that belies the relatively simple nature of the underlying relationships.

Other systems approaches

The distinct research streams, listed above, are not exhaustive. Systems ideas have been assimilated into mainstream academic disciplines particularly in engineering, computing and biological sciences. For example, control engineering is essentially a cybernetic discipline. Lovelock describes the Gaia Hypothesis (Lovelock, 1979) as being cybernetic and many other ecological concepts are fundamentally systemic, as evidenced by Capra's popular books on the subject (Capra, 1982a, 1982b, 1997, 2002). Systems ideas, such as Perceptual Control Theory (PCT), have also had a major influence in psychology (Powers, 1974).

All these approaches adopt a functionalist perspective, using systems as a way of interpreting reality and a research methodology aiming to uncover generalities in the way the world works with utilitarian value. On the other hand, in the social sciences in particular, systems ideas have often used systems as a way of looking at the world rather than a way of describing the world. Systems approaches to management (e.g. soft systems) have often adopted this stance, as described later in this thesis.

3.2.2.6 Research challenges

Whilst systems science has influenced work in a range of academic disciplines it has had difficulty standing as a legitimate independent field of academic inquiry in its own right. One possible reason for this is that it represents a paradigm shift, a break from normal science (Kuhn, 1970). If this is the case, it is to be expected that there will be debate and dispute at this early stage of its development, at least until the weight of evidence in support of the new intellectual framework becomes overwhelming. Also, because the systems idea challenges the historical framework of academic disciplines, intellectual inertia is compounded by organisational inertia

(Laszlo, 1998), which at a prosaic level is manifest in the problem of finding or developing a respectable academic outlet for the results of research or attracting research funding. Rosen (1979) characterises resistance to GST as a form of intellectual auto immune disease.

This isolation from the academic mainstream has been exacerbated by the tendency for the science to become centred around charismatic individuals, a fact that has contributed to fragmentation of the science (Umpleby, 2005). Many of the founders of cybernetics did their most important work as amateurs, without the academic infrastructures needed to promote and promulgate their ideas. Where research centres have grown up around individuals they have rarely survived their retirement or demise (Pickering, 2010).

In addition, novel ideas often can breed confusion, suspicion and hostility. Amongst the criticisms directed at systems science is that it is logically empty (Buck, 1956) or tautological since it is seen as being based on mathematical, self-referential, logic (Winther, 1985). Others argue that mathematical models cannot be transferred to the complexity of real world situations, particularly those studied by the social sciences (Checkland, 1980, Zeleny, 1986). Also, those from outside the systems community exhibit a tendency to seize on particular pieces of work and make inferences from this limited evidence that the authors of the work would not support themselves. Thus, for instance Ashby's work (1957) has been characterised as being about machines (Zeleny, 1986) whereas Ashby simply used physical models to demonstrate how a particular kind of system (which he defined in careful terms using the term machine) was capable of generating certain types of behaviour. Semantic problems clearly contribute to this confusion. Laszlo (1998) makes the point that GST really refers to a General Theory of Systems rather than a Theory of General Systems that carries with it the implication that it claims to be a theory of everything. The antipathy toward systems ideas has not been helped by what some regard (Klir, 1991) as the exaggerated claims made for systems approaches in the 1970s and 1980s, which led to charges of technocratic elitism (Leidenfield, 1978, Ulrich, 1981).

Finally the systems idea has, arguably, not yet matured as a science because it has not made the transition from a set of intellectually appealing theories into something

capable of making an important and distinctive contribution to a set of problems with real world relevance (Umpleby, 2000).

3.3 Systems in management

The following review of the contribution of systems ideas to management adopts the structure used by Jackson in his book *Systems Approaches to Management* (2000) to evaluate the potential relevance of various approaches to the study of FPMS.

3.3.1 Functionalist

The functionalist perspective holds the belief that there is an objective reality in some form. Most mainstream research into Management Control Systems and Budgeting falls into this category. The systemic perspective on functionalism involves the use of models derived from systems theory to help with the understanding and improvement of real world situations. All of the streams of system science described earlier therefore fit into the functionalist category.

Here functionalist work is summarised under 8 headings:

1. Organisations as Systems.
2. Hard Systems.
3. Systems Dynamics.
4. Organisational Cybernetics.
5. Autopoeisis.
6. Living Systems Theory.
7. Complexity Science.
8. Quality Movement.

The organisations as systems stream draws upon the GST perspective.

Organisations are open systems made up of interconnected parts, with the goal of survival. Jackson (2003) puts Parson's systems ideas, Contingency Theory, the work of Katz and Kahn (1969) and Emery and Trist (1965, 1973) within this category.

Within this tradition, systems ideas and models are used as an aid to understanding.

They are not used to guide the process of design and intervention and they are not specific about what mechanisms are used to maintain viability and to achieve goals.

The second group of functionalist approaches are those of hard systems. In this group, Jackson (2000) places operations research, systems analysis and systems engineering. In contrast to the organisations as systems approach, this is explicitly problem focussed, quantitative in nature and aims to solve problems. Workers in this field have been responsible for generating a wide range of tools and techniques, many of which have made a contribution to practical management tasks, such as inventory management and so on.

The focus of such hard system approaches is mathematical optimisation (Jackson, 2000). Usually this requires researchers to define the problem in such a way that a potentially very complex problem can be made computationally tractable, which means that the attributes of the system in which the problem is embedded are not questioned. Those aspects of systems that cannot be easily quantified are also excluded from research. At least two important figures (Ackoff, 1996, Beer, 1959b).in the world of organisational systems started their careers in operations research but subsequently came to see the work as being too restrictive in its approach to be able to tackle the major systemic issues in management

The third approach - System Dynamics (SD) – also makes use of quantitative techniques to model complexity. The objective is to map and simulate the causal patterns of a complex system as an aid to understanding, systems design and intervention. The insights gained from understanding systems dynamics have also had a significant influence on the development of management disciplines, such as Logistics. Latterly, SD approaches have been applied in a non-quantified way by Senge (1990) amongst others, in order to help managers understand and deal with the complex and often counter intuitive quality of organisational behaviour and decision making.

Unlike hard systems approaches, SD does address the structural qualities of systems and rather than attempting to optimise, it provides manager with a capability to consider options or alternative scenarios. In constructing mathematically based

models however, traditional SD inevitably ignores those aspects of systems that cannot be quantified (Sterman, 2000), but the soft SD of Senge (1990) loses the scientific rigour of the mathematical approach. Also SD is focussed on the internal structure of the system, excluding the environment or treating it as part of the system in focus. It also focuses on what is rather than attempting to construct a model of what ought to be. As a result, while SD models could play a role in FPMS, for instance in building anticipatory models, they do not provide us with a generic model capable of providing insights into FPMS.

Organisational cybernetics is largely the creation of one man, Stafford Beer (1959a, 1966, 1979, 1981, 1985), who took the ideas of the early cyberneticians, and Ross Ashby (1957) in particular, and applied them within the context of social organisations. He is best known for the Viable System Model (VSM), which claimed to be a generic model applicable to the management and control of any systems capable of being viable, i.e. surviving in a range of unpredictable and unknowable environmental conditions.

The VSM is, Beer claims, a tangible manifestation of the organisational arrangements required to fulfil the demands of Ashby's Law of Requisite Variety (LORV) (Ashby, 1957), which for Beer and others (Schwaninger, 2000) is a law of nature that has a similar status in the study of management and organisation as does the Second Law of Thermodynamics to Physics. Ashby's Law proposes a relationship between the variety (possible number of states) of the environment, a regulator and the goal set. It thus suggests a way of describing and assimilating the contextual variables studied by contingency theorists, the nature of the goals set (e.g. tight and loose) and the quality of the control system into one overarching intellectual framework. Under this scheme, distinctions between types of controls, such as formal/informal, bureaucratic/cultural dissolve, since these are merely different ways of engineering the variety of a regulatory system. This is clearly a very attractive concept for the management theorist since it can be used as a framework for analysing a wide range of management philosophies, approaches and techniques using a common language. "Is it possible" muses Waelchi "that the myriad of actual, potential and contingent approaches to organisation theory are really varied manifestations of the same law, or set of laws?" (Waelchi, 1989,52).

Beer's VSM (1981) is comprised of five levels, (labelled Systems 1 to 5) each of which makes a distinctive contribution to the survival of the system by managing different pairs of dynamic relationships consistent with the strictures of Ashby's Law (1957). This sits within a recursive framework, where individual models nest within each other whilst preserving a common set of structural arrangement like a set of Russian dolls. This makes it capable of dealing with systems of any size and complexity. The VSM was modelled on the human autonomic nervous system (Beer, 1981), which, Beer claims, is the most sophisticated control system in the known universe and therefore the only one capable of dealing with the astronomic complexity thrown up by the challenge of managing social organisations.

Beer advances the VSM as a tool both for diagnosing and designing organisations; dealing with both the structural arrangements necessary for dealing adequately with complexity, and the information flows needed to make the structural arrangement function effectively. Others would claim that the VSM could be applied in support of an interpretative intervention (Harnden, 1989). Checkland (1986) also uses the VSM within soft systems interventions.

Some might locate the concept of autopoiesis within cybernetics, but Jackson (2000) sees it as a separate and located within the functionalist stream. The notion of Autopoeisis is the creation of Maturana and Varela (1998) and is based on the contention that living organisms are characterised by their ability to create themselves. They do so as the result of the existence of circular productive processes dedicated to the creation and maintenance of the boundaries of the organism, and in so doing define the identity of the organism as separate and distinct from its environment. This idea, that originated within biology, has been transferred into the social domain, some academics regarding social institutions as autopoetic with culture, social conventions and so on being the mechanism that help define and maintain a separate identity (Luhmann, 1989, Robb, 1991) (Zeleny, 1981). By providing organisational closure, autopoetic processes form part of the control repertoire of an organisation and are potentially relevant to the study of FPMS since it may allow us to acknowledge and reconcile formal and informal control processes. The concept was quickly assimilated into organisational cybernetics, for example

Beer himself (Beer, 1994c), identified their work as consistent with the VSM, both in its healthy and pathological forms.

Like Beer, Miller (1955) set out to create a generic model with a claim to be applicable to all system types, however he drew more upon GST concepts than those of cybernetics. His Living Systems Theory (LST) is applied to organisations at eight hierarchical levels from the cell through organs and organisms, to social groups with the highest level being comprised of supranational systems. Living systems have 20 sub-systems each with their own role, and organisations are explicitly considered to be a form of life. Miller claims the LST is a descriptive model, facilitating the understanding of systems, and an approach that generates what he characterises as cross level research (Miller, 1986); research that investigates commonalities across different forms of living system, with the goal facilitating the creation of general theories of systems. While, like the VSM, the living systems model has the attraction of comprehensiveness and sophistication, it does not specifically address issues of control and is therefore less relevant to the research question under consideration.

Complexity science has also been applied to the process of management. They have proved particularly attractive to those who acknowledge the relevance of systems science to management and other social phenomena, but who regard other functionalist approaches as too rigid and static. They perceive them to be based on equilibrium ideas and rational modes of thought and not sufficiently cogniscent of the importance of flux, change and the creation of novelty. As a result, there has been as a result a plethora of popular management books exploring these ideas generated by complexity science (Beinhocker, 2006, Pascale et al., 2000, Wheatley, 1999). In the academic field Stacey (1992, 1996, 2003) is the most vocal proponent.

Complexity science has demonstrated that systems not only can exist in conditions far from equilibrium (dissipative systems (Prigogine, 1985), indeed the edge of chaos (on the boundary between very stable organisational forms and chaotic behaviour) might be optimal for innovation and the creation of novelty. Kauffman's work with fitness landscapes (Kauffman, 1993) has demonstrated how small incremental steps needs to be balanced with speculative evolutionary leaps if

adaptive strategies are not to leave organisations locked into technologies that are an evolutionary optimum in one set of environmental conditions, but fatal when it changes.

Some of these ideas are consistent with research findings within organisations and can be used to enrich existing systems models, not least those in the field of FPMS. Finally, Umpleby and Dent (1999) make a case for including the quality movement within the scope of systemic approaches to management. This work has its origins in the work carried out by Shewhart in the 1920s, which was subsequently taken up by Deming (2000a, 2000b), Juran (1964) and others and has been extremely influential in management within Japanese industry in particular. Whilst its origins are in the statistical analysis of and control over manufacturing processes, over the years it has evolved into a theory of management, leading to, amongst others Total Quality Management (TQM) and the lean management of the Toyota Motor Corporation (Liker, 2004). What these approaches have in common is that they view the corporation as a system, made up of suppliers and customers, internal and external, intimately coupled together, that relentless and continuous improvement processes are the route to business success and that this can only be achieved by working on the system, not the outputs of the system. Joseph Juran (1964) is an example of someone working in this field who has applied a quality perspective to the challenge of general management using concepts and ideas aligned to those of systems science, but without explicitly referencing them (Juran, 1964).

Whilst this approach to systemic management does not explicitly tackle the issue of control and has primarily been applied to the management and improvement of production and service systems, both the philosophy and techniques of quality management could be of value in studying FPMS. Within the financial academic community Johnson (1992, 1997, Johnson and Broms, 2000) has vigorously advocated adopting systemic performance management practices based on the total quality philosophy, and others have sought to integrate systems ideas with lean management (Jenner, 1998) and quality management (Kreitman, 1992). Flood (Flood, 1993) has also made a case for the extension of TQM philosophy by explicitly applying cybernetic concepts and in addition, Beer adopted the model of

statistical process control and adapted it to the task of detecting system incipient instability within the VSM (Beer, 1981).

3.3.2 Interpretative

All the approaches discussed above start from the premise that it is possible to define some form of consensus as to the nature of reality - objective knowledge - and from this to proceed to understand, diagnose, design or intervene in that reality in a recognisably scientific, or at least rational, way.

The interpretative approach takes a different view. This tradition regards the reality with which managers engage as so being complex and so subjective in nature that it is inappropriate to regard this world as if there was some reality waiting to be uncovered and mapped on a model derived from systems science, or for that matter from any academic tradition (Jackson, 2000). Instead of promoting systemic models of the world, they advocate using systemic methodologies to investigate the world. Some of those working in this tradition regard the world as systemic but so messy that the systemic nature of it cannot be isolated without denaturing the problem to be solved (Ackoff, 1996). Others, from a philosophical point of view, choose to make no such assumptions.

Jackson (2000) includes in this category the work of Warfield (interactive management), Churchman (social systems design), Ackoff, (social systems sciences) Mason and Mitroff, (strategic assumption surfacing and testing) Checkland, (soft systems methodology) Senge, (soft systems thinking and a raft of soft approaches to operations research and system dynamics).

The essence of the interpretative tradition, and what these various approaches have in common, is that they are focussed on problem situations, and their resolution. They do not seek to make any generalisations about the world that can be transferred from one place to another. Models, such as the VSM, may be used, but only as a way of structuring a problem situation, not as a representation of reality (Checkland, 1986). As a result, work emanating from this tradition is not, on the face

of it applicable to the diagnosis and design of FPMS as a whole; they are addressing a different problem, regarding the research questions as posed as being irresolvable. Some elements of Ackoff's work (1970a, 1970b, 1981, 1984, 1993), or at least the conclusions he draws, resonate with those of Beer, even though he fundamentally disagrees with the philosophical premise on which Beer's work is based (Ackoff and Gharajedaghi, 1996).

3.3.3 Emancipative, post-modern and critical systems theory

Because of the denial of the existence of a real world, capable of being reduced to a set of systemic models of general applicability, and because it does not share the functionalist commitment to improving the systems in use, the Interpretative tradition is not a source of academic insight that is of particular relevance in addressing the research question. There are three other streams of systemic approaches in management research that Jackson (2000) refers to, which, for different reasons, have also been eliminated from the scope of further inquiry.

In the functionalist tradition the intention is to discover something about the world that can be held to be true. It is therefore claimed to be value neutral. In the interpretative tradition the emphasis is on using the systems world view and or systemic approaches to facilitate the resolution of real world problems. It can therefore be seen to be based on a value set that sees the achievement of consensus as being both feasible and desirable. The emancipative tradition, however, sees systems in a different light; as actual or potential instruments of domination or liberation, and the role of the systems scientist to expose this with a view to bringing about a change in the world. Power and politics, it is argued, are inevitable features of social systems, which are therefore value laden. The scientist cannot opt out of this, one way or another he/she is ideologically committed. In the view of those working in the emancipatory tradition he/she has an obligation to act in the pursuit of justice and the creation of new, healthier and more egalitarian world orders. According to Jackson, critical operations research/management science, the work of Habermas, those following the critical systems approach as well as Capra's ecological sustainability all sits within what he describes as the Emancipation as

Liberation strand of this tradition. The emancipation through discursive rationality strand, comprises Beer's Team Syntegrity (TS) methodology (Beer, 1994a) and Ulrichs critical systems heuristics (Ulrich, 1983), which share an approach to emancipation based on the creation of the conditions for the open rational discourse and debate. Since the research question adopts a value neutral stance it is difficult to see this research strand furnishing insights of value.

The second approach - postmodernism - denies any sort of systemic conceptual framework that can be applied to the world or our mode of inquiry or intervention. This approach, deriving from the work of Foucault and others, emphasises the chaotic, paradoxical and contentious nature of reality (Jackson, 2000). On the surface, the description systemic with its implications of order (albeit very complex) would not appear to be an appropriate word to apply to this form of academic discourse, but Jackson (2003) claims that it is possible to use systems tools in a postmodernist fashion and for postmodernism to provide tools for the systems practitioner. Since the research question addresses issues of order, and starts from a premise of there being a consensus about reality, potentially free from ambiguity, the Postmodernist approach does not represent a fruitful line of inquiry.

Finally Jackson advocates critical systems practice (CSP), which he has had a major role in developing and promoting (Flood and Jackson, 1991, Jackson, 1985). This is based on the premise that the Management researcher is always faced with a number of different problem contexts, defined by the nature of the relationship of the participants and the complexity of the systems within which they are embedded.

Depending on the perceived nature of the problem, a different type of systems methodology is appropriate. Jackson therefore argues for a plurality of systems approaches (Jackson, 2003). Schwaninger's intelligent organisations framework also sits within this stream of work (Schwaninger, 2001). Jackson maps the various approaches against the problem definition as follows:

FUNCTIONALIST	INTERPRETATIVE	EMANCIPATIVE	POST MODERN	CRITICAL SYSTEMS
A structured way of thinking, focussed on improving real world problem situations	A structured way of thinking with an attachment to the interpretative theoretical rationale, focussed on improving real world problem situations	A structured way of thinking with an attachment to the emancipatory theoretical rationale, focussed on improving real world problem situations	A way of thinking and action with an attachment to the post modern theoretical rationale, focussed on disrupting real world problem situations by critically questioning all received wisdom and accepted practices	A structured way of thinking that understands and respects the uniqueness of the functionalist, interpretative, emancipatory and post-modern theoretical rationales and draws on them to improving real world problem situations
Uses systems ideas as the basis for an intervention strategy, frequently uses methods, models, tools and techniques drawing on systems ideas	Uses systems ideas as the basis for an intervention strategy, frequently uses methods, models, tools and techniques drawing on systems ideas	Uses systems ideas as the basis for an intervention strategy, frequently uses methods, models, tools and techniques drawing on systems ideas	Uses systems and anti systemic ideas as the basis for an intervention strategy, frequently uses methods, models, tools and techniques drawing on systems ideas	Uses a variety of creativity in enhancing systems ideas as the using methods, models, tools and techniques drawn form various on systems traditions.
<p>Guidelines</p> <ul style="list-style-type: none"> - the real world is systemic - analysis of the problem situation is conducted in systems terms - models are constructed to help gain knowledge of the real world - models are used to learn how best to improve the real world or for the purposes of design - quantitative analysis is useful since systems obey mathematical laws - the intervention process is systemic, aimed at the best way of achieving a goal - the intervention relies on expert knowledge - solutions are tested based on the criteria of efficiency and effectiveness <p>The methodology can be used in different ways in different circumstances by different users, therefore each use requires conscious thought about how to adapt to the circumstances</p> <p>Each use yields research findings as well as changing the real world situation. Can relate to the theoretical rationale, the methodology and how to use it, tools, or techniques.</p>	<p>Guidelines</p> <ul style="list-style-type: none"> - no assumption that the real world is systemic - analysis of the problem situation is conducted in a creative way, often not in systems terms - models are constructed which represent possible 'human activity systems' - models are used to interrogate perceptions of the real world and to structure debate about what changes are feasible and desirable - quantitative analysis are unlikely to be used, except to clarify the implications of world views - the intervention process is systemic and never ending aimed at relieving unease about the problem situation and to facilitate learning - the intervention relies on stakeholder participation - solutions are evaluated based on the criteria of effectiveness, elegance and ethicality <p>The methodology can be used in different ways in different circumstances by different users, therefore each use requires conscious thought about how to adapt to the circumstances</p> <p>Each use yields research findings as well as changing the real world situation. Can relate to the theoretical rationale, the methodology and how to use it, tools, or techniques.</p>	<p>Guidelines</p> <ul style="list-style-type: none"> - no assumption that the real world can become systemic in a way that alienates individuals and/or oppressive to social groups - analysis of the problem situation is conducted to reveal who is disadvantaged and how - models are constructed to reveal the source of alienation and oppression and to propose alternative social arrangements' - models are used to enlighten the alienated and oppressed as to their situation and what can be done to improve it - quantitative analysis may be useful to capture existing biases - the intervention process is systemic and never ending aimed at improving the problem situation for the alienated/oppressed - the intervention stimulates the alienated/oppressed to begin to take responsibility for own liberation - solutions are evaluated based on the criteria of ethicality and emancipation <p>The methodology can be used in different ways in different circumstances by different users, therefore each use requires conscious thought about how to adapt to the circumstances</p> <p>Each use yields research findings as well as changing the real world situation. Can relate to the theoretical rationale, the methodology and how to use it, tools, or techniques.</p>	<p>Guidelines</p> <ul style="list-style-type: none"> - no assumption that the real world is constructed through discourse in a way that leaves groups or individuals marginalised - analysis of the problem situation is conducted to reveal who is marginalised by existing power/knowledge structures - diverse forms of pluralism are used to surface subjugated discourse and allow marginalised voices to be heard - diverse forms of pluralism are used to allow stakeholders to express their diversity and possibly give permission to act - quantitative analysis is unlikely except in the process of deconstruction - the intervention takes the form of local strategising and subversion - the intervention allow the conflict to be reclaimed and diversity and creativity encouraged - facilitators and participants take responsibility for actions on the basis of exception, emotions and ethics <p>The methodology can be used in different ways in different circumstances by different users, therefore each use requires conscious thought about how to adapt to the circumstances</p> <p>Each use yields research findings as well as changing the real world situation. Can relate to the theoretical rationale, the methodology and how to use it, tools, or techniques.</p>	<p>Guidelines</p> <ul style="list-style-type: none"> - uses generic system methodologies as the basis for intervention, often naming one methodological approach as dominant, whilst being open to changing this during the course of the intervention. - must respect the principles and guidelines of the theoretical domain form which the methodology has been drawn. - uses generic systems methodologies as the basis for an intervention strategy, frequently uses methods, models, tools and techniques drawing on systems ideas - the choice of methodologies will rest on an appreciation of the various strengths and weaknesses of the different theoretical perspectives. - in order to ensure responsiveness to the complexity and heterogeneity of the problem situation attention is paid to the pluralism of the methods employed and how they are represented and deployed. <p>The methodology can be used in different ways in different circumstances by different users, therefore each use requires conscious thought about how to adapt to the circumstances</p> <p>Each use yields research findings as well as changing the real world situation. Can relate to the theoretical rationale, the methodology and how to use it, tools, or techniques.</p>

Figure 7 Characteristics of different systems research traditions. Adapted from Jackson (2000)

It is difficult to argue against an open-minded approach to the use of conceptual models. Indeed, the pluralistic methodology has been advocated from a cybernetic (a functionalist) perspective on the grounds that complex problems complex models i.e. ones that fulfil Ashby's criteria of requisite variety (Schwaninger, 1997). The research question being addressed, however, whilst it is clearly complex, aims to

make some general statements about one specific aspect of regulation – the flow of financial resources. Jackson's analysis (2000) of the problem situation would therefore seem to provide further justification for the investigation of cybernetically based approaches. If this approach is, indeed, a valid and useful line of inquiry, we would expect that a critique of MCS and budgeting research methodology and practices to generate helpful insights into the nature of the problem and possible solutions. This is the subject of the last part of this systems literature review.

3.4 A systems critique of research in accounting

3.4.1 Critique of the method

The critique of research into budgeting and MCS outlined in Chapter 2 was informed from a view from inside the discipline, based on a shared set of epistemological assumptions. Given the research objectives it is, however, appropriate to critique the literature from a systems perspective.

From a systems perspective, the research methodologies used to study MCS and related phenomena are inadequate, since they seek to isolate individual systems components from their systemic context and establish causal relationships between them, either using questionnaire based surveys or laboratory experiments. Following the tenets of the systems perspective this approach is bound to fail because it does not take account of the complex and circular nature of causality. Specifically, systems often exhibit equifinality, the ability to reach one state from any initial state, whereas a deterministic machine's end state is determined by its starting condition. According to Clemson (1984) this means that knowledge cannot be acquired by seeking to establish correlations between sets of variables. By definition, the only regularity that we would be confident of being able to uncover is the system's ability to maintain a state or pattern of states; the apparent stimuli not being stimuli, but disturbances of control variables that creates the illusion of causality (Forsell, 2008). According to Marken the uncritical and often subliminal adoption of a simplistic input/output model of systemic behaviour by the social sciences – often by those who profess to have an anti mechanistic stance – fails to produce any kind of useful insight. What you get by studying control systems as input-output systems is

exactly what you have got in the social sciences – a confusing and often inconsistent array of findings, only weakly reproducible and little more than verbal models to account for them, models with virtually no predicative or explanatory power. The results of research are a mess by any reasonable scientific standard” he continues. (Forssell, 2008,59) “After 100 years of doing this kind of research, using more sophisticated apparatus and control, the variability (in findings) is still there and it is large”.

The non-systemic nature of MCS research is revealed by the work of Luft and Shields (2003a) who examined the relationships tested for in 275 articles in 6 leading journals. They discovered that all but 6 out of 589 tests looked for linear correlations, 79% did not recognise that the impact on one variable might be dependent on others and 95% were unidirectional. Furthermore, 78% considered management accounting itself as either a dependant or independent variable only; few consider Management Accountant to be part of the system itself.

Systems researchers therefore concur with those from within the MCS research community who argue that methodologies that seek to establish causalities between variables fail to capture the richness of real life, but they would argue for the development of strong systemic models as the basis for enquiry rather than an inductive approach based on fieldwork or other anthropological approaches. Contingency Theory could be characterised as systemic because it admits to the importance of contextual relationships, but it contains no theory as such, which might help explain how and why contextual variables impact the nature of control systems found. Furthermore it is argued, the empirical methodologies used in this form of research (cross sectional, survey based) mean that one is unlikely to be developed.

From a systems perspective, the most likely source of such theory is cybernetics; the science of control and communication. This requires the use of a model appropriate to the control of complex social systems, i.e. based on socio-cybernetic thinking rather than a mechanistic first order cybernetic model. The most promising source of appropriate cybernetic theory is the work of Ashby, specifically his Law of Requisite Variety (Ashby, 1957) and the model that translates this law into a form that can be

applied to the diagnosis and design of regulatory systems in social organisations: Beer's Viable System Model (1979, 1981, 1985, 1989b).

3.4.2 Critique of the model

Ashby's work (1957) was theoretical in nature and Beer (1981) does not explicitly set out, in a structured fashion, a detailed critique of existing management control practices, neither does the VSM model directly address the issue of alternative forms of FPMS. Nevertheless, it is possible to construct a coherent cybernetic critique of conventional MCS from references made in Beer's works in particular.

It is clear where Beer stands in general with respect to conventional planning and control processes in business and government when he observes that "managers and ministers have become hopelessly entangled in immensely high variety estimations about performance in future epochs that are arbitrarily selected... [and] consists mainly in rationalising and updating plans which have been constantly falsified by unfolding history" (Beer, 1979,339) More specifically, it is possible to construct a cybernetic critique of the conventional budgeting model, working with Anthony's (1965) definition referred to earlier in this thesis.

An estimate of the profit potential of a unit, stated in financial terms

For Beer, "financial soundness expresses no more than a constraint on the viable system" (1979,113), by which he means that it is a necessary but not sufficient condition. He uses the word constraint here in the sense that it is used in linear programming i.e. a criterion that needs to be fulfilled (as opposed to optimised - the objective function). Elsewhere, he makes it clear that it does not make sense to talk of optimisation in such complex systems – management is, *inter alia*, the process of making continuous trade-offs between multiple variables on many different dimensions (Beer, 1981) . Some clue as to what this might look like we can find in the Model of Systemic Control (Schwaninger, 2001) that describes Normative goals (concerned with the legitimacy of the organisation) operating at a higher logical level, and exercising pre-control over (constraining), Strategic Goals (concerned with effectiveness) which in turn constrain Operational Goals (efficiency). Financial goals

comprise part of the set of Operational Goals and should be regarded not as an objective in its own right since its appearance or absence is a consequence of good or bad strategies. In the Model of Systemic Control these three logical levels are mapped against System 5, 4 and 3 respectively.

According to Beer, ROI (Return on Investment) does not have requisite variety, in part because it has elastic definitions that can easily be manipulated (1979, 285). Simplistic, single variable goals cannot possibly define all the dimensions of organisational performance that need to be held in balance in order for an organisation to be viable, and as Ashby notes, fixing variables can paradoxically destabilise a system, particularly if they are fast moving variables (Ashby, 1981a). According to Beer they also invite people to short circuit the system: “the skilled manager knows very well how to manipulate events to procureoutrageous conclusions. The Financial Director, with his expertise in accountancy, straddles the two worlds (of management and operations), and makes it all work” (Beer, 1979,285)

Generally covering the period of a year.

Beer is very clear about where he stands on the management convention whereby performance is managed almost exclusively within the context of the calendar year. “Orthodox management procedures appear to rely, almost wholly on snapshot accounts of the situation. It is strange and it is dangerous” (1979, 258). “There are no crucial dates in the development of the firm except those specified by convention” and “it is sad to see the whole process of corporate adaptation geared to the purely conventional annual statement of accounts and the Chairman’s address” (Beer, 1981,187).

He goes on to say that the consequence of this fixation with the financial year is that “there may be a sluggish response to certain types of fast varying input – because of the complexities of the system which dampen down initial oscillations. There might also be amplifiers in the system which increases the amplitude of dangerous oscillations which should be damped”. One of these amplifiers might be managerial action itself, which is itself a generator of oscillation, because (referring here to the low variety goals traditionally used) “the control target of steady response, which entails steady profit making and steady growth, can be achieved only relatively. The

important outcome of regulation is, as we have learned from our study of homeostasis, to hold critical variables within *physiological* limits” (all, Beer, 1981, 187).

Representing a management commitment (to delivering the objectives expressed in the budget)

Converting a plan to a commitment has the effect of eliminating flexibility; that is reducing control system variety – possibly to the point that it does not have requisite variety. If a system does not have requisite variety, according to Ashby’s Law (1957), there are only two possible outcomes. Either the regulator will fail (to achieve its goals), or extra variety will be introduced by subverting the system (see the ROI quote above). Any ultrastable systems will fail if critical services are not in the right place at the right time (Ashby, 1952). In Beer’s words: “any rigid plan, however well-conceived, will not produce the goods unless it is continuously modified...because the operation is subject to continuous perturbation as well as the perturbation of its own basic input” (1981, 186). Plans should continuously abort if they are to serve the purpose of continuous adaptation.

Subject to review and approval by an authority higher than the budgetee, which, once reviewed, can only be changed under specified conditions

In Beer’s view power should “derive from concatenations of information not from the allocation of dependencies” (1979, 324). In other words, it is valid for System 3 to make decisions based upon its synoptic perspective that is not available to System 1. In general, however, because knowledge of the environment resides with System 1, its actions should be minimally constrained in the interest of corporate cohesion and legal compliance. What this means is “making minimal use of the variety attenuators in a downward direction” (Beer, 1981,158).

Periodically is compared to actual financial performance for analysis and explanation.

Traditionally, according to Beer, we do not recognise that we import our personalities into the numerical facts (Beer, 1981). Furthermore, our measures do not have the requisite variety to absorb the variety they purport to measure, and the often figures are embellished by computer processing. Specifically, he argues (1979, 289) that

“traditional approaches to measurement (like variance analysis) are not continuous and therefore cannot detect changes in rate and periodicity of change”. They also (1979, 281) “fail to distinguish data (statements of fact) from noise (a meaningless jumble) and thereby fail to produce information, defined as that which changes us – created when a fact in data is recognised and is susceptible to action”. He goes on to advocate the use of techniques like Statistical Process Control (1981), which are capable of detecting changes in mean and variance. The use of such filters, which scientifically attenuate variety, avoids the problem associated with the use of inappropriate analytical techniques that “insert amplifiers on the wrong side of the variety equation” (Beer, 1981,97). Indeed, a manager is the “metasystemic administrator of Ashby’s Law” (1979, 263) using statistical filters and, crucially, his/her judgement to set the criteria of stability, detect instability and change the criteria, avoiding the traditional “managerial emphasis on error correction rather than error exploitation” (1981, 62).

At a more general level, in their article (1989,9-25), Lowe and Puxty give a neat summary of the problems with the conventional model of management control that a systems perspective might be expected to address:

- The interaction with the environment is largely ignored – the whole emphasis is on the internal environment.
- The assumption is that control can only be exercised after the event.
- Planning is seen as a way of setting controls, not anticipating changes. As the framework stands, it seems imply that if certain bureaucratic routines are kept to them control will result.
- The approach is not holistic in that the predictive function is lodged with top management, the assumption is that control is exercised through a closed system.
- Control over people is thought to be synonymous with control over the organisation; the mutual interaction with the environment, for example, is completely ignored.
- The social context is also ignored. Goals appear from nowhere and then become imperatives on management to achieve.

- The formal structure of the organisation is treated as an invariant; it is the role of a MCS to enable control to be effectively exercised within it – not to change or challenge it.

3.5 Conclusion

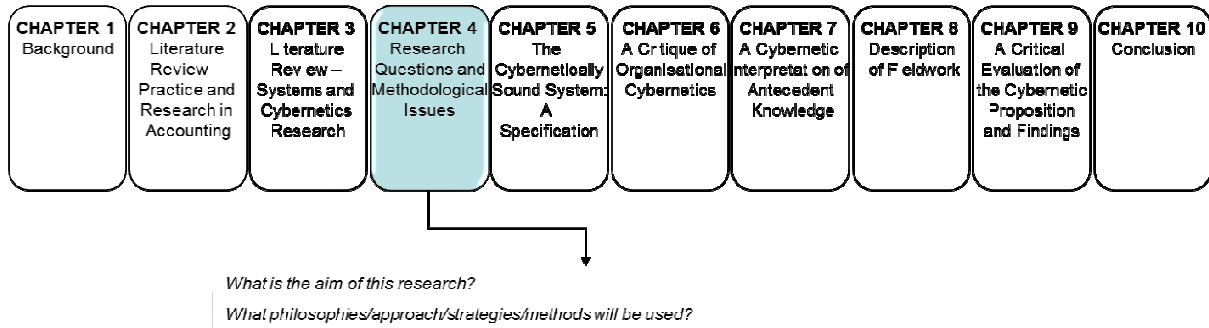
Chapter 2 concluded with a review of the state of research into FPMS conducted within the academic mainstream. The preliminary conclusion was that limited progress had been made, perhaps due to a lack of a solid theoretical underpinning for research and because of methodological problems associated with the study of complex, dynamic phenomena.

This chapter has reviewed the state of systems science and a case has been made that it could provide a solution to some of the problems encountered by those working within a classical management paradigm. In particular, systems science treats interconnectedness, complexity, dynamism and the absence of equilibrium not as problems for a researcher to struggle with, or assume away, but the very stuff of the subject; the object of study.

Cybernetics; that branch of systems science that deals with goal orientated systems, appears to be particularly well suited to the study of FPMS and MCS since it directly addresses the fundamental issue facing researchers in these fields; what characteristics does a control systems need to have in order to be able to effectively manage the affairs of an organisation. Indeed, the Law of Requisite Variety (Ashby, 1957) appears to offer a way of investigating the problem of control, couched in formal and precise scientific terms. Whilst cybernetics, as a technology, was originally applied to simple mechanical systems, it has developed beyond this and has been applied to the management of very complex probabilistic systems of the sort found in the biological and sociological domain. It also acknowledges, amongst other things, the importance of informal systems, and vision, values and identity. A rigorous model has been developed and extensively applied in the real world (the Viable System Model), and this can be used to produce a critique that echoes that emanating from many mainstream MCS researchers.

On the other hand, cybernetic models, whilst they extensively address the issue of effective organisation are often somewhat vague about the nature of the supporting processes required, and financial processes are often referred to only tangentially. It is also clear that systems science in general, and cybernetic models in particular, have made little or no impact on academic work on MCS. This gap in knowledge and understanding is the one that this research aims to fill. How this might be done is the subject of the next chapter.

4 Research Questions and Methodological Issues



4.1 Introduction

This chapter describes and justifies the proposed research approach. Specifically, it sets out the research philosophy and strategy and, based on this, specifies a design to address the research objectives. In addition, measures to mitigate any potential shortcomings of the approach proposed are discussed.

The research objectives, as set out in Chapter 1, are:

1. To review the gaps in the current understanding of the operation of control systems for the management of the flow of financial resources and re-interpret them from an appropriate systems perspective.
2. To develop a reference model for the management of financial resources based on systems theoretic principles and produce tools to aid the application of this model to the diagnosis, design, implementation and operation of financial control systems in organisations.
3. To review the application of these in the field in order to determine the nature of the impact that they may make in practice and the potential consequences for the understanding and design of control systems.

In Chapter 2 the lack of a solid theoretical foundation for MCS research was demonstrated and weaknesses in research methodology exposed. As a consequence of these shortcomings, knowledge is fragmentary. Chapter 3 reviewed the potential theoretical and methodological benefits from adopting a systems-based approach, and cybernetics identified as the most promising avenue to follow in addressing these weaknesses. This chapter describes how it is proposed to address the research objectives using a cybernetic approach, with the aim of making the following contributions:

1. Development of new theoretical foundations for MCS research
2. Consolidation and unification of existing empirical knowledge.
3. Opening new avenues for research by developing novel hypotheses and research instruments and approaches
4. Creation of a practical approach to the diagnosis, design and operation of financial performance management systems in the real world

The goal is to attempt to create a new, more general, theoretical framework for the understanding, study and practice of financial performance management. Ryan et al. (2002) argue that in the study of complex social systems it is more appropriate to talk of models rather than theories. The challenge faced by the researcher is the same, however. As a minimum he/she must:

- Explain existing empirical evidence in a coherent and parsimonious fashion
- Make additional predictions out of sample.

Umpleby calls this approach the correspondence principle (2001, 2004), and argues that it characterises the advancement of scientific knowledge in an era of normal science. This approach has informed the research design that is described in detail in the rest of this chapter. In summary, the first step involves building a model of a FPMS built on cybernetic principles. This is influenced, in particular, by the theoretical contribution of Ashby, especially his Law of Requisite Variety (Ashby, 1957), and the work of Beer who sought to articulate how cybernetic concepts and laws, such as those developed by Ashby, would manifest themselves in structures

and process of social organisations (Beer, 1979). This model will be used to generate hypotheses that will then be mapped against the findings of antecedent research to determine to what extent it is capable of fulfilling the first criteria of the correspondence principle: the provision of a parsimonious and coherent explanation of existing findings. This process will also generate novel, untested, hypotheses, which will be assessed in the field to determine to what extent it offers a plausible explanation of organisational phenomena in the real world; thereby fulfilling the second criteria. To the authors knowledge, cybernetic concepts have not hitherto been rigorously applied to the study of FPMS, and there have been no more than a handful of attempts to empirically validate cybernetic laws such as the Law of Requisite Variety (Burton and Forsyth, 1986, De Raadt, 1987b).

The proposed research design will be explicated using the framework set out by Saunders et al. (2003), as shown in Figure 8.

Research Philosophy	Research Approaches	Research Strategies	Time Horizons	Data Collection Methods
Positivism	Deductive	Experiment	Cross Sectional	Sampling
Realism	Inductive	Survey	Longitudinal	Secondary Data
Interpretivism		Case Study		Observation
		Grounded Theory		Interviews
		Ethnography		Questionnaires
		Action Research		

Figure 8 Research Design options. Adapted from Saunders et al. (2003)

4.2 Research philosophy

As Chua (1986) notes, knowledge is a social phenomenon. As such it is a function of the assumptions we make about the world (ontology), which in turn has an influence on the approach we use to gain knowledge and the criteria we use to define what constitutes legitimate knowledge (epistemology). Different research approaches also make different assumptions about human rationality, the role of the researcher and so on. Together these concepts constitute a research philosophy, and the philosophical stance adopted and the methodological practices associated with it

define a research tradition. Different research traditions can be seen as working within different paradigms (Kuhn, 1970), defined as a cluster of beliefs and dictates which for scientists in a particular discipline influence what should be studied, how research should be done, how results should be interpreted and so on (Jupp, 2006).

Often, in accounting research, the choice open to the researcher is presented as a straightforward one between adopting a positivist philosophical stance or an interpretative one. Where an option is offered it is that of a critical position, as in the categorisation adopted by Brannick and Roche (1997).

Table 1 Characteristics of different research philosophies. From (Brannick and Roche, 1997)

	Positivist	Hermeneutic and Interpretive	Critical Realist/ Action Research
Ontology	Objective	Subjective	Subjective
Epistemology	Objective	Subjective	Subjective
Theory	General	Particular	Particular
Reflexivity	Methodological	Hyper (explicit)	Epistemic (involved)
Role of Researcher	Distanced	Close	Close

Mainstream accounting research is usually categorised as positivistic. From this perspective, the world is assumed to be concrete, real and independent of the observer. In other words, the assumption is that there is an objective truth to be discovered and this truth should, ultimately, be reflected in the form of theories about the world that are general in nature. Such theories usually take the form of a simple causal if...then statement where a limited number of independent and moderating variables explain a dependant variable. The way to access this truth is by the scientific method, the hypothetico-deductive method (Brody, 1993). This involves constructing hypotheses, independent of empirical experiences, which are then

submitted to empirical test in such a way that very general statements can be made about the world. The key test for knowledge gained in the positivist tradition is that the empirical tests made should be capable of replication (Claerbout, 2009). To be capable of replication the process of acquiring knowledge needs to be highly structured, with the researcher removed from the process as far as possible; that is, the method should be objective (Brannick and Roche, 1997, Jackson, 2000). The need for theories capable of generalisation and for replication favours the experimental method, whereby that part of the world subject to study is reduced to two, or a very small number of variables that are, as far as possible, isolated from the real life context (Ashby, 1957). For the same reasons quantification is favoured. In the social sciences, where experimental techniques are of limited use, survey techniques are often used in an attempt to isolate relationship between variables statistically. To Popper (1959) the ultimate test of scientific knowledge is that it should be capable of falsification. Moreover he believed in the unity of method; that states that there is no fundamental difference between the process of acquiring knowledge in the natural and social sciences. In the positivist tradition, human actors are regarded as passive (Flood and Jackson, 1991). The implicit assumption is made that they operate within the context of laws, which, while they might not totally determine behaviour, significantly circumscribe the choices available. This fact – positivists assert – makes it possible to make generalisations about outcomes at the level of populations (Checkland, 1976).

An alternative position commonly adopted in the social sciences belongs to the interpretative tradition. From this perspective, objective reality does not exist. Particularly when dealing with social phenomena, truth should be regarded as a relative concept, which is dependent on the perspective, role values and experience of the observer (Burrell and Morgan, 1979). The world as it is observed is therefore constructed; it does not exist independent of its context of which the observer is part. In this tradition, the process of gaining knowledge involves, firstly understanding and then explaining (Checkland, 1981). Any knowledge gained is specific and particular to the situation and the criteria for determining the legitimacy of this knowledge is consensus; consensus amongst the research community but also consensus amongst the actors involved (Ackoff, 1970b). In this tradition the researcher is inevitably and explicitly part of the thing being studied (Brannick and Roche, 1997,

Hopper and Powell, 1995). Indeed, it is regarded as a positive feature rather, than as the case with the positivist tradition, something to be avoided or eliminated through the research methodology. As a result, qualitative methods are preferred to quantitative techniques (Chua, 1986). Finally, actors are assumed to have choice and act rationally in the context of the way they view and interpret the world. But, while actors are rational this does not mean that their behaviour can be predicted. The nature of the social world is such that this meaning can only be endowed retrospectively.

Table 2 Characteristics of different research philosophies according to Chua (1986)

	MAINSTREAM	INTERPRETATIVE	CRITICAL
KNOWLEDGE			
Epistemological	Theory and observation and separate.	Explanations sought. Looking for logical consistency and actors agreement to interpretation	Criteria for judging theories are time and context bound.
Methodological	Quantitative analysis favoured	Studied in context.	Historical, ethnographic and case studies used.
PHYSICAL AND SOCIAL REALITY			
Ontology	Real and external. Humans - passive	Reality is emergent and subjectively created	Humans have potentialities but these are constrained by restrictive mechanisms. There is empirical reality – real relations that are transformed through interpretation.
Human intention and rationality	Utility maximisation the only goal	All actions have meaning and intention	Rationality and intention accepted

		that are retrospectively endowed.	but critically analysed
Societal order/conflict	Stable, but there may be dysfunctionalities	Order assumed. Conflict mediated through exchange of meanings	Conflict is fundamental, due to injustice and ideology
RELATIONSHIP BETWEEN THEORY AND PRACTICE	Accounting concerned with means not ends. Accepts existing structures	Only seeks to explain and understand.	Critical imperative is the identification and removal of domination

Categorisations of research philosophies often refer to an additional dimension, in addition to ontological, epistemological and human rationality assumptions. Reference is made to purpose (Jupp, 2006); specifically, the relationship of the researcher to the change in the social order. This is reflected in the characterisation of Chua as shown above (Table 2) and that of Hopper and Powell; as in Figure 9 below.

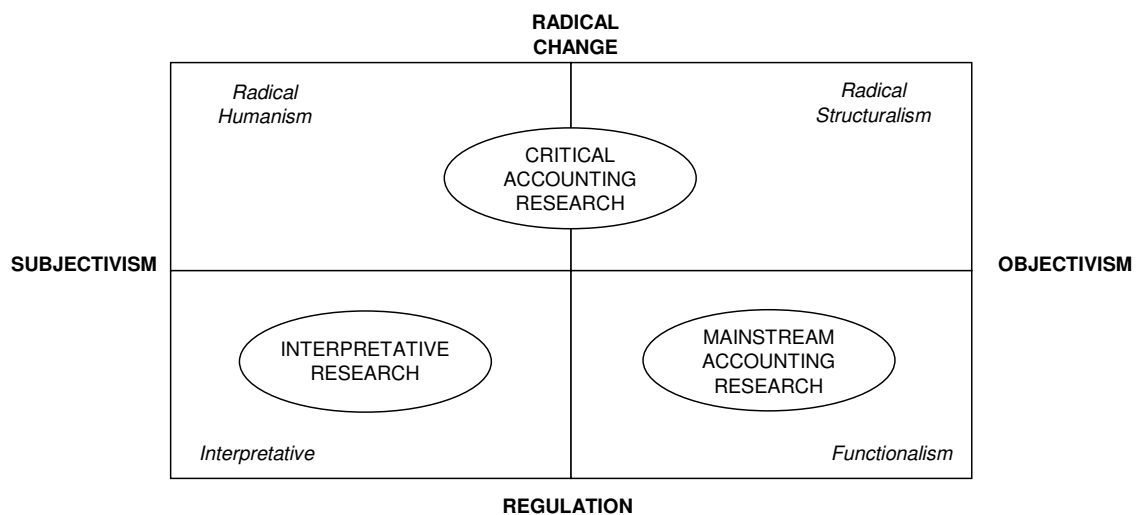


Figure 9 Research traditions in management accounting according to Hopper and Powell (1995)

Those working in the mainstream, positivist tradition work on the assumption that knowledge is neutral; it addresses means, not ends. If there is any engagement in the process of change, it is thought the act of correcting defects or dysfunctionalities

that arise from inadequate understanding of the nature of reality. This stance is often described as functionalist. Interpretative research aims to understand and explain; again with no explicit commitment to change (Jackson, 2000). Like those working in the functionalist tradition, the implicit assumption is that the world is well ordered and stable. Involvement in the process of change extends only as far as problem solving.

On the other hand, those operating within the critical tradition, while they share the interpretive perspective of the relative and subjective nature of reality and of the research process, take the view that the world is essentially unstable, with structural inequalities arising from the exercise of power, which lead to endemic conflict (Flood and Romm, 1997). The role of the researcher is to participate in the process, with the aim of identifying and help remove inequalities (Flood and Jackson, 1991, Ulrich, 1983).

Others have argued that this analysis is simplistic, particularly given the complex nature of the kind of issues that social scientists deal with. Laughlin (1995), for example, suggests that the epistemological/ontological positions described above can be reduced to a distinction between high, middle and low degrees of formalisation of theory and practice. He identifies three different ways in which researchers can orientate themselves to change to create 9 distinct characteristic (Flood and Romm, 1997) research positions. He goes on to argue that, for research in social phenomena, a medium/medium position is appropriate. This, he believes, provides for the generation of skeletal theories that then are fleshed out with empirical richness, so fully describing empirical reality Laughlin (1995).

This thesis is founded on the assumption that the systems perspective is capable of providing valuable insights. The particular systems approach to be adopted (cybernetics) does not, however, fit neatly into either the positivist or interpretive traditions. This fact, may be one reason why cybernetics has failed to find a home in mainstream academic work (Pickering, 2010). Cybernetics distinctive approach is frequently misinterpreted by those working within established research traditions. For instance, according to Espejo and Harnden, Beer's work often "disappoints positivists, and annoys phenomenologists" (Espejo, 1989,443).

The differences between the cybernetic and interpretive perspective are easy to identify. Unlike interpretevisists, cyberneticians work on the assumption that there are invariances in real world phenomena, and therefore it is possible to make general statements as a prerequisite to action and as a guide to design. They also do not shirk from quantification. For these reasons, cybernetics and other systems sciences are often mistakenly labelled functional, but there are distinctive features that differentiate the cybernetic approach from the mainstream the positivist tradition.

In ontological terms cyberneticians adopt a constructivist position. This accepts that a real material world exists but that organisms (including mankind) make distinctions based on the way that their nervous system interacts with the environment (Maturana and Varela, 1998). Pickering describes this ontology as non-modern (2010,381) or performative. The key idea is Beer's notion of an exceedingly complex system - meaning a system with its own internal dynamics, with which we interact, but can never exhaustively know. Furthermore, our perception of the systems and the actions that are based upon it can change the system in a reflexive manner. However, this does not mean that perception and the knowledge that flows from it is an entirely relative phenomenon. To the extent that our nervous systems are similar we perceive the world in the same way. Also our nervous systems have evolved such that we are provided with useful information – that is, we perceive regularities in phenomena that we exploit in order to achieve something of value, whether it be a frog catching a fly or a human crossing the road. Thus, the world is not totally independent of an observer, nor is it a purely social phenomenon; a product of an individuals perception and interpretation. Whilst the world is a subjective construction, complete relativism is avoided by the requirement for coherence and invariance (Heylighen and Joslyn, 2001). In this view of the world, simple if A then B causality cannot exist since everything is recursive; it folds in on itself. Ackoff describes this as producer – product as opposed to cause and effect; A enables B that enables C. Bateson characterises cybernetic reasoning as 'negative' (1967,405). Rather than ask why did this happen he argues, cyberneticians ask “why didnt anything else happen”. The mechanisms discovered are therefore not deterministic relationships; they are relationships that can only be expressed as tendencies that constrain behaviour.

The epistemological approach of systems scientists starts with the identification of a system; that is the process of making a distinction between entity and environment. This is, unavoidably, an act of selection made by the observer/researcher (Ashby, 1952, 1957). In other words, theory and observation are not separate, and observation is driven by purpose; distinctions co-exist with purposes (Gogun and Varela, 1979). In this research we interested not only in the distinctions made by the researcher, but also those distinctions made by actors. For example, the same objectively specified process may be interpreted by one person or group of people in a different way to another person or group.

Defining a system involves selecting a set of variables. To be capable of empirical verification these variables need to be measured but need not be enumerated. As with conventional science, variables may need to be created in order to explain the behaviour of phenomena (Ashby, 1957). However, unlike his/her scientific counterpart, a systems scientist seeks first to describe the behaviour of the whole and then proceed to explain the properties of the thing to be studied in terms of its role in the behaviour of the whole (Ackoff, 1999) rather than decompose the system into parts, look for regularities and recombine. Biological and social systems are purposive (Powers, 1995), they are not causal systems whose behaviour is entirely a product of environmental factors and their predetermined structure. Purpose implies some form of control systems, and explanation flows from identifying the controlled variable(s) and understanding the relationship between disturbances and actions in that context. To the extent that there is an observed relationship between the environment and a systems actions it is not the result of a direct causal relationship, it is merely the by-product of the operation of the control system. Power asserts that controlled variables cannot be found by deduction, only by induction (Forssell, 2008). Indeed, Beer argues that scientific explanation of systems demand a completely new kind of method; something he calls scientific analogising (Beer, 1966). This process starts with an intuitive insight and through a process of exposing, refining and testing, the underlying regularities are crystallised and ultimately expressed in hard mathematical terms.

This thesis aims to do more than create a new theoretical framework, however; it aims to develop one that has superior explanatory and predictive power to those

currently used by researchers in the field. The issue of how to determine the validity of scientific knowledge, and more specifically how such knowledge advances, has been one of the most fiercely debated topics in the philosophy of science in the 20th century, much of it centred on the debate between Karl Popper and Thomas Kuhn and their supporters. Popper (Popper, 1959) argued that new theories could not be confirmed, they could only be falsified, and that thus all scientific knowledge should be considered provisional with competing explanations engaging in some sort of a Darwinian struggle for survival. Kuhn is best known for his work on scientific revolutions (Kuhn, 1970), when a scientific paradigm is overthrown by another but he also set down criteria by which knowledge advances during periods of incremental advancement: normal science. He took the view that, in practice, that the criterion of falsifiability was not practical since unsolved puzzles were the norm, indeed were the driver of the advancement of knowledge during periods of normal science. Instead, he proposed a fivefold set of criteria to guide theory choice:

1. Accurate: it is empirically supported
2. Consistent: it is logically consistent with itself and with or theories in the domain
3. Broad scope: extending beyond competing theories
4. Simple: according to Occam's Razor
5. Fruitful: creating new insight into phenomena or relationships.

Kuhn's analysis closely mirrors that first proposed by Neils Bohr (Neislen and (ed), 1976), one of the early proponents of Quantum Theory, when challenged with the problem of reconciling it with extant theories in physics. His proposition, which he christened the Correspondence Principle, stated that a new theory, in order to be considered an advance on prior theories, had to satisfy two criteria:

1. It has to explain all phenomena within the domain of validity of the pre-existing theory
2. It has to provide new, testable, hypotheses outside these correspondence limits

Thus, in physics, Einstein's Special Relativity is equivalent to classical mechanics at speeds far away from the speed of light and General Relativity is equivalent to Newtonian gravity when the gravitational force is weak.

Although the domain of social and physical sciences are not equivalent, for example social theories rarely have a precisely defined domain of validity not do they approximate the same standards of empirical verification, the correspondence theory provides us with a simple mechanism to determine whether a systems-based theory can be considered an advance on pre-existing frameworks working within the same or similar paradigms, rather than simply another alternative.

Another issue faced by the systems scientist relates to the nature of systems theories. Ashby (1958a) held the view that the most profitable approach to building a systems science is to construct abstract models of the utmost generality, rather than seeking out and attempting to explain empirical regularities. Indeed, Bunge (1977) considered that General System Theories, of which Ashby's Law of Requisite Variety (1957) is one, should be considered hypergeneral since they are phenomenological, that is mechanism free and stuff free. As a result they are too general to yield any predictions even when enriched with empirical data. Instead, theories should be tested indirectly, by operationalising them; converting them into a material form which, it can be demonstrated, fit with existing empirical knowledge, and can be used to design viable systems – that is systems that work. Although knowledge in this form is unlikely to pass Popper's test of falsifiability, and the positivist distinction between true and false is lost, Bunge argues that such knowledge is still scientific: it is precise, not at variance with antecedent knowledge, and yields knowledge that is a guide to effective action. Knowledge gained in this way is thus subject to theoretical and practical confirmation as well as the usual empirical confirmation. Indeed, Umpleby (2002) and Beer (1966) argue that the criteria of usefulness should determine what constitutes knowledge in the systems domain.

Thus it can be seen that, despite the some similarities, not least in terms of the criterion used to drive the advancement of knowledge, systems scientists operating within the cybernetic stream adopt a subtlety different stance on ontological and epistemological matters to that of a conventional positivist researcher. On the subject

of change, however, cybernetics is more closely aligned with conventional positivist science, since it seeks to describe the way that the world is, not the way that it ought to be. This was best articulated by Beer: “regulatory finesse can be used for good or ill” (1983,119); a neutral moral stance has attracted criticism from some quarters (Ulrich, 1981). But, whereas equilibrium is arguably the implicit assumptions made about the natural order of things in classical science, systems science is founded on the premise of flux and dynamism, and is concerned with using the power of science to orchestrate change that is going on anyway (Espejo and Harnden, 1989). To that extent, there is a subtle difference of approach as also evidenced by Beer’s work where he uses a cybernetic justification for what he sees as a moral society based on principles of natural justice (Beer, 1975, 1989a).

4.3 Research approach

A deductive approach starts with the general and works to the particular; this is the approach favoured by positivists and as part of the inevitable march of science from descriptive to generative knowledge (Forssell, 2008). Interpretivists, however start with the particular and seek to draw out general statements; although it is clear that the very act of observation (what is noticed and what is not) cannot be totally theory free. Since this research sets out to test the plausibility of a systems/cybernetic model, the approach taken will be deductive. The aim, however, is not to develop and test hypotheses about the relationship between pairs (or small numbers) of variables, but to make general statements about whole system; specifically the nature of the relationship between the FPMS and organisational performance, represented as a set of controlled variables. To this end, it is proposed to develop a Cybernetically Sound System (CSS) FPMS model, based on cybernetic concepts and theory, and use this to develop hypotheses about organisational outcomes, which can then be tested.

4.4 Research strategy

The focus of this research is to develop a systems/cybernetics based model capable of providing a plausible mechanism for understanding, diagnosing and designing FPMS and a platform for further research efforts. It aims to do so by:

- Explaining existing empirical evidence in a coherent and parsimonious fashion.
- Making additional predictions out of sample.

The first step is to build a CSS model. The next step is to test the robustness of the CSS model against antecedent knowledge in two ways:

- Against prevailing academic opinion. What criticisms have been levelled at the application of systems/cybernetic concepts in this way and are they valid?
- Against prior empirical knowledge. Does the model help explain, and is it consistent with, previous findings in the research domain?

This part of the process is an extension of the literature review and will not require fieldwork, since “the correspondence principle provides a procedure for checking a new theory before any experiments are made” (Umpleby, 2001,2)

It is anticipated that this will result in some predictions of the model being confirmed and others contradicted. It is also likely that some of the predictions of the model will not ever have been tested. Indeed, to the knowledge of the author there have only ever been two pieces of empirical work that explicitly set out to test the predictions of Ashby’s Law of Requisite Variety (Burton and Forsyth, 1986), neither of which involved FPMS.

According to Yin (2003), there are five basic approaches to empirical work that can be applied, depending upon the nature of the research questions being asked and the constraints placed on the researcher in going about the task of collecting data.

Table 3 Approaches to data collection. Adapted from Yin (2003)

Approach	Form of Research Question	Requires Control of Behavioural Events	Focus on Contemporary Events	Rationale for choice of Case Study for this research
Experiment	How? Why?	Yes	Yes	Control of behavioural events is not required. Associated with a positivist paradigm.
Survey	Who? What? Where? How many? How much?	No	Yes	More relevant for a quantitative positivist paradigm and does not address how and why.
Archival analysis	Who? What? Where? How many? How much?	No	Yes/No	Does not address how and why and more focused on the past.
History	How? Why?	No	No	The focus is particularly on the past and is less concentrated on contemporary issues.
Case Study	How, why?	No	Yes	Does address both how and why and is concerned with contemporary issues.

In this study, the research questions are of a broad nature, not the specific questions of the kind that might usefully employ survey or archival approaches. Two previous studies have empirically examined the role of variety in organisational behaviour. One used archival analysis (Burton and Forsyth, 1986) to determine the impact of firm variety on performance. This study used a number of measures as a proxy for firm variety rather than attempting to measure it directly and did not seek to establish what features of company organisation or processes might be responsible for the observed variety. The other (De Raadt, 1987b), sought to determine the relationship between environmental and firm variety using survey data collected by means of semi structured interviews in a single company, but again did not set out to determine what might account for the level of organisational variety observed. While both studies reported findings that are consistent with the predictions of Ashby's Law (1957), and therefore bode well for this line of enquiry, neither provides us with a research strategy that will help answer our specific questions.

The experimental approach has been rejected since this would involve separating the subject under study from its context; an anathema to a systems scientist interested in gaining a holistic understanding. Since our interest is in gaining understanding of contemporary phenomena, the case study approach appears to be the most relevant.

The case study approach has been strongly advocated by those who felt that management accounting research had become too abstract and divorced from its real life context (Otley, 1980). However, it is also acknowledged that, without proper controls over, and rigour in, research practice, case studies can struggle to meet the criteria of external validity; generalisation of findings. Properly conducted, however, case studies can provide a powerful tool. Brannick and Roche (1997) argues that there are three common misconceptions of case study research: that it is unscientific, inimical to quantification and it is inappropriate for testing theories. Spicer (1992) also concurs that the approach has been maligned. Indeed, Otley and Berry (1994) point out that such natural experiments are common in natural sciences, such as astronomy, where it is impossible to construct experiments to test prediction about the behaviour of cosmic phenomena. The key to the successful use

of case study research is to be explicit about the theoretical position adopted in advance (Otley and Berry, 1994) and to make sure that the output of the process is appropriate, given the research purpose.

Keating (1995) identifies four uses for cases study fieldwork. In his view, the most common weakness in case study research is the failure to reference the results back to the theoretical construct used, in order to reassess their applicability and expose knowledge gaps and puzzles. This study clearly falls into the category of Theory Illustration and the criteria set out below will inform the research design and process used.

Table 4. Keating’s analysis of cases study research output by purpose (Keating, 1995)

Case Study Type	Outputs
Theory Discovery	<p>Theoretical building blocks in the form of emergent constructs and hypothesised relationships.</p> <p>Novelty and theoretical/practical significance of analysis.</p> <p>Domain of theoretical/practical applicability and relationship to existing theories.</p> <p>Summary of knowledge gaps and unresolved theoretical puzzles.</p> <p>Specification of research program to develop theoretical issues raised.</p>
Theory Illustration	<p>Evidence to support plausibility of illustrated theory.</p> <p>Re-specified constructs and relationships.</p> <p>Relative strength, limitations and domains of illustrated and rival theories.</p> <p>Recommended next steps to specify or test illustrated theory.</p>
Theory Specification	<p>Clear statement of confirmed, disconfirmed and new constructs and relationships.</p>

	<p>Operational definition of concepts.</p> <p>Testable propositions.</p> <p>Specification of further specification studies to address anomalous evidence or strategies for theory test.</p>
Theory Refutation	<p>Findings of falsification/corroborations and theoretical and practical significance.</p> <p>Refinements designed to strengthen theory weakened by negative evidence.</p> <p>Counterpoint interpretations of previous case research.</p> <p>Specification of further studies</p>

Atkinson and Shaffir (1998) approached the need for discipline and rigour in case study research from another angle; the steps in the research process. In particular, they argue for the need to identify and deal with potential observer bias and make the work more replicable. They go on to set out appropriate standards for case study research that will serve as an appropriate benchmark for this research.

Table 5 Atkinson and Shaffir’s analysis of output for different stages of the case study research process (Atkinson and Shaffir, 1998)

Developing Observations	Analysing Observations	Reporting Results
<p>Evidence to identify potential sources of observer bias.</p> <ul style="list-style-type: none"> • What was observed? • Reasons for choice of observations? 	<p>Is the generalisation appropriate given sample size?</p> <p>Construct validity</p> <ul style="list-style-type: none"> • Is preliminary hypothesis and mode of observation 	<p>Has an appropriate authority signed off the study and given permission to report?</p> <p>Theory Testing Study</p> <ul style="list-style-type: none"> • Is the environment consistent with

<ul style="list-style-type: none"> • What was omitted and why? <p>Evidence to help identify possible bias created by observation</p> <ul style="list-style-type: none"> • Observation method. • Relationship between observer and subjects. • Possible observation effect. • Behaviour of a possible control group. 	<p>identified?</p> <ul style="list-style-type: none"> • Have measures been independently validated? • Have the subjects reviewed material and confirmed appropriateness of characterisation? <p>Internal validity</p> <ul style="list-style-type: none"> • Has a reasonable argument been developed in support of the hypotheses? • Does cause precede effect? • Can cause and effect be demonstrated to be necessary and sufficient? <p>External validity</p> <ul style="list-style-type: none"> • Is evidence preserved? 	<p>the setting of the theory being tested?</p> <ul style="list-style-type: none"> • Were those things measured reasonable proxies for the theories variables? • Would the test uncover disconfirming evidence? • Would the test exclude competing and incompatible hypotheses?
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Having established that case study research is an appropriate way to corroborate propositions derived from the CSS Model, we now address the task of case selection. Choice is critical when testing theories, (Brannick and Roche, 1997, Ryan

et al., 2002) particularly if the research issues are well defined; ideally we should select cases that address these directly.

It is proposed to use two different cases. The first (Unilever Poland Foods) is a national business unit of a major multinational. This has been selected because it made a major change in its FPMS practices – from a conventional fixed budget approach to a more flexible set of practices which, it is believed, are likely to be well aligned with a CSS management model. This transformation involved making changes in organisation, process and behaviours in a very short period of time (less than a month). There is therefore a good chance that a longitudinal study (where the behaviour of a single system is analysed over time) should be able to establish whether the results of these changes are consistent with the CSS model.

The other case (Svenska Handelsbanken), is an established national bank that is well known for its distinctive and unusual management practices, which are also likely to be well aligned with a CSS Model. In this latter case, the organisation's peer group is both clearly identified and distinctively different in terms of its management practices, so it hoped that a cross sectional study (where comparisons are made between different systems, at a point in time) will determine to what extent the theoretical predictions of the model hold true. Taken together, the use of two different data collection strategies (horizontal and cross sectional) adds to the robustness of the research design.

4.5 Time horizons

The initial piece of research involves testing the predictions of a systems theory against antecedent knowledge. By its nature this process is historical and archival. There is no *a priori* reason to limit the survey to any particular period but in practice the majority of empirical research has been carried out in the last 20 or 30 years.

The second part involves two case studies one longitudinal and one cross sectional. The use of two case studies, researched on different dimensions gives greater

confidence that any findings can be generalised i.e. provides the research design with more external validity.

4.6 Data collection methods

The first part of the research involves testing the predications of a CSS Model against antecedent empirical knowledge. It is proposed to use a small number of recent articles that review and summarise the entire field of knowledge as a source. In this way, any selection bias can be avoided.

The second part of the research requires a two-step approach:

Step 1

To determine to what extent the management practices in the selected case studies are consistent with the CSS Model.

Step 2

To determine whether the performance of the organisation is consistent with the predictions of the CSS model.

Step 2 involves selecting variables whose behaviour the theory purports to predict, and that are quantified and available from archival sources. While the process of selection of variables is not without difficulty, as is the task of isolating the subject of interest, this part of the study is relatively straightforward, capable of replication, free of ambiguity and potential researcher bias.

Step 1 is more problematic. It is proposed to build a CSS Model directly from theory, using the researcher's knowledge of FPMS practices to operationalise the theory. An output of this process will be a research instrument; a diagnostic tool taking the form of a set of structured questions, with guidelines to aid interpretation and a scoring system. This will be used to collect information about performance management practices from multiple sources such that they can be assessed and scored in a

reasoned and consistent way. The evidence required to populate the diagnostic tool will be gleaned from a range of sources, including:

- Existing independent documentation and research (mainly relevant to Case Study 2).
- Original unedited video footage recorded for internal company purposes (Case Study 1).

These will be supplemented by data from semi-structured interviews conducted with employees of the two organisations, knowledgeable outsiders and independently completed diagnostics. Wherever possible, the results will be validated with representatives of the two organisations. It is important to note that the diagnostic tool is not intended to be used as a survey instrument; the nature and the scope of the research mean that it is inappropriate and impractical to use it in this way. Rather, it is a means of structuring a complex large scope inquiry, producing a concise summary of the cybernetic health of an organisations processes and a mechanism to enable analyses produced by different means or by different sources to be compared and triangulated. In this context, cybernetic health is defined as the capability of an organisation's regulatory processes to enable it to meet its defined goals in a given environment. It is therefore a necessary, but no sufficient condition for organisational success.

The data generated will, where possible, be subject to statistical analysis to test for significance. Because of the nature and quality of the data, case study number 1 (Unilever Poland) will rely more heavily on qualitative approaches.

4.7 Measures to ensure methodological robustness

A research design has been described as a logical plan for getting from here to there (Yin, 2003). The figure below summarises the logical plan proposed for this piece of research, and refers back to the framework of Saunders et al. (2003) described earlier in this chapter.

Note that a new category of research philosophy has been introduced in recognition of the argument that a systems approach requires adopting a stance that differs in a number of important respects from its closest relative: positivism. Also the use of multiple time perspectives and data collection methods will provide a rich source of evidence and therefore enhances the robustness of this research design.

Research Philosophy	Research Approaches	Research Strategies	Time Horizons	Data Collection Methods
Positivism	Deductive	Experiment	Cross Sectional	Sampling
Constructivism	Inductive	Survey	Longitudinal	Secondary Data
Realism		Case Study		Observation
Interpretivism		Grounded Theory		Interviews
		Ethnography		Questionnaires
		Action Research		

Figure 10 Proposed research design

A possible source of weakness in the proposed approach is that case study based research is context rich and therefore subjective, unlike conventional experimental or survey based methodologies. Yin suggests some ways in which the results of this form of research can be made consistent with the quality standards of positivistic science.

Table 6 Tactics to enhance the quality of case study research. Adapted from Yin (2003)

TEST	TACTIC	PHASE
Construct Validity	Use multiple sources of evidence	Data collection
	Establish chain of evidence Have key informants review draft	Composition
Internal Validity	Do pattern matching	Data Analysis
	Do explanation building	
	Address rival explanations	
	Use logic models	
External Validity	Use theory in single case studies	Research Design
	Use replication logic in multiple case	

	studies	
Reliability	Use case study protocol Develop case study database	Data Collection

This is how this study proposes use the tactics suggested by Yin (2003).

- Construct validity is concerned with whether we are actually measuring what we purport to measure. In this study, multiple sources and perspectives will be used. Data will be sourced from independent archival sources and where this is not possible and a data capture approach based on a well specified theoretical model will be used. In addition, it is proposed to involve internal and external experts to validate the results.
- Internal validity is concerned with whether we are able to make clear-cut causal inferences. In other words, have alternative explanations for the phenomena observed been eliminated in the research design? Since the approach is deductive, we will be able to derive predicted patterns of empirical evidence from logic models with a high degree of internal consistency. In this way, and through the explicit consideration a range of competing explanations, as suggested by Yin (2003), it is hoped to provide explanations of empirical phenomena with a high degree of confidence.
- External validity is concerned with the ability to generalise from the particular of the research to the general of the world. The first step in the fieldwork is to test the predictions of systems theory against antecedent knowledge. The second involves assessing two case studies, based on a strong theoretical model. If the predictions made by this model are confirmed in both the cross sectional and longitudinal cases studies, and pass the correspondence principle test, then we should have confidence in our ability to generalise from this study to other situations.
- Reliability addresses the ability to replicate the results, should the same instruments be used with the same subjects in the same conditions. The review of antecedent knowledge and the case study research will both be conducted using a well-structured model, a defined protocol and archival data

available to any researcher. This should enable other researchers to readily replicate this study and confirm or otherwise the findings.

4.8 Conclusion

This chapter has described and justified the proposed approach to the fieldwork that follows.

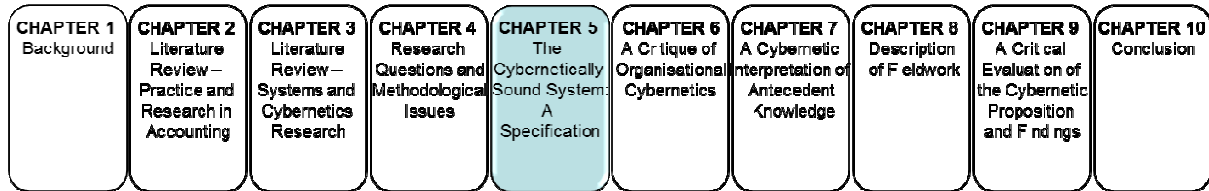
The research philosophy upon which it is based does not fall neatly into either of the two most readily identifiable categories: positivist or interpretative. Instead, the ontological stance adopted is that of constructivism; one that acknowledges the existence of a concrete reality, but which is mediated through the human nervous system and discovered through interaction with the system. This means that while our perceptions are constructs, rather than a direct representation of the world, the traps of solipsism can be avoided. While systems are unavoidably the product of distinctions made by an observer, the cybernetic approach to epistemology adopted proceeds on the assumption that there are invariances in the way in which systems behave; the equivalent of laws. Once these general laws have been operationalised in a practice domain (such as FPMS), such laws can be tested. The ultimate criterion of what passes for knowledge is is it useful? In other words, does it generate insights that lead to successful, purposeful action?

The aim of the thesis is to enhance the theoretical underpinnings of FPMS, and in order to make a claim that this has been achieved the correspondence principle must be met. This requires that the new theory demonstrate itself capable of explaining existing research findings in a parsimonious fashion, and generating new, testable, hypotheses out of sample. To do this it is proposed to operationalise an appropriate subset of systems laws by constructing an idealised model of a Cybernetically Sound System. This will be mapped against extant research and used to generate a hypothesis that will be tested for robustness and plausibility in two case studies. One of the case studies will be researched longitudinally, the other in cross section using a research instrument - a diagnostic tool – derived from the idealised model. A mixture of quantitative and qualitative, archival and interview-

based approaches will be used. The diversity of approaches used, and the intention to have the results validated by experts lend robustness to the research design.

The next chapter is devoted to the task of building an idealised model of a Cybernetically Sound System for FPMS, from first principles.

5 The Cybernetically Sound System: A Specification



*How can key cybernetic concepts be applied to the design of a cybernetically sound system?
What features and qualities should a cybernetically sound system have?*

5.1 Introduction

The objective of this chapter is to specify a cybernetically sound system for the management of financial performance (CSS). This is an original piece of work. The specification will subsequently be used to create a research instrument that can be used to test whether a systems-based approach to the design and diagnosis of FPMS offers useful explanations of, and insights into, real world phenomena. The research instrument can be found in Appendix 5.

From a cybernetic point of view, management has been characterised as the profession, of regulation (Beer, 1981). Effective regulation ensures that such a system is **viable**; stable in the face of unanticipated perturbations from the **environment** in the short term, and capable of adapting to unpredictable changes in the environment over the longer term. This chapter aims to specify what is required for the effective **regulation** of the flow of financial resources in social organisations. Since cybernetics has never been explicitly applied in this way, the specification will be built up from first principles as elucidated by authorities in cybernetics and systems, which have, for the first time, been interpreted in the context of financial control and regulation. These, and related core cybernetic and systems concepts, are detailed in Appendix 1 so as not to burden the main text with extensive references and explanations, which would otherwise disrupt the flow of the logic. The

use of **bold text** highlights the first use of terms and concepts contained in the first column of Appendix 1. Columns two and three provide a detailed explanation of the relevant concept and an interpretation from the perspective of its potential implications for the design of cybernetically sound FPMS.

The chapter is organised as follows:

1. Concepts
 - a. Conceptual Building Blocks
 - b. Organisational Form
2. Structural Principles
3. Informational Principles
 - a. Feedback Information
 - b. Feedforward Information
4. Regulatory Principles
 - a. Goals
 - b. Adaptation
 - c. Response

1. Concepts

From a cybernetic perspective, a **system** is not a naturally occurring discrete entity in the world; rather it is a distinction, a set of related **variables**, made by an observer for the purposes of understanding and utility. In this first section we will set out the assumptions made about organisational systems, their relationship with their environment and between the subsystems of which they are comprised. The section is split into two parts. Section 1A introduces the conceptual building blocks, Section 1B demonstrates how these concepts can be applied to the regulation of a social system, using Stafford Beer's Viable Systems Model (VSM) as a frame of reference (Beer, 1979, 1981, 1985). In subsequent sections, these concepts have been translated into a set of principles (34 in total), which collectively comprise the specification for a CSS. This set of principles, derived from well-established systems concepts, is original and as such represents one of the principal major contributions

of this piece of research. Its provenance in prior work is a guarantee of its internal validity. In subsequent chapters the external validity is subject to test through fieldwork.

2. Structural principles

Cybernetic regulation is mediated through organisational structure as well as the specific mechanisms used manage a social entity. The second section contains principles that describe the particular form and nature of the structural arrangements required by a CSS; specifically the subsystemic texture of the organisation and their relationships with each other.

3. Informational principles

The third section addresses the mechanics of information: the precursor of action. Shannon and Weaver (1949) and Ashby (1957) demonstrated that the nature and quality of regulation is related to, and constrained by, the provision of **information**. This section specifies the form and nature of information needed by a CSS; how information is processed and channelled to the relevant part of the system in order to inform appropriate action. The section is split between those principles that govern the operation of **feedback** processes (that information that relates to the actual state of the system), and those that govern **feedforward** (based on the anticipated state of the system).

4. Regulatory principles

The fourth and final section is devoted to the regulatory process itself. It specifies how the **goal** set and regulatory processes of a CSS should be constructed in order to facilitate the design and execution of those acts required to maintain the viability of the system. Regulation can take two forms: simple response to perturbations in the environment, drawing on an existing repertoire of regulatory acts (**single loop** or **first order learning**), or the development or enhancements of new regulatory responses, perhaps in response to a change in the nature of environmental perturbations (**double loop** or **second order learning**).

5.2 Part 1(a) Concepts: building blocks

The diagram below is a simplified model of the functions of a CSS and its environment.

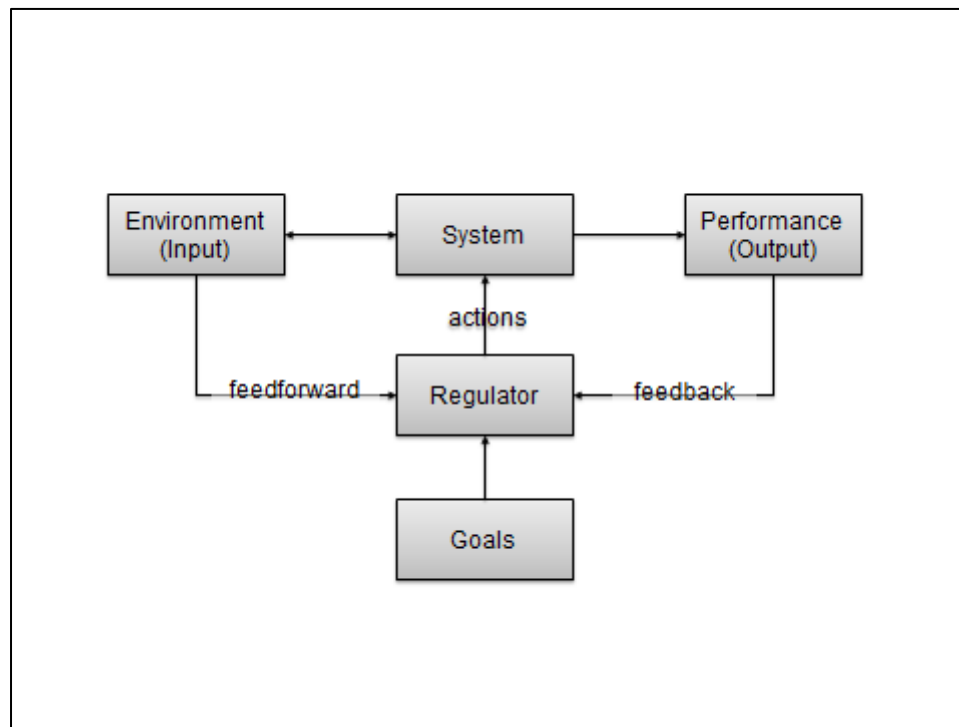


Figure 11 A CSS and its environment

5.2.1 Environment

Cybernetics takes the **environment** to be that part of the external world (represented by set of variables) with which a system interacts; with which it is **structurally coupled**. Changes in environmental variables perturb the system (i.e. change the value of its variables to create a new **system state**). While some changes in the system state will, in turn, perturb the environment, the regulator of the system cannot directly influence environmental variables. Unlike the system, the environment cannot therefore be controlled by the regulator. The environment will include other social systems that are members of the same ecosystem, (for instance, those that

compete for environmental resources) but also physical, biological and conceptual systems (such as the law).

The environment of social systems is always exceedingly complex, made up of a very large number of variables, with unknown and unstable patterns of relationships (see **chaos theory, self-organised criticality**). Environmental variables are in state of constant flux, varying at different frequencies and with different amplitudes, and in ways that are difficult to predict.

Although the environment is densely interconnected, it is not homogenous or undifferentiated. It is possible to make distinctions between groups of variables, based on patterns of observed behaviour resulting from variations in the nature of interrelationships within the environment, and between the environment and the system (see **small worlds**). Different distinctions can be made depending on the purpose of the observer and the level of resolution adopted. In addition, because of the emergence of novel properties at different levels of complexity (**emergence**), environmental phenomena may differ in nature at micro and macro levels.

5.2.2 The operational system

The operational system is that part of the organisation that is deemed to be subject to regulation. To some degree, social systems are always **self-organised** and **self-regulated** (by virtue of the actions of actors in the system) and regulation may be **informal** or implicit as well as formal and explicit. So, although it may be possible to describe with precision the form and nature of some formal systems of regulation, the distinction between regulator and system drawn here is somewhat artificial. The causal texture of the system itself is always part of the process of regulation. Since some measure of control is intrinsic to the system, the impact of formal regulatory process may depend on how its actions are interpreted and implemented by actors within the system.

Social systems are made up of interrelated sub systems, which, if the system is sizeable, are organised hierarchically. For the system as a whole to be viable, it

needs to maintain stable (**homeostatic**) relationships between itself and the external environment but also internally, between its subsystems.

For the purpose of this thesis, operational system variables are split into three categories:

1. Financial variables – those denominated in a financial currency (or derivatives thereof).
2. Resource variables – those that relate to inputs sourced from outside the system (often in exchange for money) and that are used by the system to do work i.e. change the state of operational variables. The work either takes the form of useful output (products or services) or the maintenance of the system itself (e.g. administration, management).
3. Operational variables – all other variables.

This approach is consistent with that adopted by Beer in his consulting work with a large Canadian financial institution in the 1980s (Espejo and Harnden, 1989).

Financial variables are, by definition, readily quantified. Other variables may or may not be easily quantified.

5.2.3 Output

The output of a system is comprised of those variables or system states that are deemed to be relevant in some way to the performance of the system, and thus ultimately to its viability. They will be made up of the **essential variables** of the system and those with a strong causal relationship to them. The aim of regulation is to bring about changes in their state, such that the viability of the system is maintained.

This research focuses primarily on the financial output of the system and any other (resource and operational) output that is dependent on the state of financial variables, or which influences the state of financial variables.

5.2.4 The regulatory system

The regulatory system is comprised of those mechanisms, which, by virtue of being able to modify their patterns of behaviour, intervene in the system or upon its inputs, with the aim of modifying the output of the system. Regulatory acts are made in response to, or in anticipation of, perturbations in the environment or changes in the system itself. An adequate regulator is one capable of maintaining essential variables consistently within physiological limits. Failure to do so will result in a loss of system viability; i.e. it will become bankrupt or it will lose the ability to maintain an independent existence in other ways (e.g. it will be taken over by a predator). The regulation of a system is achieved by a set of regulatory mechanisms operating in parallel; some of them formal in nature, some of them informal.

As discussed, a social system will be able to create and maintain a degree of systemic order by informal means: self-organisation and self-regulation. In contrast, formal systems are consciously designed, ostensibly with the objective of promoting or enhancing the viability of the system concerned. They do so by supplementing or modifying the informal regulatory mechanisms, but they are in turn informally supplemented and modified. This research focuses on the formal systems designed to regulate financial variables with the aim of specifying the qualities that enable this to be done most effectively.

The effectiveness of a regulator of financial variables needs to be judged in terms of its contribution to the viability of the system as a whole, not just by its ability to maintain essential financial variables within physiological limits. This is because financial variables constrain the ability to acquire resources needed to do work. Work influences operational variables, thus in helping maintain and change the fabric of the system and produce output. In the absence of operational output, the money and resources necessary to maintain the existence of the system will not be forthcoming.

The interdependencies between financial, resource and operational variables and their respective regulators and environments are shown in Figure 12 below. This

demonstrates that the viability of the system relies upon the continuous maintenance of healthy, balanced (homeostatic) relationships across all environmental interfaces.

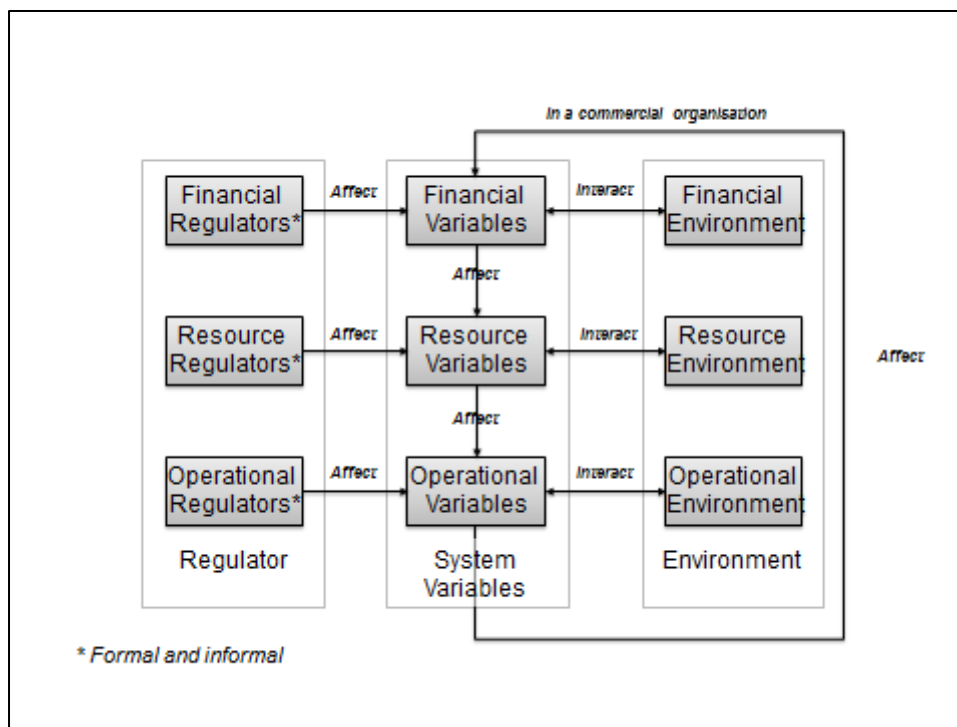


Figure 12 The relationship of variables

This principle applies to any kind of organised social system, however the pattern of relationships differs between commercial and non-commercial organisations. A commercial organisation (one that sells goods or services), once established, is self-sustaining to a large degree. As shown in Figure 13 below, it is a money pump. Money received from the sale of goods and services is recirculated; external funding from the financial environment is required only to prime and lubricate the pump. Non-commercial organisations (such as charities and government agencies) are money pipes. Since there are no customers, only beneficiaries that do not pay directly for goods or services, the financial environment is the only source of funds, which the organisation channels (often having been transformed into goods and/or services) to recipients. Whatever form the organisation takes, the financial regulator promotes system viability by controlling the flow of money through and around the organisation.

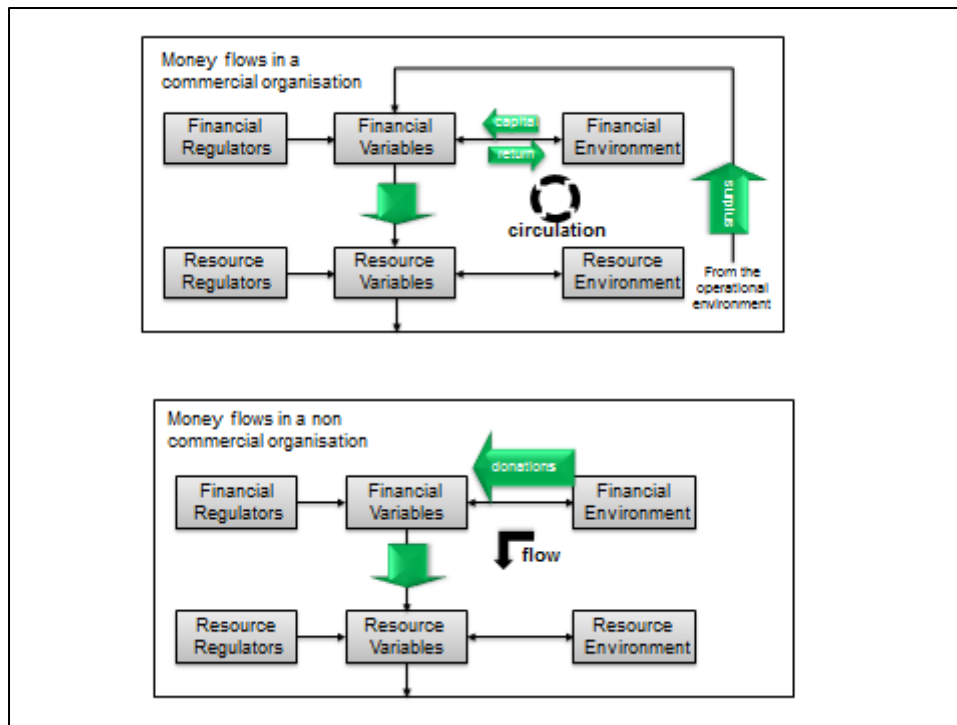


Figure 13 How relationships vary between commercial and not for profit organisations

Regulation of social systems takes two basic forms. Firstly, it may take the form of restricting (**attenuating**) the behaviour (**field**) of the system by either:

- Proscription (do anything except x), which involves placing **constraints** on **system states** or variables (for instance, by setting or changing budgets or policies).
- Prescription (do x – rather than y), which involves making interventions in system behaviour directly. Prescription can be seen as an extreme version of proscription; variables are constrained to a particular value rather than to a range (for instance, run this advertising campaign rather than here is your advertising budget).

The second form of regulation involves increasing (**amplifying**) the range of behaviour of the system, by either:

- Allowing: loosening constraints on system variables (e.g. here is some more money).
- Augmenting: increasing the capability of the system. This might involve increasing the physical capacity of the system (the system field) or by increasing its ability to self-regulate (for example through training or through the direct transfer of skilled resource). This usually involves the application of new resources. In business, this process is often termed investment, though it does not necessarily require the transfer of money, and even if it does, it is not necessarily capitalised on the balance sheet.

A CSS is likely to use all four strategies, either through direct regulatory action (e.g. do this, don't do that), or indirectly through changes the constraints placed on financial variables, or a combination of the two. Augmentation, which often involves granting permissions to use financial resources, will usually be subject to conditions that prescribe or proscribe the system in some way (e.g. by defining the use to which the cash may be put). The process of granting money or resources (or permissions to use them) is called resource allocation. This involves regulating the flow of financial resources with the view to modifying, creating or eliminating certain system states, temporarily or permanently, thereby shaping the **system field**; the range of states that the system is capable of adopting.

Given that the future is unknowable, it is important for a regulator to have a degree of **redundancy** (surplus capacity) in its regulatory repertoire to facilitate response to unpredictable circumstances. Regulatory redundancy takes two forms. Active redundancy requires:

- actions that the regulator is able to make in response to an unanticipated set of circumstances and
- the liquid or near liquid resources necessary to enact these.

Passive redundancy is the existence of a buffer capable of absorbing unanticipated shocks (such as the requirement of commercial banks to hold sufficient spare regulatory capital).

5.2.5 Goals

Goals are those output values that are preferentially selected for by the regulator. They therefore represent a constraint on the operation of the regulator. In a viable system, by definition, the physiological limits of essential variables will comprise parts of the goal set, which is also likely to include values of other variables that are deemed to contribute to the maintenance viability (because they influence the value of essential variables). Goals can be derived from an external source (either in response to the needs of an external agent, such as an investor, or as a result of peer group referencing e.g. benchmarking) or they may be the result of internal management processes; through some form of negotiation or by management fiat. Goals may apply to the organisation as a whole, but may also refer to specific subsystems and/or hierarchical levels.

Goals can take four forms:

1. specific (a value of x)
2. a threshold (more than x or less than x)
3. a range (between x and y)
4. a direction (an increase or decrease in x).

X and y may be expressed as an absolute value of a variable (x), a rate (x per month or growth of $y\%$) or in relation to another (e.g. greater than y). They may also be expressed in **fuzzy** terms (e.g. high, often). The use of the rate or relative form of goals may be particularly appropriate when the system state varies continuously, or if it is difficult to specify goals definitively due to the dynamic nature of the environment; for example if the system is in competition with other systems (e.g. for funds or for customers or resources). Goals can be held constant for a period of time or can be varied, and at different frequencies.

Since most organisations need a source of external funding (from donors, lenders or investors), and because constraints (explicit or otherwise) usually accompany the provision of resources, some financial goals have an obvious and direct bearing on

system viability. The connection will be more opaque, however, if the goals have been set as the result of internal management processes where some form of judgement has been exercised.

5.2.6 Feedback

Feedback is comprised of those **facts (data)** about the current state of the system that are potentially relevant to the act of regulation. Any feedback channel will carry **information** (potentially actionable data) and **noise** (irrelevant data) the latter of which needs to be **filtered** out (attenuated) to facilitate regulation.

Information needs to be interpreted before it can be acted upon, so **models** of the system under regulation are required in order to make sense of this information. Models also help the regulator to determine what action is required in response to feedback. Also, because a model describes a hypothesised relationship between variables, it can be used to identify those variables that impact other variables at a lag (lead indicators) thereby potentially speeding up the process of regulation. To the extent that feedback identifies significant errors between the predictions of a model and reality, it is required to improve its models, i.e. to provide the regulatory system with the capacity to learn (second order or double loop learning), without which the system will ultimately be rendered unviable as the environment changes.

This study will focus on feedback on financial variables and those variables that impact, and which are impacted by, financial variables.

5.2.7 Feedforward

Feedforward is comprised of information about possible future states of the system and may be used by the regulator to initiate action, pre-empting the feedback signal and thereby speeding up response.

Models of the system and its environment are used to create feedforward information. Many possible future system states are conceivable, depending on the

assumptions made about the future states of variables, particularly the assumption about the degree to which their values are constrained. In the shorter term, both environmental and system variables are likely to be highly constrained, and therefore outcomes are more predictable than over the long term. The feedforward process used in the short term is called forecasting, and its role is to speed up the process of response to environmental perturbations. In the longer term, variables are less constrained, as a result of which there is more uncertainty, but also more choice of regulatory response. This form of feedforward is called planning, and can be used to help shape the future of the system by simulating the impact of potential adaptive responses to possible developments in the environment. The terms short and long term and constraint are relative concepts; they may be interpreted in different ways, depending on the perspective and level of the subsystem involved.

For the purposes of regulation, it is important to be able to estimate the uncertainty associated with any projection of the future state of the system in order to determine the level of redundancy required in order to maintain viability. This uncertainty will always include unsystematic variation (noise) but, particularly in the long term, it may also take the form of potential alternative combinations of environmental and system variable states, in other words there may be discontinuities in the pattern of behaviour of systems. These alternative combinations of states could be represented as a range in the value of variables or as a set of scenarios.

Feedback information is used in combination with feedforward information to validate and to improve the models in use. A poor model will exhibit a systematic pattern of errors or variation (bias) and/or a level of unsystematic variation (noise) that compromises the efficacy of regulation.

This thesis focuses on feedforward on financial variables and those variables that impact, and are impacted by, financial variables.

5.2.8 Regulatory actions

Regulatory actions comprise those changes made to systems variables (by way of attenuation and amplification) made with the intent of bringing output variables to

more desirable states; that is, in line or consistent with the goals of the system (and by implication its continued viability). Actions are selected by the regulator based on its model of the system. There will always be a delay between the initiation of an action and its impact being manifest; the longer the delay, the more challenging the process of regulation. Social systems usually do not respond swiftly to regulatory acts, and the nature of the subsequent delay may be variable or complex, and consequently difficult to anticipate.

This study is focussed on changes made to financial variables in order to achieve system goals, whether the goals are denominated in financial terms or not.

5.2.9 Time

Time is an important feature of any regulatory system in two respects. Firstly, the relationship between the frequency of environmental perturbances and the speed of response of the regulator is crucial. If response is too slow there is a greater chance that essential variables will be driven outside their physiological limits; if it is too fast the system will become unstable. When subject to a continuous stream of perturbances, a lack of synchronisation can lead to unpredictable oscillations in the system that can also threaten viability.

Secondly, all variables should be free to vary continuously over time, so as not to unnecessarily constrain system responses. The act of commitment necessarily constrains the regulator, but any arbitrary constraints imposed on regulatory frequency and horizons (e.g. restricted to a financial year with updates every quarter) risks destabilising the system and so should be avoided.

Ideally, both feedback and regulatory responses would be instantaneous, but since this is not possible, feedforward is necessary to speed up the regulatory process, thereby damping potential oscillations arising as a result of lags in the feedback/response process. In order to be effective, feedforward information, and the regulatory process it drives, should:

- ❑ be enacted at the same frequency of environmental perturbances (so fulfilling the requirements of **Ashby's Law of Requisite Variety (1957)**),
- ❑ use a horizon that is at least as long as the lag of the relevant regulatory actions concerned, (otherwise the regulator will not have the information necessary to be able to act in time).

5.3 Part 1(b) Concepts: organisational form

In order to specify a CSS in a form that can be used to diagnose or design a system in the real world, the abstract conceptual principles outlined above need to be set within an organisational context. For this purpose the Viable System Model (VSM) will be used as a framework. The VSM is the only organisational model based explicitly on cybernetic principles. It provides a cybernetic language to describe organisational form and a framework to describe how regulatory mechanisms relate to such a structure. It therefore provides an appropriate organisational model upon which to base the specification for a CSS. The root form of the VSM is shown below.

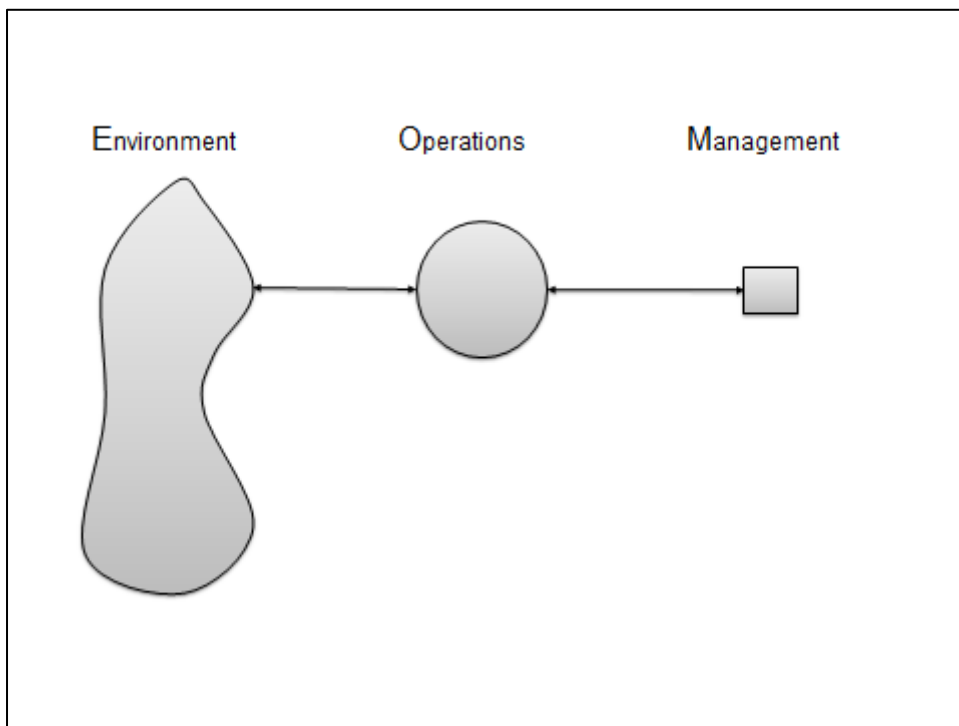


Figure 14 The root form of the VSM

The Environment shown above is taken to be the source of the environmental perturbations referred to in Section 1A, and comprises, inter alia, customers, suppliers, competitors, government agencies, interest groups and financial stakeholders. Financial stakeholders include lenders, borrowers, shareholders and (particularly relevant for not for profit enterprises) donors. Operations is equivalent to the Operational System described earlier, and is that part of the organisation that directly interacts with the environment. It is taken to be self-organising and self-regulating in a way that is largely opaque from the perspective of the Management (or Regulatory) system that is attempting to regulate it (or more accurately, regulate its process of self-regulation). The Management system itself is, by the same token, a self-organising and self-regulating system.

5.3.1 Variety

The complexity of the three systems is described by their **variety**: the number of states that each respective system is capable of adopting. Normally the Environment has much greater variety than Operations and Operations significantly greater variety than Management.

According to Ashby's Law of Requisite Variety (LORV) (1957), in order for an organisational system to be viable (i.e. capable of sustaining independent existence) an acceptable balance needs to be struck, and consistently maintained, between the varieties of the Environment, Operations and Management. An acceptable balance is one that enables the value of essential variables to be held within physiological limits. In other words, all three elements need to be in a state of sustainable dynamic equilibrium (**homeostasis**). Homeostatic balance is maintained by a systems responding appropriately to changes in situational variety (where the Environment comprises the situational variety of Operations, and Operations the situational variety of Management).

5.3.2 Physiological limits

The physiological limits for an organisation are shaped by the nature of the relationship between Operations and the Environment. For financial variables, the relationships and associated essential variables are likely to include:

For lenders – SOLVENCY (within overdraft limits, interest cover etc)

For investors – ATTRACTIVENESS (dividends level, share price appreciation versus peers etc)

For donors – EFFICACY (impact on target groups of recipients etc)

In a CSS the nature of the physiological limits will significantly influence the way that goals are expressed.

The exact form and nature of the relationship with external financial stakeholders is the result of a resource bargain, often struck through a process of negotiation. A resource bargain is an agreement to provide a defined level of funding subject to certain conditions, for which the system is held accountable. In agreeing a resource bargain, the provider of funds (itself an organisational system) contributes to the regulation of the system in focus.

Since financial variables impact many resource and operational variables, financial regulation needs to take account of the health of many other external homeostatic relationships. In addition, in an organisation of significant size and complexity, it will be necessary to regulate many subsidiary (or proxy) variables in order to maintain essential variables in homeostatic balance with the environment.

5.3.3 Homeostat

Homeostasis is maintained by the operations of a **homeostat**; a mechanism which, when faced with situational perturbations, is capable of bringing variables back within target values (shown in Figure 15 below). Such an adjustment needs to be accommodated in good time; any delay in receiving information or acting upon it being prejudicial to the stability of the system and potentially its viability. In order for

a system to be viable, the homeostat needs to be an **ultrastable** system; one capable of responding to unanticipated perturbations (for which, by definition, it has not been designed).

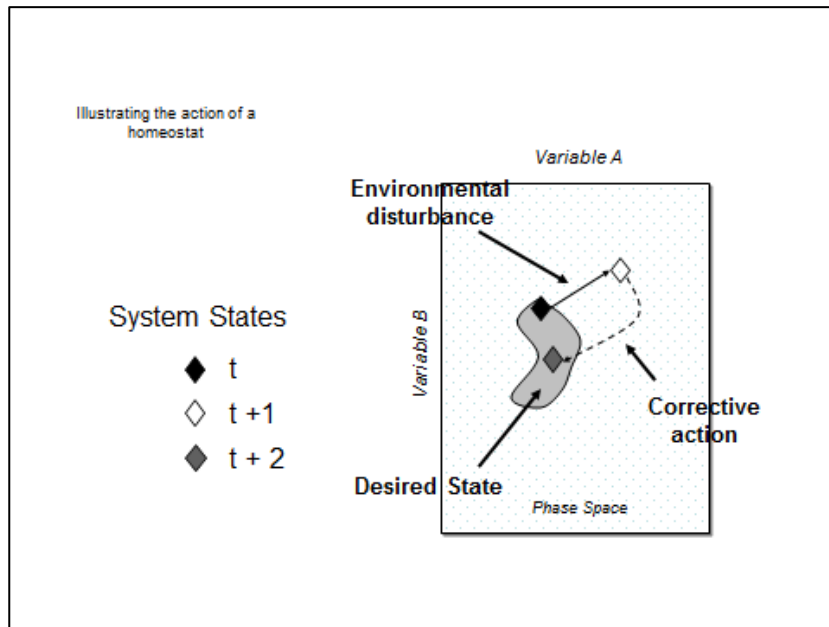


Figure 15 The Operation of a Homeostat

5.3.4 Variety engineering

Successful regulation is the outcome of the process of manipulating the constraints of Operations consistent with Ashby's Law (LORV) (1957). An increase in constraints (thereby reducing variety) is called attenuation, and removing or loosening them (increasing variety) is termed amplification. Variety is engineered (amplified or attenuated) using a range of mechanisms, all of which are deployed in the VSM:

- structural - changing the way in which the regulated system is configured
- informational – modifying the variety of information available to the regulator
- procedural – directly intervening in variety of the regulated system

Regulation is a form of **variety engineering**, used by Management to exercise control over Operations.

Operations needs to maintain a homeostatic relationship with the Environment, and Management with Operations, so our simplified model can be conceptualised as two interlocking homeostats, maintained in balance by amplification and attenuation, as shown in Figure 16.

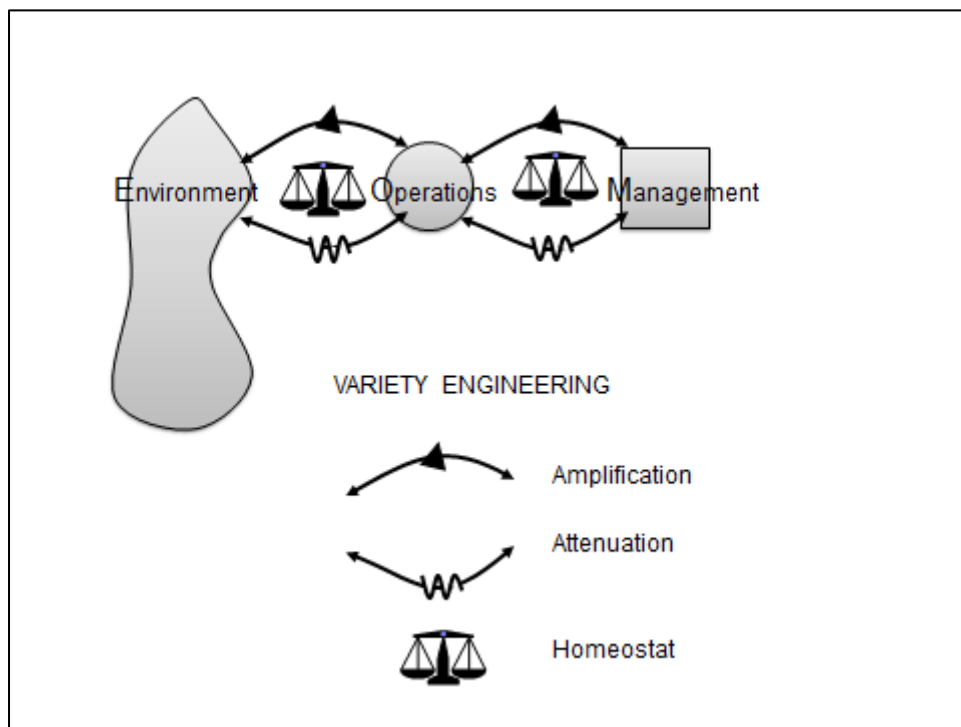


Figure 16 Variety engineering

In addition, as already discussed, within this model there are at least three dimensions: those concerned with financial, resource and operational variables respectively. A homeostatic balance with the Environment needs to be maintained, across and between all three dimensions simultaneously, as shown in Figure 17 below.

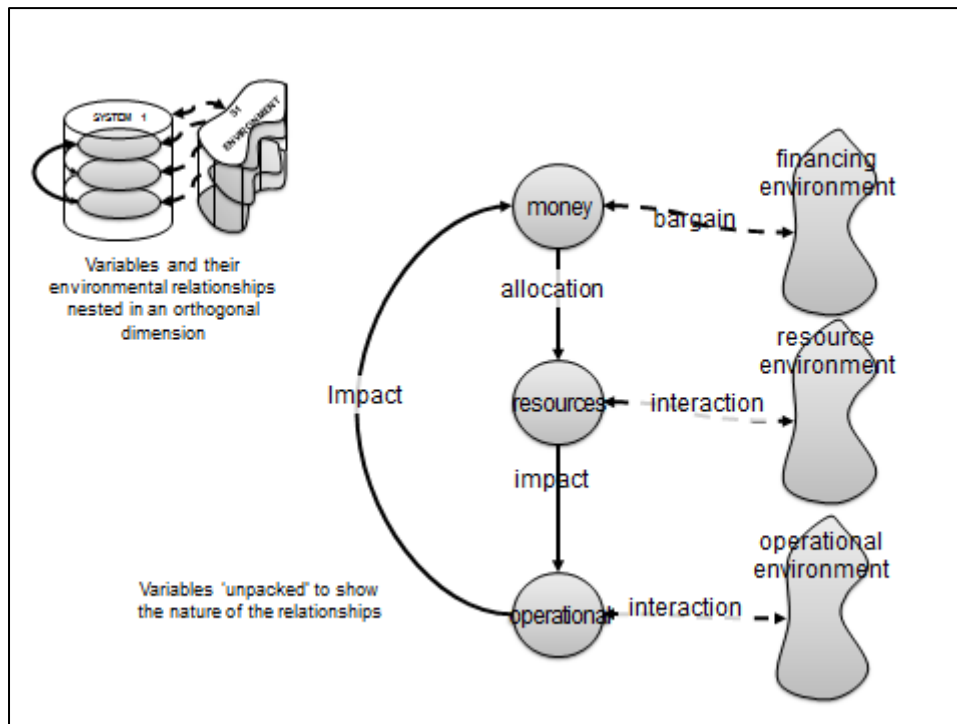


Figure 17 Variables mapped onto the VSM

The most important mechanism for engineering the financial variety of the systems is the internal resource bargain, which comprises part of the homeostatic arrangement between Management and Operations. Allocating money (granting permission to use it) increases the varieties of the recipient elemental units, but the conditions attached to this allocation modify (attenuate) the increased variety in a defined way. Whilst the conditions of the resource bargain constrain action, they only do so minimally, so there is a net increase in variety. The conditions specified in the resource bargain can, up to a point, be changed. But, once money is committed (by an irreversible action) the nature of the attenuation becomes more severe and cannot easily be modified, at least without financial penalty. The act of commitment also involves the loss (or diminution) of liquidity, thereby reducing potential redundancy and increasing the exposure of the system to unforeseen events. The instant at which a commitment is made is therefore a critical moment in the cybernetic regulation of organisations (Ackoff, 1984).

5.3.5 The Variety balance

Since Ashby's Law (1957) is immutable because it is a consequence of a mathematical invariance (Beer, 1979), and Environmental variety is significantly greater than that of Operations, and Operations greater than that of Management, the dominant regulatory theme is that of attenuation. The challenge for management is to do this intelligently. This challenge is encapsulated in Beer's First Principle of Organisation (Beer, 1979):

Managerial, Operational and Environmental varieties, diffusing through and institutionalised system tend to equate, and they should be designed to do so at minimal damage to people and cost (Beer, 1979).

Since the system has no direct (procedural) control over the Environment (at least legally), then environmental variety has to be attenuated by other means. This could include buffering (passively absorbing variety e.g. through the use of agents) and filtering (eliminating perceived irrelevant variety as part of the information management process). In parallel, operational variety can be amplified, for example through communication (e.g. advertising) or by increasing its capacity to respond. Capacity might be represented by tangible phenomena (assets) but, since people and their abilities comprise part of the capacity, this may include amplifying human capacity by training, recruitment or by importing skills.

In turn, Management needs to manage its variety balance with Operations. Amplifying its own variety (e.g. by employing extra people or extra procedural controls) carries certain risks. It is likely to increase the cost of regulation, but also it may have the indirect consequence of attenuating the variety of Operations, thereby prejudicing its ability to manage its own balance with the environment (red tape or the pejorative use of the term bureaucracy are examples of this). Any prescriptive or proscriptive regulatory actions (by direct command or by imposing constraints such as budgets) restrict elemental **autonomy** (variety). Intelligent regulation will only do so in the interests of the viability of the system as a whole; by maintaining

organisational **cohesion**, improving the collective efficiency of operations or the effectiveness of its actions.

There is a limit to the amount of environmental variety that a simple organisational model can handle using procedural and informational mechanisms to engineer variety. Beyond a certain level, the system needs to adopt structural responses to cope with increasing complexity. There are three types of structural response, all of which involve creating subsystems with different, specialised roles.

5.3.6 Horizontal segmentation - divisionalisation

One way of amplifying the variety of Operations is to create a **multistable** system by divisionalisation, a process whereby a number of Operational Units are spawned, each of which has the freedom to respond (within limits) to the variety of a defined segment of environmental variety. Beer uses the term System 1 (S1) to describe these subsystems.

Creating a set of elemental units, each of which has the ability to respond independently to a subset of environmental perturbations, has three potential advantages:

- Each has to deal with less Environmental variety.
- Collectively, it provides more Operational variety than one elemental System 1.
- It will respond more quickly to environmental perturbations by virtue of having fewer variables to manage and shorter feedback loops.

On the other hand, segmentation has created a new source of variety that needs to be dealt with by the Management system – that created by the interaction of the System 1's with each other. System 1's can interact directly (perhaps as a result of an internal customer-supplier relationship) or indirectly (as a result of sharing organisational resources or overlaps in the environment). Although maintaining homeostasis between a set of internal elemental units is less onerous than a single unit maintaining external homeostasis, failure to do so will lead to a loss of

organisational cohesion that might ultimately threaten system viability. This provides one rationale for the second form of segmentation.

5.3.7 Functional segmentation – managerial subsystems

Horizontal segmentation (described above) helps absorb external environmental variety but creates the need for a mechanism to maintain homeostasis in the internal environment. There is now a need for **metasystemic** management; operating on a higher logical level than that of the collection of Systems 1.

In the VSM, the primary responsibility for managing the internal environment falls on a metasystemic Management subsystem that Beer labels System 3 (S3 or Control). This requires, amongst other things, that processes to help co-ordinate the activities of the interdependent subsystems be set up, and mechanisms for identifying and exploiting synergies between the individual elemental units as well as allocating resources.

The organisational arrangements that System 3 uses to regulate the collection of elemental systems are complex and subtle, not just because of the amount of variety that has to be handled, but also because it must be done, as far as possible, without compromising the ability of each System 1 to manage its own external relationships (i.e. with minimal attenuation of elemental variety). There are five components of the major homeostat through which the relationship between S3 and the set of S1 is mediated:

1. System 2 (S2): this is a subsystem that has an anti-oscillatory role. It is responsible for the routine co-ordination of the activities of System 1, using a variety of mechanisms. According to Malone, there are three forms of interdependency that trigger the need for co-ordination: where units share a common resource, where they are involved in producing a common output, and finally where they are serially organised in a process (Malone, 2004). Such coordinating arrangements include the maintenance of operational policies, procedures and protocols that facilitate collaborative working, operating a high variety information processing arrangement that uses

intelligent filters to look for signs of incipient instability in any of the environmental homeostatic relationships, and short run regulation (programming) based on feedback from the intelligent filters and from System 1 forecasts. System 2 plays the pivotal role in maintaining organisational cohesion without compromising the autonomy of Systems 1.

2. A Command Channel, which dispenses proscriptions and prescriptions (e.g. orders and policies)
3. A Resource Channel, whereby resources (of a financial or non-financial nature) are allocated subject to an internal resource bargain, made up of permissions to deploy resources, subject to certain conditions
4. An Accountability Channel, which monitors compliance to the conditions of the resource bargain and provides System 3 with a high level summary of performance.
5. System 3* (S3*), which provides System 3 with the capability to diagnose problems, explore opportunities for organisational synergy and reassurance that Systems 1 are operating in line with organisational policies. To do so it deals with problems or systemic issues, actual or potential (Hoebeke, 1994). Unlike System 2, the operations of System 3* should be non-routine in nature, (i.e. it employs sampling methodologies) since the issues with which it deals cannot be specified in advance.

Whereas each System 1 is responsible for part of the environment, System 3 deals with the whole, but its view of the environment is mediated through its System 1 constituency. It has no direct access to the outside world. The perspective of S3 is that of inside and now.

The managerial metasytem has to do more than maintain the stability of the current internal milieu; it needs to make sure that the organisation as a whole develops new capabilities to deal with potential future environments i.e. it can accommodate the out there and then. In the VSM, this is the role of System 4 (S4 or Intelligence). To discharge this role, S4 needs to:

- Monitor and extrapolate environmental trends.
- Investigate the nature of potential alternative future environments arising as the result of:
 - Changes in the nature of the systems environment.
 - Potential changes to the boundaries of the systems environment.
- Build models that describe alternative potential future organisational capabilities (to adapt to future environments).
- Compare these to a model of the current organisation (as used by S3 to regulate the current internal milieu) to identify what needs to be done to maintain and enhance organisational capabilities; in other words to create adaptive options.

System 3s primary concern is response; the deployment of regulatory acts to meet the challenges of the current environment. System 4s role is adaptation; the creation of appropriate structures and mechanisms (in the form of an adequate repertoire of regulatory acts) to meet anticipated future environments. The drive to **respond** and the drive to **adapt** need to be held in homeostatic balance (i.e. in an unstable equilibrium with creative tension). There is no optimum or correct balance to be struck between the two imperatives; ultimately it requires a value judgement that has to be exercised by another entity. In the VSM, making value judgement this is one of the roles of the final element of the managerial subsystem: System 5 (S5 - Policy).

The role of System 5 is to administer **organisational closure** by taking responsibility for all those things that lie outside the logical calculus of regulation. Such undecidable propositions can only be resolved by value judgements, like those involved in making trade-offs between investment in maintaining present or creating new capabilities. The value judgements exercised by S5 also include those involved in defining the ethical stance of the organisation, its mission and values and the policies that flow from them. Such statements of policy are a powerful engineer of variety (when interpreted in a local context), and collectively help define the identity of the organisation; the thing that helps distinguish the system from its environment, which is preserved over time. Finally, System 5 is informed by the **algedonic** signal, which is mediated through an information channel that bypasses other managerial

subsystems. This provides alerts that speed up metasystemic response in the event of an extreme, persistent or unusual set of circumstances (of a positive or negative kind) of a nature that are significant in the context of the continued viability of the system. System 5 may choose to act on this Algedonic Signal through the command channel, or may help catalyse a change in management mode (and therefore a change in the way in which regulatory signals are processed). This might involve, for example, triggering a switch from business as normal to crisis mode (exploiting the **polystable** nature of organisations). In so far as these arrangements help shape and guide collective behaviour, they form part of the regulatory framework for the whole organisation.

Unlike conventional organisation charts, there is likely to be no simple one to one, or many to one, mapping of individuals to systemic roles. Indeed, it is likely that one individual or department may contribute to the work of more than one subsystem.

The complete arrangement of functional entities and their interrelationships is illustrated in Figure 18.

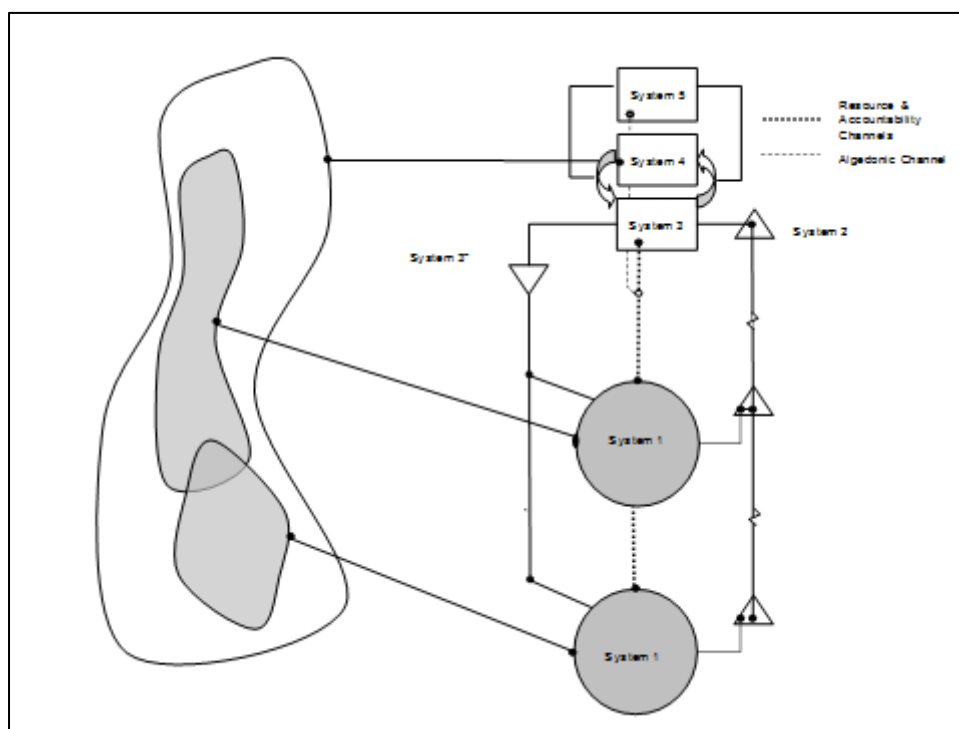


Figure 18 The Viable Systems Model

5.3.8 Logical segmentation - recursions

As well as horizontal and functional segmentation, another structural response to potentially overwhelming environmental variety (or inadequate system variety) is to vertically segment the organisation (see the **law of requisite knowledge**). This is done by creating nested combinations of Operations and Management units organised in a **recursive** fashion (shown in Figure 19). Under this arrangement, lower levels filter or attenuate variety, leaving higher levels to absorb the **residual variety** of the environment as well as that variety that is created by the semi-autonomous actions of the lower level units. Recursivity also provides the system with the ability to recognise and respond to the emergence of novel environmental phenomena at meta levels.

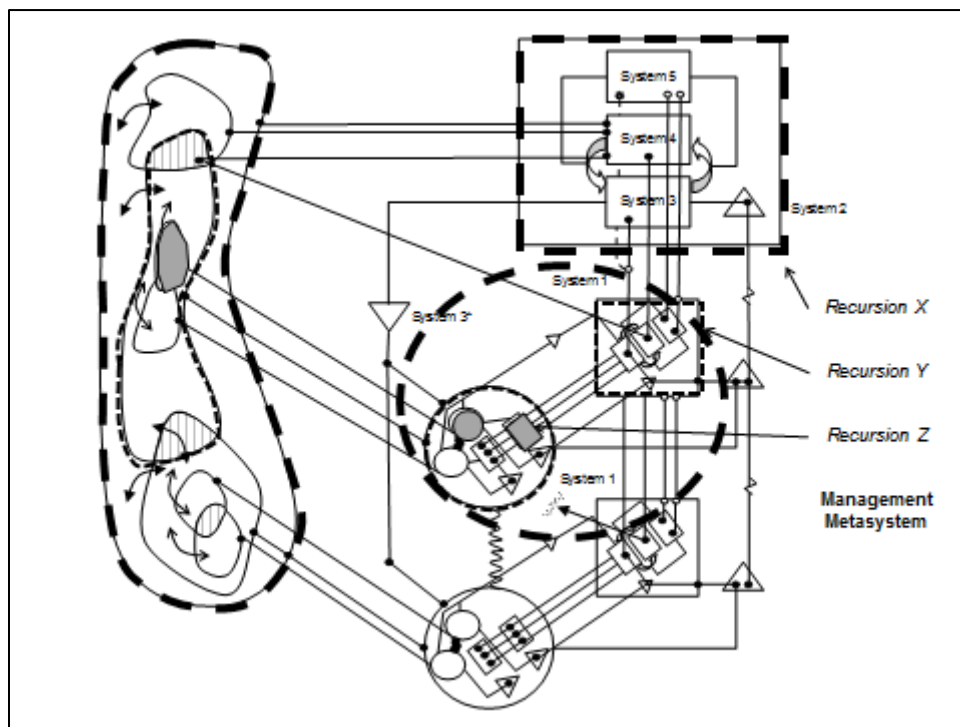


Figure 19 Recursions in the VSM

A detailed model of the VSM, showing all the structural arrangements and relationships described above at multiple levels of recursion, is contained in Appendix 2.

5.3.9 Summary

A cybernetic structure can be conceptualised as a set of five interlocking homeostats, as shown in Figure 20 below, replicated at multiple levels of recursion and on different dimensions. To be viable, any system needs to maintain a balance, individually and collectively, using a combination of measures that attenuate or amplify the variety of object or subject systems.

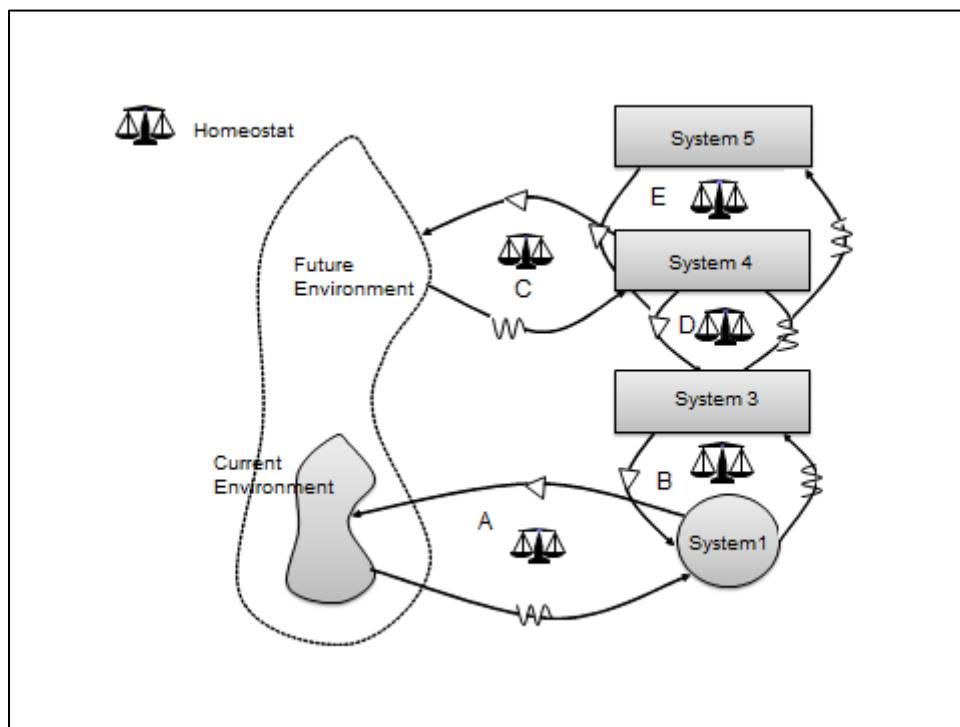


Figure 20 The VSM as a set of interlocking Homeostats

Homeostats A and B operate at an operational level; in different ways they manage the actual output of the operational system; that which deals with what is the case. Homeostat A is responsible for maintaining a homeostatic relationship with the external environment, the overriding aim of which is the maintenance of **stability**; keeping the actual value of key variables (actuality) within acceptable limits (stability

criteria). Homeostat B is responsible for maintaining a stable internal environment and promoting (synergistic) incremental improvement.

Homeostat C operates at a strategic level; what could be the case. Its role is to maintain a stable (simulated) homeostatic relationship between models of the external environment and the system in the future; in other words to build its capability. Homeostat D strikes a balance between the current and future state of the system; in other words it identifies and promotes adaptations (changes to the system) and so create the conditions for successful regulation in the future. This requires, by definition, introducing a degree of instability into homeostatic relationships managed by A and B in the current epoch, in the interests of being able to maintain stability in future epochs.

Homeostat E directly oversees Homeostat D and in doing so defines the potential of the whole system. It operates at a normative level; what should be the case.

Beer (1981) and others (Schwaninger, 2001) have proposed systems of measurement based on these three levels: operational, strategic and normative. Beer proposes a Triple Index to measure achievement. The collective performance of S1- S3 is captured by the ratio of actuality to capability, which defines productivity. The performance of S3-S4 is measured by the ratio of capability to potentiality; latency. Overall systems performance is measured by the ratio of actuality to potentiality. Goals may also be expressed at operational, strategic or normative levels (Schwaninger, 2001).

5.3.10 Concepts: conclusion

This section has set out some fundamental principles of cybernetic regulation and how they might be applied to the management of financial variables. This has been mapped onto a generic organisational model. Financial regulation plays a pivotal role in organisations. Financial variables often have a very direct bearing on system viability. They also constrain the operation of many other important regulatory mechanisms in the organisation.

If this analysis is correct, a cybernetically sound FPMS is a necessary, but not sufficient, condition for any viable system.

5.4 Part 2 Principles: structure

The premise of this thesis is that, in order to be cybernetically sound, any organisational system needs certain structural components – subsystems and channels linking them. This requirement also applies to FPMS specified according to cybernetic principles. Drawing upon the concepts outlined in Section 1 of this chapter, this section specifies these structural components and describes the qualities that they require to be able to effectively regulate financial variables. These 12 principles effectively comprise the structural arrangement that, according to Stafford Beer, are necessary for a systems to be viable. As an aid to the diagnosis of problems in failing or dysfunctional systems, some behavioural characteristics potentially symptomatic of the absence or failure of each component are also detailed.

5.4.1 Principle 1 ELEMENTAL AUTONOMY:

A CSS should contain a number of autonomous elemental units (S1), tightly coupled with their environments on the horizontal axis. These elemental units should be structured such that they absorb the maximum amount of relevant environmental variety through self-regulation.

Explanation: The CSS should be, as far as possible, based on a structure comprised of largely self-contained entities (often taking the form of profit centres) capable of an independent existence. They enjoy a high level of empowerment (extensive decision making powers), meaning that they are largely self-regulated. They should be defined such that that they are closely aligned with those segments of the environment most relevant to the value exchange (in the form of goods and or services) with the organisation. By doing so, the interdependencies between the elemental units, which necessarily place a constraint on independent action, are minimised.

Failure symptom: *In the absence of externally orientated autonomous units, the ability to absorb environmental variety will be compromised; environmental needs will be unmet or poorly addressed*

5.4.2 Principle 2 OPERATIONAL DIRECTORATE:

A CSS should have a metasystemic management function (S3), responsible for managing organisational cohesion and collective performance. It does so by actively managing the extant internal environment, made up of the collection of elemental units (S1), with the overriding objective of ensuring that the external homeostatic relationships managed by the elemental units themselves are healthy. It should do so using 5 vertical channels (see below).

Explanation: There needs to be single operational management centre for each set of elemental systems. This synthesises all the information pertinent to the management of operations in the present epoch, and uses it to take coherent regulatory action, including the allocation of resources. Since a single individual is unlikely to have the requisite variety (knowledge) to be able to act in this capacity, a facility to quickly assimilate real time information and facilitate collaboration between the contributors to the S3 function is required. A model for such a centre might be the Operations Rooms used in the Second World War, or NASA's Mission Control. The Operational Directorate is also responsible for providing services to support S1, to exploit any synergies that might exist.

Failure symptom: *A lack of a single nexus of control for the internal environment, capable of integrating the various channels and strands of regulatory information, compromises the viability of the whole system. Symptoms include a failure to provide S1 with coherent, quick decisions.*

5.4.3 Principle 3 RESTRAINT ON COMMAND:

A CSS should use Command Channel on the vertical axis that S3 uses to make interventions in S1 affairs. This should be minimally used; as far as possible it should only be used to proscribe and guide behaviour, using mechanisms that allow for appropriate local interpretation.

Explanation: So as not to compromise elemental autonomy, centralised control should make the minimum use of dictate and detailed policies. Centralised control over elemental units should, as far as possible, take the form of a communication of the overall aims, goals and values of the organisation, which can be interpreted by the units in a context specific way. In extreme situations, such as an emergency which threatens systems viability, interventions might be more prescriptive in nature.

Failure symptom: *Prescription, or clumsy proscription, which unnecessarily attenuates elemental variety, prejudices their ability to absorb environmental variety. This may be manifest in chaotic behaviour or paralysis.*

5.4.4 Principle 4 CONTINUOUS ALIGNMENT:

A CSS should have an active, high variety, S2 operating in real time² on the vertical axis. Its role is to routinely co-ordinate S1 activities, in the interests of the elemental units themselves. This should include the maintenance of metadata, operational policies and protocols, and the management of regulatory and performance information and programming.

Explanation: In order to maintain cohesion with minimal need for centralised intervention, there should be a mechanism to facilitate elemental co-ordination. This requires, inter alia:

- A common language for the exchange of information
- Capabilities to handle and exchange detailed information management (actuals and forecasts used for regulation/real time control) and short term³ planning tasks along with:
- Associated operational policies and procedures.

The nature of the tasks requires that they should be routine, standardised processes carried out in real time.

Failure symptom: *A lack of high variety, real time co-ordination mediated through shared protocols, makes it difficult for elemental units to effectively collaborate leading to slow collective response, collaborative failure, oscillation or ataxia.*

² 'Real time' is taken to mean at a rate equivalent to the frequency of environmental perturbations..

³ 'Short term' is taken to mean that the range of environmental perturbances that can be expected, and the set of regulatory responses designed to deal with them, is constrained

5.4.5 Principle 5 SPORADIC SAMPLING:

A CSS should have S3* mechanisms on the vertical axis that facilitate high variety, ad hoc, investigation of the operational component of elemental units. These are required in order to check adherence to organisational polices (communicated via either the S2 or Command Channels), investigate actual or nascent problems or opportunities and explore opportunities for synergistic improvements.

Explanation: The need for centralised intervention and supervision is minimised by the use of sporadic deep dives into the workings of elemental units, by-passing elemental management units. Such activities would include internal audits, and ad hoc analysis and investigations, but will also include informal activities such as management by walking about. To be effective they need to be carried out in a non-routine manner.

Failure symptom: *A lack of a high variety audit channel will result in a failure to identify and exploit potential synergies and increase the risk of failure in internal control mechanisms or rectify persistent problems.*

5.4.6 Principle 6 CONTINUOUS RESOURCE BARGAINING:

A CSS should have a mechanism to allocate (grant permission to use) resources in real time to elemental units, subject to a negotiated resource bargain for which the elemental units are held accountable. Resource permissions will relate to specific regulatory acts (as prescribed in the Resource Bargain), the maintenance of elemental operations and the local (elemental) regulatory capacity (both expressed as proscriptions in the Resource Bargain).

Explanation: Financial resources are allocated by centralised management to elemental units subject to a negotiation that imposes conditions on the recipients. This will include constraints (e.g. on spend), goals and milestones. Bargains are struck as and when required, but if it is done on a regular cycle then it should be at a frequency that is aligned with the rate at which the elemental units need to change in

order to operate effectively in the environment. This will vary for different organisations and for different units within the same organisation.

Failure symptom: *A lack of a mechanism to allocate resources in a timely fashion will result in elemental units being unable to fund activities properly and/or oscillations in spend.*

5.4.7 Principle 7 ACCOUNTABILITY:

A CSS should have an accountability channel on the vertical axis that allows the management of elemental units to reassure metasytemic management (S3) that their environmental homeostats are operating effectively, and within the terms of the resource bargain. Information is provided by exception subject (inter alia) to the filtering of elemental management.

Explanation: Management reporting up the line is based on a subset of that information used for real time control and is exception based; i.e. subject to judgemental filtration by elemental management. By providing targeted feedback, it helps ensure the effective use of resources and facilitates learnings – which can then be shared with other elemental units. By definition, the content of the reports (whatever form they take) will vary, and the cycle (frequency of update) should be determined by the metabolic rate of that part of the business or activity.

Failure symptom: *A failure to provide feedback prejudices the system's ability to use resources efficiently and effectively and reduces the capacity to learn (from success or failure). Failure to properly attenuate informational variety will lead to the metasytem being overwhelmed by irrelevant elemental variety, prejudicing its ability to intervene appropriately.*

5.4.8 Principle 8 DEVELOPMENT DIRECTORATE:

A CSS should have a metasytemic function (S4), responsible for maintaining and enhancing the regulatory capability of the system. This requires continuous⁴ monitoring of trends in the environment, and the creations of models (of the existing and possible environmental and systems states) to

⁴ Continuous is taken to mean that activity is uninterrupted.

help create options for response and adaptation. To discharge this role effectively, S4 should exchange information with S4 at different levels of recursion and maintain an intensive dialogue with S3; the managerial subsystem responsible, inter alia, for overseeing current operations and sanctioning the allocation of those resources needed to enact the options.

Explanation: For each set of elemental units, there needs to be a strategic management centre responsible for synthesising information about trends and their potential impact on the organisation, with the aim of exploring the range of possible organisational responses (options) and crafting these into feasible projects. The management of the complex set of relationships implicit in this role, and the process of selecting options for transfer into the operational arena (via S3), requires a high variety Operations Room capability.

Failure symptom: *A failure to develop adaptive options that maintain or enhance the ability of the organisation to respond to environmental perturbations, or an inability to translate these into operational reality, will be manifest as a failure of creativity and innovation or as white elephants (failed projects based on an inadequate understanding of environmental needs or organisational capabilities).*

5.4.9 Principle 9 LEADERSHIP:

A CSS should have a metasystemic function (S5), which provides leadership for the whole system. Leadership⁵ provides organisational closure by, inter alia, creating and maintaining system ethos (system boundaries, aims and values) as articulated in policies, practices and behaviour. In doing so, this helps define the systems identity. It should also maintain the overall health of the system by overseeing the S3/S4 homeostat (which may involve making interventions to resolve conflicts or impasse) and acting on algedonic signals.

Explanation: Many decisions in organisational life cannot be made according to strict rational criteria e.g. DCF calculations. Also, an organisation will encounter unanticipated circumstances that demand an immediate response or the exercise of local initiative so as not to overburden the command channel. By articulating and

⁵ 'Leadership', as used here, signifies a function - responsible for synthesising the collective will of the whole system - not an organisational role

reinforcing (by actions) a clear set of aims and values, effective leadership facilitates coherent local self-regulation. Algedonic signals help S5 safeguard the viability of the whole system by facilitating speedy response to opportunity or threat. This may take the form of direct intervention by S5 or the direction of systemic attention and priorities by changing the management mode (e.g. such as putting the system on action stations).

Failure symptom: *A failure of leadership compromises overall organisational coherence, which may manifest itself in internal conflict or in an incoherent approach to the world. The system may be slow and uncoordinated in its response to unanticipated situations, or be trapped in an inappropriate management mode e.g. too relaxed in the face of threat (complacent) or overly anxious when not (neurotic).*

5.4.10 Principle 10 ORGANISATIONAL OVERRIDE:

A CSS should have an Algedonic Channel, whereby signals of an exceptional nature, which could portend opportunity or risk, are channelled directly to S5, overriding all meta-systemic filters.

Explanation: If the regulatory filters operating in real time detect an extreme set of circumstances, then an alarm should be raised to the highest level of management immediately, which requires that the processes which, in normal circumstances, interpret and filter information, be overridden.

Failure symptom: *A lack of an override channel risks critical situations being overlooked (inappropriately filtered out) or acted upon too slowly.*

5.4.11 Principle 11 FRACTAL STRUCTURE:

A CSS should have a recursive (self-similar or fractal) structure, with the minimum number of levels necessary to absorb environmental variety at every relevant level of recursion, and any residual variety from lower organisational recursions.

Explanation: The same structure and control mechanisms should be replicated at every level of the organisation, nested within each other, such that a whole viable system (S1-S5) comprises S1 at the next level of recursion. All other things being

equal, the fewer levels the better, since they will function at lower (management) cost and will be more responsive, since feedback loops will be shorter. Self-similarity also means that learnings from one part of the organisation are relevant to others; thus facilitating the process of continuous improvement.

Failure symptom: *Inadequate recursivity compromises the ability of the system as a whole to absorb the variety of the organisations environment, resulting in unmet needs and missed opportunities. Unnecessary variety in (or levels of) internal control arrangements leads to bureaucracy and a lack of clarity about roles and responsibilities.*

5.4.12 Principle 12 CONTINUOUS EXTERNAL RESOURCE BARGAIN:

Where a CSS seeks funding from an external source, it should be subject to a negotiated resource bargain. This will be supported by an Accountability Channel that operates in real time to reassure the funding system that the conditions of the resource bargain (which determines some of the essential variables of the system in focus) have been complied with.

Explanation: External sources of finance will usually be made available subject to terms and conditions, which have to be met in order to preserve the viability of the system. As a result, these need to be actively monitored and, as far as possible, aligned with the internal regulatory mechanisms.

Failure symptom: *A failure to provide adequate reassurance to external resource providers will lead to surprises that undermine their confidence, and which may provoke unwanted command channel interventions. These prejudice the viability or independence of the organisation, directly or indirectly by increasing the difficulty or cost of securing new funding.*

5.5 Part 3 Principles: Information

All organisational regulatory acts, including the regulation of financial variables, are dependent on information, specifically information that is capable of being assimilated (interpreted and acted upon) by the human brain. Some of this information will be received in unstructured ways; through personal observation or

interaction. This section focuses on structured, quantitative (financial and non-financial) information, routinely supplied for the purposes of effective regulation of financial variables. Drawing on the concepts set out in Part 1 it specifies what information is required, what qualities it should have and the mechanisms required to produce and manage it.

5.6 Part 3(a) Principles: feedback information

5.6.1 Principle 13 DATA CAPTURE:

A CSS should collect, in real time, extensive amounts of data on the actual state of financial variables and those non-financial variables that impact, and are impacted by, changes in financial variables and are deemed to be relevant to the maintenance of stability, i.e. healthy (internal and external) homeostatic relationships.

Explanation: Since there are a very large number of potentially relevant variables, (financial and non-financial; internal and external) and it is not known, a priori, which of these contains a signal that may need to be acted upon, a large amount of data should be collected. Primarily, such data relates to concrete variables (i.e. excluding variables or values created purely by accounting convention) in order that the collection process is fast and free from ambiguity. Since regulation is a continuous activity, data should be organised in a time series, with the collection frequency being aligned to the rate of change in the system concerned (rather than to artificial epochs such as accounting periods).

Failure symptom: *Inadequate data will manifest itself in decision being taken on gut feel or through political processes. If data capture is artificially attenuated, critical information may be lost. If data is not collected sufficiently frequently or organised in a time series, changes in system state cannot be detected, resulting in oscillation or instability. An exclusive focus on financial data will render regulation less effective and may have unintended consequences.*

5.6.2 Principle 14 ELEMENTAL INFORMATION:

A CSS should, through S2, provide elemental units with information to facilitate self-regulation, (i.e. maintain and improve stability and performance) including that information necessary for the effective management of interdependencies with other elemental units. A subset of this information will also be supplied to S3 to enable it to discharge its responsibility for the set of elemental units. Such information should be systematically attenuated to provide the minimum amount of information necessary for the effective regulation of financial variables. In addition, they should receive information from S2 about their own performance (i.e. compared to a meaningful benchmark) and that of other elemental units, so as to promote learning (incremental improvement/adaptations).

Explanation: The regulatory information filtered by S2 serves to provide information to help S1 maintain stability; by monitoring the health of the homeostatic relationship with the environment and between elemental units. Particularly given the large amount of data (and the limited capacity and capability of the human brain), there should be a process for automatically filtering incoming data, using statistical routines, to separate signals (potentially significant changes in state of a variable) from noise. Arithmetic means of filtering (e.g. averages, totals and variances from some form of a plan) have the effect of suppressing temporal shifts and provide no guidance as to the probability (and therefore potential significance) of a particular set of data points. Filtered noise, which has no further regulatory value, should be disposed of. Information on performance, whereby S1 information is analysed in a way that enables meaningful comparisons to be made (against peers – internal or external - or against some form of performance standard such as that of capability as used in the Triple Index) also helps accelerate S1 learning and adaption by identifying anomalies that may be a source of insight.

Failure symptom: *Without statistical filtering, information on potential instability could be missed or action taken inappropriately in response to noise. Without relative measures of performance opportunities for incremental improvement and synergistic learning may be missed.*

5.6.3 Principle 15 METASYSTEMIC REPORTING:

The S3 of the elemental units of a CSS should routinely, through the Accountability Channel, supply S3 of its metasytem with information that provides reassurance that the subsystem is performing in line with expectations and that the terms of the Resource Bargain are being observed. By its nature, this will be provided by exception (though at a frequency appropriate to the rate of change in the environment).

Explanation: Management of the elemental units should periodically account for the use of resources. This will include reporting back against the constraints/goals/milestones established in the Resource Bargain.

Failure symptom: *Without the right kind of reassurance from the management of elemental units, they could be overwhelmed by ad hoc metasytemic information requests and or inappropriate interventions, and opportunities to adjust or learn may be missed.*

5.6.4 Principle 16 ALERT AND ALARM:

A CSS should include mechanisms to systematically identify that information that is exceptional by virtue of its nature, size or recurrent nature, and to channel that information, in real time, to S5 of the metasytem via the algedonic channel

Explanation: The process for detecting algedonic signals and the mechanism used to communicate it should ideally be automatic (or at least subject to well defined criteria), to ensure that the message is triggered (only) when it should be, and is not suppressed or slowed down on transmission.

Failure symptom: *A lack of an appropriate mechanism for triggering alarms on the override channel risks critical situations being missed or suppressed or acted upon too slowly.*

5.6.5 Principle 17 ENVIRONMENTAL MONITORING:

A CSS should routinely monitor environmental trends in order to inform the production of feedforward information; both short term forecasting (mediated through S2) and S4 planning activity.

Explanation: In the short to medium term, trended environmental information helps to identify emerging patterns. This helps make forecasts more reliable and may potentially signal a need for (adaptive) change.

Failure symptom: *Failure to recognise external trends may manifest itself in a failure to identify environmental instability or discontinuities to which the organisation should respond, and/or plans being out of touch with reality.*

5.7 Part 3(b) Principles: feedforward information

5.7.1 Principle 18 FORECAST INFORMATION:

A CSS should share through S2, (forecast) information on the projected state of key financial variables (and those variables that impact and are impacted by changes in financial variables) relevant to the maintenance of healthy internal and external homeostatic relationships. The forecasts are based on a model of the existing organisation, prevailing environmental conditions and committed and planned regulatory actions. They should be produced at a frequency at least equivalent to the rate of change in the environment or the system, and should cover the time lags associated with regulatory action.

Explanation: Forecasts are an estimate of future actuals, which means the regulator of a system is not obliged to wait for feedback information before acting. This helps preserve system viability, since time lags are a common cause of instability.

Projection of future outcomes requires the use of models of the environment, the system under regulation (maintained by S4) and the incremental impact of regulatory acts already taken or planned (which may be changed in response to the forecast).

Since, by definition, models are a simplified representation of reality and so can only imperfectly estimate the impact of anticipated changes in variables, forecasting will use a far smaller set of variables than that used for measuring actuals. Such models may be statistical, mathematical or judgemental (i.e. based on implicit mental models). Since the role of forecasting is to close the information gap arising from the time lags involved in the feedback process and regulatory action, the forecast horizon should therefore be at least equivalent to these lags, and should be refreshed at a rate equivalent to the rate of change in the variables used for

regulatory purposes, not at an arbitrary frequency (e.g. according to accounting periods).

Failure symptom: *A failure to forecast, or with the required horizon or frequency will deprive the regulatory process of the information it needs to take anticipatory action. This failure will be manifest in systems instability and/or failure to meet expectations/goals.*

5.7.2 Principle 19 FORECAST RISK:

Forecasts prepared by a CSS should be amplified by estimating the uncertainty (unsystematic error) attached to any forecast that could prejudice the effective regulation of financial variables.

Explanation: Any forecast will be subject to unsystematic error (noise), which should be estimated and taken into account when using such feedforward information for regulatory purposes (decision making). This helps to ensure that the system maintains an appropriate level of regulatory redundancy.

Failure symptom: *A failure to estimate forecast error can lead to instability. Firstly, the level of regulatory redundancy required to dampen the system may not be provided. Also, unsystematic error (noise) may be mistaken for a signal, thereby amplifying instability.*

5.7.3 Principle 20 BIAS MEASUREMENT:

The models used by a CSS to forecast future outcomes should be maintained and improved through the elimination of systematic error and the reduction of unsystematic error. This is determined by reference to feedback on actual outcomes (error) within the time lags associated with regulatory acts.

Explanation: Whilst unsystematic error in forecasts is unavoidable, systematic error (or bias) renders forecasts unreliable. It is therefore important that forecast performance is monitored, by analysing the pattern of errors through time, in order that models be improved (by eliminating bias and reducing excessive noise). Such measurement needs to be made over the short term (within the time lags of regulatory acts), to avoid it being corrupted by conscious changes in regulatory actions in response to the forecast.

Failure symptom: *Without appropriate systematic measurement processes there is no mechanism to improve forecast performance (models). In addition, there will be a delay in spotting changes in the pattern of behaviour of either the system or environment, thereby compromising system stability.*

5.7.4 Principle 21 PLANNING INFORMATION:

A CSS should, through S4, provide information on potential future states and so inform the process of adaptation (the creation of new options). This should be updated at a rate at least equivalent to the rate of environmental change, cover a horizon equivalent to the time lags of the adaptive acts concerned, and be validated by reference to those produced at other levels of recursion (that address different perspectives and timescales).

Explanation: The models used in forecasting assume a relatively stable and constrained set of environmental and organisational variables and values. In the short term, these may be influenced by the deployment of relatively modest and well understood regulatory acts. Over the longer term, environmental variables are less constrained, and so the organisation needs to have planning information that helps it adapt – by evolving its structure and processes – to more fundamental changes in its environment, which are less predictable in nature (because the environment is less constrained). Since the objective and timescales are different to short term forecasting, (the identification of significant novelty rather than the maintenance of short term stability) this requires a different set of models, based on a different perspective (i.e. using a different set of attenuating filters). They are likely to be updated less frequently, as and when new information becomes available, and so cannot be scheduled, as significant changes in the environment are non-repetitive in nature.

Failure symptom: *The lack of appropriate planning models increases the risk that the system will fail to provide a stream of feasible options to adapt, to exploit the opportunities or mitigate the risks associated with changes in the nature of the environment.*

5.7.5 Principle 22 SCENARIO GENERATION:

A CSS should, through S4, produce multiple alternative future outcomes that reflect the potential uncertainty in the environment and the consequences of adaptation.

Explanation: In the short term, the environment and the system under regulation are relatively constrained; as a result, the uncertainty associated with forecasts is (disasters and other extreme events aside) primarily a question of degree. In the longer term, less can be assumed about the nature and variability of variables, therefore feedforward information should take the form of simulations of alternative, feasible scenarios (sets of possible systems states and trajectories). These, along with their associated probabilities, provide an estimate of future uncertainty. The scenarios help raise situational awareness and help construct appropriate contingency plans, which facilitate swift, appropriate response.

Failure symptom: *Without planning scenarios there is a risk that the organisations will not be attuned to the possibility of unanticipated outcomes. It may be slow to spot changes, and its set of adaptive options will be too restricted, thereby making it more vulnerable.*

5.7.6 Principle 23 LEARNING BY DOING:

The S4 of a CSS should, by research and experimentation, actively create information to reduce the uncertainty in the environment and the consequences of adaptation.

Explanation: That feedback information needed to create and validate the modelling assumptions upon which longer term plans are based, is often not readily available. As a result, evidence should be generated through ad hoc (survey) research and by experimentation (e.g. through pilots/trials). This might involve the creation of exploratory projects by S4, commissioned through S3.

Rationale: *A failure to validate those assumptions upon which planning information is based, exposes the organisation to higher levels of risk.*

5.8 Part 4 Principles: Regulation.

The crux of a cybernetically sound FPMS is the process of regulation. This involves intervening in the system; changing the state of financial variables in order to maintain and enhance the viability of the system. In a CSS, these acts are made within the context of a cybernetically sound structure and in response to cybernetically sound information. The regulatory acts comprise the determination of goals, and the selection and enactment of regulatory acts.

There is one overriding principle that governs all forms of regulation:

5.8.1 Principle 24 REQUISITE VARIETY:

The regulatory systems of a CSS should, for all variables, at all levels, and over all time scales, be designed to comply with Ashby's Law of Requisite Variety. This requires that the variety (flexibility) of all control systems (formal and informal) be at least that required to match the variety of the environment, given the variety of the goal set. Flexibility takes the form of a sufficiently large portfolio of regulatory acts, matched with a level of liquid resources sufficient to enact them.

Explanation: Since the LORV will always assert itself, and the variety of the environment cannot be controlled, then an effective regulatory system should provide requisite variety. Specifically, the variety (tightness) of the goal set and the variety (flexibility) of the control system (taking account of formal and informal mechanisms and the resources that they consume) should be at least equivalent to the variety (turbulence and rate of change) of the environment. Success will be manifest in goals (which necessarily include the physiological limits of essential variables) being consistently achieved.

Failure symptom: *Failure to create a regulatory system with requisite variety will be manifest in system instability (which ultimately may prejudice viability) or an increase in informal (often dysfunctional) behaviour to restore the variety balance, such as the creation of budgetary slack.*

5.9 Part 4(a) Principles: Goals

5.9.1 Principle 25 LIMITED GOAL SET:

In order to comply with LORV, a CSS will limit the number of variables used for goal setting and express them in high variety terms; as thresholds, ranges as a direction or in fuzzy terms. Essential variables (with a range corresponding to the physiological limits) should always be included in the goal set. This will include goals for financial variables arising from the Resource Bargain struck with the providers of funds.

Explanation: Since the environment will always have greater variety than that of the regulatory system, and the introduction of constraints (such as goals) leads to an exponential decay of flexibility (regulatory variety), a CSS should be minimally constrained by goals. That is, they should be limited in number and expressed in high variety terms. The goal set should always include those financial variables (or good proxies for them) that form part of the set of essential variables by virtue of the constraints agreed with external providers of finance.

Failure symptom: *Failure to specify the goals set appropriately will increase the demands on the regulator, thereby increasing the regulatory load and or the risk of dysfunctional behaviour or system instability. Failure to heed the constraints placed on funding by external providers may lead to them taking action that could result in the loss of independence (i.e. being sold) or system failure (bankruptcy).*

5.9.2 Principle 26 GOAL HIERARCHIES:

In a CSS, goals should be hierarchically arranged in order to guide the regulator in making trade-offs. This will include (inter alia) those related to essential variables, which will always be prioritised against non-essential variables, constraints that need to be met (but no more) before objectives are optimised. Since the aim is to maintain the health of the total system, goals for different variables (Financial/Resource and Operational) and goals related to

the maintenance of identity (Normative) capability (Strategic) and current performance (Operative) should not be prioritised over each other.

Explanation: It is unlikely that even the most effective regulator will be able to meet every goal at all times; choices (trade-offs between goals) therefore need to be made. In order to guide the regulatory process of a CSS to its primary aim, (the maintenance of viability by holding essential variables within physiological limits) a range of constraints and goals will be required, some of which will be more directly related to the state of essential variables than others. In the event that regulatory acts under consideration lead to the prospect of some of these goals being sacrificed, it is important that the regulator is able to make appropriate distinctions between goals. Given the overriding need for homeostatic balance, care needs to be exercised to ensure that the essential variables at different functional levels (operational, strategic and normative) are treated equally. In particular, the attachment of financial incentives to the achievement of goals needs to be managed such that the regulatory process does not become distorted.

Failure symptom: *A failure to appropriately guide the regulatory selection process increases the risk that those goals that are easy to meet, and/or are supported by incentives, will be prioritised over those that are not (and which may be more pertinent to system health).*

5.9.3 Principle 27 CHANGES TO GOALS:

In a CSS, goals should be changed only when necessary; where a significant change in the environment demands it, in order to institutionalise an improvement in performance (positive feedback), or in the event of a change in system capability arising from a regulatory action. Specifically, automatic changes to goals on a predetermined arbitrary cycle should be avoided.

Relative, directional goals and those related to the (internal or external) Resource Bargain provide appropriate mechanisms to achieve these ends, and point in time goals should be avoided where possible.

Explanation: Changes to goals are a cause of (endogenous) perturbations that unnecessarily destabilise the system, and so should be avoided wherever possible. Goals should be changed, however, where there has been a systematic shift in the environment or the system under regulation. It follows that goals should not be

routinely changed on some arbitrary cycle (such as every accounting period), and that some goals (for example those which are frequently impacted by regulatory acts made in response to environmental perturbation) should change more frequently than those that are not (for example those related to the maintenance of the infrastructure of elemental units). Where goals relate to performance, (which is a relative concept) expressing goals in relative terms is one way of ensuring that they are changed at an appropriate frequency.

Failure symptom: *Frequent changes to goals (that are not related to changes in the environment or the capability of the system) introduce additional variety and thereby place an increased load on the regulator. Also, there is an increased risk of instability, particularly around goals period ends, where point in time goals are used.*

5.10 Part 4(b) Principles: regulatory actions

5.10.1 Principle 28 CONTINUOUS TOTAL SYSTEM CONTROL:

In a CSS, regulation will be informed by a mixture of feedback and feedforward (forecast) information, supplied in real time, and should take account of the impact on all relevant goals and constraints, irrespective of the set of variables under regulation.

Explanation: A cybernetically sound FPMS is directly responsible for the regulation of financial variables but, by virtue of its control over the flow of resources, contributes to the regulation of all other system variables. Consequently, the regulation of money must involve the use of non-financial information. Because of the pernicious impact of time lags on regulation, all feedback information should be made available in real time (not only at some arbitrary accounting period end), and feedforward information should be used to compensate for any lags in the flow of information, or in the regulatory process itself.

Failure symptom: *Failure to take account of the total system impact of the regulation of financial variables will compromise system viability.*

5.10.2 Principle 29 LOCUS OF REGULATION:

In a CSS, regulatory acts will take place at different levels of recursion, at different frequencies and involve regulatory acts of different amplitudes. Decision making should take place at the lowest level of recursion where the requisite knowledge exists, consistent with the overriding need to maintain overall organisational cohesion and effectiveness.

Explanation: The level at which regulation takes place depends upon:

- Where the requisite knowledge resides. This could be at any level of recursion and is a function of the availability of information and the competence – variety – of the regulator) .
- The required speed of response and
- the need for co-ordination between elemental units.

Access to local knowledge and speed favour decision making at lower levels; knowledge gained from a synoptic perspective and the need to co-ordinate action favour higher levels.

Failure symptom: *Failure to empower elemental units will unnecessarily delay regulatory response and thereby risks system stability. If decision making is too decentralised, it increases the risk of action being uncoordinated and ineffective use of resources.*

5.10.3 Principle 30 OPTION GENERATION:

In a CSS, options for systemic adaptation should be continuously generated (by S4) at a rate at least equivalent to the anticipated rate of perturbation in the environment. The variety of the portfolio of available options should be at least as great as the uncertainty attached to projections of future environmental and system states. The portfolio of options created should be consistent with the strategic posture.

Explanation: Out of the infinity of possible adaptations to possible futures, a range of options, covering both what the system does and how it does it, needs to be crystallised at a rate that matches the rate of anticipated change in the environment. Each option should be based on a conceptually sound model, and be organisationally, technically and economically feasible. The set of options should be at least equivalent to the uncertainty in the projections of the environment. Option

generation, will be guided by the capability of the system, the demands of the environment (as anticipated by S4) and organisational policy (as defined by the activities of S5). This will include guidance as to those parts of phase space (fitness landscape) that the system wishes to enter, develop, defend or exit, and the balance between incremental and speculative moves.

Failure symptom: *Failure to create an appropriate range of options weakens and slows down the process of adaption, thereby prejudicing viability. An exclusive focus on incremental change risks the system failing to react to disruptive change. One focussed on speculative change will lead to sub optimisation within any specific environment and risks dissipating resource.*

5.10.4 Principle 31 OPTION SELECTION:

In a CSS, options are selected through the operation of the S3/S4 homeostat. This needs to be done in time to match the change in environmental variety, taking into account the lags of the regulatory acts. This process involves selecting groups of options, based on the quality of their business cases, and simulating their impact in order to demonstrate their systemic feasibility (coherence and affordability) and estimate the uncertainty attached to their enactment. Contingency plans may be created to insure against this uncertainty.

Explanation: The process of enactment involves selecting, through the operation of S4/S3 homeostat, those options that are appropriate to the emerging reality with which S3 (and its elemental units) is faced. Since the demand for resources (almost) always exceeds supply, and S3 does not necessarily have the requisite knowledge to make resource allocation decisions, a priori, there needs to be a process of competition between (a market made up of) business cases prepared by the elemental units concerned. The selection process also requires a form of system simulation (planning) to demonstrate that the set of options selected are coherent, affordable and within the capacity of the system to implement. Subsequent to selection, detailed planning can commence, but no commitment should be made until after a resource bargain is struck between S3 and the collection of S1; selected options may be aborted if needs change. Some options might be held (i.e. not

committed) as insurance (a form of redundancy) against a particular scenario (e.g. a contingency or a disaster recovery plan).

Failure symptom: *A failure to select an appropriate range of options at any appropriate rate, risks systemic response being uncoordinated, inappropriately resourced (either needing too much or too little) and slow.*

5.10.5 Principle 32 THE NATURE OF INTERNAL RESOURCE BARGAINS:

In a CSS, commitment of resources is mediated through a Resource Bargain, whereby permission to use resources is granted subject to certain conditions.

The conditions will prescribe limits on (the level or rate of) resource usage, the (financial and non-financial) goals to be met, and define constraints on action or timing. The Resource Bargain should minimally constrain elemental variety, consistent with the need to maintain organisational cohesion, ensure the effective use of resources and promote learning. As a result, different conditions will be attached to the resources allocated to the maintenance of the infrastructure, in support of the local regulatory capacity of elemental units and that committed to specific regulatory acts that, by virtue of their nature or size, are administered by S3.

Explanation: The Resource Bargain administers the act of commitment; the process of collapsing a large set of options into that small number that are to be exercised. The allocation of resources associated with the process amplifies the variety of elemental units (subject to the conditions of the bargain), at the cost of reducing the regulatory redundancy available to the metasystem (and involves sunk costs that cannot be recouped in the event of change). The exact nature of the variety balance struck is a function of the nature of the environment (i.e. its turbulence and the rate of transformation), the regularity competence (requisite knowledge) of S1 vs. S3, and the need to maintain organisational cohesion. Commitment to maintenance of elemental infrastructure is likely to be subject to less stringent conditions (because of the low rate of change and existence of requisite local knowledge) than commitment to action in response to specific, significant environmental perturbations, which may have implications for the system as a whole.

Failure symptom: *Premature commitment will reduce flexibility and/or incur higher levels of wasted resource (sunk cost or poor investment). Delayed commitment will*

reduce the speed of response. Over or under circumscribed commitments risks the ineffective use of resources.

5.10.6 Principle 33 TIMING OF REGULATORY ACTS:

In a CSS, regulatory acts should be enacted at a frequency at least equivalent to the rate of perturbations (from the environment or from the system). The timing of commitment is dependent on the level of knowledge about (degree of uncertainty attached to) the future state of the environment and the system being regulated (e.g. the availability of resources) as informed by the forecast administered through S2. High levels of uncertainty can be mitigated by deferring commitments.

Explanation: In order to comply with the LORV, the rate at which commitments can be made must match the frequency of those perturbations in the environment that are subject to regulation, rather than on an arbitrary cycle related to accounting reporting convention (e.g. annual). By definition, this means that regulatory cycles (frequencies) will differ for different types of resource bargain (see above), between different parts of the organisation and over different horizons. All regulatory acts involve a lag and are made under conditions of uncertainty (information deficit). The level of uncertainty needs to be matched by regulatory redundancy; one source of which is the deferral of commitment, since it maintains resource liquidity and allows the information deficit to be reduced by the passage of time.

Failure symptom: *Failure to match the rate of change in the environment will make the system less stable. Failure to balance commitment with uncertainty increases the risk of the failure to meet goals.*

5.10.7 Principle 34 ENHANCEMENT OF REQUISITE KNOWLEDGE:

In a CSS, the models used to inform regulation should be maintained and improved based on feedback from the elemental system responsible for execution (received through the Accountability Channel) and from the results of (internal and external) peer group actions.

Explanation: The effectiveness of regulation (and the quality of feedforward information) is a function of the quality of the model (in this instance the business case) upon which forecasts and regulatory acts are based. Since a model can only be improved by feedback, there is a need for a systematic post mortem process (organised by S3 and informed by information received through the Accountability Channel) to collect and share leanings amongst elemental units. This should include an assessment of the uncertainty associated with classes of regulatory acts.

Failure symptom: *Failure to build appropriate feedback mechanisms reduces the effectiveness of regulatory actions. This may be manifest as repeated regulatory action having little discernable effect.*

5.11 Conclusion

This chapter has set out an axiomatic specification for a cybernetically sound system; an idealised model for an effective FPMS. The cybernetic concepts that provide the foundation for the model have been set out, and how these are manifest in the financial affairs of social organisations elucidated. Beer's Viable System Model (Beer, 1979, 1981, 1985) has been used as a framework, enabling the primitive forms to be translated into the organisational realm. Finally, this has been articulated in a set of 34 principles, that can be used to design and diagnose problems in real world FPMS. These principles have been used to create the research instrument – a diagnostic tool - for use in subsequent fieldwork (see Appendix 5).

Although the creation of such a model, based on cybernetic principles, has never been attempted before, the idea of applying cybernetic concepts to the study of social organisations is not new. Indeed, the idea has been the subject of criticism from both the mainstream academic MCS and broader systems communities. As a result, before starting any fieldwork, it is necessary to examine these criticisms to determine how well founded they are.

6 A Critique of Organisational Cybernetics

CHAPTER 1 Background	CHAPTER 2 Literature Review – Practice and Research in Accounting	CHAPTER 3 Literature Review – Systems and Cybernetics Research	CHAPTER 4 Research Questions and Methodological Issues	CHAPTER 5 The Cybernetically Sound Systems A Specification	CHAPTER 6 A Critique of Organisational Cybernetics	CHAPTER 7 A Cybernetic Interpretation of Antecedent Knowledge	CHAPTER 8 Description of Fieldwork	CHAPTER 9 A Critical Evaluation of the Cybernetic Proposition and Findings	CHAPTER 10 Conclusion
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To what extent are the mainstream academic criticisms of the cybernetic approach justified ?
To what extent are the 'systems theoretic' criticisms of the cybernetic approach justified ?

6.1 Introduction

The purpose of this chapter is to review the criticisms that academics and researchers have levelled at the application of cybernetics to social systems, and then to assess the extent these criticisms apply to the cybernetic model developed in the last chapter. This will inform subsequent phases of research.

The criticisms emanate from the Accounting (Management Control Systems) and from the Systems communities. These are examined in turn.

6.2 An Accounting critique

The first, and most well-known critique of the impoverished cybernetic model of MCS, was made by Hofstede (Hofstede, 1978). This was directed at the model expounded by Anthony (1965), i.e. a traditional budgeting model. Hofstede characterised the model in use as a cybernetic-in-the-narrow-sense feedback loop, i.e. a simple first order error controlled servo-mechanism; a form of control model that cyberneticians have dismissed as being “too simple, too analytic” (Beer, 1981,113). Indeed, Ashby (1957,57) took the view that the complexity of biological and social organisations rendered the simple concept of feedback loops unhelpful –

one could only infer feedback (i.e. the return of information about the state of a system back to itself) by its behaviour.

Notwithstanding this, and Hofstede's admission that his "was a much narrower use of the term cybernetic than that advocated by Wiener" (Hofstede, 1978,451), it is worthwhile examining the criticisms made by him and others in detail, since we cannot simply assume that misattribution of blame invalidates the arguments made to substantiate the criticisms. Broadly speaking these fall under four headings: that the conditions required for cybernetic control do not exist, that cybernetic control is based on naïve and simplistic assumptions about human behaviour, that the cybernetic model is simply inappropriate and that cybernetic models are empty; they lack content.

6.2.1 The Conditions for cybernetic control do not exist

The case against

One of the most common criticisms is that the conditions for cybernetic control do not exist Hofstede (1978), Otley (Berry and Otley, 1980, Otley, 1983), Willmer (1983) Dermer (Dermer, 1988, Dermer and Lucas, 1986). The conditions in question are taken to be:

1. The existence of a standard corresponding to the effective and efficient accomplishment of the organisation's activities.
2. The ability to measure actual accomplishment.
3. The ability to use the information feedback to eliminate the difference between the standard and the actual, which implies an ability to predict the outcome.

Critics have identified the following problems in each of these dimensions:

1. Goals are missing, unclear or ambiguous. Organisations do not have goals, only people do, and the process of achieving consensus as to what should be achieved is mediated through a political process, i.e. one that cannot be

submitted to cybernetic analysis. Most organisations do not have complete consensus about objectives, or power is concentrated in such a way that allows a single person or group of people to impose them on a group of people. “In such cases decisions, if they are consciously taken at all, are based on processes of negotiation and struggle and cannot be derived from any prior organisational objective” says Hofstede (1978,456).

2. In practice, there are very many measures, and the reliability of the measurement process is poor, so for many organisations, or activities within organisations, output can only be defined in qualitative and vague terms. As a result, Hofstede argues, decision making (i.e. the resource allocation process) is judgemental and based on the one thing that can be readily measured; the cost of an activity. One consequence of this, (and the fact that that an individual may have personal goals or objectives that differs from those of the organisation) is that gaming behaviour is fostered, and this has little to do with the effectiveness or efficiency of the organisation. Another problem is that there are often large time lags involved, which mean that the error signal arrives too late for correction to be made. Otley (1983) recognises that, unlike conventional budgeting systems, Beer’s cybernetic model relies heavily on time series data in order to detect systems instability, however he believes that much of the information used in organisations may be of rudimentary and ephemeral nature, thus invalidating this form of control. Dermer and Lucas also believe that the ambiguous and difficult nature of real life invalidates the traditional cybernetic model of control (Dermer and Lucas, 1986).
3. The cybernetic model presupposes a recurring cycle of events, where the outcome of an activity can be readily measured and predicted with reasonable certainty, based on prior experience. Sutherland (1975) argues the cybernetic paradigm is characterised by the use of deterministic models. In reality, he believes, management activity is non-repetitive, and the complexity and time lags involved associated with real life situations is such that prediction of outcomes is impossible. In any event, outputs may not even be measurable. There is also scepticism that feedforward mechanisms can be made effective, since this “assumes that interventions are programmable in advance as a known function of environmental disturbances – a condition unlikely to be fulfilled in most management control situations” (Hofstede, 1978,451).

Hofstede (1978) and Otley (1983) both recognise that a cybernetic model can be extended beyond a single closed loop structure, with feedback loops and second and higher order feedback loops controlling the process of goal setting and overriding the first order systems. But, even where higher order loops are deployed, the goal (and the controller) always sits outside the system to be controlled, thereby, they argue, stifling self-regulation and other social control processes.

The conclusion drawn by such critics is that the use of a cybernetic model to understand and help define organisational systems cannot be justified in most situations; it can only be applied when the process being controlled is well specified, repetitive with a clear criterion of success and the time taken to effect a response is short i.e. for some kinds of operational processes (Vickers, 1967b).

Hofstede builds a typology and control processes based on this analysis (1981):

1. Political control is the only form of control possible where objectives are unambiguous.
2. Judgemental control is possible where objectives are clear but outputs not measurable.
3. Intuitive control is possible if outputs are measurable, objective clear but the effect of interventions not known, but the activity is non-repetitive.
4. Trial and error control applies where all the above conditions are met, but the activity is repetitive.
5. Expert control applies If the effects of interventions are known, but the activity is non-repetitive.
6. Routine control that can only be applied if the effects of interventions are known and the activity is repetitive.

In this typology, only levels 4 through 6 are characterised as cybernetic.

Finally Hofstede (1981), Otley (1983) amongst others, argue that a cybernetic model is incapable of learning, except in a very limited way. Presumably, this view is based on the conception of cybernetic control being exercised exclusively through a simple

negative feedback loop, using predetermined algorithms acting upon externally specified goals, both of which are held constant irrespective of changes to circumstances.

The evaluation

The analysis above is clearly based on low order error controlled cybernetic systems, of the sort used to control machines. Traditional MCS and budgeting systems have many of the features of a simple control model, and to this extent they are reasonable criticisms of standard control practices, as promoted by Anthony and others. They are less valid as criticisms of models based on the principles of organisational cybernetics, however, since:

- None of the promoters of the traditional model of MCS, as first articulated by Anthony, ever claimed more than a loose connection with cybernetics, nor have serious systems scientists ever described these models as cybernetic. In practice, the link between traditional models and cybernetics extends no further than the use of terms such as feedback, which, through casual everyday use, have lost their original scientific meaning. Those authors who have claimed that their work is based on cybernetic principles (Amey, 1979, Maciariello, 1984, Schoderbeck, 1967, Schoderbeck and Kafelas, 1975) make little or no reference to recognised authorities on the application of cybernetic principles to social organisations, tending to adopt a simple single order control model of the sort used in engineering.
- Attempts by cyberneticists to apply their ideas to the regulation of complex social systems, from Ashby onwards, have recognised that the simple prescriptions of control theory cannot be applied without supplementation or significant modification.

Specifically, Ashby and Beer in particular have a rather different take on the criteria for cybernetic control adopted by their detractors:

1. For both Beer and Ashby, the only thing that can be said with any certainty about goals in the context of complex cybernetic systems, is that they must be related to survival or viability – the ability to maintain an independent existence. In Ashby's work (1957), goals are expressed as physiological limits, within which the essential variables of a system needs to be maintained. He does not explicitly state where these goals come from, but the implication is that they are preferentially selected by some form of evolutionary process; system states that are not consistent with survival are, by definition, eliminated. In this way, systems self-organise around the criteria consistent with survival (Ashby, 1962), through the mutual operation of mutually vetoing homeostats. Ashby is sceptical about an observers ability to identify goals through introspection (Ashby, 1981b), indeed it is naïve to assume that complex interacting systems have goals at all, at least in the conventional sense of the word.

An important quality of Ashby's concept of a goal is that it should not be expressed as a single value of a variable, since this would lead to a system being in permanent oscillation, which is inconsistent with system stability (and therefore viability). Instead, it should be expressed as a range of values, which, according to the Law of Requisite Variety, reduces the load on (variety required by) the regulator, thereby increasing the chances of success. Neither does he believe that goals must be quantified; homeostatic control of temperature in the human body, for instance, does not involve numeration.

Beer regards the whole question of purpose and goals as a vexed one; "the purpose of the system is what it does" (1979,13). He sees purpose as an anthropomorphic concept (1983); a quality imputed by an observer in order to explain the actual behaviour of a system; he argues that the observer assumes that the states the system is perceived to select reflect an a priori purpose, which might not exist. In other words, a goal is not a property of a system, it is a function of the observer and her/his attempt to make sense of observed reality (Morgan, 1981). Thus, in Klir's words; "a goal is defined in terms of some specific restriction of systemhood properties that a cognitive agent (observer) dealing with the systems considers desirable under certain

circumstances” (Klir, 1991,171). Beer’s position is therefore very close to that adopted by some of the critics of cybernetics. The desired state is an outcome of the way in which interactions are negotiated by the system, informed by environmental conditions (by an input channel from the metasytemic landscape) and an understanding of the health of the system. Specifically, a goal is a compound phenomenon; to have requisite variety, goals cannot be expressed in terms of one variable such as money, which is, at best, only a constraint (i.e. a necessary but not sufficient condition). In summary, from Beer’s cybernetic perspective, a goal can be said to exist in that a system has demonstrated the ability to achieve and maintain a set of states consistent with its continued existence; it is not a set point that is externally imposed on the system.

Indeed, building on Bateson’s analysis of cybernetic causality (1967), it is possible to construct an argument that cybernetic control is the antithesis of goal seeking behaviour, in that it is more appropriate to interpret behaviour as the avoidance of negative states rather than seeking out positive ones. Thus, Morgan asserts, the cybernetic perspective offers “a basis for principles of organisational strategy and design of a new and powerful kind by suggesting that systems learn and evolve and do so by avoiding undesirable states (noxious) rather than pursuing those that are actively desired. This replaces the traditional idea that a sound organisation embodies a goal orientation backed by sound principles of instrumental control” (Morgan, 1981,523).

2. Feedback, in the form of the ability for a system to recognise its own state rather than a specific channel, is necessary for cybernetic control. It does not, however, matter what form this information takes, whether it is quantified or unquantified, vague or specific – it might be as simple as acceptable or unacceptable - just that it is adequate to inform the process of regulation. Cybernetic control does not, therefore, rely on the provision of high quality, quantified data of the kind assumed by critics. Cybernetic systems in the organic or social worlds are based on an assumption of uncertainty and thus exhibit massive redundancy (or duplication); a quality that von Neumann

demonstrated enables a system to produce reliable outputs to any level of quality with unreliable components and information (Beer, 1959a).

3. The Ashby Conant theorem is a deductively derived law that applies to any kind of system (Conant and Ashby, 1962). It states that every good regulator of the system must be a model of that system. Whilst a perfect model will be capable of perfect regulation, in order for a system to survive the model need only be good enough. Cybernetic control, argues Pickering, is like sailing; it involves a continuous interplay with an environment that can ever be fully known or controlled (Pickering, 2010). This does imply, as detractors assert, some predictive capability, but this is a requirement for any kind of conscious purposeful behaviour. It is difficult to believe that critics would claim that organisational behaviour is unconscious and random, which it would be if there was no predictive capability at all. The cybernetic process of regulation is not reliant on algorithms of the sort used to control well understood, repetitive operations, since these will not have requisite variety and will be vulnerable to changes in the systems or its environment (Beer, 1981). Rather, “it will make extensive use of heuristics or search routines, which will be improved in an evolutionary way – extinction is a very effective form of feedback. Such models are also likely to be probabilistic rather than deterministic in nature” (Ashby, 1957, Beer, 1981).

Most cyberneticians (such as Ashby, Beer, Powers but particularly Pask whose entire approach to cybernetics was an attempt to understand the process of learning) take the opposite stance to those critics who argue that cybernetic approaches are incapable of learning. For instance, Beer was explicit that even simple regulation such as that of Ashby’s homeostats could not operate *without* learning; there would not be enough time available to a system using simple trial and error techniques, given the likely rate of environmental disturbances (Beer, 1966). To demonstrate how this might work, he constructed a machine, the algenode, which was able to learn by adjusting the probabilities in its search routines (models) based on experience (feedback). Furthermore, the objective of survival requires that a viable systems desired state be relevant to the prevailing set of environmental states; demanding, what Beer calls an input channel from the metasystemic environment

(Beer, 1981). Beer and other cyberneticians (such as von Foerster) explicitly recognised that the existence of errors (as the result of having an imperfect regulatory model) is a prerequisite to learning. They are progenitors of change in the environment, the system under regulation, or the result of a potentially valuable experiment in regulation (Beer, 1981).

It is therefore clear that the kind of cybernetic system specified by Ashby and Beer is capable of exercising control and learning without fulfilling any of the necessary conditions described by the critics. Indeed, Beer's VSM exhibits all six forms of control in Hofstede's classification.

Ironically, Hofstede proposes, as an alternative, a non cybernetic model, based on small self-regulating cells, which he calls homeostatic – in other words the very model of organisation used by Beer and Ashby. Why Hofstede should do this is unclear; he quotes Ashby and the Law of Requisite Variety in arguing against the cybernetic paradigm, thus demonstrating a familiarity with cybernetic work and some understanding of its implications for the control of complex systems (Hofstede, 1981). Indeed, he regards the terms ultrastability and homeostasis as “near synonyms” (p208). This curious mixing of criticism of the cybernetic paradigm with advocacy of cybernetic remedies occurs elsewhere in Hofstede's 1981 article. For instance, he recognises that adaptive systems of the kind he advocates have been modelled by Ashby as regular first order cybernetic feedback cycles with a second-order loop superimposed on it, and applied, as double loop learning, to organisational situations by Argyris (1982). To promote learning, in organisations where it is stifled by the tendency to move to standard operating procedures, he argues for a range of measures of a kind advocated by Beer. These include Hedburg and Jonssons semi confusing information systems (1978) - equivalent to VSMs System 3* - and a court jester whose role is to collect the weak and suppressed signals from the environment and have direct access to the top decision makers with unpopular news (equivalent to the VSM's algedonic signal).

In conclusion, particularly if we take Beer's work to be the manifestation of organisational cybernetics, it is difficult to sustain the criticism that social systems are, by their nature, inimical to control by cybernetic means. Indeed, the kind of

alternatives proposed by critics often echo the positions adopted by Beer, which suggests that critics were not sufficiently well acquainted with his work.

6.2.2 Naive and simplistic assumptions about Human behaviour

The case against

It has been argued that the conventional cybernetic paradigm is based on simplistic and naïve assumptions about human behaviour and that it promotes the division of labour (Hofstede, 1978, Zeleny, 1986). Critics contend that control is exercised externally, by controllers with a Theory X view of the world (Hofstede, 1978), based on the assumption that actors behave in a mechanistic, robotic fashion, or can be made to do so by the application of rewards for appropriate behaviour (Willmer, 1983). Hofstede (1981,199) argues that “as soon as people are part of the process, the effects of interventions are not known”. In particular, he believes that the cybernetic model is undermined by the rewards it creates for psychological short cutting, which take the form of:

1. Changing the objectives, rather than the process itself.
2. Changing the measurements, rather than the process itself.
3. Making intended interventions, but making unintended interventions at the same time (e.g. adjusting cost at the expense of quality).
4. People withdrawing from the systems by absenteeism.

The pseudo control associated with the cybernetic approach can only be avoided, Hofstede argues , by “rewarding the interest in the process itself by moving control down to the level of those who actually intervene in the process” (1981,199).

The evaluation

Two questions need to be answered here. Does Beer’s VSM address the issue of motivation and other relevant aspects of human behaviour, and if not does this invalidate its use as a model?

Beer does not explicitly consider the psychological argument, except in so far as he regards human beings as viable systems with an interest in self-determination. In the absence of specific guidance, we can do no more than speculate about what assumptions organisational cybernetic might hold about human nature. A conjecture might be that S1-S3 of the VSM is responsible for securing material necessities from the environment and S4 for learning and development. Ultimately decisions would be mediated through S5; the seat of consciousness and the source of moral sensibility. Motivation (like purpose) might be inferred from observed patterns of behaviour associated with the correction of homeostatic imbalances, and thus would be context dependant, rather like Maslow's hierarchy (1943).

While the design of VSM makes no explicit assumptions about human nature, Beer, like his critics, does acknowledge that the way in which organisations are controlled can result in dysfunctional behaviour. However, he regards such behaviour as the result of ignorance of cybernetics principles not as a consequence of applying them. For instance, self-serving bureaucracies are symptomatic of pathological autopoiesis (Beer, 1994c) and the kind of short circuiting measures described by Hofstede, are the inevitable consequence of trying to control a high variety system (involving people) with a low variety regulator. Also, Beer regards intrinsic control (self-organisation and self-regulation) as necessary components of the regulation of exceedingly complex (social) systems; thus cybernetic control should seek to exploit this, not suppress it. As a result, Beer advocates adopting exactly the same organisational architecture as that proposed by Hofstede (1981); decentralised, empowered units. However, he goes one step further, by articulating the mechanisms needed (S2 to S5 and recursions) necessary to ensure that such units operate in a coherent and co-ordinated fashion, with minimal constraints on their autonomy.

This analysis is consistent with that of Perceptual Control Theory (PCT) (1974) – a cybernetic based approach to human psychology. Powers (the creator of PCT) posits 9 control levels within the human psyche, and in this model motivation is simply an expression of the feelings that are aroused when there is a gap between the current and a desired state at a high level in this hierarchy. Lower levels in this

hierarchy, constrain higher levels and gaps would probably be expressed as needs or urges, if indeed they were consciously accessible at all. Thus, motivation is an emergent property of the system. It is also consistent with Kauffman's speculations (Kauffman, 2008), and it resonates with Boulding's hierarchy (Boulding, 1956). Also, as already noted, Beer was sceptical that purpose as such exists. For Beer purpose and all such other cultural manifestations – are an emergent property of the system as perceived by an observer (Jackson, 1989).

In conclusion, whereas Anthony, in his seminal work on Management Controls Systems (Anthony, 1965), argues that management control is fundamentally a form of applied social psychology; the cybernetic model makes no explicit assumptions about human behaviour, at either the individual or collective level. The VSM, for instance, is logically derived from cybernetic first principles, and does not recognise as design considerations the need to motivate people or to constrain political behaviour. If you believe that such considerations cannot be excluded, the claim that the cybernetic approach is naïve may have validity. Another interpretation is that the cybernetic model is an incomplete representation of organisational life, as any model is bound to be. If the cybernetic model is intentionally an abstraction from reality, rather than a representation of it, the claim that cybernetics promotes a simplistic model is more difficult to sustain. Indeed, advocates of the VSM would argue that it is the only model that comprehensively specifies the requirements for regulating complex social organisations, which by definition are made up of autonomous entities capable of exercising free will. This interpretation is not a post hoc rationalisation of Beer's position; it is consistent with the founding principles of the science. Introducing the 1948 Macy conference on cybernetics, Fremont-Smith is quoted as saying: "the concept of teleological mechanisms...may be viewed as an attempt to escape from...old mechanistic formulations that appear inadequate, and to provide new and more fruitful conceptions and more effective methodologies for studying self-regulating processes, self-orientating mechanisms and organisms and self-directing personalities" (Whittaker, 2009,250). The characterisation of cybernetic models as deterministic is, therefore, probably another case of critics conflating mainstream MCS and bona fide organisational cybernetics.

6.2.3 Inappropriate model

We now turn to the epistemological case against cybernetics; the claim that it is fundamentally inappropriate approach to the study of complex social systems.

The case against

A main source of this criticism in the accounting literature is Otley (1983). Whilst the conclusion he draws is damning, his argumentation suffers from some inconsistency. For instance, he criticises Beer's work for being intuitive rather than carefully argued but also for the VSM being justified in a reductionist manner Otley (1983). Perhaps this apparent contradiction can be explained by the fact that in the *Brain of the Firm* (which Otley references) Beer builds the VSM based on the model of the human autonomic nervous system (a process that Otley regards a dangerous use of analogy) whereas in *Heart of the Enterprise* (that Otley does not reference) the characteristics of the VSM are constructed from cybernetic first principles. Also, after having noted that cybernetics might be thought to be solely concerned with biological phenomena if one confines oneself to certain of its literature, he goes on to say that it is concerned with control by reaction to errors in closed systems (Otley, 1983,68), which biological phenomena are clearly not.

The issue of whether cybernetics can be applied to the study of open systems (as described by von Bertalanffy and other General System Theorists) also exercises Otley greatly, but again the critique is rather confused. He states that "the cybernetic concepts that apply to closed systems (e.g. Requisite Variety and entropy increase) do not necessarily apply in open systems" (1983,68), but later in the same article acknowledges that "cybernetics is not restricted to the study of closed systems as the definitions given earlier clearly indicate" (1983,68), . Merchant and Otley find it "difficult to draw a meaningful divide between (cybernetics and General Systems)...though a simple distinction would be to suggest that cybernetics deals with closed systems, whereas systems theory has a more explicitly open perspective and stresses the importance of emergent properties in such systems" (2008,786).

However, the objection most frequently raised by management control academics who are critical of the use of the cybernetic model of control, is that, because it stems from the study of physical or hard systems (Otley, 1983), it is inappropriate to the design of human activity systems. “Those concerned with control theory” argue Berry and Otley, “have tended to ignore the special characteristics of human organisations that distinguish them from other systems” (Berry and Otley, 1980,231). In support of this view, a number of critics (Emmanuel and Otley, 1985, Hofstede, 1978, Otley, 1983) cite the nine-level *Skeleton of Science* expounded by Boulding (1956). This categorises systems based on their level of complexity:

1. Static frameworks.
2. Dynamic systems with predetermined motions.
3. Closed loop control or cybernetic system.
4. Homeostatic systems like the biological cell.
5. The living plant.
6. The animal.
7. Man.
8. Human organisations.
9. Transcendental systems.

This analysis locates cybernetic systems at Level 3. Critics argue that, in the interests of conceptual simplification, a Level 3 model may be used to shed some light on Level 8 human activity systems (just as early thinkers in management used the organisation chart – a Level 1 model), but it is inappropriate to use lower level systems as a model to design control systems for higher levels. Because of the simplistic and mechanistic assumptions made about the relationships among the people involved, any attempt to do so will result in failure (Boulding, 1956); the fate of initiatives such as PPBS (Planning, Programming and Budgeting System) and management by objectives. In Hofstedes words (1978,458) “blanket application of a cybernetic philosophy to non-cybernetic organisational processes can only do more harm than good”.

In summary, the nub of the epistemological critique is that organisational cybernetics:

1. Is not rigorously derived.
2. Is based on a closed systems approach.
3. Cannot be applied to complex systems.

Evaluation

The argument that the VSM is not rigorously defined is difficult to sustain. The derivation of the VSM can be traced back to *Decision and Control* (Beer, 1966). Here, Beer argues that the scientific study of complex systems requires a new kind of approach that he describes as scientific analogising; and it is this methodology that Beer uses, in *Brain of The Firm* (1981) to develop the VSM. The process of developing a scientific model of a complex system starts with an analogy. This is partly out of necessity, (given the level of complexity involved) but also, Beer argues, because it is consistent with Systems Theoretic principles that hold that there are invariants in the way systems are organised, irrespective of the material from which they are constructed. Beer (1966) then sets out the steps in converting an analogy into a scientific model. The ultimate test of the legitimacy of a model, is whether it provides helpful predictions of real world phenomena; that it proves to be useful by yielding insights that can be used to improve affairs. Otley expressed the opinion that the validity (of a cybernetic approach) has not been demonstrated, indeed, is not demonstrable (Otley, 1983); a view that Beer disputed. In addition, in *Heart of the Enterprise* (1979), Beer derives the VSM from cybernetic first principles, making no reference to the analogy (the human nervous system) that inspired its creation. Anderton regards Beer's work as having "a rare combination of intellectual depth and emergence from intimate involvement with the world of practical affairs" (Anderton, 1989,41). Jackson supports this analysis (1989,419):"the VSM is often criticised for offering a simplistic picture of an organisation based on a mechanical or organic analogy. In fact, it provides a highly sophisticated organisational model which is one of the most advanced findings of modern organisational science, which, since it is underpinned by the science of cybernetics generates enormous explanatory power compared with the usual analyses carried out in organisational theory".

The second criticism requires that we have a clear understanding of what open and closed systems are, and an agreement about their applicability. Unfortunately, this is not forthcoming. Von Bertalanffy (1972) argued that conventional scientific practice has inappropriately applied scientific concepts used to study of closed systems, in physics in particular, to the study of systems in the biological domain that are qualitatively fundamentally different. This is because they are necessarily open to the exchange of energy and matter with their environment, and are able to sustain dynamic equilibrium, unlike the closed systems of physics. While the case he made is valid, systems scientists argue that the terms open and closed, although they are helpful descriptively, are not sufficiently precise or unambiguous to be used scientifically (Ackoff, 1974). Indeed, as Beer (1994b) notes, the only truly closed system is the universe itself; everything else is to one degree or another open. This lack of definitional clarity might help explain some of the incoherence of the criticisms levelled against cybernetics. An appreciation of the inadequacy of these terms can be gained by considering how cybernetics draws distinctions between energy, matter, information and organisation. For Ashby, cybernetics applies to systems that are information tight (note: not closed), by virtue of the fact that information about the state of a system is fed back to itself in some way. His formal position as a theoretician is that whether the systems is open to matter or energy or not, is an irrelevance. However, the fact that he developed his ideas with the aim of understanding complex biological and social systems – which are clearly open – makes it clear that the cybernetic concepts he developed should not be confined to the study of closed systems. Cybernetic systems are only definitively closed in an organisational sense. According to Beer (1959a) (using an argument based on Gödel's theorem), organisational closure is a prerequisite for cybernetic control (through S5) and Maturana and Varela the definition of life itself (autopoiesis) is predicated on such closure. Indeed, Waelchi in his analysis of organisational models, contrast approaches based on cybernetic principles with traditional approaches, which, because they are based on assumptions of closed systems he regards as dangerously defective (Waelchi, 1989).

Finally, Ashby, Beer and those that followed them, would find themselves in agreement with Boulding's analysis of *the skeleton of science*, save in one respect;

they would not agree that cybernetic systems are confined to Level 3. In fact, the VSM is explicitly modelled on a Level 7 entity – the human brain. The reason why Boulding chose to characterise Level 3 as cybernetic may be that he himself was seeking to establish a distinction between cybernetics and the open systems approach (Level 4 and above) of the GST movement of which he was part. More likely is that at the time when the article was published there had been no serious attempt to apply cybernetic principles to the control of complex systems. The first attempt to do so (Ashby's *Introduction to Cybernetics*) did not appear until later in the year (1956) in which Boulding published

In summary, much of the criticism levelled at the cybernetic paradigm is based on the perception that it is based on a reductionist machine model of the world. Whilst it is true that there are shared concepts between control engineering and cybernetics, (although these are not recognised by engineers see (Porter, 1976)) and early cybernetic theory was influential in the early years of computing, cybernetics has evolved since the mid 1950s to take account of the levels of complexity and indeterminism associated with social systems; a fact not acknowledged by the critics of cybernetics.

6.2.4 Lacking in content

The case against

The final major criticism levelled against cybernetics from within the MCS research community is that it is empty. By this, one assumes, it is meant that it exists merely as a set of principles or concepts that have not been, or cannot be, translated into a form that can be applied in practice or used as a framework for research. Vickers, for instance, argues that cybernetics lacks specificity and fails when applied to real life (Berry et al., 1995c). Although a number of authorities recognise the potential usefulness of cybernetics, it has failed to inform empirical work (Otley et al., 1995) and there is a dearth of results (Emmanuel and Otley, 1985). Thus, Puxty concludes that “the abstract nature of the theory of systems stands as a skeleton to be completed” (1993,133).

The evaluation

Given Beer's extensive output, both as an author and practitioner, it is difficult to sustain the argument that there has been no attempt to convert cybernetic insights into operational reality. However, as already noted, cybernetics in general, and the VSM in particular, have failed to establish a secure foothold in academic institutions and remains a curiosity, at best, with practicing managers. In the field of MCS research in particular, nobody has attempted to use the VSM as a vehicle to understand, analyse or design control systems, a gap that this thesis attempts to fill. A few authors claim a cybernetic stance, but their work has been criticised, with some justification, as limited and simplistic. Others have attempted to model systems of control based, to a degree on systems concepts, but none of these represents more than a tentative starting point based on some loose conjectures.

In summary, the criticism that cybernetics has failed to develop into an approach capable of being applied to the study, design and operation of a system of financial management is a justified one.

6.2.5 The accounting critique - conclusion

In conclusion, many of the criticisms made of the prevailing management control paradigm are valid, both in terms of the substance of those criticisms and the reasoning behind them. They are not, however, a well-founded critique of the cybernetic paradigm of organisational control. The purveyors of the traditional model never described it as cybernetic and it has never been claimed as such by cyberneticians; at best they would regard it as bad cybernetics. The label cybernetic was primarily used by those seeking to denigrate conventional control practice, many of whom seem to have a less than perfect grasp of systems science in general and cybernetics in particular; especially that applied in the organisational domain. As a consequence, the term cybernetic has acquired a derogatory connotation that, arguably, has discouraged subsequent serious research into cybernetic ideas.

A possible reason for this is supplied by Morgan, who contends that cybernetics has largely been conceived of as a technique rather than an epistemology. The latter “principally focuses on the role played by information in processes of self-regulation and control...and replaces the mechanical principles of classical theory within an image of a network of relationships in which part and whole are mutually defined” (Morgan, 1982,522), a conclusion shared with Pickering (2010). Morgan claims that this raises a major paradox; that the use of a cybernetics as a technique can violate the principles of cybernetic epistemology. This is a view that resonates with the findings of the analysis above.

Thus, Lowe and Puxty state that “despite Hofstede’s misgivings there is no poverty of management control philosophy. Open systems approaches to organisations are fruitful; cybernetics in not merely a matter of negative feedbacks (as Hofstede seems to imagine) and the understanding we already have of organisational processes, although certainly still fragmented, is sufficient to give the beginning to a new route that is still unmapped by Anthony” (1989,24) .

6.3 A systems critique of cybernetic research into organisations

The application of the cybernetic model to social systems has been subject to criticism from outside the systems science community.

Stacey (2003) expresses the view that cybernetic systems cannot learn, and Amey (1986) accuses Beer of exclusively focussing on feedback controls. Neither of these criticisms stand up well to scrutiny; large parts of Beer’s work, in particular, is devoted to developing cybernetic models of learning (e.g. the algenode) and feedforward (S4). Checkland also questions the rigour of Beer’s logic and scholarly standards (Checkland, 1980) and von Bertalanffy took issue with what he saw as the failure of cybernetics to deal with systems open to energy and matter (Bale, 2005). These issues have already been addressed in the preceding section of this chapter. Different challenges, however, emanate from workers in other strands of social systems science, and it is to those we will now turn. In addition, there have been questions raised about the scientific status of Ashby’s Law of Requisite Variety (1957), upon which the edifice of Organisational Cybernetics is built.

6.3.1 The interpretative systems critique

The case against

Those working within the interpretative tradition hold the view that a system, at least within the domain of social organisations, is not a real world phenomena; it is a social construction, a way of looking at the world, informed by the purpose of the observer. It is the role of the system scientist to expose the implicit models of the world that shape an individuals perceptions and actions – using a systemic methodology – in order to allow them to reconstitute a new model, which better serves the collective purposes of the social group of which they are part. The criticisms of Beer’s cybernetics from this quarter are twofold. Firstly, it assumes that systems are real world phenomena, that exist independent of observers; secondly, that the question of purposefulness is ignored. The interpretative position is that social systems are, uniquely, purposeful systems made up of purposeful systems (Ackoff, 1974).

Checkland, the creator of Soft Systems Methodology (SSM) is one who believes the view that Beer’s methodology is inappropriate since it assumes that systems are real world phenomena; instrumentalities (Checkland, 1986). The foundation of his methodology is Vickers work in appreciative systems (Vickers, 1967a) - the idea that it is people’s perception of the world that is systemic, not the world itself. Beer’s model therefore only has a role as a conceptual device to help people orientate their perceptions; it has no practical value in itself, independent of SSM. A social system is made up of self-conscious entities that are affected by predictions about themselves, which means that it is not possible to construct law like statements in the social domain. As a result, Checkland (1981) concurs with those who believe that the VSM, as a cybernetic model, belongs to a lower level in Boulding’s hierarchy of systems. Thus, while it is intuitively obvious that a hierarchy of system which are open must entail processes of communication if the systems are to survive (Checkland, 1981), “a typical management science model, constructed in terms of

multiple interacting feedback loops, even if complicated, is only a Level 3 model” (1981, 106).

Ackoff, another prominent systems scientist, believes that VSM is a Level 7 model in Bouldings classification. He terms it animalistic however, since it is derived from the human autonomic nervous system, and its shortcomings are a result of it being inappropriately applied to a Level 8 phenomena; a social system. A fundamental difference between these two levels is that a Level 8 organisation is a purposeful system - that is one capable of exercising choice about outcomes - made up of purposeful systems (human beings), whereas the organs of a human being (at Level 7) do not have free will. Ackoff and Gharajedaji (1996) argue that the misuse of models in this way has been widespread and damaging to the study of social science. In the past, mechanistic models were applied to social systems (e.g. in Fords production system) but they fall down when (unspecified) interaction between the parts is required. They also characterise Forrester’s System Dynamics models as mechanistic. The animate model, represented by Alfred Sloan’s conception of General Motors divisionalised structure and the VSM of Beer, fail when the exercise of free will by the parts (people) becomes important. They go on to argue for a social systemic model that is democratic, based on an internal market, a multidivisional organisation structure using interactive planning methodologies and a decision support process that facilitates learning and adaptation (Ackoff and Gharajedaji, 1996).

Evaluation

The core of Checklands (1981) criticism of Beer’s work is that it is functionalist; it assumes that systems are real world phenomena and that it is possible and desirable to intervene in them to improve real world affairs. There are those within the Organisational Cybernetics community (Anderton, 1989) that argue that is too narrow a view of the VSM. Because it helps people organise their perception of the world, it can be used within the hermeneutic tradition. The central position of Ashby and Beer is, however, a functionalist, one, at least in the sense that the primary objective of the scientist is to understand the world with a view to helping systems work better. They would also concur with the ontological position of interpretivism;

that a system is not a real world phenomena, to the extent that our comprehension of a systems is based on the selection of variables; a system as such does not exist in the real world, independent of the observer (Ashby, 1952).

But, for Ashby in particular, a scientist is a particular sort of observer; one whose purpose is to discover invariances in the world, and therefore the process of selection – the creation of a system – is done with the objective of being able to extract knowledge about the world that has some predictive capability, and so is useful. They would not claim to be able to explain everything about every situation; our sensory capabilities are constrained, our intellect limited and real world variety infinite, so reality is ultimately unknowable. The goal of science is to isolate those elements of any situation (within a prescribed set of situations) that are not unique, because they are an expression of a fundamental characteristic of organised relationships; a law. Specifically, the phenomena of focus in this thesis (i.e. money), and its purpose (to identify the characteristics of effective control systems), leave relatively little scope for multiple, mutually irreconcilable, interpretations of reality, so a functionalist methodology is appropriate. There is also little justification for Checkland labelling Beer's work as Level 3 system, on the grounds that it is based on the notion of feedback loops. From Ashby onwards, cyberneticians have regarded the notion of feedback loops in the conventional sense, unhelpful to the study of systems above a certain level of complexity. Also, because feedback – circularity in relationships – is so ubiquitous in nature, in systems from metabolic pathways through to complex economic systems, very little scientific endeavour would ever qualify for promotion from Level 3 if we were to apply Checkland's criteria.

Beer himself recognised that the use of the human nervous systems as a model for social systems had its limitations: the fact that “the units of the body politic are themselves self-conscious” is “a weakness in our model” (Beer, 1981,161). But, if you accept Beer's notion of scientific analogising, this lack of a one to one correspondence does not deal a fatal blow to the endeavour; indeed it is not surprising. The process of building a scientific model in this way is an iterative process, involving the progressive elimination of those elements of the analogy that are irrelevant, unhelpful or inappropriate, preserving what is of value. But, the legitimacy of VSM does not rely entirely on Beer's scientific analogising approach.

While, in *Heart of the Enterprise* the neurobiological provenance of the model is acknowledged, the VSM is build up independently, from cybernetic first principles, without recourse to analogy.

Whilst Beer is sceptical about the whole notion of purpose (1979), (which he regards as an ex post rationalisation of behaviour as observed and interpreted by an independent agent) the psychological dimension is not absent from his work. For instance, the VSM explicitly places self-consciousness (the ultimate example of the self referential nature of systems) and its emergent quality, identity, in System 5. The VSM as articulated in *Heart* and subsequent work, is founded squarely on the principle of recursion; that every viable system is comprised of viable systems to infinity. All these systems exhibit organisational closure, which may or may not be expressed as self-consciousness or free will in the sense that we understand it as human beings. Whether or not free will (in other words a high degree of autonomy) exists is “a computable function of systemic purpose as perceived” (Beer, 1979,158). As a result, Beer sees no fundamental distinction between purposeful and animalistic systems. Indeed, he argues that the expressions of free will characterises cybernetically sound social organisations such as national governments. This is clearly demonstrated in his work with Allendes government in the early 1970s in Chile; Allende famously characterised Systems 5 as el Pueblo – the people. It also explains why, despite being derived from an animalistic model, the VSM displays most of the characteristics of the social systemic model that one of his critics advocates as an alternative (Ackoff, 1993).

In conclusion, most of the criticisms levelled against the VSM from the interpretative tradition arise because these different strands of systems research start from a different ontological premise. It is not possible to prove or refute the criticism made, because there is no definitive answer to questions such as do systems exist or are they simply a convenient way of conceptualising the world? This does not invalidate Beer’s work. Ultimately, its legitimacy as a conceptual tool rests upon its ability to demonstrate its usefulness in the real world.

6.3.2 The critical systems critique

The case against

The interpretative perspective criticises the cybernetics of Ashby and Beer on the grounds that it does not reflect the way that the social world is. Detractors from a Critical systems background argue that it is the product of amoral technocratic reasoning, which pays insufficient attention to the way the world ought to be; it emphasises stability rather than change (Ulrich, 1983).

Although he was not alone (Grosch, 1973, Hanlon, 1973), the most strident critic from this quarter is Ulrich (1981), who regards Beer's scientific work as archetypal of many failures in the application of systems ideas to the social domain – it has absorbed theory but has not grounded it in critically reflective (moral and political) considerations. Ulrich recognises that, because it is based on biological rather than mechanistic logic, the VSM represents an improvement on earlier forms of cybernetics. But, he argues, it is flawed because it is aimed at achieving intrinsic control rather than supporting intrinsic motivation (in pursuit of purposefulness). As a result it is, or can be, used to support an authoritarian style of management. Other critics (Flood and Jackson, 1991, Jackson, 2000) argue that the defining feature of organisations are individuals who perceive, attribute meaning and act based on personal perspectives and motivations and that by failing to assimilate this important dimension of organisational life the VSM does not facilitate the process of negotiation between different viewpoints and value positions (Jackson, 2003) . Zeleny also takes issue with what he sees as the “multilayered hierarchies of command, large staffs, bureaucracy, overspecialisation, centralised data and information systems, complex control and accounting systems, rigidity, singleness of purpose, dedicated technology and challenger type organisation” of “variety engineered organisations” (1986,2). He goes on to argue that “our human productive systems do not need to be further regulated, controlled and engineered, just the opposite, they have to become freer, more autonomous, more flexible and more innovative.” His conclusion is that the picture Beer paints is “not ethical or desirable” (1986,2).

Evaluation

Ulrichs criticism (1981) was based on a Kantian distinction between Practical and Theoretical Reason; i.e. between what is and what ought. Beer's perspective is that of a scientist in the tradition of Hume; the VSM is a description of what is – the necessary and sufficient conditions for a viable system; what all viable systems have in common. He argues that there is no moral dimension to knowledge per se; regulatory finesse can be used for good or ill. He repeats his view that purpose is an anthropomorphic concept; "I worry about imputing any purpose to a system other than what it does"(Beer, 1983,117) .Having eschewed any obligation to pursue an ethically motivated approach to generating knowledge, it is clear (from Beer's work in Chile, *Platform for Change, Designing Freedom*) that he believed that democratic, decentralised organisational models are an outcome of applying sound cybernetic reasoning. Moreover, he believed that scientists such as him had a very strong moral duty to *use* knowledge in an ethically responsible manner. This view is corroborated by Jackson (1989) amongst others who, for this reason, label Beer's work with the VSM structuralist rather than functionalist and Team Syntegrity (a model to facilitate democratic social decision making, placed by Beer at the interface of S3 and S4) as part of the critical systems stream.

In reviewing the criticisms of Beer's work from this quarter Pickering (2010) concludes that, whilst it is fair to label much of it as technocratic, much of the comments demonstrate a denatured understanding of the VSM. In addition, there is an irreconcilable difference in the epistemology of Beer's cybernetics and that of the Critical Systems tradition. To the extent that the apparatus of control developed by Beer in Chile could be applied to social ends other than those intended (i.e. for repression) he is open to the charge of political naiveté. There is, however, nothing inherent in Beer's cybernetic approach to justify the charge of authoritarianism.

6.3.3 The validity of Ashby's Law

The case against

Another criticism levelled at those seeking to apply cybernetic ideas to social organisations, is that Ashby's Law of Requisite Variety (1957) – upon which much of it is based – is either trivial, inappropriate or an invalid scientific concept. For example, Checkland regarded the LORV as unexceptional and not a law of nature (Checkland, 1980) Can a trivial algebraic property be extended into successful regulation of the most complex social domain of human interactions? Zeleny asks (1986,244). In support of this view, Zeleny cites Wiener and Ashby as being sceptics – only their interpreters made the arching leap which the founders (of cybernetics) never cared to make. This is, however, based on a very selective use of material; both men devoted a considerable amount of their time to advocating and exploring the implications of cybernetics in the social affairs (Ashby, 1958b, Ashby, 1957, Wiener, 1954). If the claim that cybernetics is to be validated cannot be applied in the social domain, it must rest, not on selective quotation from authorities, but upon the argument that Ashby' Law (1957) is either false or that social phenomena are, in some way exempt from its strictures. The work of Winther (1985) is important in this regard; even though the work was unpublished it is influential, since Winther was a pupil of Ackoff ,who promoted his views.

Winther's argument (1985) runs as follows:

1. Ashby's Law (1957) is a deductive system, i.e. a theorem rather than an empirically derived law.
2. The concept of variety is structural, i.e. not teleological, since it relies only upon the observer's power of discrimination.
3. Therefore the law is either tautological, since its conclusions are a simple reformulation of its premises, or wrong, because it does not recognise that an observers purposes inform the process of selection of variables and therefore the concept of variety.

He also takes issue with the fact that, because it is a deductive system, it cannot be meaningfully tested; in Ashby's own words- it owes nothing to experiment. This means that as a result any meaningful evaluation of Ashby's Law (1957) has to be made not of the law as such – but pragmatically, by considering the extent to which its premises are relevant and adequate for one's purposes. Winther (1985) uses Ashby's demonstration of the LORV, using a two-dimension payoff matrix (see Appendix 4), to critique the LORV. He concludes that it assumes:

A. A simple goal seeking system and that the system only pursues one function.

Clearly this is too restrictive or outrightly wrong, since the one property that distinguishes human beings from machines is the former's ability to select goals.

B. The set of actions available to the system is fixed independently of the environment and known by the system.

C. The set of relevant possible states of the system's environment is fixed and known with certainty.

As a result, Winther (1985) believes that the premises of Ashby's Law (1957) are not relevant or adequate: "I contend that the Law of Requisite Variety is of little use in the design of social systems" he concludes.

Evaluation

Firstly is the LORV a deductive system, and if so, what are the consequences?

There is little doubt that it **is** a deductive system; Ashby (1957) was clear that as a result it applied to all systems whether they exist or not. It therefore has the same status as mathematics, another deductive system which, as Beer observed, no-one would ever accuse of being tautological. Providing you accept the axioms of the Law, and the deductive logic employed, it cannot be disproved; it can only be demonstrated to be more or less useful in explaining real world phenomena. In this respect, Bunge regards all General Systems Theory to be of this type; they are too general to be testable. Whilst they are not testable, he argues that "they are confirmed by being shown either to fit a whole family tree of specific theories (i.e. theories concerning specific systems) or by taking part in the design of viable

systems. The former may be called conceptual confirmation and the latter practical confirmation, and either kind differs from the usual empirical confirmation” (1977,683) .

So, for instance, Winther (1985) compares the LORV to Euclidean geometry; and: who would consider testing Euclidean geometry experimentally. Following Bunge’s (1977) logic, it cannot be experimentally tested directly; but it can be tested indirectly. Many empirical laws rest on the assumption of Euclidean space, and in so far as those laws are demonstrated to be valid, then the assumptions of Euclidean geometry must also be validated. Thus Newton’s Laws, and the edifice of classical science built on his foundations, are based on Euclidean geometry and only following Einstein’s work was it demonstrated that Euclid’s system did not hold in all circumstances and across all scales. Another example is Shannon’s information theory (Shannon and Weaver, 1949), which is also a deductive system closely related to the LORV (Ashby considered his work to be a generalisation of Shannons 10th Theorem). Information theory has not, and cannot, be experimentally tested directly, but much of what we have now come to call information technology apply Shannons theorems, and because such systems work in a way that is consistent with the theoretical predictions, Information theory is taken to be validated. Winther’s argument (1985) that scientific laws can *only* be derived from empirical observation is therefore unsound. Deductively derived laws, provided they are empirically validated, are no less legitimate than those derived from empirical observation.

Winthers second criticism (1985) of the LORV rests upon an incomplete understanding of Ashby’s work. He did not, as Winther (1985) claims, exclude the observer and his/her purpose from the definition of variety. “Any material system contains an infinity of variables and therefore of possible systems” Ashby says “The world around us contains only certain facts that are capable of guiding transformations that are closed and variable” (1957,39) and, in his view, it is the scientists job to isolate the correct variable in such a way that such prediction are possible. He illustrated his view by describing how Newton, when studying the action of pendulum, chose to ignore many characteristics of a pendulum (e.g. colour), and found that in order to explain its behaviour (his purpose) he observed he had to create a new variable, i.e. angular velocity (Ashby, 1957).

Finally, in criticising the premise upon which he believes the LORV is based, Winther (1985) is guilty of confusing the device that Ashby used to illustrate the operation of the LORV with the phenomena that the LORV sought to explain. Ashby (1957) used the two-dimensional pay off matrix as a simple scientific model to illustrate how the Law operates; it does not in any way define what phenomena the Law seeks to explain any more than Galileo's experiments with inclined planes and balls means that findings can only be applied to inclined planes and balls with similar properties. Ashby clearly states that the logic implicit in the matrix applies to variables with any degree of complexity, including compound targets and that goals need not be of any particular form (Ashby, 1957). Similarly, the set of actions need not be fixed, nor need they be known – indeed it is likely that they will not be (as evidenced by the Chapter on Markovian machines in Ashby's *Introduction to Cybernetics* (1957)) and therefore regulation will always be less than perfect. By using the payoff matrix, Ashby was simply seeking to demonstrate, logically, that the variety of the regulator could, *under no conceivable circumstances*, be less than the variety of the environment divided by the variety of the goal. Nor, as Winther claims (1985), did Ashby assume that the state of the environment is known and fixed. Indeed, to have done so would have made no sense given the phenomena that Ashby was seeking to explain - ultrastability – the ability of a system to respond to perturbances in *a way for which it has not been designed*.

In conclusion, Winther's arguments (1985) do not amount to a repudiation of Ashby's Law (1957). They do present a challenge, however. The repudiation of Winther's arguments does not prove that Beer and others are right to apply Ashby's law to the design of social systems; empirical validation is required. This can be done either by demonstrating that prediction made using cybernetic models are consistent with a body of existing knowledge, or that they are validated pragmatically by demonstrating that they work in practice. What is clear is that the LORV cannot be unilaterally dismissed as tautological, wrong, or too trivial to be of use.

6.3.4 The systems critique - conclusion

Whereas most of the criticisms levelled against the cybernetic paradigm from management control researchers are based on an inadequate understanding of the cybernetics developed by Beer and others, the criticisms from within the systems science community largely emanate from their different perceptions of social reality and the role of scientific enquiry. In that sense they are incommensurable. On the other hand, Beer's work sometimes defies attempts to force it into a neat epistemological box; as Harnden and Espejo note (1989,443) his work often "disappoints positivists and annoys phenomenologists". Arguably, the subtlety and versatility of the model supports the case for using the VSM to investigate the complex and many faceted phenomenon of organisational control.

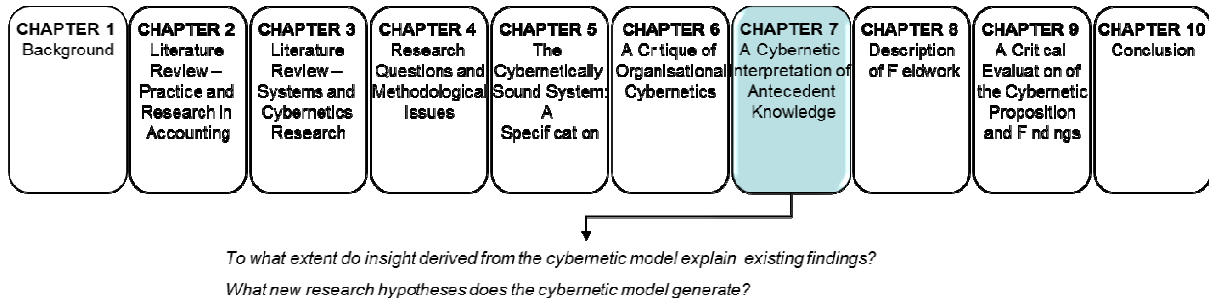
6.4 Overall conclusion

Cybernetics has suffered as a result of being associated with the conventional, and in the eyes of some, discredited Management Control System paradigm. In particular, many academics understanding of cybernetics extends no further than simple first order feedback systems of the sort used in control engineering. This may account for the fact that cybernetics has made so little impact on the field. Where the work of Ashby and Beer is acknowledged by management control researchers there often appears to be a failure to appreciate the subtlety of their ideas and recognise that much of their own tentatively advanced diagnosis of organisational ills and cures are consistent with the models promoted by Organisational Cybernetics. This may, in large part, be the result of the paradox that the use of cybernetic technique, in isolation, may be inconsistent with cybernetic ontology and epistemology. His academic ostracism of cybernetics has been compounded by criticisms from within the systems science community that have their root in differing ontological and epistemological perspectives, rather than any fundamental disagreement on the science.

In conclusion, there is no obvious *a priori* reason why a cybernetically based model should not be applied to the design and diagnosis of FPMS, but the usefulness of

this approach has to be empirically validated. Following the correspondence principle, this requires that we demonstrate that its predictions are consistent with existing knowledge in the field and that it is capable of generating new hypotheses, which are themselves capable of empirical refutation. This is the subject of the next chapter.

7 A Cybernetic Interpretation of Antecedent Knowledge



7.1 Introduction

The aim of this thesis is to determine whether a model for FPMS based on cybernetic principles is capable of providing a robust intellectual framework to guide academic research and the design and diagnosis of real world systems and practice. To test the validity of the argument, we need to assess the extent to which the CSS specified in a previous chapter satisfies the correspondence principle. This states that any new theory, if it is to be entertained as a potential contribution to existing knowledge, needs to demonstrate that its predictions are consistent with extant knowledge and that it is can generate novel hypotheses capable of validation (refutation).

This chapter comprises four sections:

- Section 1 develops a set of hypotheses based on cybernetic principles.
- Section 2 the predictions of the cybernetic model that will be tested against the findings of researchers working in the Contingency Theory field.
- Section 3 determines the extent to which cybernetic hypotheses are supported by other management control research.
- Section 4 examines the resultant research opportunities and challenges.

7.2 Section 1: cybernetic hypotheses

The CCS developed in Chapter 5 employs a wide range of cybernetic concepts, a number of which warrant further academic attention. However, pre-eminent amongst these concepts is Ashby's Law of Requisite Variety (1957); the defining characteristic of a cybernetically sound model of regulation is that it has requisite variety. Ashby's Law states that, if a system is to be viable, the net variety of the regulator and its goal set (which collectively we will describe as the control system) must be at least as great as that of its situational variety; the range of perturbations in that subset of the total environment relevant to the system. We can develop a set of generic hypotheses, or propositions, based on Ashby's Law. The first two treat the regulator as a dependant variable:

Proposition 1: high situational variety will tend to be associated with high regulatory variety.

Proposition 2: low goal set variety will tend to be associated with high regulatory variety.

High situational variety may take the form of a fast changing, turbulent or unstable external environment. But, since CSS also have to regulate the internal environment of the system, it could also be manifest as flexible, autonomous or undisciplined organisational elements operating in different markets or geographies. Whether the situational variety is external or internal to the system, the regulatory challenge is the same; the regulatory repertoire needs to be capable of matching the moves (variety) of the situation. In other words, the regulator needs to have sufficient flexibility – requisite variety.

If, however, the goal set has very high variety, the regulatory flexibility does not need to be as great, which brings us to the second proposition. In fact, an extreme case (e.g. if the goal set was comprised of very wide limits attached to a single variable) the regulator would not need to be very flexible at all, even if the variety of the situation was high. In practice, however, most organisational systems have target values attached to many variables, and they are often specified in low variety terms

(e.g. as a single point value). In the MCS literature, low variety goal sets are often describes as being tight. All other things being equal, the tighter the goal (the lower their variety) the more flexibility (higher variety) demanded of the regulator.

Contingency Theory, upon which much MCS research is based, assumes that control system characteristics are a dependant variable – a product of its environment, in the particular environmental uncertainty with which it has had to deal (as pointed out by de Raadt (1987a) Jackson (2000) and Puxty (1993)). In this respect, Contingency Theory is a weak form of Ashby's Law – a fact of which most of its practitioners are ignorant. If Ashby's Law held, we would thus expect to see our two propositions confirmed by the findings of contingency research except where the research methods used were inadequate, perhaps as a consequence of being framed in the absence of a rigorously defined theory. This proposition is examined in Section 2. However, Ashby's Law allows us to construct at least four other propositions where the control system is treated as an independent variable.

Proposition 3: inadequate control system variety will tend to be associated with manipulation of the formal system.

Proposition 4: inadequate control system variety will tend to be associated with high levels of personal stress.

Proposition 5: inadequate control system variety will tend to be associated with organisational failure.

Proposition 6: adequate control system variety will tend to be associated with good, stable performance.

Note that all these propositions are expressed as tendencies. According to Ashby's Law (1957), if there were no such tendency the system concerned would be incapable of surviving. Unlike in the natural environment, where evolutionary pressures are strong and time scales long, it is possible for systems to survive with less than optimal regulatory systems, particularly (in a commercial environment) if competition is weak, or (as in the case of a public enterprise) if a system had some form of external help - life support. If, however, the control system variety is inadequate, then, at the very least, the operation of Ashby's Law would lead us to

expect to detect patterns of dysfunctional behaviour, i.e. that which is at variance with the espoused purposes of the systems or the prescribed regulatory processes. This is often referred to as control games in the MCS literature.

The pathologies could take a number of forms. If the regulatory system variety were deficient, we might expect actors in the system to attempt to restore the variety balance by informal means (Hypothesis 3). This could take the form of ignoring or circumventing the strictures of the formal system, creating organisational slack (both of which increase regulatory variety) or it could involve negotiating looser goals (higher goal set variety). These acts may subvert the internal formal system, but in extreme cases such behaviour could be at variance with the external regulatory framework, i.e. involve breaking the law. Alternatively, if cybernetic balance (as defined by the LORV) could not be restored, by fair means or foul, individual actors could experience role conflict (Hopwood, 1976). This comes about because being a good employee involves two irreconcilable sets of behaviour – meeting targets and adhering to the rules set out in the formal system. This, we hypothesise, could manifest itself in high levels of personal stress (Hypothesis 4). Since behavioural phenomena are treated as a dependant variable, these two propositions are consistent with the line of enquiry adopted by the workers in what we have termed the psychological stream of MCS research.

In Section 3 we will assess the extent to which findings from the psychological stream of research corroborates cybernetic propositions three and four. We will also determine to what extent MCS research supports or refutes the final two cybernetic propositions (numbers five and six), where system performance is the dependent variable. Firstly, a chronic lack of cybernetic balance will ultimately manifest itself in system failure (Proposition 5). This may take the form of complete breakdown (e.g. bankruptcy) or the loss of independence (e.g. being taken over), but could equally be manifest in an inability to consistently maintain the state of the system within its goal set, short of complete failure. Conversely, a system with requisite variety should, according to the final cybernetic hypothesis, demonstrate consistent performance; that is, the value of the variables that matter should be held stable, within an acceptable range, irrespective of the degree of turbulence in the environment (Hypothesis 6).

As the first step in determining to what extent our cybernetic FPMS model meets the requirement of the correspondence principle, the propositions defined above will be mapped against extant research findings, in the following way:

1. Where possible, identify an independent summary of MCS research as a source. The reasons for doing this, rather than referring back to the original studies, are twofold:
 - a. To avoid selection bias; the risk of selecting those studies that support a particular point of view.
 - b. Logistical; the volume of literature is enormous. For instance, Chenhall (2003, 2007) cites over 250 papers in his review of Contingency Theory based MCS research.
2. Assess the degree to which the summarised findings are consistent with the six cybernetic propositions advanced.
3. Determine to what extent a cybernetically grounded theory does, or could, address the recognised weaknesses in MCS research.
4. Identify those cybernetic propositions that have not been empirically tested, in order to inform the next phase of research.

7.3 Section 2: cybernetic proposition 1 and 2: Contingency Theory

This section draws heavily upon Chenhall's recent comprehensive and authoritative analyses of Contingency Theory research in MCS (Chenhall, 2003, 2007). In these he sets out 23 propositions that summarise the findings to date. They are organised around seven Contingent Factors. We will consider each in turn.

7.3.1 Contingent factor: the environment

Contingency Theory originated in organisational theory. The basic proposition is that there was no universally appropriate form of organisation; it is, instead, dependant on the nature of the organisations environment, particularly the level of uncertainty

with which it is faced. The concept of uncertainty continues to play a central role in the thinking of MCS researchers to this day (Chapman, 1997), (Hartmann, 2000).

According to Chenhall (2003, 2007), MCS research supports three findings in this area:

1. The more uncertain the external environment, the more open and externally focussed the MCS.
2. When tight financial controls are used in uncertain environments, they are associated with the simultaneous use of flexible, interpersonal interactions.
3. The more hostile and turbulent the environment, the greater the reliance on formal controls, including traditional budgets.

Although it is not entirely clear what open and externally focussed mean in this context, it is not unreasonable to equate this to high variety and, as a result, conclude that first finding is consistent with the first cybernetic proposition. The second finding is consistent with the third proposition. It appears that the lack of variety in the formal control systems has been compensated for by informal means, as we have predicted. The third finding is more problematical (as it is for Chenhall (2003, 2007)); not only does it appear to contradict one of the fundamental assumptions upon which Contingency Theory is based, it also appears inconsistent with some of the other findings.

Perhaps the answer to this conundrum lies in the use of the word hostile to describe the environment. Arguably, this is not a quality of the environment per se, it is more a function of the organisation. So, for example, for a buggy whip manufacturer, the invention of the internal combustion engine contrives to make the environment hostile, but for a prospective automotive manufacturer the environment is full of opportunity, and for an organisation with a low variety control system, any form of environmental turbulence is hostile. From a cybernetic perspective, there is a world of difference between environmental turbulence that creates a challenge to adapt – to create new variety – and environmental turbulence that threatens to drive the values of essential variables outside physiological limits, and so threaten its viability. In the latter case, cyberneticists would expect an algedonic signal to alert System 5

to the imminence of the danger and so trigger a change in management mode, akin to fight or flight in animals (which involves suppressing those responses that are not directly relevant to the task of dealing with the perceived threat). In summary, it is clear that the notion of hostility is not a quality of the environment, but a function of the interaction between the environment and the system.

Chenhall (2003, 2007) acknowledges that Contingency Theory research has suffered from the lack of consistency and clarity in the use and description of environmental features. The concepts used by researchers include turbulence, hostility, diversity, complexity, dynamism, controllable/uncontrollable and ambiguity. He concludes: the application of a single valid and reliable measure of environmental uncertainty would assist in comparing the results of studies and help build a coherent body of knowledge on the effects of this variable on MCS design. Arguably, the cybernetic concept of variety might fulfil this role, though measuring variety poses a challenge. There has been only one study in the field that has attempted to measure variety directly, (De Raadt, 1987b) and this claimed a positive link between environmental and control system variety.

7.3.2 Contingent factor: technology

In our cybernetic model, the regulator does not respond directly to environmental perturbances, but to changes in the operational system that such perturbances may bring about. The way in which the operational system (i.e. the internal environmental) responds to changes in exogenous variables is therefore important for regulation. The nature of the technology employed by an organisation is one factor that shapes the nature of the internal environment.

Chenhall (2003, 2007) identifies three findings pertaining to technology and MCS that have been validated by researchers in the field:

1. Technologies characterised by standardised and automated processes rely more on traditional MCS (including budgets) and there is less incidence of slack.

2. With higher task uncertainty, there is less reliance on standard operating procedures and accounting performance measures, but higher incidence of participation, broad scope MCS and greater use of personal controls such as clans control.
3. Higher levels of process interdependence are characterised by the use of more informal controls, more frequent interaction and greater use of aggregated and integrated MCS.

All three propositions are consistent with cybernetic proposition number 1, which by referring to situational variety, can be applied to the regulation of any kind of variety, exogenous or endogenous. The third finding suggests a way of dealing with variety emanating from an internal source – task interdependency- a situation that justifies the need for a System 2 type co-ordinating functionality. Chenhall (2003, 2007) identifies three factors associated with technology that influence the design of MCS: complexity, task uncertainty and interdependence. Cybernetic researchers would recognise simply as different manifestations of variety.

7.3.3 Contingent factor: contemporary technologies

MCS research over the last 20 years has generated a set of findings relating to the use of advanced technologies, such as Just In Time (JIT), Total Quality Management (TQM) and Flexible Manufacturing (FM). Chenhall (2003, 2007) summarises these findings thus:

1. TQM is associated with broadly based MCS, which are flexible, non-financial and interactive.
2. The relationship of enhanced technologies and non-financial performance measures depends upon the degree to which they feature in compensation and incentive packages.
3. JIT and FMS are associated with the use of informal controls and non-financial performance measures.
4. FM is associated with the use of informal integrative measures.

5. Supplier partnerships are associated with non-financial measures, informal meetings and widespread interaction.

From a cybernetic perspective, the issue of whether a technology is advanced or contemporary is irrelevant. Novelty is a superficial matter – what is more important is the variety engineering considerations. Most of the advanced technologies originate in the practices developed in Japan since the Second World War, which were heavily influenced by the prophets of the Quality movement; men such as Deming, and Juran. According to this philosophy, the overarching aim of manufacturing (and by implication any other form of process) was to produce product of the highest possible quality, that is with the minimum amount of (unwanted – by the consumer) variation from piece to piece. In turn, this requires minimising wasteful variation in the upstream conversion processes (including waste in the form of stocks). In the language of variety, this requires engineering variety out of the product and the process that, according to Ashby's Law (proposition 1), requires a regulator of very high variety. Again, from a cybernetic perspective, the nature of the mechanisms used in regulation is irrelevant, however, it is clear that broad scope and informal mechanisms have a higher variety than formal financial mechanisms (Waelchi, 1989). It is interesting to note, that while engineering the variety of the environment is usually not an option open to the regulator, this appears to be what is done in practice – as evidenced by proposition 5.

All of the empirically derived findings from contingency based MCS research in this area can taken as corroboration of a single cybernetic proposition– with one exception. Finding number two identifies a link between incentive pay and the successful introduction of new technology. Without understanding the exact nature of the schemes used, and therefore their variety engineering implications, it is difficult to draw any conclusions. For instance, incentives are commonly attached to an output variable in a way that serves to reduce the variety of the goal set (by making people intolerant of deviations from the goal set, for instance), but it is conceivable that they could be used to encourage the use of non-financial performance measures, which would increase the variety of the regulator, with exactly the opposite consequences from a variety engineering perspective.

7.3.4 Contingent factor: organisation

Chenhall (2003, 2007) lists six findings:

1. Increasing size, diversity of organisation and increasing technology are associated with more decentralised organisational forms that make more use of formalised MCS processes.
2. Research and Development tend to make more extensive use of participative budgeting methods than marketing; who in turn use broader scope MCS than production.
3. The use of participative budgeting is associated with a decentralised organisation and a consideration (as opposed to initiating) leadership style.
4. Aggregation and integration of MCS are associated with decentralisation.
5. Team based structures are associated with participation and the use of comprehensive performance measures for compensation.
6. Organic organisation structures are associated with the perception that future orientated MCS are more useful, and with effective implementation of activity analysis.

Early contingency theorists postulated a clear set of relationships between the environment, organisational structure and management control, but this clarity is apparently not manifest in the findings of MCS researchers. For instance, Burns and Stalker (1961) suggested that an organic organisational structure would be better suited to an uncertain environment than a mechanistic one but, Lawrence and Lorsch (1967) suggest, such increased differentiation (autonomy in cybernetic language) would require sophisticated (high variety) mechanisms to achieve integration (coordination). However, finding number one suggests that formalised controls may be associated with decentralisation; a finding that appears to contradict Lawrence and Lorsch's (and cybernetic) hypotheses, but also elements of other research findings (findings three, four and five).

Chenhall (2003, 2007) suggests a number of reasons for the apparent incoherence in the findings. Measuring structure is problematic. Also, it is possible that studies have focussed on the more tangible formal process and neglected the less obvious

informal mechanisms that may operate in parallel. The problem might lie with experimental design; are researchers indirectly measuring environmental qualities, as mediated through organisational structure? A cybernetic analysis would propose that structure and process need to be considered together as part of the organisational response to the environment and the requirement for viability; organisation is not an independent variable, as MCS researchers seem to assume. In addition, an implicit assumption in contingency research is that the existing arrangement represents an equilibrium situation i.e. an optimal organisational response. In fact, due to organisational inertia, the organisation may well have failed to adapt its processes and structure appropriately to changes and consequently be performing sub optimally.

In summary, while cybernetic propositions are consistent with the conjectures of early contingency theorists, MCS research has failed to validate or negate either, most likely because of weaknesses in research design. Chenhall (2007,181) concludes that “the ways in which MCS combine with elements of organisational structure to provide differentiation and integration within contemporary organisational structures provide many opportunities for worthwhile research. Particularly, there are few that have considered the fit between organic structures and MCS”. Cybernetic models could provide an appropriate theoretical framework to guide such research.

7.3.5 Contingent factor: size

Size is, most likely, positively correlated with situational variety (i.e. the variety of the internal environment), so, in line with cybernetic propositions one, we would expect, all other things being equal, to find high regulatory variety. This could take the form of increased self-regulatory capacity in the form of decentralisation, for instance, increased centralized regulatory capacity, or a mixture of the two. This is not inconsistent with the key findings of researchers:

1. Larger organisations are more diversified and have more formalised control processes.
2. Large organisations have more divisionalised organisational structures.

3. Larger organisations have more sophisticated and participatory control processes.

It is difficult to be more definitive, because researchers do not describe phenomena in a way that makes for easy inference to be made about variety. For instance, does formalised mean low variety. Often it does; detailed and mechanistically interpreted rules are very low variety. But the laws by which societies are regulated, for instance, are very formal but, in so far they legislate against extreme behaviour, they only minimally constrain behavioural variety. Conversely, a bank robber's instruction to staff: do not move a muscle or I will shoot you is informal, but low, variety. Also, Chenhall (2003, 2007) points out the measurement of size are problematic. Should we measure profit, turnover, assets or number of employees, for example? And, are any of these good proxies for variety?

7.3.6 Contingent factor: strategy

The MCS work on strategy is important because it recognises that the relationship between context and MCS is not deterministic. Managers can choose strategic posture, just as in the cybernetic model System 5 is required to make value judgements about, for example, the balance between adaptation and response. Like other contingency research, however, the search for archetypal combinations is based on an implicit assumption of equilibrium, and there are also definitional and measurement issues with the concept of strategy.

Chenhall (2003, 2007) identifies four key research findings in this area:

1. Conservative strategies (e.g. cost leadership) are more associated with traditional, rigid control such as budgeting than are entrepreneurial strategies.
2. Customer focussed and product differentiation strategies are associated with broader scope MCS and budgeting slack.
3. Entrepreneurial strategies are associated with both traditional, formal controls and organic decision making and communication.

4. Harvest and defender strategies use more formal measurement and targeting systems than prospector strategies, which tend to be more informal, open and subjective.

All of these findings are consistent with the first cybernetic proposition. Chenhall (2003, 2007) recognises that the apparent contradiction in finding number three could be because organic (i.e. high variety) systems are required to promote innovation, but tight control (low variety) to curb excess in implementation. Contingency researchers do not however, have a well-defined organisational model to explain why striking such a balance (between the here and now activity of Systems 1-3 and the out there and then System 4 in VSM terms) is important, and how it might be carried out (through the System 3/ System 4 homeostat overseen by System 5). As a consequence, contingency research is less well directed than it might be.

7.3.7 Contingent factor: national culture

Chenhall's (2003, 2007) summary is short and to the point:

1. National culture is associated with the design of MCS.

While there is a relationship, Chenhall (2003, 2007) concludes that there is little consensus about its nature. The fact that there is an effect is consistent with cybernetic theory, since the variety of the operational system (and its capacity for self-regulation) that the regulator needs to control will be affected by cultural characteristics such as power distance (acceptance of organisational authority), uncertainty avoidance (reliance on rules) and confusion dynamism (respect for tradition), to name three of the cultural values identified by Hofstede (1984). But, like many other organisational characteristics, there are enormous measurement problems, particularly, Chenhall (2003, 2007) believes, because it seems likely that other variables such as markets and technologies, may interact with culture in systematic ways to affect MCS design. This statement encapsulates one of the problems with traditional research methodologies that a systems-based approach seeks to avoid; the assumption that extraneous variables can be controlled for, or

ignored. Systems scientists believe that social systems are so interconnected and causally recursive that it is inappropriate to assume simple causality (as we do when we use a simple independent/dependent variable experimental structure) and therefore impossible to eliminate the effect of external factors. Indeed, if researchers were successful in isolating variables, they may change the nature of the phenomena that they seek to study.

7.4 Section 2: conclusion

It is clear for this review of the findings from over thirty years of contingency-based research that cybernetic propositions are not in conflict with antecedent knowledge in this field. The premise upon which the early organisational theorists based their work is consistent with Ashby's Law of Requisite Variety (1957), and much of the empirical work surveyed confirms, or is consistent, with these original propositions, and by extension cybernetic theory. Indeed, where there is confusion or vagueness in the findings, the use of cybernetic terms would be beneficial, a view supported by de Raadt (1987b). In particular, adopting the concept of variety would help to sharpen the definition of contextual variables, since researchers frequently use descriptive terms that are ambiguous and imprecise. Indeed, it is the failure of researchers to consistently and unambiguously define variables that prevents us from being more definitive in our conclusions about the extent to which extant research is consistent with cybernetic propositions.

Cybernetic theory is a good candidate for the integrating theory that many academics believe that contingency research lacks (Birnberg et al., 1983, Briers and Hurst, 1990, Otley, 1980, 1999). Because it is able to explain similar phenomena in a more parsimonious fashion, cybernetic theory satisfies Occam's razor. And because research methodologies using it do not rely upon assumptions of equilibrium conditions or unidirectional causality, and can be used to build organisational models to help test theory, there is a prospect of developing more powerful research approaches.

But, contingency work provides only partial validation of the cybernetic approach. It only addresses cybernetic proposition 1 – the relationship between contextual

variables (situational variety) and MCS flexibility (regulatory variety). In particular, we might have expected the hypothesised relationship between the tightness of goals and MCS flexibility to have been tested with contingency research, but the former does not seem to have been recognised as an independent variable.

7.5 Section 3: other cybernetic propositions

We will now examine the findings of MCS research that treat the control system as an independent variable. Firstly, we will determine the extent to which this corroborates cybernetic hypotheses three and four, which propose that inadequate control system variety will be associated with behavioural dysfunctions. Two difference summaries of MCS research in the psychological stream will be used to test these conjectures. Secondly, the evidence that exists to support the hypothesised link between control systems variety and organisational performance will be reviewed.

Two cybernetic propositions suggest a potential association of inadequate control system variety (high variety goals and or low regulatory variety) with stress and the creation of budgetary slack and other forms of illegitimate data manipulation. I will use Hartmanns review of RAPM literature (2000) as the source to investigate the former and Dunk and Nouri's budgetary slack literature review (1998) for the latter.

7.5.1 Proposition 3 and budgetary slack

Dunk and Nouri (1998), drawing on over 100 studies, found strong support for cybernetic proposition number four. Budgetary slack (and other forms of data manipulation) are strongly associated with task difficulty (low variety goal set in relation to the available regulatory variety) and task variability (high situational variety). They also identify many other factors that are positively correlated with this behaviour, including budget participation (necessary but not sufficient), risk aversion, motivational type, role ambiguity, need for control and the need for power. In

summary, there is strong empirical support for cybernetic proposition number three in the MCS literature.

7.5.2 Proposition 4 and RAPM

The large body of RAPM literature (Hartmann cites nearly 200 sources) sprung from dialectic between the seminal work of Hopwood (1973), and the subsequent challenge from Otley (1978).

The theoretical conjectures that informed Hopwoods work resonate with the reasoning underpinning the generic cybernetic hypothesis. He suggested that accounting performance measures (APM) are inadequate (too crude) for the management of a complex enterprise, and if they are rigorously enforced (through a budget conscious style of management) this will generate high levels of work place stress. In other words, APM do not have requisite variety, and if opportunities to inject variety by unofficial means are denied (because of a low variety management system), disagreement and role conflict will ensue. The fact that employees work in an interdependent environment, (where their variety is constrained by that of their co-workers) makes this situation even more intolerable.

Hopwood (1973) found empirical support for this hypothesis, but this was not corroborated by Otley(1978).. The subsequent debate by them led to furtheradditional research in an attempt to resolve this impasse, much of which involved searching for contingent variables that might explain this apparent contradiction. In Hartmanns opinion (2000), this research has failed to produce a coherent body of knowledge. There is strong empirical support for the creation of slack and data manipulation (i.e. cybernetic hypothesis four), but not for adverse psychological impact, even allowing for national culture, environmental characteristics, strategy, task, budgetary participation, interpersonal relations and personality factors.

There are a number of possible reasons for the failure to reach a definitive conclusion. One is that, in the absence of good theory, the hypotheses were poorly

specified. Secondly, the psychological theories that the hypothesis draws on are not themselves sufficiently robust; the relationship between context and stress is complex. Social systems themselves are also highly complex, so there are many methodological problems associated with the specification and measurement of variables.

7.5.3 Propositions 5 and 6

These two propositions suggest a link between cybernetic fitness (i.e. requisite variety) and performance. There is a dearth of research findings in this area. Chenhall (2003) suggests two reasons for this. Firstly, researchers have avoided the question altogether by implicitly assuming that the situation that they study represents an optimal equilibrium; a highly questionable assumption. Secondly, there are considerable methodological problems involved in defining and measuring performance, including:

- It is questionable whether phenomena such as the usefulness of information or job satisfaction can be used as proxy measures of performance, as some researchers have suggested.
- Self-assessment is a dubious way of measuring performance.
- It is difficult to specify what performance actually is. For instance, it may not be wise to assume that meeting targets represents good performance since this assumes that the target setting process is optimal; a notion that has been challenged by many academics.

There is one study that has set out to test this link. Burton and Forsyth (1986) sought to measure organisational variety using 14 proxy variables, corroborated by independent expert assessment, and claimed to have discovered a strong correlation with performance as measured by Return on Assets.

This is another area where a cybernetic formulation might be of value. In organisational cybernetics, success or performance performance is viability – the ability to sustain an independent existence. In order to do this, the system needs to

maintain essential variables within physiological limits, so a record of the behaviour of the essential variables over time may allow us to measure cybernetic performance directly.

7.6 Section 3; conclusion

As shown above, many doubt that an organised body of empirical work exists in the contingency area, but to the extent that there are corroborated research findings, they are consistent with cybernetic propositions three and four. On the other hand, there has been little work to test other cybernetic propositions, specifically those that propose a link between requisite variety and organisational performance.

A major reason cited for the failure of RAPM research has been the lack of good theory, and some (Chapman, 1997, Hartmann, 2000) have suggested that an appropriate source of theory should be based on the concept of uncertainty. There exists, it is suggested, an uncertainty paradox, which needs to be resolved; the fact that conventional accounting performance measures (based on budgeting) are least useful when they are most needed (in conditions of uncertainty when prediction is difficult). Hartmann suggests five avenues that uncertainty based RAPM research should follow, most of which could be readily formulated in terms of cybernetic terms, using the concept of variety. A consequence of the LORV is that the quality of regulation is constrained by information, and in Information Theory information is treated as a reduction in uncertainty (Shannon and Weaver, 1949). There is thus a strong link between uncertainty and cybernetic theory that could be exploited.

7.7 Section 4; research practice: issues and opportunities

The correspondence principle posits that, in order for it to claim that it advances knowledge, a new theory must make predictions that are consistent with existing laws and create new hypotheses out of sample, capable of empirical validation. Based on the evidence reviewed in the chapter, organisational cybernetics can make a reasonable claim to have satisfied this principle. Although, in common with many

other branches of social science, Management Control Systems research has failed to create law like statements of very general applicability, none of the findings contradicts generic hypotheses derived from cybernetic theory, and there are many instances of empirical corroboration. In addition, three out of the six propositions generated at the start of this chapter, (a small part of a potentially large set) have not been extensively tested.

In addition to suggesting new lines of enquiry, cybernetics could help provide the theoretical underpinning that MCS has lacked. The concept of variety enables some of the thinking behind contingency theory to be formulated in a rigorous and parsimonious way, and it addresses the need expressed by RAPM researchers for a theoretical construct based on uncertainty. It also offers the prospect of developing approaches to deal with some of the methodological issues that researchers have struggled with, such as the specification of variables, the definition of performance and complex causal relationships; few a priori assumptions about organisations and their nature are needed. Finally, it has already been demonstrated that cybernetic theory can be amplified into a complex, well-defined organisational model capable of being used as a precise research instrument and a basis for the design of real world systems.

Nevertheless, there remain a number of challenges facing the researcher wishing to fulfil the second condition of the correspondence principle by testing the new cybernetic propositions. These include:

- The definition of variables. What features of the environment, the organisational system and its output are relevant for the purposes of measuring variety? For example, how do we determine what constitute essential variables and their physiological limits? And, how do we define the measures of variety to be used?
- Measurement of variety is problematical. In particular, many aspects of the control system are likely to be intangible; aspects of cultural control, for example.

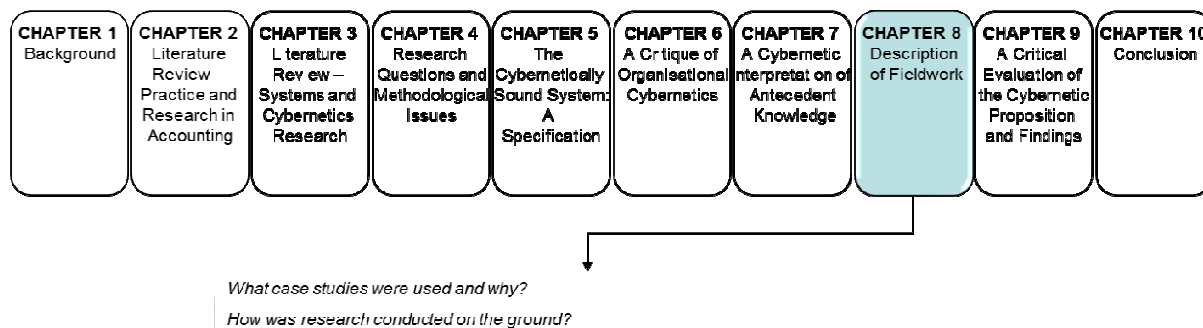
- Availability of data. Soft data needs to be collected using survey instruments designed for the job, and given the scope for multiple interpretations of subtle concepts like the variety of the control system, collecting data might require extensive researcher involvement. Even hard data, of a nature that meets the precise requirements of the researcher, may be difficult to come by.
- Control systems, and in particular their informal qualities, may change over time, or be context dependant.
- There are likely to be (unknown) time lags that interfere with the relationships between variables.
- How do we establish a causal link between control systems variety and organisational failure? Specifically, how do we disentangle proximate from underlying causes?
- What constitutes good performance, and how is stability to be measured?

The approach to fieldwork set out in the next chapter needs to take cognizance of all of these issues.

7.8 Conclusion

There is a good case for treating cybernetics as the underpinning for MCS research. Its predictions are consistent with the findings of both the Contingent and the psychological research streams, and it also suggests new research hypotheses that might be tested. Furthermore, a systems-based research model addresses a number of the recognised weakness in conventional research methodology, although adopting the proposed approach throws up a number of new challenges for prospective researchers.

8 Description of Fieldwork



8.1 Introduction

The objective of this chapter is to describe the process designed to test the plausibility of cybernetic proposition number six, consistent with the research approach outlined in Chapter 4. This proposition proposes that there will be a correlation between the performance of an organisation and the cybernetic soundness of the FPMS, the aim being to determine whether there is any evidence that will undermine the theoretical framework set out Chapter 5. The two qualities of organisational performance that are to be tested are relative performance (compared to an appropriate benchmark) and the stability of performance over time, since both (it is suggested) are qualities associated with the existence (or lack of) requisite variety of the organisations control systems.

8.2 Outline of the research methodology

In the last chapter, two cybernetic propositions were identified that have not been tested in the MCS literature, to date:

Proposition 5: inadequate control system variety will tend to be associated with organisational failure.

Proposition 6: adequate control system variety will tend to be associated with good, stable performance.

This stage of the research aims to test the credibility of the second of these propositions. To do so, two corporate subjects were chosen. The testing process involved:

1. Mapping the subject organisation against the VSM in order to make an initial assessment of structure, from a cybernetic perspective, and to determine key features (such as organisational recursions).
2. Assessing the cybernetic soundness of the FPMS using a research instrument based on the specification for a CSS FPMS (as described in Chapter 5). This is the independent variable in this study.
3. Quantifying the performance of the organisation and its stability over time in order to measure the variety of the controlled variables. This is taken to be the dependant variable. In the cross sectional study, the same analysis was carried out on peer group organisations.
4. Assessing the degree of correlation between the results of the assessment of cybernetic health of the organisation and its performance characteristics.
5. Determining to what extent the findings support or contradict the proposition.

Description of the mapping process

Although the diagnostic tool used to assess cybernetic health is clearly written, the cybernetic perspective on organisation is unfamiliar to most managers. Therefore, in order to help respondents interpret the questions in the research instrument, the main contact in both organisations participated in mapping their organisation against the VSM. Through this process they were helped to identify key cybernetic features, such as the number and nature of organisation recursions, what a System 2 channel looks like in their organisation and so on. The aim of this procedure was to promote a consistent and well-informed set of responses with minimal intervention from the researcher, with the attendant risk of introducing bias. Wherever possible, the result of the mapping exercise was cross-correlated with other sources.

Description of the research instrument

The research instrument (diagnostic tool) comprises a set of questions, one for each of the 34 principles set out in Chapter 5. For each question, respondents were asked to score the subject organisation on a scale of 1 to 5; the subject being their own organisation now or in the past, and/or a peer organisation with which they were familiar.

To help interpret the questions and ensure a degree of consistency, each question is supported by a statement that describes poor cybernetic qualities (Statement A), which we would expect to be given a low score, and one that describes good qualities (Statement B), which would attract a high score.

The research instrument covers all aspects of an organisations control system, potentially covering a number of recursions. Because of the nature and scope of the enquiry, the number of potential respondents (with the requisite knowledge) is limited. It is also not intended to be a survey instrument of the sort that is used to gather the views from a large population of subjects. Rather, it is a means of structuring a complex diagnostic case study inquiry, producing a concise summary of the cybernetic health of an organisation's processes with a view to corroborating propositions derived from the CSS model. It also provides a mechanism to enable analyses produced by different means or by different sources to be easily compared and triangulated; within method triangulation (Smith, 2003).

It is also likely that any single respondent may be unfamiliar with some features covered by the survey, or the features at different levels of recursion, or that some questions are deemed not applicable to the organisation. In these circumstances, respondents were asked to leave the question unanswered.

The scores from the assessment were then averaged under three headings: Structure, Information Management and Cybernetic Regulation, ignoring questions that were left unanswered. See Appendix 5 for an example of the research instrument and the instructions given to participants. Finally the scores from the different sources were tested against each other using Wilcoxon's non-parametric

test (Curwin and Slator, 2002) to determine to what extent the picture they painted of the cybernetic health of the organisation(s) differed.

8.2.1 Tests carried out on the performance characteristics of the organisation

The next step in the process was to identify a key performance variable(s). This should ideally comprise variable(s) that the organisation explicitly aims to control, that have a characteristic that is deemed to represent (good) performance, for example an increase in, at least x% or better than.

Next, as much time series data as possible was collected, for each performance variable and each organisation. Where the data is distorted by exceptional events that would otherwise compromise the analysis, these were adjusted for. The data was then smoothed using rolling moving totals, to eliminate seasonal effects and noise. Finally, the level of performance was assessed, relative to peer group organisations or to the performance of the subject organisation in the past. The following chapter details the measures and methodologies used, along with the rationale.

In order to quantify the stability of performance over time the standard deviation of results was calculated, using the conventional formula based on deviation from the mean value, but over a series of moving horizons. Calculating a standard deviation in a conventional fashion, using a single fixed horizon, fails to distinguish between variation (around a fixed mean) and trend (changes in the mean). The use of a series of moving averages allows us to largely eliminate the effect of trends in the data series without making any assumptions about the nature of the trends, and also to track changes in the level of variation. Thus meaningful comparisons can be made between organisations and over time.

8.2.2 Assessment of the results

To corroborate the proposition, the performance and stability results need to be shown to be significantly different – both better and more stable - to the comparators and be associated with high cybernetic scores. It is also important to demonstrate that:

- For any of the comparators, no variable exhibits the same performance characteristics. That is, that the perceived differences seen are not the by product of the organisation successfully controlling for other variables.
- There is no other credible explanation for the observed performance characteristics.

8.3 Subjects

The first subject of this research is Svenska Handelsbanken (SvH), a large universal bank, with an income of E3 billion and net assets of E216 billion. It is headquartered in Sweden but has retail banking networks in four other European countries. The second is Unilever Poland Foods (UPF), a local business unit (Turnover E300m) of the large Anglo-Dutch multinational business.

The reasons for this choice are:

1. The ability to negotiate access in both cases.
2. Both have distinctive performance management systems, which differ significantly to their peers and which are believed to be consistent with CSS FPMS.
3. The choice enables two different research approaches:
 - a. Svenska Handelsbanken has a long established and unique FPMS and a rich record of performance information. As a result, it supports a cross sectional study, based on a comparison with Nordic peer banks.
 - b. Unilever Poland radically changed its performance management .practices and structure within a very short period of time. This makes it

a good subject for a longitudinal study: comparing cybernetic fitness and performance characteristics before and after the change in practice.

8.4 First research subject: Svenska Handelsbanken

8.4.1 Background

Svenska Handelsbanken has a long history, having been founded in 1871. In addition to its retail banking operation, SvH now operates in the mortgage, insurance and capital markets (Kroner, 2009).

For most of its history, SvH was little different from peers. Like its Nordic banking competitors, in the 1960s it followed the trend to US style divisional organizations and performance management based on budgetary control. However, this changed at the end of that decade after it was hit by a corporate scandal that led to most of the Board being forced out. Subsequently, an ex academic econometrician, Dr Jan Wallander, was recruited from a small competitor to run the business (Hope and Fraser, 1998, 1999).

As well as being a respected research economist, Jan Wallander had served as a non executive director for many large Swedish companies before being asked to take charge of Sundvallsbanken, a small regional competitor to SvH. For many years, Sundvallsbanken had successfully operated with a very different management model to most of the rest of the sector. Having witnessed this at first hand, Wallander insisted that he had free hand to import the practices from Sundvallsbanken as a condition of taking the SvH job. And so, starting in the late 1960s, Wallander engineered a radical change in the way in which SvH was run (Wallander, 2003).

What is now known as the Svenska Handelsbanken model has a number of distinctive features (Kroner, 2009, Hope and Fraser, 1998, 1999):

- Extreme decentralization. Most of the decision-making powers in the bank are vested in the local branch.
- Flat organisational structure – there are only three levels: branch, region and corporate. There are few, small, central functions and they are designed to support local decision makers, not force central initiatives upon them.
- No traditional, fixed performance management processes such as annual targets and budgets. Instead, performance is compared to internal and external peers. In addition, extensive use is made of a range of performance management practices characterized by interactivity and informality.

The management model has been strengthened and deepened over the years, and it is perceived by the bank as a source of competitive advantage (Wallander, 2003). Indeed, insiders argue that their way of doing business is the reason why the bank has proved to be remarkable resilient. For example, SvH was the only Swedish clearing bank that did not need government support in the banking crash of 1992 – the result of the collapse of the asset bubble subsequent to the deregulation of the banking sector in 1989. More recently, only 3 of the 25 largest European banks avoided a similar fate in 2008/9. SvH was one (Kroner, 2009), the others being Spains BBVA and Deutsche Bank.

Although much publicized and studied, its management model has not been copied. Amongst the authors who have referenced the SvH model are:

- Jan Wallander, in his own two works *Budgeting: and Unnecessary Evil* and *Decentralization: Why and How to Make It Work* (Wallander, 1999, 2003).
- Hope and Fraser, the founders of the Beyond Budgeting Round Table, a cross industry research group dedicated to specifying and promoting an alternative management model to those founded on budgets and other forms of fixed performance contract. SvH was the main case study for their *Beyond Budgeting* book (Hope and Fraser, 2003) and has been the subject of a number of research reports (1998, Hope and Fraser, 1999).

- Kroner, a former investment analyst for the Nordic banking sector, whose book (2009) *A Blueprint for Better Banking* appeared subsequent to the latest banking crash.

Prior to completing the diagnostic questionnaire, three key sources assisted in the process of mapping SvH against the VSM: the former chief financial officer (CFO), Kroner and the current Head of Investor Relations at the bank. The former CFO has also independently validated all the responses.

8.4.2 Approach to fieldwork – cybernetic health

Three sources were used to populate the diagnostic tool.

A first assessment was compiled by the researcher using available published information and personal knowledge. This was amended and validated by the former CFO of SvH. The second was independently completed, using the same diagnostic tool and methodology, by the author of a book about the bank (Kroner, 2009) based on his extensive knowledge of the sector and interviews he conducted in the course of his research. His contribution included an assessment of the cybernetic health of peer banks. Finally, a set was completed by four SvH staff, one branch manager, one person working in investor relations and two from the personnel function. Two of this number has worked for other banks at some time in their career; the others have only ever worked for SvH. The output of this process was therefore seven independently derived assessments of cybernetic health, six for SvH, one for its peer banks. These were compared using Wilcoxon's pairwise test (Curwin and Slator, 2002) to determine to what extent they significantly differ in their assessment of cybernetic health.

8.4.3 Approach to the fieldwork – analysis of performance

The performance metrics chosen for analysis were Pre Tax profits (PTP) and Return On Equity (ROE), that is, pretax profits expressed as a percentage of shareholders

equity (net assets). ROE is a well-established measure of organisational financial performance. It is particularly appropriate for banks, since their primary goal is to generate a surplus on their investments, which (bad debt provisions aside) can be easily measured. When Wallander took over as Chairman, SvH explicitly adopted the goal of beating the average ROE of their Nordic Banking peer group (1999, Wallander, 2003) (SvH Annual Report 2008). PTP is the prime driver of changes to ROE, and is therefore a sensitive indicator of the capacity of the regulatory systems to absorb environmental variety.

Performance data (see Appendix 6) was collected from two sources. The first set of data was provided by an independent investment analyst of the Nordic banking sector (Bergoe of Fox, Pitt, Kelton (2009)). This data covers key metrics by quarter for all key Nordic banks for Quarter 1 Q1 2000 to Q2 2009. This data was adjusted by this analyst for exceptional events and one offs (such as acquisitions and disposals) that otherwise would have rendered comparisons invalid. Secondly, annual performance data were provided by Svenska Handelbanken itself, for 1989 onwards. This data had been adjusted by them for exceptional events and one offs, but had been subject to independent audit as part of the normal year-end reporting process.

Performance was analyzed in the following ways:

Test for stability:

The standard deviation of performance of all peer group companies was calculated over a moving 12-quarter period between Q1 2000 and Q2 2009 (27 data points), using Fox, Pitt, Kelton data.

Test for relative performance

The average ROE for 27 moving annual periods and for the entire time series was calculated.

Test for significance

The results were analyzed using two different non-parametric significance tests (Friedman's test, Wilcoxon's test (Curwin and Slator, 2002)) to determine whether we can assert that the pattern of results for SvH (or any of its peers) was different, statistically, to its peer group, in respect of variation, relative performance or both.

8.4.4 Second research subject: Unilever Foods Poland

8.4.4.1 Background

Unilever is a large Anglo Dutch multinational business (Turnover cE40 billion) primarily engaged in the manufacture and sale of detergents, personal care products, foods (including tea, spreads, mayonnaise, cooking sauces etc.) and ice cream (Anonymous, 2011). It has operations in most countries of the world, but entered Poland and the other countries of the former Eastern Bloc only in the 1990s.

Unilever's global category teams are responsible for large scale innovation across the world, but on a day to day basis the business is run on geographic lines. Poland is part of Unilever's European business group and is itself split into three profit responsible business units reporting to the national board of directors. They are:

Foods

Ice Cream

Personal and Home Care

In common with most Unilever businesses, senior and middle management is comprised of a mixture of local and ex-patriots.

For many years, Unilever has consistently delivered acceptable returns to investors, but its revenue growth has often lagged behind its peers, notably Proctor and Gamble, LOreal and Reckitt Benkiser in Home and Personal Care and companies

such as Danone and Nestlé in Foods. For this reason Unilever's shares have traded at a discount to its peers.

When Niall Fitzgerald was appointed the new Unilever Chairman in 1996 he made accelerating the growth of Unilever his number one priority. Subsequently, a new five year strategy was launched in 1999 (Path to Growth) and this was supported by a spate of management initiatives, organizational restructuring and acquisitions (such as Bestfoods, Ben and Jerry's and Slimfast) and divestments (e.g. the sale of the Chemicals business to ICI) (Cescau and Rivers, 2007).

In common with many Unilever businesses, in 2002 the Polish Foods business found itself meeting its profit targets but failing to deliver the consistent sales growth that Path to Growth was intended to produce. In an attempt to stimulate growth, the National Board had adopted an interventionist management style, pushing activities (such as product launches, promotion and advertising) through the business in order to meet short term (quarterly) financial targets for revenue. As a result, the business results were characterised by high levels of advertising and promotional spend, but inconsistent performance: short term spurts in sales that collapsed as soon as the promotional support for specific activities was scaled back in the face of budgetary constraints (Morlidge, 2005) .

As a result of the lacklustre performance of the Polish business a new chairman of the Polish business was appointed in January 2003, and he immediately set about making changes. This included:

- Focusing the board on high level matters such as strategy, managing organizational change, managing risk.
- Delegating day to day responsibility for the management of performance to a cross functional senior management team (the Foods Leadership Team – FLT). Hitherto, the business had been run on functional lines; there being little effective teamwork between Sales, Marketing, Finance and Supply Chain functions.

- Process changes, e.g. promoting the adoption of Sales and Operations Planning (S&OP), in order to improve short term management of the Supply Chain.

Unfortunately, the perceived improvements in ways of working were not immediately reflected in performance (i.e. growth). As a result, in late 2003 the chairman asked the FLT to review every aspect of the way in which the Foods business was organized and run. After two weeks of focused deliberations away from the workplace, they presented their recommendations to the board in January 2004. These were accepted without reservation and were immediately implemented. Within a few weeks (before the end of January 2004), the foods business made a series of sweeping changes to its structure and practices. These included:

- Setting up nine autonomous, cross functional Business Teams (BT) responsible for maximizing their individual performance, including the development and implementation of all new activity in the market place.
- Giving the FLT responsibility for optimizing the portfolio of activities across all BTs, subject only to an overall constraint on profit delivery.
- Establishing a system of coaching whereby members of the FLT operated in a non executive capacity in BTs, with a member of the National Board fulfilling the same role on the FLT.
- Eliminating the practice of setting annual low level targets for revenue growth, profit and discretionary spend. Instead, BTs and the FLT were to act together to continuously define stretch ambitions for revenue growth subject only to the constraint of delivering the collective annual profit target. To this end, instead of discretionary spend being constrained by annual budgets, it was to be allocated by the FLT to activities proposed by BTs in a competitive quarterly process – the objective being to maximize collective performance.

Subsequent to these changes there was a dramatic improvement in sales performance of the Foods business, which was sustained over a number of years. As a consequence, the Polish Foods business was adopted as a case study by the global performance management initiative which had inspired much of the thinking

behind these changes (Dynamic Performance Management – DPM). This initiative led by the author of this thesis, who was at that time a Unilever employee. In order to capture and promote the learnings from the Polish experience, a series of interviews were recorded with management in the summer of 2005 (Morlidge, 2005).

The changes made to organisational structures and processes in early 2004 are still (as at 2010) in place, but there have been significant changes in personnel and their roles over the last six years. In particular, the chairman who instigated the changes moved in 2006, and in the same year the role (and personnel) of the BTs was impacted by a series of changes made across Unilever to the product innovation process. Development of many new market place activities is now the responsibility of regional and global teams; local teams are only now responsible for implementation.

8.4.5 Approach to fieldwork – cybernetic health

Diagnostic assessments capturing the before and after state of the Polish Foods business system were completed by:

- The author, based on analyses of 6 hours of interviews with 9 key employees, recorded in August 2005 in the course of producing a video of the businesses management practices for corporate communication purposes (Morlidge, 2005).
- Personnel from the Polish business: one individual (the former financial controller) who was in a good position to make a high level assessment of the practices before and after the changes made in January 2004. At the time the fieldwork was conducted (2009), no other potential respondents with requisite knowledge of the organisation and its history were still in position.

Prior to completing the diagnostic assessment the former financial controller was involved in mapping the organization against the VSM. Finally, the four sets of assessments were tested for significance using Wilcoxon's paired test (Curwin and Slator, 2002).

8.4.6 Approach to the fieldwork – analysis of performance

The performance metric chosen was that of revenue. The data (Appendix 6) was provided by local management in monthly buckets, which were then smoothed to produce a moving annual total, thus allowing us to eliminate seasonal effects by using moving annual totals. Subsequently, this data was analyzed for stability using the same technique described above. The before and after January 2004 performances were then compared. In the absence of an appropriate technique, no test of significance was performed.

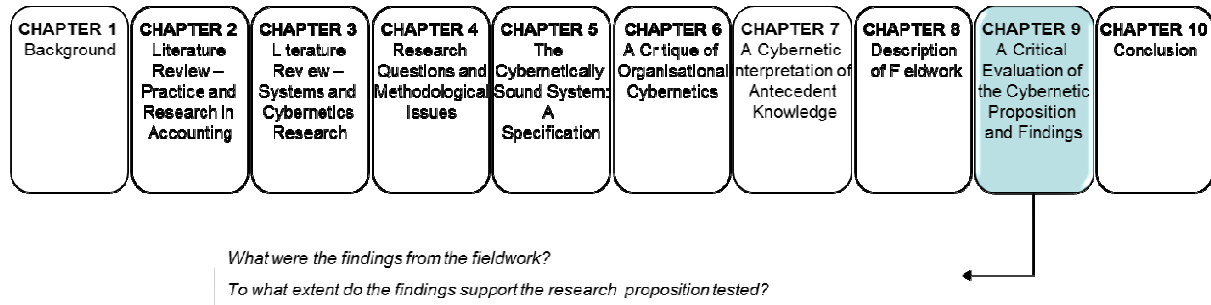
In addition, in order to rule out the possibility that the findings were a simple consequence of increases in the level of discretionary spend, the pattern of advertising and promotional expenditure was compared to the pattern of sales growth. Also, an attempt was made to determine to what extent changes in the nature of the market may have contributed to changes in the level of performance.

8.5 Conclusion

The two case studies chosen enable the research proposition to be tested in two different ways. Svenska Handelsbanken can be compared to its peer group in the Nordic banking sector in a cross sectional study while the characteristics of the Unilevers food business in Poland are the subject of a longitudinal study; before and after a major change in practice. The dependent variable (business performance) can be analysed statistically, and while the dependent variable is assessed using qualitative techniques, measures have been taken to guard against bias in the evaluation process.

The findings of the fieldwork are set out and critically evaluated in the next chapter.

9 Critical Evaluation of Cybernetic Proposition and Findings



9.1 Objective

The objectives of this chapter are threefold:

- To present and analyse the findings from fieldwork.
- To interpret the findings in the light of the cybernetic proposition.
- To determine what conclusions can be drawn, given the methodology employed.

Under the first heading we will review the results of the survey of the cybernetic health of Svenska Handelsbankens management system, and compare them to the results of the survey of peer group companies. Then the level and stability of the business performance will be analysed over the period 2002 to 2009, and compared to peers. Finally, we will consider whether the observed findings could be the result of factors other than those hypothesised, or whether they could be interpreted in another way. The same process will be repeated for the second case study - Unilever Poland – but in this instance the assessment of cybernetic health and performance will be compared before and after a major change in management processes, rather than with peers.

The methodology used in this fieldwork will then be assessed based on four criteria:

- Construct validity – are we measuring what purport to measure?
- Internal validity – can we make clear causal inferences?
- External validity – can we generalize?
- Replicability – could the results be replicated?

Finally, we will discuss to what extent the findings support the cybernetic proposition, and whether this, taken in conjunction with the review of antecedent findings from the previous chapter, meet the correspondence principle, thus supporting the argument for the use of a theory based on cybernetic principles in MCS research.

9.2 Findings – Svenska Handelsbanken

9.2.1 Cybernetic mapping

Before we set out to assess the cybernetic health of Svenska Handelsbanken, it was first necessary to map the organisation against the VSM, in order to help orientate the lead contact and help him interpret the diagnostic questions. This involved working through a presentation based introductory guide to the CSS, and helping the subject to translate theoretical concepts into familiar organisational terms. A rigorous, detailed mapping may require many months of work, but fortunately the structure of the company is very clear, has been stable over a number of years and maps very easily against the VSM.

For the purposes of this exercise, it is most important firstly to map the recursions. The results are shown below. We can see that, despite the size and complexity of the bank, there are only three levels of recursion. There are 11 regions in the group (some of which are countries), and between 40 and 50 branches in each region. The company has a number of product lines, but the organisation is not structured around these. At each level of recursion, the organisation is assumed to have sufficient variety (knowledge and the flexibility to act upon it) to absorb the

environmental variety entailed (customer and stakeholder needs). All customers (including corporate customers) are owned by a branch, and every branch and every region is a profit centre with a large degree of autonomy. Specialist support (e.g. access to capital market products, IT systems) is provided to banks as a service, subject to an internal transfer price, negotiated annually between representatives of the branches and the service provider.

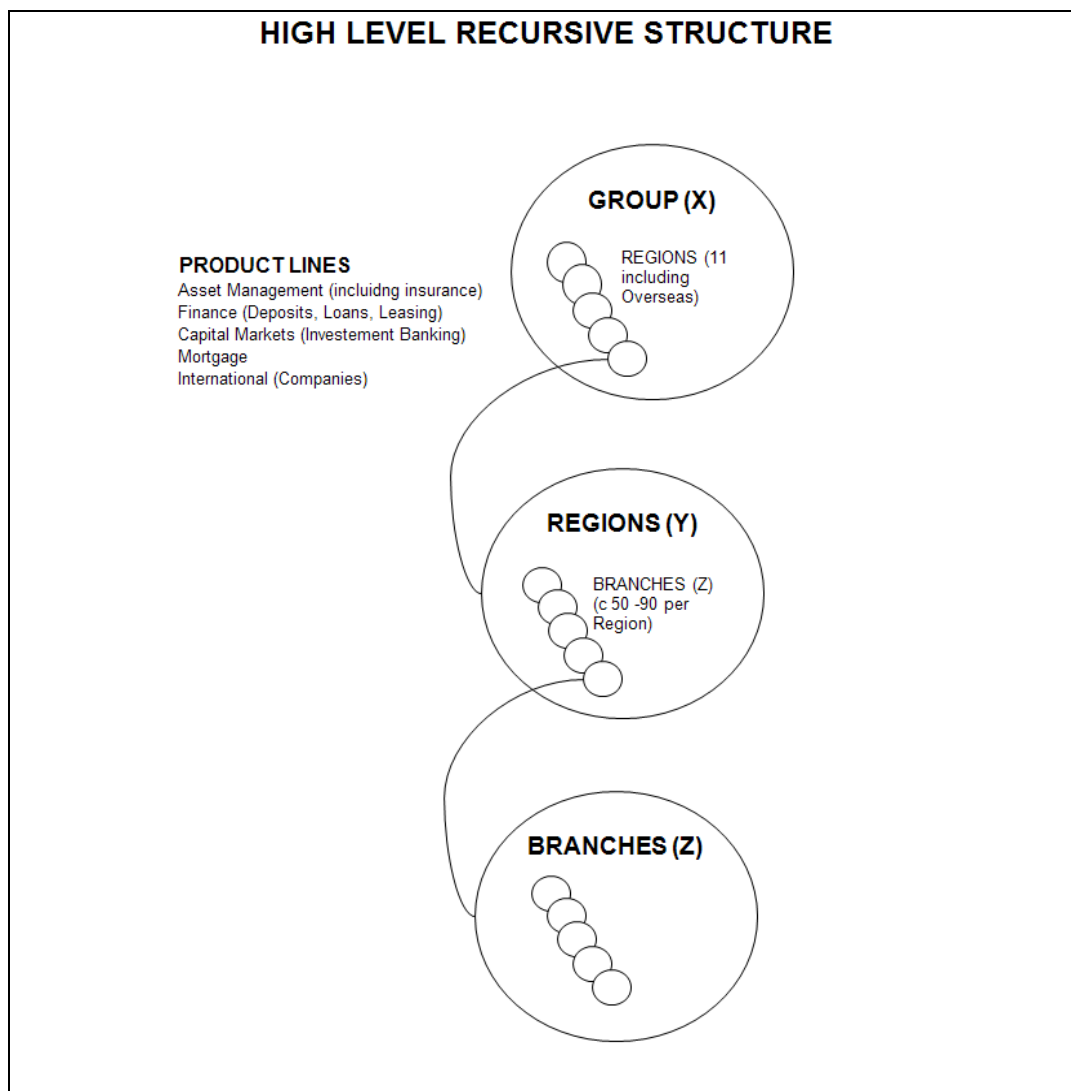


Figure 21 A high level VSM mapping of Svenska Handelsbanken

At a more detailed level a preliminary review of the cybernetic features of the organisation was carried out in conjunction with the lead contact. This used the

framework provided by the twelve structural principles set out in the CSS specification (Chapter 5). The results of this are summarised below.

	Description	Cybernetic Principle	Evidence
1	Elemental Autonomy <i>How is the customer/consumer facing part of your organisation structured? How much autonomy do these business units have?</i>	A CSS should contain a number of autonomous elemental units (S1) tightly coupled with their environments on the horizontal axis which are subsets of the overall organisational environment. They should be structured such that they absorb the maximum amount of relevant environmental variety through self regulation.	Svenska Handelsbanken is organised around its branches (Recursion Z); the branch is the bank. Each of which has a large amount of freedom to operate, within the formally defined policies and principles ('Our Way') and subject to well defined corporate measurement metrics (Cost Income Ratio compared to internal peers) and processes. This freedom includes responsibility for all customers within its region ('the church tower principle') including most pricing and lending decisions. 98% of loans are made at branch level and 50% of staff have lending authority. At the next recursion level (Recursion Y) Regions have an equivalent level of autonomy subject to the same set of constraints, the major difference being that the metric for performance is defined differently (Return on Equity compared to internal peers).
2	Operational Directorate <i>How are groups of business units managed?</i>	A CSS should have a metasystemic management function (S3), responsible for managing organisational cohesion and collective performance. It does so by actively managing the extant internal environment, made up of the collection of elemental units (S1), with the overriding objective of ensuring that the external homeostatic relationships managed by the elemental units themselves are as healthy as possible. It should do so using 5 vertical channels (see below).	Regional and Corporate Management have clearly defined responsibility for the oversight of the elemental units at the next level of recursion. This involves taking responsibility for internal co-ordination (S2) oversight (S3*) and providing services that it is uneconomic to devolve. This includes things such as IT and Legal services (Recursion X), and telephone banking (Recursion Y). A central planning committee, comprising of representatives from all levels, sets prices and policies for the central service units, and monitoring the performance of the loans (Accountability).
3	Restraint on Command <i>How do business units receive guidance and direction?</i>	A CSS should use Command Channel on the vertical axis which S3 uses to make interventions in S1 affairs. This should be minimally used; as far as possible it should only be used to proscribe and guide behaviour using mechanisms that allow for appropriate local interpretation.	In SVH managers must 'learn to keep their hands by their side'. All loans are initiated by branch - none by the centre. There are very few instructions issued (using the command channel) - managers perceive that they have total authority - subject to SVH way. Manager are only given their positions when they can be trusted to work in the right way.
4	Continuous Alignment <i>How are the activities of business units co-ordinated and knowledge shared?</i>	A CSS should have an active, high variety, S2 operating in real time on the vertical axis to routinely co-ordinate S1 activities, in the interests of the elemental units themselves. This should include the maintenance of metadata, operational policies and protocols, and the management of regulatory and performance information and programming.	Consistent, transparent accounting systems/metrics operating in real time help share knowledge and promote learning. S3 managers facilitate sharing of learnings between peers. Strict rules of 'ownership' of customers ('the church tower principle') limits the need for co-ordination. On the down side, informal inter branch/recursion co-ordination - can sometimes be difficult/clumsy.
5	Sporadic Sampling <i>How do higher management keep in touch with what is happening on the ground?</i>	A CSS should have S3* mechanisms on the vertical axis that facilitate high variety, ad hoc, investigation of the operational component of elemental units. These are required in order to check adherence to organisational policies (communicated via either the S2 or Command Channels), investigate problems and explore opportunities for synergistic improvements.	Presidential visits to all regions (Recursion Y) every year take up 15-20% of the CEO's time. At least 50% of the time in any visit is spent in unscripted/unstructured conversation: the mantra is 'Listen and learn'. Regional managers visits all branches (Recursion Z) every year, with a similar structure to the presidential visits. Area managers (within Regions) coach/monitor branches. They are perceived as acting as intermediaries rather than representatives of the Region and they are not accountable for the performance of their area. Monthly letters written by leadership at all levels of recursion are openly shared.
6	Continuous Resource Bargaining <i>How are resources allocated?</i>	A CSS should have a mechanism to allocate (grant permission to use) resources in real time to elemental units, subject to a negotiated resource bargain for which the elemental units are held accountable. Resource permissions will relate to specific regulatory acts (as prescribed in the Resource Bargain) and the maintenance of elemental operations and the local (elemental) regulatory capacity (both expressed as proscriptions in the Resource Bargain).	Elemental units are free to incur costs, subject to the performance measurement process which ensures that thrift is encouraged (league tables etc). S3 is responsible for sanctioning branch lending proposals (Internal Resource Bargain) that exceed local limits. These local limits are allocated based upon an assessment of the competency (requisite knowledge and past record) of the managers concerned.
7	Accountability <i>How are business units held responsible for the resources they have been allocated?</i>	A CSS should have an 'Accountability' Channel on the vertical axis whereby the management of elemental units are able to reassure metasystemic management (S3) that their environmental homeostats are operating effectively within the terms of the resource bargain. Information is provided 'by exception' subject (inter alia) to the filtering of elemental management.	S3 is responsible for monitoring the performance of the loans and the relative performance of branches and region (via internal league tables)
8	Development Directorate <i>How is innovation managed?</i>	A CSS should have a metasystemic function (S4), responsible for maintaining and enhancing the regulatory capability of the system. This requires continuous monitoring of trends in the environment, and building models (of the existing and possible environmental and systems states) to help create options for response and adaptation. To discharge this role effectively S4 should exchange information with S4 at different levels of recursion and maintain an intensive dialogue with S3; the managerial subsystem responsible, inter alia, for overseeing current operations and agreeing the resourcing needed to enact the options.	Development Department at Recursion X develops scenarios 2-5 years out and possible options for change. Monitoring of external trends also relies heavily on intimacy with the market at branch (Recursion Z) level. Many initiatives (e.g. new products) emanate from lower levels of recursions.
9	Leadership <i>What guides and hold the organisation together?</i>	A CSS should have a metasystemic function (S5) which provides leadership for the whole system. Leadership provides organisational closure?? by, inter alia, creating and maintaining system ethos (system boundaries, aims and values) as articulated in policies, practices and behaviour. In doing so this helps define the systems identity. It should also maintain the overall health of the system by overseeing the S3/S4 homeostat (which may involve making interventions to resolve conflicts or impasse) and acting on algedonic signals.	Clear and consistent management philosophy/definitions of success (above average ROI through superior customer service) followed over 40 years. These were documented in 'Goals and Methods' then 'Our Way' which is clearly owned/updated by the CEO. This approach is a consistent refrain in presentations/Annual Reports etc. The test of decisions made by leaders is: 'is it natural?' The Friday meeting, which involves representatives from Systems 3.4 and 5 at Recursion X is conducted without a preset agenda (or minutes), thus avoiding unnecessary attenuation of variety.
10	Organisational Override <i>How do important, non routine, messages get to the right people?</i>	A CSS should have an Algedonic Channel, whereby signals of an exceptional nature, which could portend opportunity or risk, are channelled directly to S5 overriding all meta-systemic filters.	There is continuous monitoring of information systems in real time to detect significant patterns. Area Managers also have an important role in surfacing anomalies at Recursion Z.
11	Fractal Structure <i>What principles guide the design of the organisational structure?</i>	A CSS should have a recursive (self similar or fractal) structure, with the minimum number of levels necessary to absorb environmental variety at every relevant level of recursion and any residual variety from lower organisational recursions.	The bank has a clear organisational structure, which are consistent within and between recursions, of which there are a limited number (3).

Figure 22 Summary of detailed cybernetic mapping of Svenska Handelsbanken

The most striking aspects of the banks structure and processes revealed by this mapping exercise are:

1. The extreme nature of decentralisation to branches: S1 at the lowest level of recursion. The high level of autonomy, coupled with sophisticated mechanisms to ensure cohesion and coordination (see Points 2 and 3 below) and people development process designed to monitor and enhance the

requisite knowledge of local staff enables the organisation to run effectively with a very high S1/S3 ratio (<50:1).

2. The important role played by informal controls and culture in the organisation. The development and maintenance of informal ways of working attracts as much management attention as do the formal controls. This is evidenced by the almost hallowed status of the Our Way booklet (a manifestation of S5), and the (paradoxical) rigour with which visits, informal meeting structures and open letters to staff are conducted (all of which promote high variety communication and exchange).
3. The strength of S2 and S3* channel in the organisation. For example, at Recursion Z area management visits provide S3* capability. The strict allocation of customers to individual branches (the church tower principle) at Recursion Z and the clear primacy of the geography over product at all recursions, reduces the scope for confusion and therefore the demand placed on S2. The tightly defined and transparent information processes and well defined operation procedures provide the S2 capability required to absorb the residual variety. As a result of this, and the informal controls described in Point 2 above the level of activity on the command access (i.e. direct intervention by the metasystem) is extraordinarily low for such a large and sophisticated organisation.
4. The simplicity and rigour of the organisations information processes. In counterpoint to the consciously informal nature of many of the banks communication processes, its information and measurement processes are tightly defined and very detailed. They are also transparent to the organisation, thereby facilitating co-ordination, promoting organisational learning and providing some algedonic functionality.
5. The care exercised in determining what activities should be centralised and how they are run so as to maximise their synergistic impact. For example, while IT provision is highly centralised, its development agenda and its capacity to recover its costs from the organisation are controlled by their internal customers (at lower levels of recursion) rather than by the management of the metasystem of which they are part.
6. The fact that the requisite knowledge of individuals is incorporated into organisational design. For example, authority to grant credit (without recourse

to the metasystem) is based on the individual, not their position or the size of the branch.

7. The majority of activity emanates from the bottom up. Thus new products are developed by S4 at Recursion X in response to needs identified by S4 at Recursion Z. Although they might be subject to scrutiny at higher levels, all credit requests are generated by Recursion Z (or lower since most members of staff have the authority to grant credit).
8. Some cybernetic features are difficult to detect, particularly when their activity is intermittent. Thus it is difficult to pin down S4 and the Algedonic Channel in some parts of the organisation.
9. The high level of functional redundancy (See Appendix 1). Many activities serve multiple purposes. Thus Area Management provide S3* and Algedonic functionality. The companies information systems serve to support organisational learning (part of a S3 synergy promoting role), S2 coordination and the provision of algedonic signals.
10. The consistency with which the approach to management is maintained, over time and across geographies. In contrast to many organisations leaders are primarily selected for their capacity to maintain the status quo, rather than to challenge it. In this way there is limited scope for the proliferation of unnecessary (internally generated) variety.

Ideally, it would be desirable to produce a detailed mapping at every level of recursion and to use a number of respondents from every level to complete the detailed diagnostic questionnaire. Unfortunately, this was not possible. There was only one respondent from Recursion Z (a branch manager), however the three respondents from Recursion X, and the former CFO who validated to one of the external surveys, all have experience of working in a range of different jobs at various levels of the bank. Nevertheless, the exercise was adequate for the primary purpose of the exercise: to assess the cybernetic health of the organisation as a whole.

9.2.2 Assessment of cybernetic soundness

The results of the survey of cybernetic health are shown below (Figure 23). For each question the average score is represented by a black mark and the range of responses from the six different sources by the dark bar. Coverage (the percentage of each question to which an answer was provided by respondents) is shown as a white bar.

The average score for Svenska Handelsbanken is high (4.4 out of 5) and the coverage is acceptable at 85%. With one exception the spread between the highest and lowest score is no more than 2; 25 of the questions had a spread of 1 or less. The scores for Structure (questions 1 to 12) and Regulation (questions 24-34) are higher than those for Information.

Considering the results in detail there are two sets of anomalous results. Firstly, questions 24 to 27 were all received scores of 5. These questions related, in the main, to the question of goals. SvH has a very consistent, clear and slightly idiosyncratic approach to goal setting that is very tightly aligned to the cybernetic reference model, so the results are not surprising. The other question that received a unanimous five out of five was question 24, which asked directly whether the management systems provided requisite variety, perhaps the most telling question in the set.

The other set of anomalous responses were in part of the Information section: numbers 17 through 22. Here both the scores and the coverage were low. Part of this might be explained by ignorance. Processes like scanning the external environment (17) and scenario generation (22) may be carried out formally only at a high level of recursion, perhaps by a small number of people, and we would not necessarily expect this information to be widely shared. Most of the questions in this range, however, addressed the issue of forecasting. The bank does not have a formal forecasting process of the kind that you might normally expect in organisations of this scale and sophistication. Individual branch managers do, however, informally forecast the performance of their branch as a matter of course,

but they do not share this with the rest of the organisation. In addition, every loan application is by definition, accompanied by a forecast, since otherwise there would be no confidence that the loan would be repaid. Arguably such subtleties are lost on most respondents; however the best interpretation of the results is that they are a fair reflection of normal practice. Jan Wallander himself was sceptical about forecasting, and as a result he explicitly set the bank up so that it would operate as a self-regulating entity; one which would not need top down interventions to steer a course. This analysis is entirely consistent with cybernetic theory.

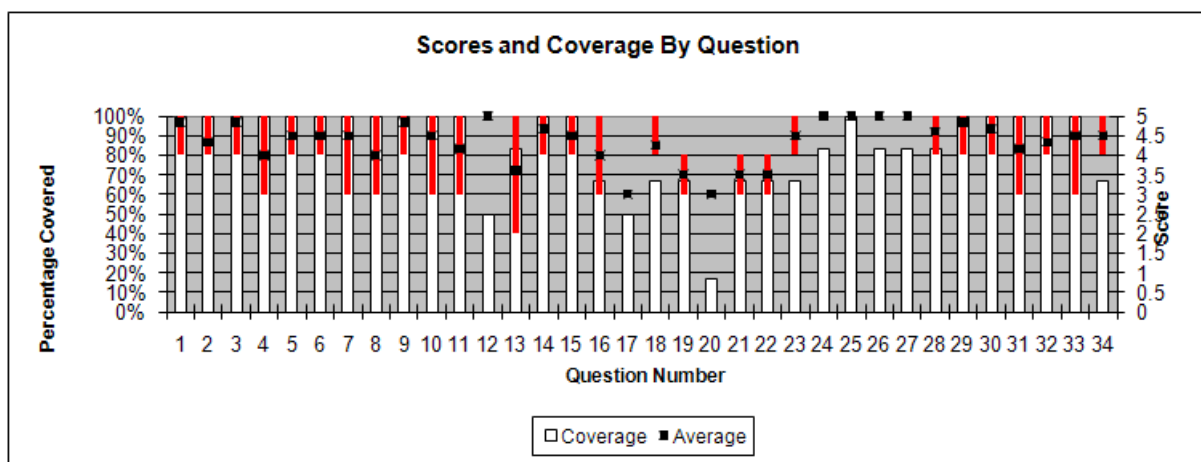


Figure 23 SvH cybernetic questionnaire: scores and coverage by question

The assessment of the cybernetic health of peer group banks was carried out by the author of a book about Svenska Handelsbanken, who by virtue of his previous role as an analyst for the sector is in a good position to make high-level judgements about the practices of a range of peer banks. This was done in parallel with his assessment of SvH using the same methodology. The results are shown in Figure 24 below.

The coverage is significantly lower for peer banks, which probably reflects the difficulty inherent with making a generic assessment across a range of banks, of which the respondent has limited knowledge. There is a significant difference between the scores for peer banks and SvH. On average, the difference in the scores is 2.4, with a slightly higher spread in Structure and Regulation than

Information. This result is not surprising, since the cybernetic approach to information management is less different to the traditional performance management model than it is for structure and regulation. Also, as already discussed, the banks approach to forecasting does not score highly. Taking the relative scoring of the single assessor, his scoring for Svenska Handelsbanken is similar to that of the other respondents; he scores Structure and Information slightly higher and Regulation lower, but the differences are not significant in the context of the difference between the bank and its peers across the entire range of questions. Of the 16 questions answered for peer banks, the score was the same or higher than that for Svenska in only one instance. The largest differences between the bank and its peers (where they were located at extreme opposite ends of the scale) related to autonomy, the locus of regulation and option generation (question 1, 29 and 30), which reflects the decentralised nature of the bank’s management model and sporadic sampling, (question 5) which is a reflection of SvH’s distinctive approach to monitoring such autonomous units.

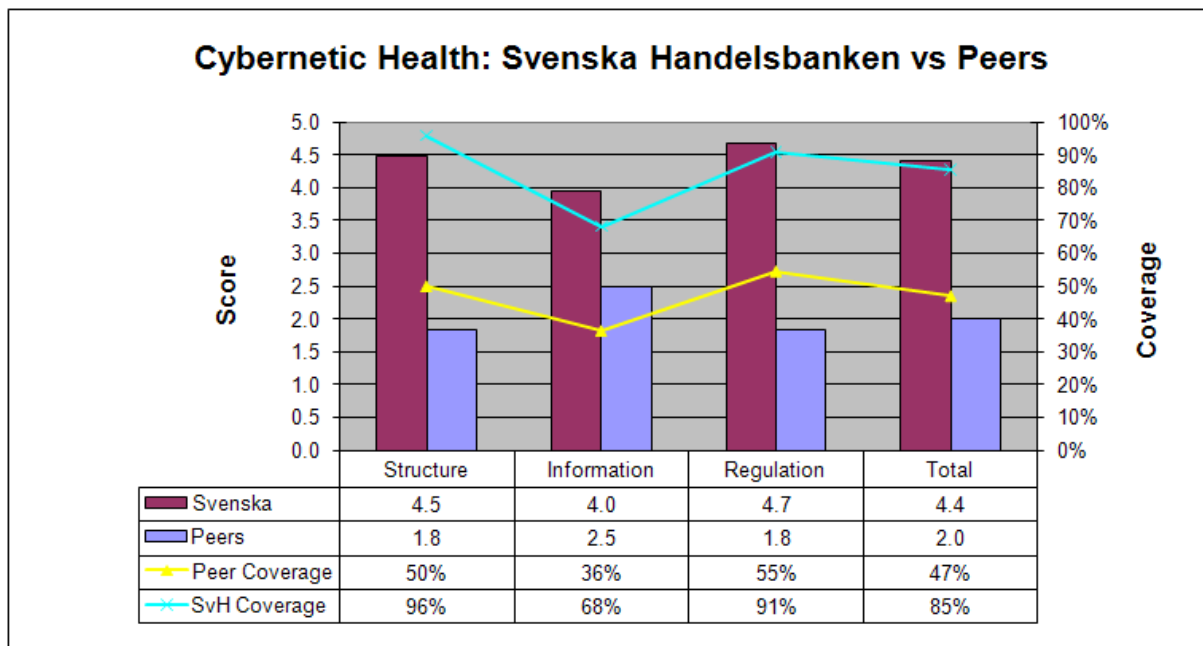


Figure 24 A comparison of the cybernetic health of SvH with its peers

The seven assessments were also statistically analysed, as follows:

1. For those 14 questions where there was a complete set of responses the cybernetic score of all respondents were compared (21 sets of comparisons in all).
2. These were then tested using Wilcoxon pairwise significance test (Curwin and Slator, 2002) against the following null hypotheses:

Hypothesis 1

There is no significant difference between the cybernetic score for Svenska Handelsbanken and its peer banks.

Hypothesis 2

There is no significant difference between the cybernetic Scores of Svenska Handelsbanken.

The results are shown below (Figure 25), where a shaded cell represents a significant difference between a pairs of scores, with the peer banks scores given the number 7.

	1	2	3	4	5	6	7
1							
2							
3							
4							
5							
6							
7							

KEY:
 1- 6: Svenska Handelsbanken
 7: Peer Group Banks
 Dark Shading - significant to 1%
 Light Shading - significant to 2%

Figure 25 A summary of the difference between cybernetic scores for Svenska Handelsbanken

This analysis shows that:

1. The scores for the peer bank are very significantly different (at a level of 1%) to any of those for Svenska Handelsbanken. Thus hypothesis number one can be rejected, which is consistent with the cybernetic proposition.
2. One of the set of scores for Svenska Handelsbanken (number 6) is significantly different from the others, albeit in two of the five cases only at a 2% level of significance. Thus the second hypothesis cannot be rejected. This assessment was from a source that had not participated in the mapping exercise and had worked in the bank for all his career, suggesting that a failure in comprehension or calibration could be the source of the difference.

In conclusion, it is clear that Svenska Handelsbanken maps very well against a cybernetic model for the effective regulation of financial resources; significantly better than do its peers. If the cybernetic hypothesis that has been posited is valid we would expect this difference to be reflected in its relative performance as measured by the level and stability of its performance.

9.2.3 Assessment of performance

The average 12-quarter moving average of Return on Equity (ROE), and the standard deviation of Pre Tax Profits (PTP) for Svenska Handelsbanken and its five Nordic peer banks is shown in Figure 26. Where the results are worse than the average for the period – a lower return or higher volatility - the relevant cell is shaded.

From a cursory glance at this table it seems clear that Svenska Handelsbanken's relative performance is good. For the 27 data points the bank's return was better than average on every occasion and delivered a worse than average volatility for only 5 out of 27 periods. The only comparable performance was that of SEB who almost matched SvHs level of return (25 out of 27 periods) but had an average level of variation in profit (being higher than the average on 16 out of 27 occasions).

Table 7 Financial performance of Nordic banks

	Danske Bank		Svenska Handelsbank		Nordea		SEB		Swedbank		DIB Nor		Average	
	SD PTP	ROE	SD PTP	ROE	SD PTP	ROE	SD PTP	ROE	SD PTP	ROE	SD PTP	ROE	SD PTP	ROE
4Q02	17.6%	4.9%	9.9%	6.2%	22.6%	6.0%	16.3%	5.3%	18.4%	4.2%			17.7%	5.4%
1Q03	17.0%	4.8%	9.9%	6.1%	20.8%	5.1%	14.9%	5.1%	17.8%	4.1%			16.7%	5.0%
2Q03	11.5%	5.0%	10.6%	6.0%	18.8%	4.6%	15.1%	5.1%	17.9%	4.1%			14.8%	4.9%
3Q03	9.4%	4.9%	10.6%	5.8%	16.9%	4.0%	14.8%	5.0%	18.6%	4.0%			13.7%	4.6%
4Q03	10.7%	4.9%	10.6%	5.7%	17.2%	4.0%	13.7%	5.2%	16.4%	4.1%			13.8%	4.6%
1Q04	10.8%	4.8%	12.1%	5.6%	19.2%	4.0%	18.6%	5.1%	16.7%	4.2%			15.3%	4.6%
2Q04	11.1%	4.8%	12.6%	5.5%	17.9%	3.9%	16.9%	5.0%	17.7%	4.3%			15.0%	4.6%
3Q04	11.0%	4.7%	12.5%	5.5%	13.7%	4.1%	15.6%	5.2%	20.1%	4.4%			13.9%	4.7%
4Q04	14.5%	4.9%	12.6%	5.5%	16.9%	4.2%	15.4%	5.3%	21.3%	4.4%			15.9%	4.7%
1Q05	16.0%	5.0%	12.6%	5.5%	17.3%	4.3%	16.5%	5.4%	20.9%	4.4%			16.5%	4.8%
2Q05	18.0%	5.1%	13.3%	5.5%	20.7%	4.6%	18.7%	5.5%	22.4%	4.5%			18.7%	5.0%
3Q05	18.9%	5.3%	9.6%	5.6%	20.5%	4.7%	16.8%	5.8%	21.0%	4.6%	30.4%	4.2%	19.2%	5.0%
4Q05	20.0%	5.5%	9.1%	5.6%	20.3%	4.9%	18.3%	5.9%	18.8%	4.8%	27.3%	4.4%	18.9%	5.2%
1Q06	20.0%	5.6%	16.6%	5.8%	20.0%	5.1%	19.3%	5.9%	16.2%	5.0%	24.4%	4.6%	19.4%	5.3%
2Q06	19.6%	5.6%	16.3%	5.8%	22.1%	5.3%	19.8%	6.0%	15.3%	5.1%	21.5%	4.7%	19.5%	5.4%
3Q06	18.5%	5.8%	15.1%	5.8%	20.5%	5.5%	18.5%	6.0%	16.5%	5.2%	18.4%	4.8%	18.3%	5.5%
4Q06	18.2%	5.7%	14.6%	5.9%	18.0%	5.7%	19.0%	6.1%	16.8%	5.3%	15.8%	4.8%	17.2%	5.6%
1Q07	17.2%	5.7%	14.4%	5.8%	17.5%	5.7%	20.1%	6.1%	14.7%	5.3%	14.1%	4.8%	16.5%	5.6%
2Q07	12.1%	5.6%	14.5%	5.9%	16.0%	5.9%	20.1%	6.2%	13.7%	5.4%	12.9%	4.8%	14.8%	5.7%
3Q07	7.6%	5.6%	13.7%	5.9%	13.2%	5.9%	17.2%	6.1%	12.4%	5.5%	11.0%	4.8%	12.3%	5.6%
4Q07	8.9%	5.3%	13.9%	5.8%	12.3%	5.9%	14.4%	6.1%	12.1%	5.5%	10.8%	4.7%	11.9%	5.6%
1Q08	15.8%	5.0%	16.5%	5.6%	9.6%	5.9%	16.1%	6.0%	9.8%	5.3%	22.5%	4.4%	14.2%	5.4%
2Q08	17.1%	4.7%	16.8%	5.5%	9.0%	5.8%	15.2%	6.0%	10.5%	5.2%	22.2%	4.4%	14.2%	5.3%
3Q08	26.7%	4.3%	18.9%	5.3%	7.3%	5.7%	20.3%	5.7%	12.3%	4.9%	22.8%	4.2%	16.6%	5.0%
4Q08	98.0%	3.2%	19.6%	5.4%	6.6%	5.6%	20.5%	5.3%	20.9%	4.7%	24.2%	4.2%	27.7%	4.7%
1Q09	100.7%	3.0%	16.3%	5.2%	6.8%	5.4%	23.3%	4.5%	58.3%	4.4%	24.5%	4.1%	32.4%	4.4%
2Q09	102.1%	2.9%	16.5%	5.1%	7.0%	5.2%	23.8%	3.6%	96.3%	4.1%	25.1%	3.9%	36.2%	4.2%

The picture is even clearer when the data is presented graphically (see Figure 26). This chart plots each period on a matrix, relative to the average for that period; represented by the position of the axes. The average over the whole 27 period run is plotted in a different colour. The top left hand quadrant is the best position to occupy (higher than average returns, lower than average volatility), the bottom right the worst. Although most banks (e.g. Nordea) occasionally occupy the good quadrant, this is not sustained. Svenska Handelsbanken, by contrast, only falls out of this quadrant on 5 occasions, and the average is firmly within it.

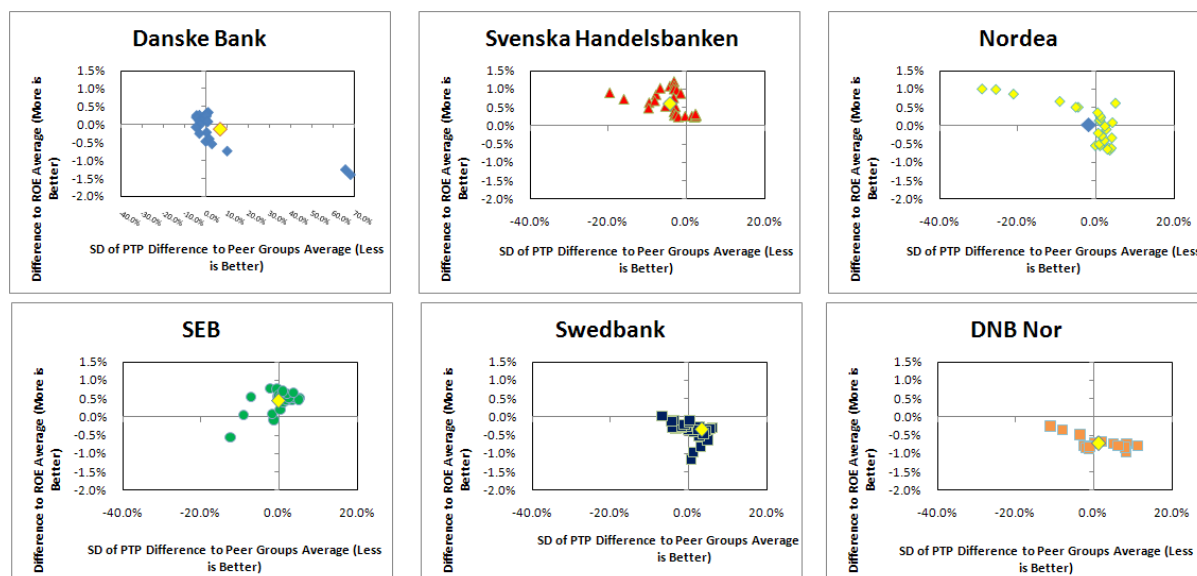


Figure 26 Comparison of the performance of Nordic banks

So there appears to be a clear difference in the relative performance of Svenska Handelsbanken; but is the difference significant, or is it the result of chance? Unfortunately, there are no non-parametric tests for significance (i.e. those not reliant on a normal distribution of data) that can be applied in these circumstances, since the time series data is not independent. A formal hypothesis testing procedure is therefore not appropriate. Notwithstanding this problem, two different ranked correlation tests were used, in order to help assess the likelihood that the observed differences were the result of chance, short of complete statistical confidence. The first of these is Freidman’s test, which determines the probability that a ranked series of data sets has been drawn from a single homogenous population (Curwin and Slator, 2002). The second is Wilcoxon’s signed rank test that determines whether the difference between any two ranked data sets is significant (Curwin and Slator, 2002). The results are summarized below in Figure 27.

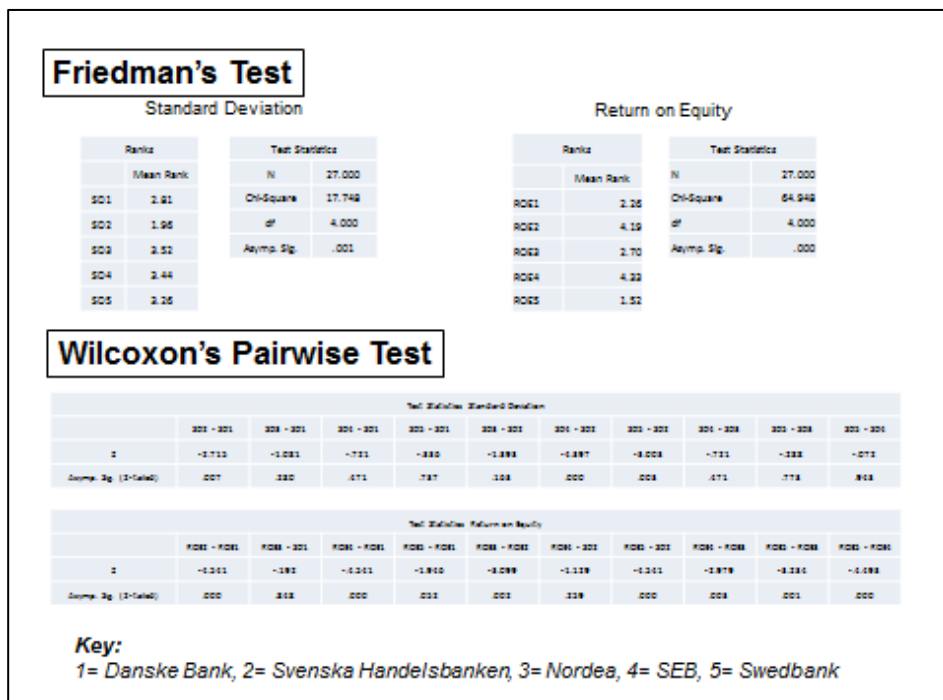


Figure 27 Summary of significance tests on performance

Firstly, Friedman's test (Curwin and Slator, 2002) was applied to the entire data set for both ROE and PTP (from which DNB Norway was excluded, since we do not have a complete set of time series data). In both cases the differences were highly significant (at a greater than 0.1% level of significance). Subsequently Wilcoxon's signed rank test (Curwin and Slator, 2002) was applied to every pair of banks in turn, for both ROE and PTP. These showed a significant difference (at a 5% plus level) between the volatility of PTP for Svenska Handelsbanken and all other businesses except Nordea. No other pair wise test shows a high level of significance.

Tests on ROE data show a similar picture. Again, Svenska Handelbanken shows significant differences again all other peers except one (SEB), which is also significantly different from all peers except one. In addition, there is a significant difference between the ROE performance of Nordea and Swedbank.

These statistical tests largely confirm the results of our earlier assessment; that while SvH and SEB have similar levels of return, only Svenska displays a significantly different pattern of performance on both dimensions; exhibiting a combination of significantly higher returns and lower volatility in performance.

Could the results we observe be ephemeral; the result of a combination of short term factors which favoured Svenska Handelsbanken? Ever since Jan Wallander introduced its management model in the late 1960s the bank has tracked its relative ROE performance against its Nordic peers. This analysis is audited, and appears in the published annual report and accounts (see Figure 28 below). What this extract from the published accounts shows, is that for each of the last 36 years (a period which includes the Swedish banking collapse of 1992) the bank has had a ROE equal to or higher than its peers. If the time series data was independent (which it is not), the odds of this being a purely chance occurrence are approximately 100,000 million to 1. Clearly, therefore, the relative performance of the bank in the early 2000s was not a lucky streak. This also makes it unlikely that the relative performance of the bank is the result of market positioning or any other aspect of the banks strategy or business model that can be relatively easily copied.

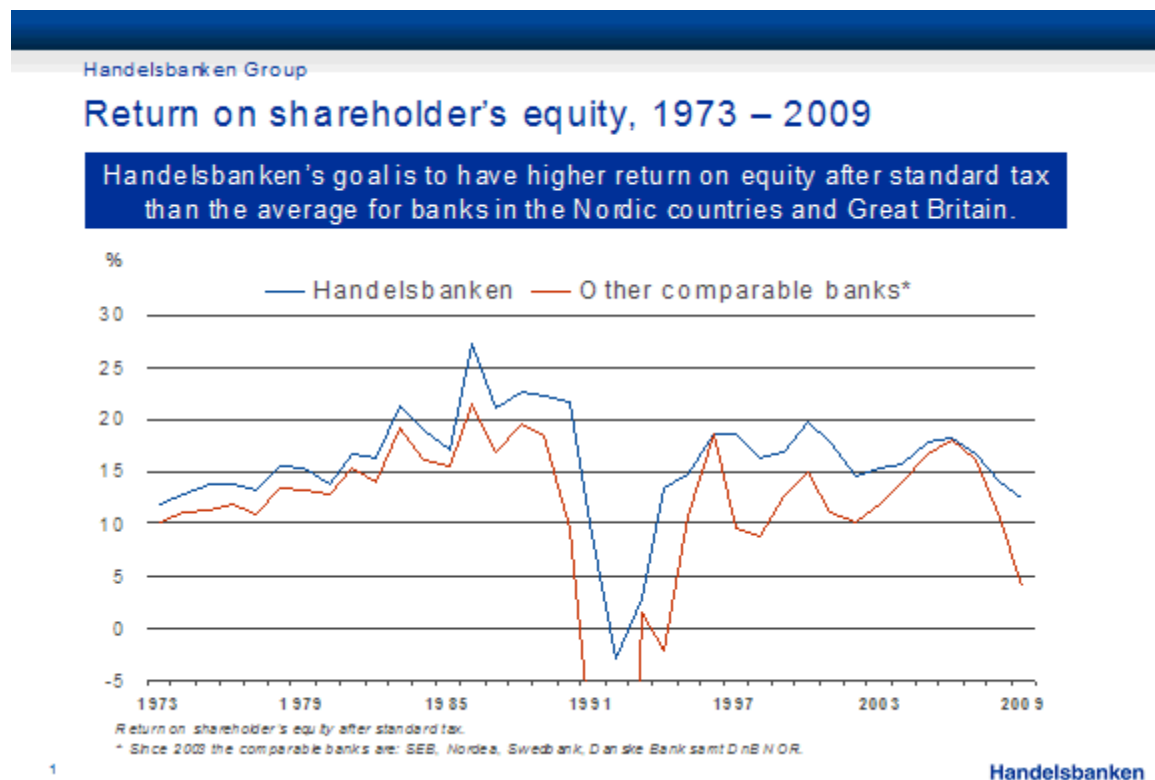


Figure 28 Historical trends of Return on Equity for SvH

The sustainability of the bank's relative performance in terms of the volatility of results is more difficult to assess, since relative comparable data over a long time series is not available. An assessment using internal bank information show that the

period after around 1998 (see Figure 29 below) to be one of relative stability of performance compared to the previous ten years, however this period included the Swedish banking collapse, so no firm conclusions can be drawn from this analysis. What is surprising, however, is how little the recent global banking crash has affected the volatility of the bank's earnings.

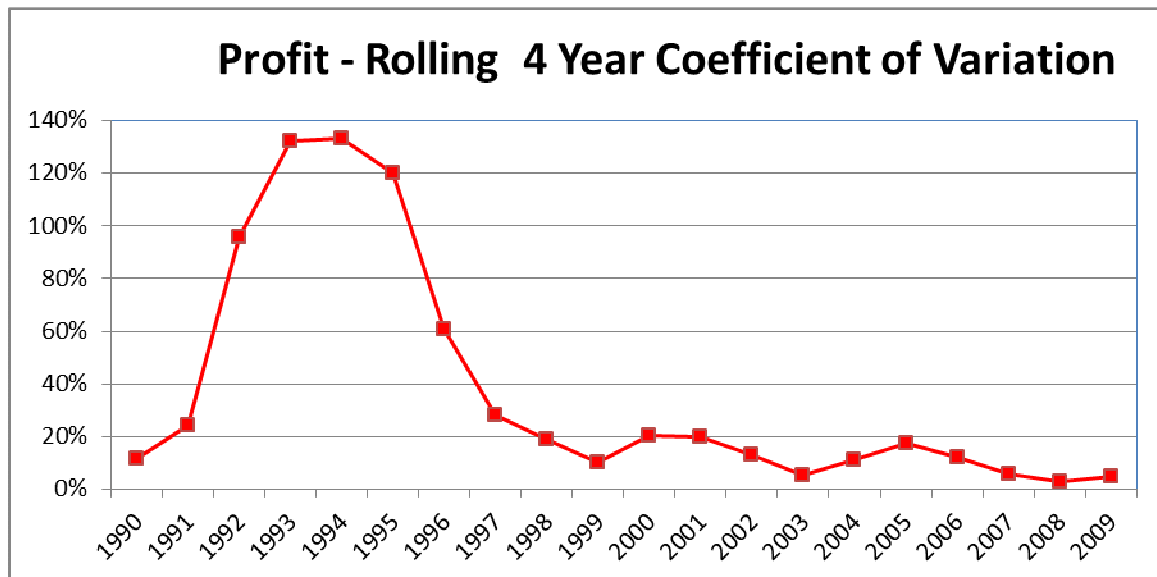


Figure 29 The history of performance volatility at SvH

9.2.4 Analysis of findings

In summary, Svenska Handelsbanken scores highly in terms of the cybernetic health of its performance management systems, and there is a range of evidence to suggest that it is higher than peers, although it is difficult to assess the size of the gap or how significant it is. Consistent with the cybernetic hypothesis, SvH's performance is significantly better than that of its peers and exhibits a greater level of stability. The combination of consistently higher than average rewards and lower volatility runs counter to accepted economic wisdom. The combination of these two findings is consistent with the cybernetic proposition.

Correlation does not, of course, prove causation, but the nature and scale of the observed differences in organisational characteristics and performance is highly persuasive. This does not rule out there being other contributory factors not captured

by the cybernetic assessment. For example, anecdotally, managers refer to the importance of the bank reward scheme, based on the Oktogonen Foundation, which works effectively to align the long-term interests of employees with that of the company. Clearly, the recruitment and personnel practices of the bank could be a major contributor to its success, and its stability over time, since the level of staff turnover is very low. Both of these factors are excluded from the cybernetic survey, although they are not unrelated to the cybernetic factors that were measured.

In conclusion, while it is impossible to be sure, based on the results of this fieldwork we can be very confident in asserting that Svenska Handelsbanken *is* distinctly different from its peers, in the way it does business and in the quality of its performance, and that cybernetic factors are, at the very least, a significant part of the explanation for this difference.

9.3 Findings – Unilever Foods Poland

9.3.1 Cybernetic mapping

A high level cybernetic mapping of the organisation created in January 2004 is shown below. There were three categories within the Polish business, however only the Foods Category was restructured at this time. Before January 2003, the organisation below the Board comprised a series of functional teams reporting to a Board Director; representing a set of poorly defined systems at recursion level Y with no effective S3/4/5 metasystem functionality. The January 2004 changes involved the creation of a set of Business Teams (viable systems) at recursion level Z and a powerful metasystem for recursion Y – manifest in the Foods Leadership Team.

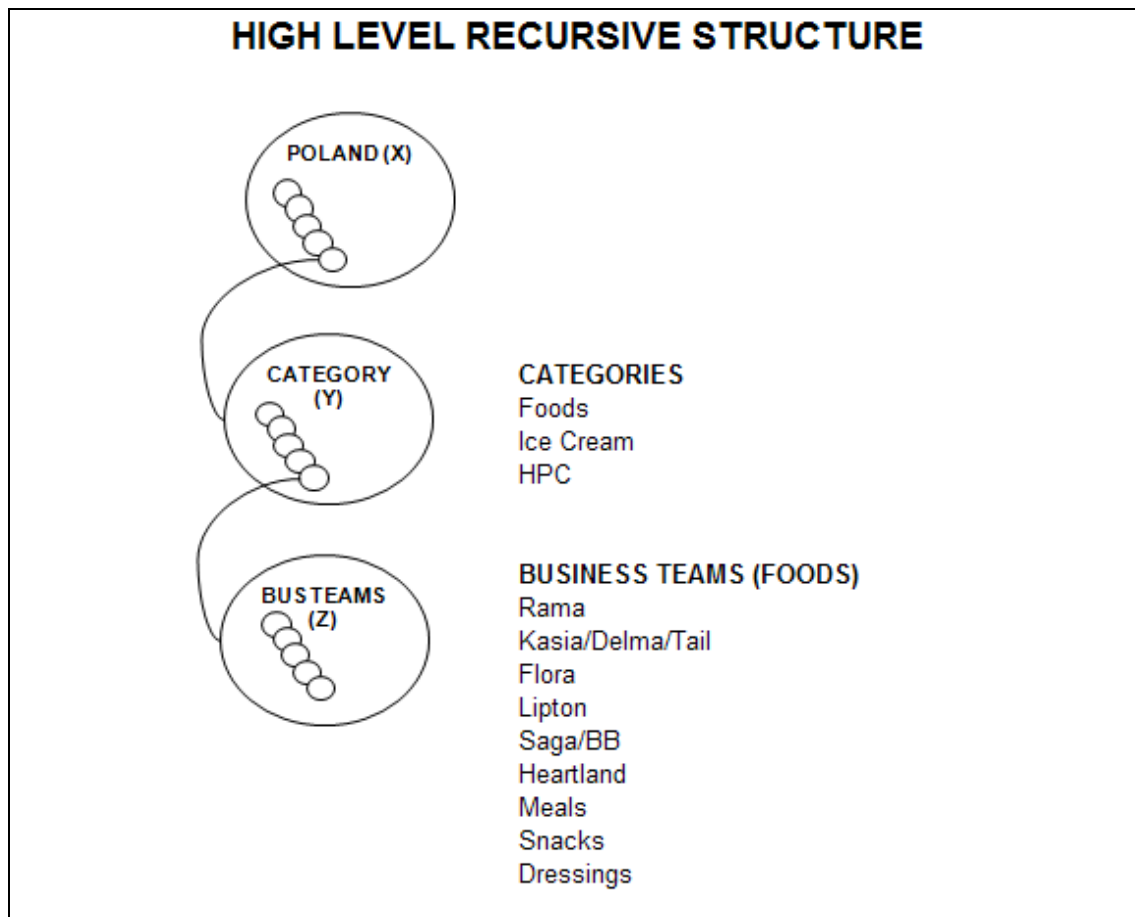


Figure 30 A high level VSM mapping of Unilever Foods Poland

A number of other changes of cybernetic significance that cannot be represented on the diagram above were also made, including:

- Radical decentralisation of decision making authority to the FLT and to Business Teams.
- The creation of a real time investment management process.
- A new (flexible) approach to goal setting.
- A system of continuously monitoring of forecast quality.
- The routine assessment of forecast risk and creation of contingency plans.
- The introduction of a coaching system.
- An informal (high variety) meeting processes between the FLT and the board and Business Groups.

- The introduction of a system of routine post mortem on previous periods activities.

The result of a detailed cybernetic mapping, conducted in association with the lead contact is shown below.

Description	Cybernetic Principle	Evidence
1 Elemental Autonomy <i>'How is the customer/consumer facing part of your organisation structured? How much autonomy do these business units have?'</i>	A CSS should contain a number of autonomous elemental units (S1) tightly coupled with their environments on the horizontal axis which are subsets of the overall organisational environment. They should be structured such that they absorb the maximum amount of relevant environmental variety through self regulation.	Prior to the change, investment decisions followed the budget or were the result of board level override. Afterwards Business Teams are free to propose investments and suggest targets etc. All teams have responsibility for setting budgets and are cross functional and have therefore got the capability to exercise autonomy. The FLT have oversight/challenge role and they are also free to propose strategy/targets/make investment calls for themselves. More recent changes (post this research) has not changed budgetary and freedom to execute but reduced the degree of freedom in other respects (limited and more informal influence on product and communication).
2 Operational Directorate <i>'How are groups of business units managed?'</i>	A CSS should have a metasytemic management function (S3), responsible for managing organisational cohesion and collective performance. It does so by actively managing the extant internal environment, made up of the collection of elemental units (S1), with the overriding objective of ensuring that the external homeostatic relationships managed by the elemental units themselves are as healthy as possible. It should do so using 5 vertical channels (see below).	Prior - the business operated on functional lines, with no co-ordinating body below the Board - which itself did not operate very effectively in the capacity. Now, FLT very clearly in the Operational Directorate role. It is primarily responsible for continuous resource allocation with only occasional intervention. The weakening of functional silos (since now the business agenda is stronger than functional agenda) resulted in faster responsiveness to BT needs, although this is not always properly coordinated, which can create capacity problems.
3 Restraint on Command <i>'How do business units receive guidance and direction?'</i>	A CSS should use Command Channel on the vertical axis which S3 uses to make interventions in S1 affairs. This should be minimally used; as far as possible it should only be used to proscribe and guide behaviour using mechanisms that allow for appropriate local interpretation.	Previously the Board was very interventionist (although this did change when the new Chairman arrived in January 2003). Now the Board is 'hands off', but within the context of strategy and a clear operating model. Units were strongly driven by 'how' and relatively less by 'what', more by intuition, communication, relatively less by detailed research.
4 Continuous Alignment <i>'How are the activities of business units co-ordinated and knowledge shared?'</i>	A CSS should have an active, high variety, S2 operating in real time on the vertical axis to routinely co-ordinate S1 activities, in the interests of the elemental units themselves. This should include the maintenance of metadata, operational policies and protocols, and the management of regulatory and performance information and programming.	S&OP was introduced toward the beginning of 2004, thereby improving coordination across the supply chain by providing transparency of plans and issues. Now, however, as well as a monthly OSOF (One Set of Figures), there are meetings between the FLT and the Board and Business groups on at least a weekly basis. There are well established procedures/process governing most forms of regular interactions.
5 Sporadic Sampling <i>'How do higher management keep in touch with what is happening on the ground?'</i>	A CSS should have S3 mechanisms on the vertical axis that facilitate high variety, ad hoc, investigation of the operational component of elemental units. These are required in order to check adherence to organisational policies (communicated via either the S2 or Command Channels), investigate problems and explore opportunities for synergistic improvements.	The HR Director acts as coach for the FLT, and FLT members also coach different business teams. There are also 'cool zone' meetings between the FLT and the Board which are agenda less and held in 'neutral territory' (the Staff Restaurant). All these allow 'the finger to be kept on the pulse'. Hitherto, these did not exist. BTs were "reviewed" in the board meetings once/twice a year.
6 Continuous Resource Bargaining <i>'How are resources allocated?'</i>	A CSS should have a mechanism to allocate (grant permission to use) resources in real time to elemental units, subject to a negotiated resource bargain for which the elemental units are held accountable. Resource permissions will relate to specific regulatory acts (as prescribed in the Resource Bargain) and the maintenance of elemental operations and the local (elemental) regulatory capacity (both expressed as proscriptions in the Resource Bargain).	The FLT allocates investment funds on a quarterly basis, but with an option to override in the event of an unforeseen problem/opportunity. There is also some flexibility at a local (sales level). Not known whether this approach extends to other costs. Some freedom is kept at a total organisational level to allow worthwhile initiatives to get extra funding. This process was also designed to create spiral of positive competition between teams. Prior to this, the budget determined resource allocation (although Board often overrode this in an unstructured fashion).
7 Accountability <i>'How are business units held responsible for the resources they have been allocated?'</i>	A CSS should have an 'Accountability' Channel on the vertical axis whereby the management of elemental units are able to reassure metasytemic management (S3) that their environmental homeostats are operating effectively within the terms of the resource bargain. Information is provided by 'exception' subject (inter alia) to the filtering of elemental management.	Each project is justified on business grounds, and is reviewed post hoc for learnings etc. Range targets are also provided to BTs (top and bottom line). Hitherto adherence to the budget target was the only criteria for which cost centre managers were held accountable. Generally information provision was very limited but there was a great focus on results generated against those targets.
8 Development Directorate <i>'How is innovation managed?'</i>	A CSS should have a metasytemic function (S4), responsible for maintaining and enhancing the regulatory capability of the system. This requires continuous monitoring of trends in the environment, and building models (of the existing and possible environmental and systems states) to help create options for response and adaptation. To discharge this role effectively S4 should exchange information with S4 at different levels of recursion and maintain an intensive dialogue with S3; the managerial subsystem responsible, inter alia, for overseeing current operations and agreeing the resourcing needed to enact the options.	At the time of the survey Business Teams were largely responsible for their own innovation. The FLT and Board managed strategy (within the context of Unilever's strategy). There is also no organised system for external monitoring. Arguably cross functional structure itself led to faster gasping signals from market (sales > marketing) but this was more about speed than quality of information or information systems. Structure itself generated better external info by desilosing. The prior position is unclear.
9 Leadership <i>'What guides and hold the organisation together?'</i>	A CSS should have a metasytemic function (S5) which provides leadership for the whole system. Leadership provides organisational closure?? by, inter alia, creating and maintaining system ethos (system boundaries, aims and values) as articulated in policies, practices and behaviour. In doing so this helps define the systems identity. It should also maintain the overall health of the system by overseeing the S3/S4 homostat (which may involve making interventions to resolve conflicts or impasse) and acting on algedonic signals.	Prior to the changes the Board operated at a S3 level. Afterwards both the national board and the FLT demonstrated very powerful leadership qualities - such that it was very clear to everyone what the business stood for. One example was how the FLT was given the opportunity to create a new way of working, and the lengths they went to enrol and motivate the BT members. Identity was generated by visibility of FLT in the organisation. Goals (expressed as growth and profit ranges) were communicated and evaluated in monthly cascade meetings. There is clear reference for behaviours in early communication to the organisation and in 'BT opening' workshop - commitment, results, team etc. Issue resolution was quick thanks to informal relationships ("corridor discussions" and frequent, weekly FLT meetings).
10 Organisational Override <i>'How do important, non routine, messages get to the right people?'</i>	A CSS should have an Algedonic Channel, whereby signals of an exceptional nature, which could portend opportunity or risk, are channelled directly to S5 overriding all meta-systemic filters.	The coaching and 'cool zone' meetings now provide one mechanism for this to happen, as does the explicit emphasis on risk in the reporting process. It is difficult to assess how effective these processes are, informal culture supported information travelling fast through hierarchy.

Figure 31 Summary of detailed cybernetic mapping of Unilever Poland

From a cybernetic perspective the most noteworthy aspects of the change undergone by the Polish foods business were as follows:

1. The autonomy given to Business Teams (S1). As part of this change BTs were formally given more decision making authority and the responsibility for proposing activities to exploit opportunities and mitigate threats. In cybernetic terms they were charged with absorbing environmental variety. The explicit cross-functional nature of the teams enhanced their requisite variety; thereby enabling them to discharge this role more effectively.
2. The cybernetic quality of the restructuring of the management metasystem. Whereas previously the Board was actively engaged in S3 and even S1 activity, the restructuring planted them firmly in a S5 role. S3 operational management was clearly delegated to the FLT and the previous functionally orientated organisation (that was ill equipped to absorb environmental variety) consciously neutered.
3. The introduction of a continuous resource bargaining process. The quarterly allocation of resources in response to BT proposals is better equipped cybernetically to absorb environmental variety than the previous annual budgeting process. It is also worth noting that the allocation criteria included the degree of alignment with a clearly articulated strategic framework (S4) and the results of prior formal post hoc reviews of activity (Accountability and learning). The whole mechanism was thus consciously designed to promote a positive feedback (growth) loop, since success attracts more resources which in turn creates more resources for allocation, and so forth.
4. The new goal setting process. Targets (as proposed by BTs and endorsed by the FLT) were expressed as a range (threshold to gold) and subject to continuous review based on an assessment of organisational capability and prevailing market conditions. It thus echoes the principles of Beer's Triple Index whereby actuality is compared to capability (thereby measuring productivity) and potentiality (performance).
5. The importance of informal processes. Two important informal processes were introduced as part of the transformation. Firstly, a board member was appointed to coach the FLT and FLT members were assigned as coaches to BTs. Since coaches were explicitly restricted to operating in a non-executive

capacity this provided the systems with a S3* and algedonic functionality. In addition, frequent unstructured meetings between BTs and the FLT and the FLT and the board (cool zone meetings) played an important role in maintaining high variety exchange between different systemic levels.

6. The importance of leadership. The ways in which the Board conducted itself with the FLT and the FLT with the BTs clearly had a profound impact. Specifically the degree of commitment to, and consistency of, behaviour with the espoused vision and values behind the changes was important.
7. The speed of change. A radical shift in management processes and the performance characteristics of the business was accomplished over a very short period of time. This may reflect the extent to which the (cybernetic) principles that underpinned the transformation are consistent with widely held common sense views of what constitute good management. Clearly it also demonstrates how sensitive a system can be to a change in organisational context and the influence of a small number of individuals, for good or ill.

9.3.2 Assessment of cybernetic soundness of FPMS

Two surveys were completed for Unilever Poland, both of which assessed the situation after the January 2004 reorganisation with the situation that prevailed before – the guidance given suggested the ante assessment be fixed on January 2003 (since numerous small changes were made during 2003, before the major shift in the management model in early 2004). One survey was based on an analysis of interviews conducted in August 2005 (SM), the other by the person who was financial controller of the Foods business through this period (AM). The results are summarised below (Figure 32).

Overall, there was a two point shift in the cybernetic score. This is slightly less than the gap we observed between the scores for Svenska Handelsbanken and its peers (2.4) but it is significant, particularly given the short period of time over which these changes took place. The two surveys arrived at similar ante scores for UPF, but SM assesses the post position some 0.8 points higher. Nevertheless, the ante to post shift in the more conservative assessment (AM) is still significant: 1.8 to 4.4; nearly

double. Before the changes, the scores for Structure, Information and Regulation are similar; after there are larger spreads in Structure and Regulation; the same pattern that was observed in the case of SvH.

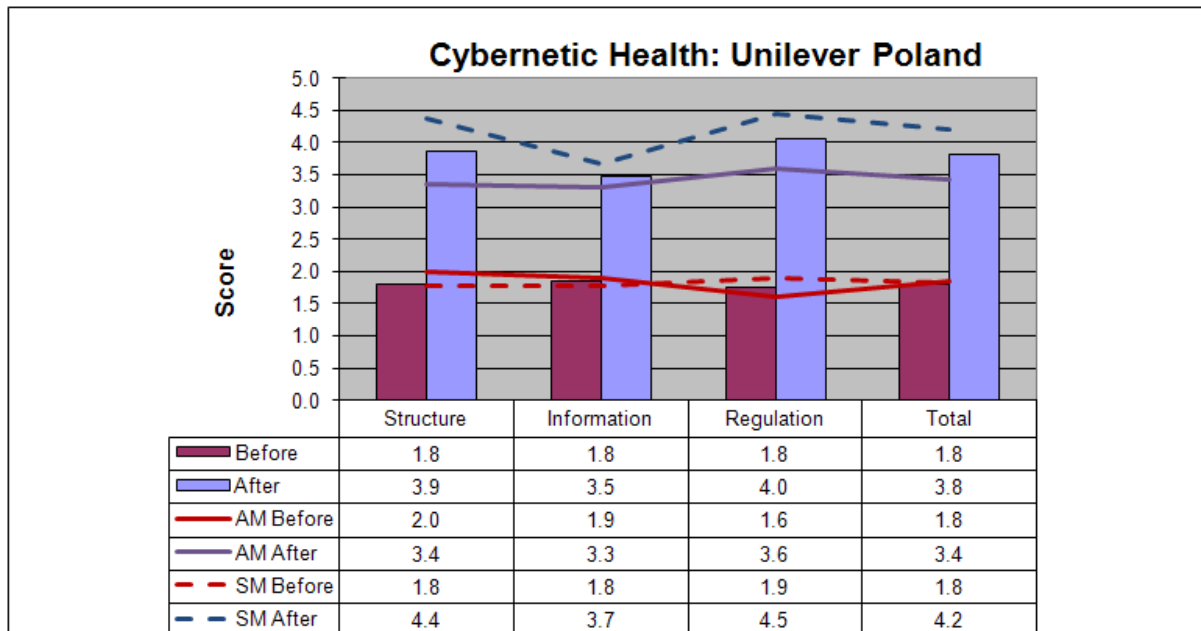


Figure 32 The cybernetic health of Unilever Poland before and after

Looking at the individual scores (Figure 33), none were registered against question 12 (because in this case there *is* no external resource bargain) and question 22 (scenario generation). There were no questions with larger spreads than 3 points, but of the seven questions that registered the largest movements, three were the same as the SvH big movers. They were questions 1 (autonomy), 29 (locus of regulation) and 30 (option generation), perhaps suggesting that the decentralisation of power is one of the most significant aspects of a move to a more cybernetically sound management model.

In no case did the cybernetic score reduce from ante to post, but AM registered no change against 4 or the 34 questions. Again, however, given the short period of time covered by this survey, it is surprising that there were not more instances of this. Where low spreads were recorded, it should not necessarily be seen as evidence of poor cybernetic health. Rather, it frequently reflects subtleties in the (high variety)

real life situation which, for good cybernetic reasons, cannot be captured by a (low variety) research instrument completed by someone with limited personal variety. So, for example, although the new management model involves frequent changes to targets (as reflected in the low cybernetic score for question 27), such changes were an attempt to maintain a constant level of relative stretch (i.e. goal variety) and the targets were articulated in high variety terms (ranges), consistent with recommended cybernetic practice; this detail was not captured by the research instrument.

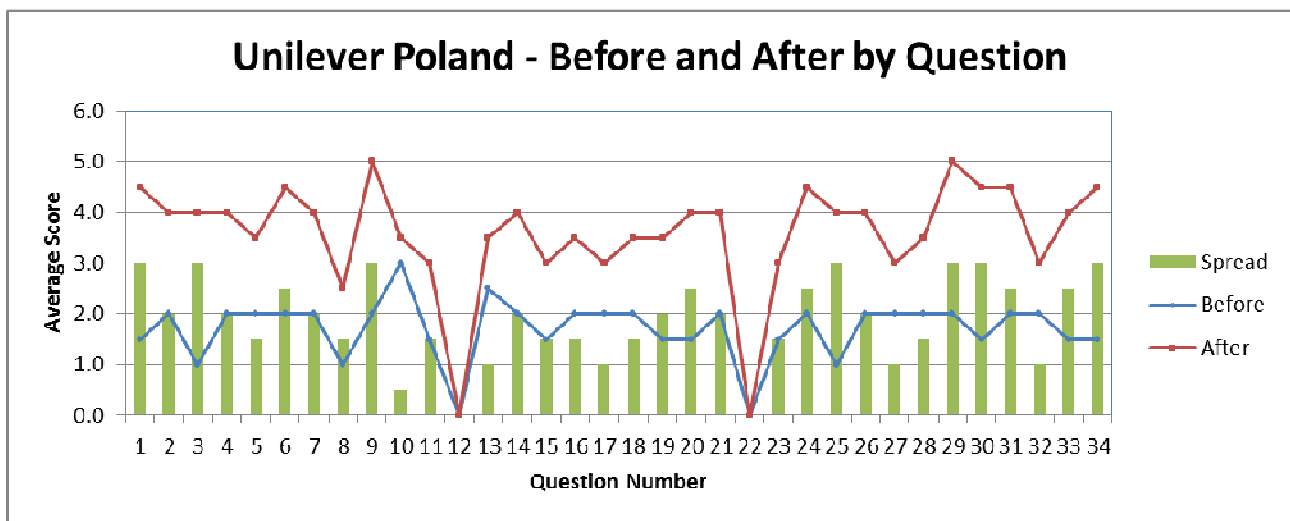


Figure 33 Responses to the cybernetic questions before and after

The four sets of scores were then analysed using Wilcoxon's pairwise test (Curwin and Slator, 2002) using the following hypotheses:

Hypothesis 1

There is no significant difference between the cybernetic scores for Unilever Poland before and after its transformation.

Hypothesis 2

There is no significant difference between the cybernetic scores for Unilever Poland before its transformation.

Hypothesis 3

There is no significant difference between the cybernetic scores for Unilever Poland after its transformation.

In this case there were 29 questions with a full set of responses, but only 6 pairwise comparisons. The results are summarised below, where shading represents a significant difference at 1%.

	1	2	3	4
1				
2				
3				
4				

KEY:
1. AM before
2. SM before
3. AM after
4. SM after

Figure 34 An analysis of the cybernetic scores for Unilever Poland

This analysis confirms the results of the analysis of the scores above, showing:

1. That both ante and post scores differ significantly. Thus the first null hypothesis can be rejected.
2. The two sets of ante scores do not differ significantly, thus the second null hypothesis can be accepted.
3. The two sets of post scores do differ significantly, so the third null hypothesis must be rejected.

In conclusion, it seems clear that, between January 2003 and January 2004 there was a significant shift in the management model employed by Unilever Poland in the direction of one that was more cybernetically sound.

9.3.3 Assessment of performance (before and after)

The goal of the Polish business at this time was to generate revenue growth, whilst maintaining an adequate level of profitability. Its recent history, however, had been characterized by the business engaging in high levels of market place activity in order to meet what were perceived as stretching quarterly targets, which generated levels of revenue performance that could not be sustained beyond the very short term. So, for example, high levels of promotional discounting might have generated a short term boost to sales by encouraging consumers to stock up, so simply pulling demand forward from future periods, rather than creating new demand.

We can see this reflected in sales patterns, shown as moving annual total below (Figure 35). For orientation purposes, distinctive markers pick out January 2003 and January 2004, the reference points for the cybernetic survey. Revenue levels are moderately high, but very volatile, up until the end of Quarter 1 2003. After then the pattern shows less volatility but a steady decline until January 2004, after which it exhibits steady growth.

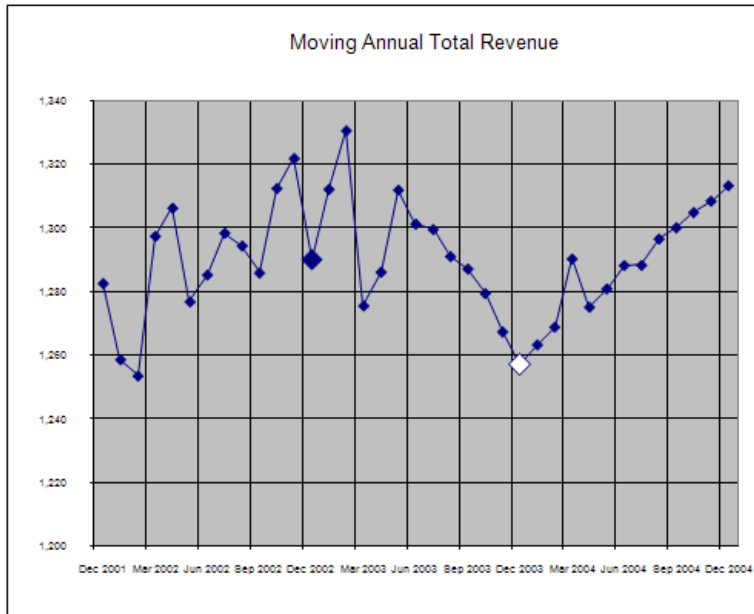


Figure 35 Unilever Poland - revenue trends (scale: millions of Zloty)

As we would expect, the 12-month rolling standard deviation calculation for the same period (Figure 36 below) shows a high levels of volatility (15-25%) until January 2003, when it precipitously declines. After June 2003 the level of volatility is sustained below 10%, less than half its pre-2003 levels.

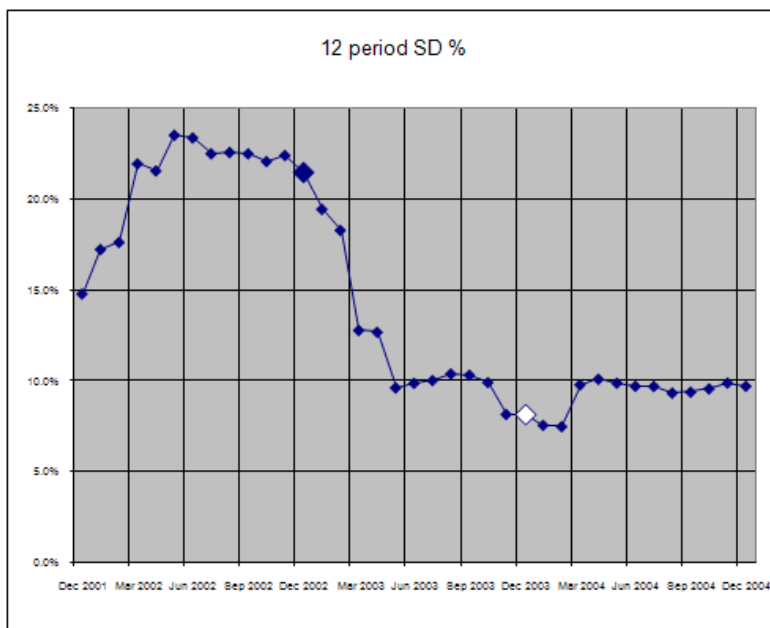


Figure 36 Unilever Poland: volatility of revenue

The reason for this is clear from Figure 37 below, which shows the monthly revenue plotted against a three month rolling average. Up until the end of June 2002 there is a clear pattern of sales peaking at the end of quarters, which is consistent with the notion of pulling demand forward. Between then and the year-end, sales were still volatile, but the quarterly peaking pattern is not evident. From January 2003 onwards, the monthly numbers track the rolling average much more closely.

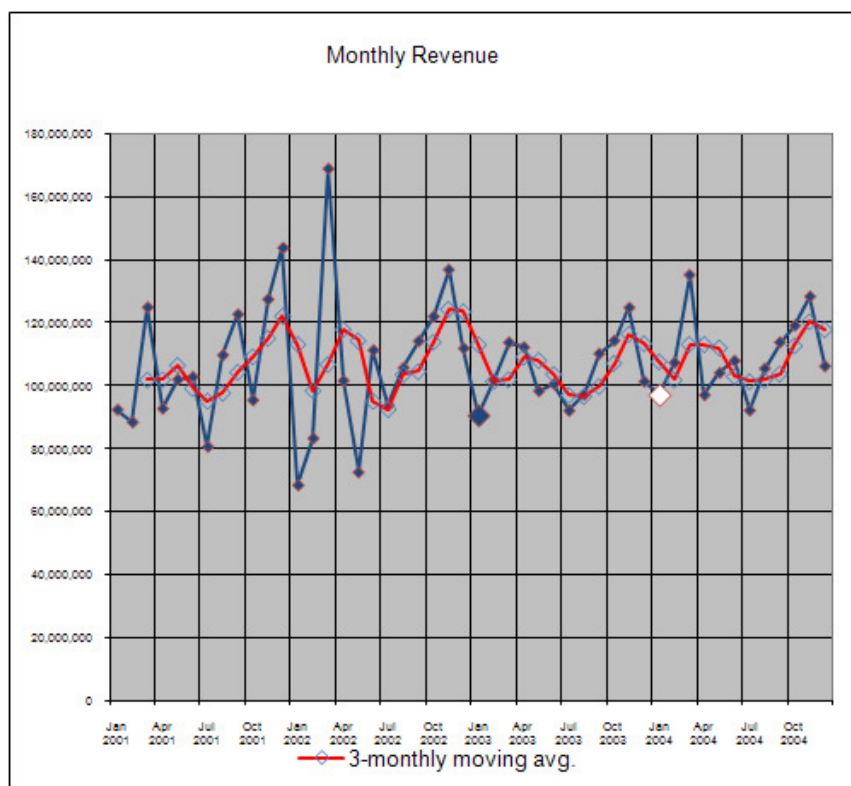


Figure 37 Detailed analysis of revenue trends: Unilever Poland (scale: Zloty)

The reason for the drop in volatility before January 2004 may be the result of changes in practice instituted during 2003. For instance, when the new chairman arrived in January he consciously adopted a less interventionist policy, and started the process of decentralization by creating cross-functional Business Teams.

This change in management approach is reflected in the patterns of Advertising and Promotion (A&P) spending. In this kind of business, revenue growth is believed to be correlated with the amount of money spent on (well directed) advertising and promotion. In Figure 38 below, it is clear that the level of spend dropped through 2003, which is consistent with the hypothesis of there being less top down intervention aimed at pushing revenue growth, and the reduction in volatility in sales. However, what is very striking is that the level of A&P spend continues to fall during 2004, at a time when sales were rising. This runs counter to conventional wisdom and supports the hypothesis that the changes introduced in January of that year made a significant difference to the organizational capabilities; there was a clear and immediate improvement in the effectiveness of spending. From mid Q4 2004 onwards the level of A&P spend rose, probably evidence of a positive feedback loop kicking in: higher levels of revenue, achieved with lower levels of A&P, generate a surplus over an acceptable level of profit, which can then be invested in A&P, thus leading to higher sales, and so on.

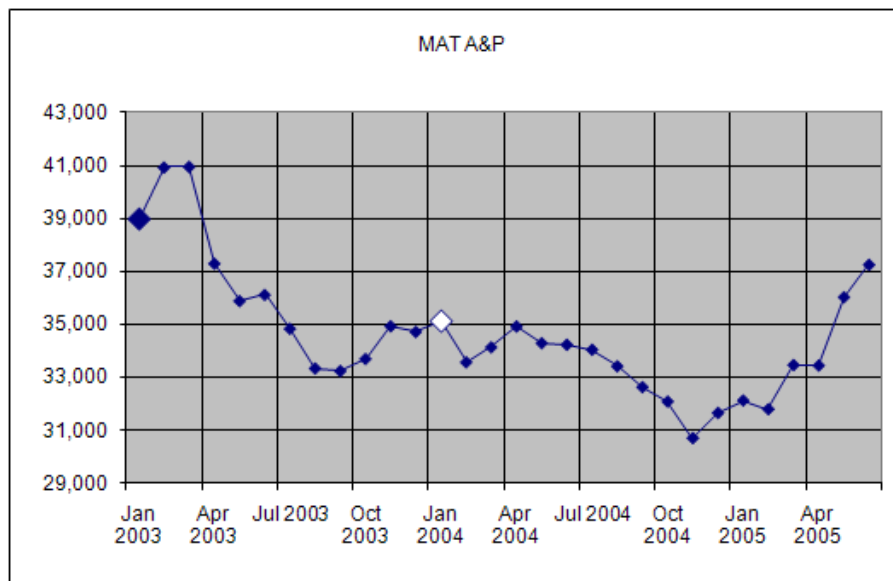


Figure 38 Trends in Advertising and Promotion spend: Unilever Poland

9.3.4 Analysis of findings

In summary, it is clear that Unilever Foods Poland made a major change in organisation and practice in a very short period of time; a change which is reflected in a significant improvement in its cybernetic health. Our research proposition would expect the improvement in cybernetic health to be associated with an improvement in the variables being controlled for and a reduction in the volatility of performance, which is clearly what occurred. Indeed, the nature and timing of breaks in the historic record are remarkably clear.

Might there be other factors that account for this shift in performance? One explanation for such a change would be a change in the external environment; perhaps a significant increase in market growth. However, this is not supported by the evidence. Market research data produced for the company shows that of its ten peers, Unilever Poland had the lowest level of growth at the end of 2003. By the end of 2004 its level of growth was the highest, so it is clear that the increase in revenue in 2003 reflected an improvement in the relative performance of the business, not an increase in the market.

One factor that comes out very strongly in the interviews conducted in the business was a change in behavior and improvement in morale. Although, the formal reward system did not change over this period, there was an increase in the use of non-monetary rewards such as group holidays paid for by the company as recognition of achievement. These factors were not captured in the cybernetic survey and it is not possible to assess to what extent these might have contributed to the improvement in performance, or indeed whether they were simply a consequence of the improvement. It is difficult to see how they could be associated with the reduction in the volatility of performance, however.

In conclusion, it is clear that the change that took place in this business was significant, and was of a nature that is consistent with the cybernetic proposition being tested. It is not possible to determine to what extent the way in which performance was acknowledged contributed to the change in business outcomes.

9.4 Evaluation and justification of the methodology

In both cases studied, therefore, we have no evidence that is inconsistent with the cybernetic proposition tested. The confidence with which we can assert this is, however, contingent upon the robustness of the methodology used. At this juncture, therefore, it is worthwhile reflecting upon the research approach in the light of the knowledge gained from its use.

This will involve submitting the methodology to four tests:

1. Construct validity – did the approach used successfully measure what it purports to measure?
2. Internal validity – how confidently can we make clear causal inferences based on the nature of the evidence gathered?
3. External validity – to what extent can we generalize from the specific cases to a wider population?
4. Replicability – could the research be replicated in a way that would validate the results?

9.4.1 Construct validity – are we measuring what we purport to measure?

We will turn first to a consideration of the approach used to measure cybernetic health, and then that applied to performance.

The scope of the challenge involved in assessing the cybernetic health is large. It involves attempting to survey a broad range of organisational practices across the full scope of the organisation and, in the case of Unilever Poland, over an extended period of time. It is therefore not surprising that there were a limited number of respondents with the requisite command of organisational knowledge. Also, the approach used did not differentiate between different streams of business, different recursions and the timing of changes. These problems were compounded when an

attempt was made to extend the assessment to peer group companies, in the case of SvH.

In addition, contributors sometimes had difficulty interpreting the questions, possibly one consequence of the attempt to render subtle cybernetic concepts into plain English. We see this with the scores of the outlier assessor for SvH (number six) and the scoring given to forecasting in the case of SvH and goal setting in UPF. On the other hand, the measures taken beforehand to help the main contact understand the cybernetic context may well have introduced bias into the survey process.

Finally, the scoring mechanism inevitably involves an oversimplification of the situation. All the questions received an equal weighting and no attempt was made to understand the extent the nature of any interdependencies between the various aspects being assessed. In other words, there is a presumption of independence. The compression of all this information down to an arithmetic average is also a very crude measure.

The diagnostic approach used to assess cybernetic health may, therefore, have failed to capture many subtleties and nuances that a more in depth and unstructured analysis by an expert might have revealed.

On the positive side, the diagnostic tool used to assess cybernetic health was well structured and solidly founded upon theory – none of the questions posed were superfluous or arbitrary. Despite its theoretical provenance, the diagnostic was written in plain English, and the use of illustrations undoubtedly made it easier for respondents to interpret them in a consistent fashion. Multiple independent sources were used, and wherever possible the results were subject to independent scrutiny and challenge. In these circumstances, the fact that the results were so consistent and clear-cut provides a large amount of confidence that, whatever the weakness in the approach taken, we did succeed in producing an adequate measure of cybernetic health.

The measurement of performance also involved some compromise. It comprised a small number of variables, when it is very likely that the control systems included in

the survey has a part to play in controlling many other (often non-financial) variables. In both cases, minor adjustments were made, thus running some risk of introducing error and bias.

On the other hand, the criteria used to select and then measure the performance variables were clear and the rationale behind the process robust. The data used was archival, thus it was not produced specifically for the purpose of this research. It was also a subset of the information in regular use within the organisations concerned for performance management purposes, and therefore it is subject to external audit as a matter of routine, which is a guarantee of its quality. Where adjustments were made to the data, the process was independent of the researcher. Again, the fact that the results were consistent and clear-cut should give us confidence that the measurement process was robust.

In summary, while the measurement processes employed could be refined, and with time and effort a richer and more nuanced picture of the cybernetic qualities of the organisations concerned might have been produced, nothing has been unearthed that undermines confidence in the research findings.

9.4.2 Internal validity – can we make clear causal inferences?

A factor that all researchers should constantly bear in mind is that correlation does not necessary imply causality. In this case it is possible that factors other than (but perhaps related to) cybernetic health might contribute to the observed patterns in performance. For example, in these two cases, the way in which people are rewarded and managed may well have had a bearing upon outcomes. Indeed, this stance that there might be other factors involved is itself cybernetic in nature. If the world is made up of a large number of interconnected entities, related to each other in contingent, dynamic and ultimately unknowable ways, then it is dangerous to attempt to explain behavior using simple statements of unidirectional causal logic.

It is also possible, if unlikely, that the organisations used as comparators were either indifferent to their financial performance (as defined), or relied on mechanisms other

than those set out in the cybernetic questionnaire to control other variables. Furthermore, it was not possible to apply robust significance testing to either set of performance variables.

On the other hand, the hypothesis being tested was clearly expressed, the theoretical relationship between independent and dependent variables theoretically well-articulated and the justification for the chosen performance variables and the measurement techniques used was compelling. Also, while the significance testing was incomplete, the results were clear-cut. This was so for both cases, one of which looked at relationships in time, the other, over time. In addition, most of the alternative potential causes of the observed behavior have been examined and ruled out.

In summary, we can be reasonably confident that the hypothesized relationship between the cybernetic soundness of the FPMS and the nature and stability of performance has, indeed, been observed in both these cases.

9.4.3 External validity – can we generalize?

There are a number of reasons why we might be cautious about generalizing from these cases to a broader population. The cases were chosen specifically because they were likely to yield a result; positive or negative. Svenska Handelsbanken has a management system that is well known to be very different to that of its peers. The nature and scale of the transformation undergone by the Polish Foods business is unusual. Whether we would be able to distinguish any kind of relationship between cybernetic health and the nature of performance in examples that were less distinctive is open to question; it is possible that other factors would swamp the effect of the management system, making it difficult to draw the same conclusions. We must also be cautious since, as already discussed, we do not understand whether all the elements of the cybernetic prescription are equally important, in all circumstances, and whether particular combinations of particular elements are more significant than others. As we have also seen, any attempt to generalize must also take account of the subtlety of variety engineering in real life.

There is good reason to be confident that the findings are not unique to the particular cases studies. The results are clear-cut and consistent with theory and prior knowledge in the field. Significantly, some aspects of the findings are inconsistent with received wisdom, and no explanation other than the one that is proffered in this thesis is forthcoming. The same phenomenon has been observed in two companies in completely different industries, and appears stable over time. The results have been confirmed in studies using two different approaches: using cross-sectional and longitudinal perspectives.

As a result, it is reasonable to conclude that there is a relationship between cybernetic health and particular qualities of organisational performance that is of general applicability. Like any theory, it would be unwise to make too many claims about its significance or relevance until more is known about the exact nature of the mechanisms involved, but this is not unexpected given the novelty of the investigation conducted.

9.4.4 Replicability – could the results be replicated?

There are a number of reasons why it may be difficult to exactly replicate the results of this research. It might be difficult to find other cases that will yield such clear-cut results, one way or the other, and to control for the contextual variables that could influence the outcome. In addition, there are a number of ambiguities and subtleties involved in interpreting the survey questions that make it unlikely that we would get exactly the same results if it were possible to turn the clock back and repeat the exercise. Also, a researcher without a deep understanding of the cybernetic principles involved may find it difficult to appropriately construct and run the process and to interpret the findings in the way described here.

On the other hand, the research methodology is well structured and simple to follow, and the research instruments and techniques used are relatively simple and easy to understand. Most researchers would be capable of repeating the process in a way

that was faithful to this study. The use of archival data to study performance makes it easy for researchers to repeat the process, and to test and challenge the findings.

In summary, this fieldwork is, in principle, replicable. The complexities of the phenomenon being studied, and our primitive grasp of the nature of the processes at work, make it unlikely that exactly the same results would be forthcoming if the fieldwork were repeated, but enough has been done to give confidence that the findings of this fieldwork are not an artefact of the methodology employed.

9.4.5 The cybernetic proposition– critical evaluation

As with any research in the social sciences we have to proceed with caution; an inevitable consequence the inherently complex and difficult nature of the phenomena being studied. Also, some weaknesses in the methodology, such as the limited number of assessments and potential selection bias in the Polish case study, and the lack of resolution for different recursions, business units or peers in the case of Handelsbanken emanate that a certain degree of circumspection is required when making claims based on this research. Some such deficiencies are inevitable given the scale and ambition of this work however, and can, and should, be remedied in subsequent studies as anticipated in the original research design.

The results of this fieldwork are, however, very promising. It set out to test the plausibility of the proposition that adequate control system variety will tend to be associated with good, stable performance and we can now say with confidence that the conjecture has passed a critical examination and is therefore worthy of further serious academic study.

In both cases, we have evidence of good cybernetic scores being associated with a combination of improved and more stable levels of performance. In Unilever Poland higher and more consistent growth is associated with a sharp improvement in cybernetic health. Svenska Handelsbanken demonstrates a combination of higher cybernetic scores, and better and more stable returns than its peers. In most cases where some form of statistical analysis is possible the correlations are highly

significant. Contrary evidence has been searched for, but none has been found, nor is there a convincing alternative explanation for the observed phenomena.

Because the outcome - high reward/low risk - runs counter to conventional wisdom this is unlikely to be the result of chance. This and the strong theoretical underpinning to the hypothesis and a supporting body of congruent antecedent knowledge further bolster confidence in the results.

There is perhaps only one piece of evidence that suggests that the cybernetic perspective falls short of a complete explanation. In both cases, the role of rewards and other processes associated with levels of motivation in the workforce was not covered by the cybernetic analysis, and there is anecdotal evidence that these are important factors. This is a shortcoming, but it is noteworthy that in both cases the reward processes acknowledged collective performance, after the event. They did not take the form of the individual incentives that Agency Theorists suggest are necessary to align employee with corporate interests. This suggests that the weakness (if that is what it is) represents a failure to explain fully, rather than a failure to test a credible competing alternative explanation for events.

Finally, the results of the fieldwork also need to be seen in the context of the historical paucity of theoretical constructs in MCS research and the general absence of empirical work that convincingly confirms or refutes research hypotheses, or provides a foundation for theory development. In addition to a strong theoretical model, capable of explaining the findings of antecedent MCS research, and a means of translating it into a real world context, the results demonstrate a capability to generate novel, testable, hypotheses for which there is convincing empirical support. In addition, this is one of a limited number of pieces of MCS research that has managed to incorporate performance variables into its scope.

In conclusion, the results of this fieldwork provide strong support to the contention that a cybernetic based theory of control is highly credible and worthy of further academic attention. In addition, the superior level of performance exhibited by the more cybernetically healthy organisations suggests that the application of cybernetic concepts in business has potentially very significant economic value to practitioners.

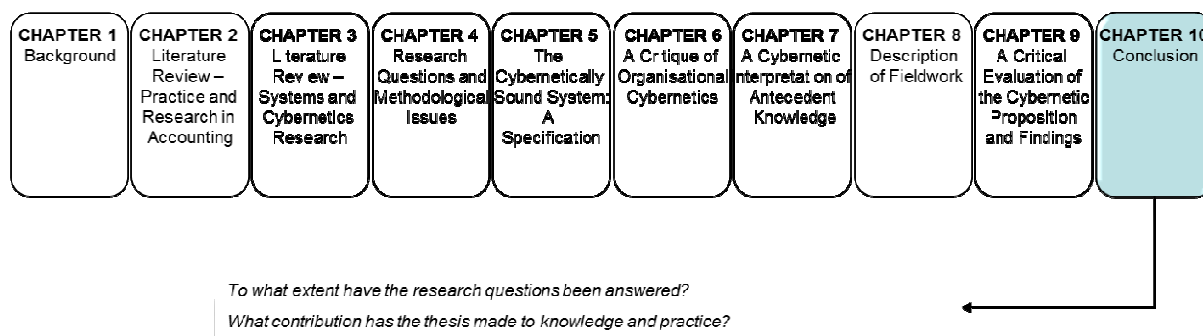
9.5 Conclusion

In this chapter, the results of the fieldwork designed to test the proposition that adequate control system variety tend to be associated with good, stable performance, have been presented and analysed. The conclusion is that the findings provide strong support for the proposition, although there is scope for refinement of the methodology, and a need for replication of the work.

The results are consistent with the theory underpinning the cybernetic model for FPMS advanced in this thesis, and lend support to calls for systems-based approaches to be reintroduced into academic work in MCS. They also open up the prospect of developing methodologies and techniques for application by practitioners.

The next, and final, chapter will review the research objectives set out at the beginning of this thesis in order to determine to what extent they have been met. It will also suggest ways in which the insights from this work can be carried forward in academia and exploited in practice.

10 Conclusion



10.1 Introduction:

The objective of this, the final chapter, is twofold. Firstly, we shall assess the extent to which the thesis has successfully fulfilled the research objectives. The second aim is to assess the contribution made by this research.

10.2 Review of research objectives

The research objectives set out at the beginning of the thesis were:

1. To review the gaps in the current understanding of the operation of control systems for the management of the flow of financial resources and re-interpret them from an appropriate systems perspective
2. To develop a reference model for the management of financial resources, based on systems theoretic principles and produce a methodology and tools to aid the application of this model to the diagnosis, design, implementation and operation of financial control systems in organisations
3. To review the application of these in the field in order to determine the nature of the impact that they may make in practice and the potential consequences for the understanding and design of control systems.

We will now determine to what extent this thesis has succeeded in meeting each of these objectives in turn.

10.2.1 First research objective - gaps in understanding: a systems perspective

The perceived weaknesses in the existing Management Control Systems research can be summarised under two headings: weaknesses in theory and weaknesses in research methodologies.

Mainstream MCS research has suffered, according to many authorities, from having an impoverished theory, stemming from the inappropriate application of mechanistic approach to exercising control and the unquestioning adoption of a rigid, hierarchical, top down view of organisations. Others take the view that theory is not so much impoverished as non-existent. There is a strong consensus that there is a need for a unifying theory capable of generating testable hypotheses.

The lack of an appropriate theory has contributed to perceived shortcomings in methodology. Research has been characterised by mindless empiricism, using survey based techniques to test a range of hypotheses based on a poorly specified theory (Contingency Theory). Research is seen as overly empirical; indeed in some streams of research technical virtuosity has become almost an end in itself. It has also been criticised as poorly directed, based on questionable assumptions (such as assumptions about linear causality and the existence of equilibrium conditions), using flawed research tools and with poorly defined or missing variables; for example performance is rarely included. As a result, research has been characterised by low levels of replicability and a failure to develop a coherent consensus around a well-defined body of knowledge.

This thesis has presented a strong case to support the argument that systems theory, and in particular cybernetics, is well qualified to remedy the perceived gap in MCS theory. Cybernetics claims to be the science of communication and control and thus addresses head on the fundamental issue for MCS: the need to consistently achieve results in the context of an unpredictable environment. Cybernetics provides

a strong theoretical foundation for research into management control, primarily based on Ashby's Law of Requisite Variety (1957), and a strong, well specified model to help apply it to social organisations: Beer's Viable Systems Model (Beer, 1979, 1981, 1985).

Little of this is new, but systems ideas do not feature at all in current MCS thinking, having been dismissed by researchers 20 years ago based on a flawed understanding of cybernetics. Systems theories have never been developed into testable propositions in MCS research.

Cybernetics provides a strong theoretical foundation for MCS research and Ashby's LORV (1957) in particular is capable of generating a range of well defined, testable hypotheses. It also provides clarity about the definition of variables, based on the concept of variety. A systemic perspective assumes complex sets of interdependent variables and it is not based on questionable ontological assumptions about equilibrium, linear causality and so on; an organisation is conceived of as an organic whole, continuously striving to survive in an unpredictable environment by maintaining a dynamic balance between autonomy and cohesion, response and adaptation.

The systems perspective is not without its weaknesses. For example, little work has been done that addresses psychology within an organisational context, in particular with respect to the motivation of people, which is central to the philosophy of a number of streams of MCS research (such as that of Anthony (1965), RAPM (Hopwood, 1973) and that based on Agency Theory (Demski and Feltham, 1978)). On the other hand, while cybernetics is silent on the matter, the aforementioned research streams are based on poorly defined or simplistic models of motivation that have not been empirically corroborated, so this shortcoming is not a serious blow to its claim. In addition, while the theoretical rigour of the cybernetic approach and the sophistication of the Viable System Model are attractive, the corollary is that a cybernetically based approach to the design and testing of FPMS can be complex. In particular, measuring variety, particularly when applied to something as intangible, subtle and sophisticated as an entire organisation control system, can be very problematic. However, it can be argued that one of the weaknesses of competing

approaches is that they are based on naïve and simplistic assumptions about organisations, so perhaps complexity is the price that has to be paid for legitimacy.

The most convincing reason for believing that a cybernetic approach is capable of making a significant contribution to MCS research is the results of applying it. Using this approach, we are able to generate propositions that are consistent with much of the corpus of existing findings. Thus, according to the correspondence principle, it satisfies one of the two criteria that any new theory needs to fulfil in order to be taken seriously as an alternative to existing frameworks. It also satisfies Occam's Razor by providing a parsimonious explanation of phenomena. In particular, Ashby's LORV (1957) is a compact model capable of explaining a wide variety of empirical findings that hitherto have required complex and convoluted reasoning. It also has met the second criteria of the correspondence principle, since it has helped generate new testable hypotheses (out of sample predictions) that have not been refuted by pre-existing research and that cannot be easily explained by other existing theories. Furthermore, fieldwork has provided some evidence that seems to corroborate this new, cybernetically generated proposition.

In summary, a systemic perspective has provided novel insights into existing MCS research findings and represents a highly credible alternative foundation for the field.

10.2.2 Second research objective – a model and methodology for applying Systems Theory to FPMS

Starting with the process of identifying those systemic laws and principles relevant to the purpose of the financial control of organisations, this research has specified a cybernetically sound conceptual framework for the regulation of financial variables. This framework has been embedded within an appropriate (cybernetically derived) organisational model and the resulting idealised archetype translated into a research instrument that can be used for a number of purposes, including the assessment of the cybernetic health of an organisations FPMS and the diagnosis of regulatory problems. It can also be used to help design sound financial performance

management systems, process and techniques, a subject that is addressed in the next section.

Furthermore, a methodology to assess the quality of performance, based on cybernetic criteria, has been devised. As far as we are aware, the approaches used to translate theory into a practical model and to measure the effectiveness of regulation are novel. Indeed, this is one of a few pieces of research that has factored performance variables into research.

In summary, this thesis has demonstrated how systems theory can be applied in MCS research and practice. The methodology developed can be used by workers in this field and provides opportunities for the extension of systems-based MCS research into other areas. Some of the potential avenues that could be explored by further research are addressed in the final part of this chapter. The issues explored in this thesis – how the design of organisational practice can contribute to performance – is also of great relevance for practitioners.

10.2.3 Third research objective: to assess the potential impact on practice and in academia

The impact of these ideas will potentially be manifest in two areas: practice and academia. We will address the field of practice first.

Practice

There are three ways in which this research might have an impact on the world of management practice:

1. Firstly, there has been a lively debate going on for many years about the appropriateness of the budgeting model for management contemporary businesses, and a number of improvements or suggested replacements have been proposed. The systems-based FPMS developed during the course of this research could inform and shape this debate.

2. Secondly, there is a suggestion that many of the process and practices used by managers on a day-to-day basis are unsound, from a cybernetic perspective. Insights from this research may help diagnose the problems with conventional practices and suggest how they might be improved.
3. Finally, fieldwork has uncovered a way to measure the effectiveness of FPMS that shed light on a dimension of organisational performance not captured by traditional approaches to performance measurement. It is possible that this approach may have applications outside the world of academic research.

In order to assess the potential impact of the approach developed in this thesis to the development of management ideas we can use the CSS FPMS questionnaire to assess the nature and size of the gap between the traditional approaches and the CSS model. In addition, we can compare it with the alternatives proposed by management thinkers over the last decade, in response to the perceived inadequacies of the budgeting model. The results are shown below.

Principles

		Budgeting	Balanced Scorecard	Levels of Control	Beyond Budgeting
ORGANISATION STRUCTURE	1 Elemental Autonomy	2			5
	2 Operational Directorate				
	3 Restraint on Command	3		4	5
	4 Continuous Alignment	1			4
	5 Sporadic Sampling	1	3	4	3
	6 Continuous Resource Bargaining	1			5
	7 Accountability	1	3	2	3
	8 Development Directorate				
	9 Leadership			4	4
	10 Organisational Override			4	
	11 Fractal Structure	1			
	12 Continuous Ext Resource Bargain				4
INFORMATION	13 Data Capture	1	4		4
	14 Elemental Information				3
	15 Metasystemic Reporting'	1			
	16 Alert and Alarm	1			
	17 Environmental Monitoring				
	18 Forecast Information	1			4
	19 Forecast Risk	1			
	20 Bias Measurement				
	21 Planning Information	2			
	22 Scenario Generation		3		
	23 Learning By Doing	1			
REGULATION	24 Requisite Variety				
	25 Limited Goal Set	1	2		5
	26 Goal Hierarchies	2	4		
	27 Changes to Goals	1	1		5
	28 Continuous System Control	1	5	5	4
	29 Locus of Regulation	1			5
	30 Option Generation	1	4		4
	31 Option Selection	1			4
	32 Nature of the Int Resource Bargain	1			4
	33 Timing of Regulatory Acts	1			4
	34 Enhancement of Requ Knowledge	1			4
Answered		24	9	6	20
Coverage		71%	26%	18%	59%
Average Score		1.2	3.2	3.8	4.2

Figure 39 Comparison of the cybernetic health of alternative FPMS

While the results for conventional budgeting shown in the first column are not scientific – they are the results of a subjective assessment based on a non-existent archetypal organisation - the score of 1.2 (compared to the maximum score of 5) clearly indicates that the traditional FPMS is cybernetically unsound; in cybernetic language it lacks requisite variety. Organisational structure, and informal (self organising) mechanisms are critical components of the cybernetic model. Neither is explicitly addressed in the traditional model, but there is an implicit assumption that

businesses are (and, one assumes, should be) run based on a strict hierarchical model, with power (and the control of resources) being delegated to lower levels according to tightly controlled, formal, processes. Information in a traditional budgeting model is confined to variance against plan, hence the low level of response to the questions in that part of the assessment tool.

The cybernetic critique of conventional management practice is therefore consistent with much of the criticism of this approach emanating from academic and practitioner communities. The academic analysis of the causes of the deficiencies in the traditional model - the inappropriate application of a cybernetic model of control - is shown to be demonstrably false, however.

The table above also shows the results of the same analysis applied to some emerging concepts in management thinking. Popular management literature is replete with books that claim to have uncovered the reasons for the success of different businesses, most of which provide little more than anecdotal evidence in support of their claims and little detail on the practical measures needed to implement the ideas in practice. There are, however, three solidly grounded ideas that merit detailed consideration. Their scores, using the same approach to measuring cybernetic health, are shown in columns two to four.

1. The *Balanced Scorecard* (Kaplan and Norton, 1992), referred to henceforth as the BSC, is an innovation that has enjoyed a considerable amount of success with practitioners. It has respectable academic origins, since it was developed from insights in the book *Management Accounting: Relevance Lost* (Johnson and Kaplan, 1987). In this book, Johnson and Kaplan argued that one of the major shortcomings of the contemporary approach to management accounting was the failure to recognise the importance of non-financial factors and the underlying patterns of causality ultimately manifest as financial performance. The BSC is a methodology for surfacing these patterns of causality and embedding them in a technique for the measurement and targeting of organisations, based on four perspectives: Financial, Customer, Process and Learning. It is positioned as a supplement to traditional

budgeting, rather than a replacement, so the scores in the table reflect where the practices advocated differ from the assumed norm.

2. The Levers of Control (LOC) framework (Simons, 1995) also has its origins in academic research. It is the result of over a decade of research into the mechanisms actually used by managers to exercise control over organisations. The findings suggested that traditional budgeting techniques (part of what Simon describes as Diagnostic Control Systems) are only part of the armoury used by successful executives. The other levers identified by Simons are: Belief Systems, Boundary Systems and Interactive Control Systems. Where the BSC is prescriptive, the LOC is descriptive, so the scores in the table reflect the difference between espoused systems of control and those observed in practice by Simons.
3. The Beyond Budgeting (BB) model emanates from outside the academic community (Hope and Fraser, 2003). It comprises six Process Principles and six Organisational Principles that was the result of the study of a number of organisations that had successfully managed without budgets for many years; the most notable of which is Svenska Handelsbanken. In summary, the process principles advocate externally reference targets and flexible resource allocation processes, the organisational principles a decentralised structure relying on self organisation and informal mechanisms of control. Unlike the BSC and LOC the BB model is advocated as an alternative to traditional budgeting and so its scores cover a similar range of cybernetic questions.

Using the diagnostic tool to assess these ideas shows that:

1. The Balanced Scorecard's average score is relatively high (3.2), reflecting the fact that it was created to remedy a perceived weakness in traditional management accounting approaches to the control of organisations. However, it has a low level of coverage against the idealised CSS (26%), because it focuses on a small area of performance management (measurement and goal setting) and assumes linear rather than circular causality. It is thus best thought of as a technique than an approach to management. As a result of this, it is difficult to attribute much significance to the high average cybernetic score. Indeed, if, where the BSC was silent on a

- question, the score from traditional budgeting practices were assumed the coverage increases to 74% but cybernetic score would drop from 3.2 to 2.0.
2. The Levers of Control framework has a similar score to The Balanced Scorecard (3.8) but maps less well onto the Regulation principles and very successfully onto the Structure principles. For example, Simons Belief Systems and Boundary Systems align with the Restraint on Command principle, Interactive Control Systems with Sporadic Sampling and Diagnostic Control Systems with Accountability. The framework is silent on many detailed aspects of organisation control in the Regulation and Information parts of the questionnaire and so has a low level of coverage (18%). If the scores for traditional budgeting were assumed wherever the LOC was silent the coverage would increase to 76% but the score drop from 3.8 to 1.8.
 3. The Beyond Budgeting model covers a larger proportion of the cybernetic model than the other two approaches (59%); it addresses many aspects of structure and regulation, although it is not explicit on many detailed aspects of control, particularly with respect to information management. Given that it is explicitly positioned as an alternative to conventional budgeting it is not reasonable to assume the Budgeting scores where the BB model is silent. Its average score is also high (4.2) – equivalent to the scores we saw from the cybernetic exemplars in the fieldwork. So, although all three alternatives considered score more highly than the traditional budgeting model, the Beyond Budgeting model is closest to the cybernetically derived FPMS,

This analysis shows that the systems-based approach is consistent with recent trends in management thinking about how organisations should be run. Unlike the three alternatives considered above, however, the model is theoretically grounded; it is also more comprehensive in its coverage and in some areas more explicit about the nature of the control mechanisms required. Moreover, there is empirical evidence (as opposed to anecdote) that cybernetic health is associated with the rare and valuable combination of good performance and stability of results. As a result, there is an opportunity for insights from this work to be deployed to refine and develop contemporary management thinking in organisational performance management, potentially becoming the source of a comprehensive alternative management model.

The second area where this thesis could make a contribution in the field is with respect to management procedures and processes.

There are many ways in which a cybernetic approach to FPMS could inform practice.

These include:

1. The use of annual (and quarterly) epochs in traditional FPMS, aligned to legal reporting requirements, are inappropriate. They artificially close the system, thereby rendering regulation less effective and promote instability in organisational performance. Instead, performance should be measured and managed on a continuous basis using rolling horizons (Principle 18), with the horizon reflecting the different regulatory lead times of different businesses and recursions within them. For example, SvH has a targeting process that is independent of financial period ends, and Unilever Poland makes extensive use of moving annual totals for tracking performance in place of calendar based measures.
2. In setting targets managers should take account of the variety of the financial targets they set (principle 25); specifically:
 - How many targets.
 - How they are defined.
 - How stretching they are.
 - How frequently they are changed (principle 27).
 - Their relative priority (principle 26).
 - Their relationship with (dynamic) external variables.
 - The relationship between financial and non-financial targets.

The most important consideration in target setting for manager is the balance that needs to be struck between the variety of the environment, the control systems and the targets set, as prescribed by Ashby's Law of Requisite Variety (principle 24). Since environmental variety cannot easily be influenced and control systems variety is difficult to change at short notice, the target

setting process has a critical role to play in ensuring that cybernetic balance can be maintained.

3. A cybernetic perspective could help improve forecasting processes. Indeed, a management book has already been published that draws on many of the lessons learned in the course of producing this thesis (Morlidge, 2010). For example:
 - Conventional forecasting practice is anchored on accounting periods, in particular year ends, whereas a cybernetic perspective advocates adopting a rolling horizon based on decision making lead times and frequencies of updates that are tied to the rate at which new information, pertinent to regulation, becomes available (principles 18,21).
 - The cybernetic focus on regulation helps define the nature of the variable that should be forecast (essential variables or those with a strong causal relationship to them) and the criteria for forecast quality (an absence of bias and variation within the associated physiological limits).
 - A cybernetic approach identifies the need for real time feedback (principle 20) to maintain/improve the quality of the models used to generate the forecast (a software model to support this process is currently being commercialised)
 - Risk should be included in forecasting routines (principle 19), and matched with regulatory redundancy (principle 30).
 - An understanding of System 2 functionality (principle 4) could help design better forecasting architectures. Specifically this involves understanding the systemic role of forecasts (anti-oscillatory and synergy facilitation) and the nature of the coupling required between different organisational recursions.

4. The pivot point of the cybernetically sound FPMS is the resource allocation process. Traditionally budgets are fixed, for a financial year as part of a top down allocation procedure. This thesis suggests that process need to be:
 - Continuous (principle 28).
 - Multi-level (principles 29,32) and
 - Should recognise the need for redundancy (regulatory options – principle 30 - and liquidity – principle 33)

5. Traditionally, management accounting approaches to measurement are based on period end comparisons of actuals to plan or budget. Cybernetics tells us that annual budgets do not have sufficient variety – in laymans terms they are rendered out of date too quickly to make them useful. Also, the use of monthly or quarterly data buckets overly attenuates data; information of potential significance to the regulation process is lost in the aggregation process. Instead, data should be captured and processed in real time (principle 13), which involves filtering the data in order to help separate signals from noise (principle 14). The only useful comparator (other than history) for data analysis is the latest forecast. This is an effective way of identifying unanticipated events and it also help ensure the robustness of the forecasting model in use since it tests the quality of the understanding of the system embedded in the forecasting model (principle 20).

6. System 2 – the co-ordination channel – plays a key role in the cybernetic FPMS. The nearest equivalent in traditional management practice is the annual budget setting process. The clear articulation of the nature of the co-ordination process that the cybernetic approach provides could help managers design more effective mechanisms for aligning organisational activities; thereby promoting self-management as well as damping oscillations in performance more effectively than conventional practice (principle 4).

In addition, the model defined in this thesis and the methodology used to apply it, could be applied by managers in the field with relatively little modification. This could be used to diagnose of the health of their FPMS and help identify areas for improvement.

The final area in which this thesis could have an impact in the field is through the application of the technique used to analyse organisational performance. The use of relative measures of absolute performance is not novel (it is sometimes called benchmarking) but the use (and the technique) of relative measurement of performance *stability* is new. This could have value as a way of measuring the health of an organisation; for example forced or manipulated performance (around an

accounting period end for example) would be manifest as an increase in variability. More important, since there is some evidence of a correlation between the stability and relative level of performance, the variability measure might be something that could be used in routine performance monitoring, rather than just as a diagnostic tool.

Academia

We will now turn our attention to the opportunities for further research opened up by this thesis, . Firstly, the fieldwork conducted to date is sufficient merely to assert that it has credibility. In order to go beyond what has been done, and rigorously test cybernetic hypotheses it will be necessary to conduct a more thorough analysis of a wider range of organisations, involve a larger number of respondents and analyse a broader range of performance variables. If such studies confirmed the findings contained in this thesis this would represent a breakthrough in MCS research.

Before further fieldwork takes place, however, it might be necessary for researchers to revisit the research tool developed as part of this thesis. There is scope for further development of the cybernetic questionnaire to make it more balanced, precise and user friendly: capable of being used on a larger scale with less need for intensive researcher involvement. For example, it would be helpful to:

- Simplify the questionnaire and remove ambiguities.
- Refine/improve the principles and how they are assessed.
- Better understand the causal links between principles.
- Improve the approach to assessment, perhaps including need for more sophisticated quantification of responses, weighting and so on.
- Develop an approach to calibrating responses in order to help ensure consistency of assessment of different respondents.
- Develop an understanding of the significance of differences or changes in scoring.
- Develop a more sophisticated scoring system.

In the opinion of the researcher, this tool is well suited to case study work; it is inadvisable to attempt to use it to conduct large-scale surveys. The extensive criticism made of survey based research methodologies has already been discussed in Chapter 2, but, in addition, the complexity and subtlety of organisational controls arrangements (that is their variety), demands more sophisticated data collection and interpretation than is afforded by simple survey instrument, naïve respondents and statistical analysis. The cybernetic model upon which the diagnostic questionnaire was based (VSM) was created using an analogy of the human nervous systems, so it is unsurprising that its application in real life should require the sophistication of a medical diagnosis rather than that of a market research tool.

The approach used to assess performance variables would also be worthy of further study; potentially it provides a new lens through which to investigate organisational behaviour. In addition to providing researchers with a valuable tool to help them assess the effectiveness of control, it may help them identify and track changes in organisational behaviour and identify potentially fruitful areas for further research. Also, as researchers in the field of Perceptual Control Theory have demonstrated, there is great value in looking to output variables in order to determine what an entity is actually controlling for - its real rather than espoused purpose. This may provide an interesting way for MCS researchers to tackle what, up to now, has proved to be an important, but vexatious, topic.

The hypothesis tested in this research is one of six derived from cybernetic theory in Chapter 7. This points to perhaps the most important contribution that this work could make: reigniting interest in the development and testing of MCS theory. This comes at a time when developments in the economic environment have highlighted the weaknesses in (and dangers of) conventional thinking about organisations and the workings of economies. There are, no doubt, many other hypotheses that could be generated using a cybernetic approach.

MCS research in the middle ground has over the last twenty years has, in the opinion of many critics, become moribund. The empirical approach, associated with work in the psychological and Contingency Theory strands has proved to be largely sterile and quantitative theory development based on agency theory is too theoretical

and divorced from the real world. Critical and post-modernist approaches are too abstract and of little practical use. Systems approaches based on biological analogies and complexity science are beginning to enter mainstream macroeconomic thinking (Arthur, 1994, 1990, Beinhocker, 2006), and there is arguably a need to develop complementary theory to account for, and help effectively manage, the behaviour of agents in this economic ecosystem; organisations. The cybernetic model is a strong candidate for that theory, providing as it does a framework to explain and integrate many of the findings from the empirical work in MCS carried out over the last half century, which can be used to generate new insights and hypotheses.

However successful the cybernetic approach is however, there remains a gap in its ability to explain the full range of organisational phenomena of interest to MCS researchers. The motivation of individuals is rightly considered to be an important dimension of organisational performance. Conventional theories of motivation are not well integrated into MCS research and the cybernetic approaches used in this thesis are largely silent on this issue. There are, however, complementary systems approaches to the study of human behaviour, such as Perceptual Control Theory, that hold out the prospect of developing a more comprehensive model of organisational behaviour. The job of reconciling systems approaches to organisational regulation with theories of motivation lies in the future.

10.2.4 Research objectives: summary

In the introduction to this thesis it was stated that the successful achievement of the research objectives would require us to be able to answer in the affirmative to eight questions. The answer to each of these questions is yes, the evidence for which is summarised below.

Table 8: Summary of achievements

Question	Answer	Reference
Have we developed a framework for the management of financial resources that is new to the field, comprehensive, coherent and consistent with established systems theory?	A comprehensive and coherent theoretical framework has been developed, manifest in 34 Principles. This has been cross referenced to an extensive set of systems concepts whose provenance and relevance has been described and analysed.	Chapter 5 Appendix 1, Appendix 3
Are we confident that criticism of Systems Theory and its application in this domain do not undermine the legitimacy of the framework?	The challenges raised by critics have been extensively discussed, and their validity assessed. In the main, the criticisms can be demonstrated to be false or based on ignorance or misunderstanding of the systems literature.	Chapter 6
Do we have a methodology that will allow the theoretical framework to be applied to the understanding and study of practice in real life organisations?	A research instrument has been developed that takes the 34 principles developed in Chapter 5 and frames them in a form that can be applied in the field as either a diagnostic or measurement tool.	Appendix 5
Are the predictions of the theoretical model consistent with the findings of extant research in the field?	The predictions of the theoretical model have been compared to the findings of prior research, in particular that originating from the Contingent Theory stream. No findings have been found that are inconsistent with the systems-based theoretical model.	Chapter 7

Does the framework allow us to develop new hypotheses that are capable of being tested?	<p>Novel hypotheses based on the new theoretical framework have been generated.</p> <p>The description and analysis of fieldwork has demonstrated that the hypothesis selected is both capable of being tested empirically.</p>	<p>Chapter 7</p> <p>Chapter 8, Chapter 9.</p>
Does empirical observation (fieldwork) confirm the ability to test the hypotheses and their plausibility as explanations for real world phenomenon?	The analysis of fieldwork demonstrates that the theoretical framework is capable of generating explanations of real work phenomena that are novel and empirically sound	Chapter 9
Are there well defined ways in which new insights can be applied to the design and operation of procedures and processes for use by practitioners?	<p>The potential value of the insights generated by this approach to management have been demonstrated to be:</p> <ul style="list-style-type: none"> • Informing the ongoing debate about the value of conventional budgeting practice • Suggesting ways in which specific management processes can be improved • Suggesting a way of managing that has tangible benefits manifest as improved and more reliable levels of performance 	Chapter 10
Are there well defined opportunities for further research into the field?	The work generates many opportunities for future research, inter alia:	Chapter 10

	<ul style="list-style-type: none"> • Extending and refining the tool set and the fieldwork used in this thesis • Generating and testing new hypotheses 	
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10.3 An assessment of the originality of this thesis

The primary requirement for a PhD thesis is that it make an original contribution to knowledge (Phillips and Pugh, 2000). Originality can be manifest in a wide variety of ways. A review of the literature (Collis and Hussey, 2003, Howard and Sharp, 1996, Phillips and Pugh, 2000) revealed at least twenty:

1. Setting down a major piece of new information in writing for the first time.
2. Continuing a previous, original, piece of work.
3. Carrying out original work (designed by a supervisor).
4. Providing a single original technique, observation, or result, in an otherwise unoriginal but competent piece of research.
5. Showing originality in testing somebody else's idea.
6. Carrying out empirical work that has not been done before.
7. Producing a novel synthesis of existing work.
8. Using existing material to provide a new interpretation.
9. Trying out something that has previously only been done abroad.
10. Taking a particular technique and applying it in a new area.
11. Bringing new evidence to bear on an old issue.
12. Being cross-disciplinary and using different methodologies.
13. Looking at areas that people in the discipline have not looked at before.
14. Adding to knowledge in a way that has not been done before.
15. Worthy, in part, of publication.
16. Originality as demonstrated by the topic researched or the methodology employed.
17. Evidence of an original investigation or the testing of ideas.
18. Competence in independent work or experimentation.

19. An understanding of appropriate techniques.
20. Demonstrating and ability to make critical use of published work and source materials.

This thesis is original in a number of respects, covering the majority of the twenty attributes listed above. These are described below, with the number in parentheses relating to the attribute number.

The most obvious original characteristic of this thesis is that it is multidisciplinary (point 12), since deals with the application of systems theory to an important aspect of management control: financial performance management systems. This means that we have to consider other aspects of its originality with reference to both research fields.

Within the systems field there has been one other attempt to compile an inventory of systems concepts and tease out their relevance to general management (Clemson, 1984) but this (Appendix 1) is the first time that their relevance to financial control has been attempted (13, 7). The development of a structured framework to help the application of theory to real life (Chapter 5) has never been attempted before (17,6) and by definition the development of a research instrument (Appendix 5) to facilitate fieldwork is novel (4,6,17). Ashby's Law of Requisite Variety has been empirically tested on two other occasions ((Burton and Forsyth, 1986, De Raadt, 1987a) and to the authors knowledge it is the first time that aspects of the Viable Systems Model has been subject to empirical (quantitative) test (5).

In the field of MCS research this is arguably one of very few attempts to produce a comprehensive theoretical framework (1,3,14). Anthony's work (Anthony, 1965), was not theoretically grounded nor are more recent attempts to establish a framework for research (Ferreira and Otley, 2009, Malmi and Brown, 2008, Otley, 1999). None of these cover informal as well as formal control, or seek to cover the strategic, management and operational domains. It is the first attempt since Amey (1986, 1979) to apply systems ideas in a structured fashion in MCS research, but it is the first time that the VSM has been used to help construct MCS theory (2,3,10). In addition, this thesis has developed (Chapter 7) and tested (Chapter 9) a novel

hypothesis based on Ashby's Law (5) and developed a new way of measuring performance (16). Indeed, it is one of very few pieces of MCS that has attempted to incorporate a performance variable within its scope (6). The result of the fieldwork, that suggested that there was a link between cybernetic health and the performance characteristics of an organisation, is also original (4,14).

Finally, aspects of this research have already been published (15). In the academic literature the theoretical foundations of the work and the mechanisms by which this might be applied to FPMS have been described (Hoverstadt et al., 2007, Morlidge, 2009). Some of the insights gleaned in the process of this research have also been used to inform management practice (Morlidge, 2010).

10.4 Conclusion

Systems based approaches briefly entered the consciousness of MCS researchers in the 1970s and 1980s but were rejected, mainly because of a false perception that they were promoting a mechanistic model of organisational control. In retrospect, the failure of academics to properly engage with systems thinking was unfortunate, and has impoverished research in this field.

This thesis has demonstrated that cybernetic approaches in particular potentially have a significant contribution to make to addressing one of the main shortcomings in MCS research: the failure to develop a coherent theoretical framework to help explain and consolidate the mass of empirical findings in this area. In addition, it has been demonstrated that cybernetic theory can be developed into a practical research approach capable of developing and testing new hypotheses – with some promising results. Furthermore, it is not difficult to identify many potential implications for the practice of management in day to day organisational life.

Given the resurgence of interest in systems ideas, not least in areas of economic life, now is arguably a good time for the MCS research community to reengage with some of the ideas that surfaced, but were cast aside, half a century ago.

11 References

- ACKOFF, R. L. (1962) The Nature of Science and Methodology. IN ACKOFF, R. L., MINAS, J. S. & GUPTA, S. K. (Eds.) *Scientific Method: Optimising Applied Research Decisions*. Chichester, Wiley.
- ACKOFF, R. L. (1970a) *A Concept of Corporate Planning*, New York, Wiley.
- ACKOFF, R. L. (1970b) The Nature of Planning. *A Concept of Corporate Planning*. New York, Wiley.
- ACKOFF, R. L. (1974) Towards a system of system concepts. IN COUGER, J. D. & KNAPP, R. W. (Eds.) *Systems Analysis Techniques*. Chichester, Wiley.
- ACKOFF, R. L. (1981) Design of Management Systems. *Creating The Corporate Future*. New York, Wiley.
- ACKOFF, R. L. (1984) Alternative Types of Planning. IN ACKOFF, R. L., FINNELL, E. V. & GHARAJEDAGHI, J. (Eds.) *A Guide to Controlling Your Organisations Future*. Chichester, Wiley.
- ACKOFF, R. L. (1991) Beating the System. *Ackoff's Fables*. Chichester, Wiley.
- ACKOFF, R. L. (Ed.) (1993) *Corporate Perestroika: The Internal Market Economy*, Chichester, Wiley.
- ACKOFF, R. L. (1996) The Future of Operational Research is Past. *Systems Research*, March, 13-23.
- ACKOFF, R. L. (1999) Our Changing Concept of The World. IN ACKOFF, R. L. (Ed.) *Ackoff's Best*. New York, John Wiley and Sons.
- ACKOFF, R. L. & GHARAJEDAGHI, J. (1996) Reflections on Systems and Their Models. *Systems Research*, 13-23.
- AGYRIS, C. (1952) The Impact of Budgets on People. *The Controllershship Foundation*.
- AGYRIS, C. (1990) The Dilemma of Implementing Controls: The Case of Management Accounting. *Accounting, Organisations and Society*, 15, 503-511.
- AHL, V. & ALLEN, T. F. H. (1998) *Hierarchy Theory. A Vision, Vocabulary, and Epistemology.*, New York, Colombia University Press.
- AHRENS, T. & CHAPMAN, C. S. (Eds.) (2007) *Doing Qualitative Field Research in Management Accounting: Positioning Data to Contribute to Theory*, Oxford, Elsevier.
- AMEY, L. (1986) *Corporate Planning: A Systems View*, New York, Praeger.
- AMEY, L. R. (1979) *Budget Planning and Control Systems*, London, Pitman.
- AMIGONI, F. (1978) Planning Management Control Systems. *Journal of Business Finance and Accounting*, 279-291.
- ANDERSON, P. W. (1972) More is Different. *Science*, 177, 393-396.
- ANDERSON, S. & WIDENER, S. (Eds.) (2007) *Doing Quantitative Field Research in Management Accounting*, Oxford, Elsevier.
- ANDERTON, R. (1989) The need for formal development of the VSM. IN ESPEJO, R. & HARNDEN, R. (Eds.) *The Viable Systems Model: Interpretations and Applications of Stafford Beer's VSM*. Chichester, John Wiley and Sons Ltd.
- ANONYMOUS (2011) Unilever.
- ANSARI, S. L. (1977) An integrated approach to control systems design. *Accounting, Organisations and Society*, 2, 101-112.

- ANSARI, S. L. (1979) Towards an Open Systems Approach to Budgeting. *Accounting, Organisations and Society*, 4, 149-161.
- ANSWERTHINK (2003) Quo Vadis Budgets? Frankfurt.
- ANTHONY, R. (1965) *Planning and Control Systems: A Framework for Analysis*, Boston, MA, Harvard Business School.
- ANTHONY, R. & DEARDEN (1980) *Management Control Systems*.
- ANTHONY, R. & GOVINDARAJAM, V. (1995) *Management Control Systems*, Chicago, Irwin.
- ANTLE, R. & FELLINGHAM, J. (1995) Informational rents and preferences among information systems in a model of resource allocation. *Journal of Accounting Research*, 33 (Supplement), 41-58.
- ARGYRIS, C. (1952) The Impact of Budgets on People. *The Controllorship Foundation*.
- ARGYRIS, C. (1982) The executive mind and double-loop learning. *Organizational Dynamics*, 11, 5-22.
- ARGYRIS, C. (1990) The Dilemma of Implementing Controls: The Case of Management Accounting. *Accounting, Organisations and Society*, 15, 503-511.
- ARGYRIS, C. & SCHON, D. (1978) *Organisational Learning: A Theory of Action Perspective*, Reading MA, Addison-Wesley.
- ARTHUR, B. (1994) *Increasing Return and Path Dependence in the Economy*, Ann Arbor MI, University of Michigan Press.
- ARTHUR, W. (1990) Positive Feedback in the Economy. *Scientific American*, 92-99.
- ASHBY, R. (1958a) General Systems Theory as a New Discipline. *General Systems Yearbook*, 3.
- ASHBY, R. (1958b) Requisite Variety and Implications for the control of Complex Systems. *Cybernetica*, 1.
- ASHBY, R. (Ed.) (1962) *Principles of the Self-Organising System*, Pergamon Press.
- ASHBY, R. (1970) Connectance of Large Dynamic (Cybernetic) Systems: Critical Values for Stability. *Nature*, 228, 784.
- ASHBY, R. (1973) Some peculiarities of complex systems. *Cybernetic Medicine*, 9, 1-7.
- ASHBY, R. (1981a) The Effects of Controls on Stability. IN H, B. B. & KLIR, D. G. (Eds.) *Mechanisms of Intelligence: Ashby's writings on Cybernetics*. Seaside California, Intersystems Publications.
- ASHBY, R. (1981b) Setting Goals in Cybernetic Systems. IN H, B. B. & KLIR, D. G. (Eds.) *Mechanisms of Intelligence: Ashby's writings on Cybernetics*. Seaside California, Intersystems.
- ASHBY, R. (1981c) Some Consequences of Bremmerman's Limit for Information Processing Systems. IN H, B. B. & KLIR, D. G. (Eds.) *Mechanisms of Intelligence: Ashby's writings on Cybernetics*. Seaside California, Intersystems.
- ASHBY, W. R. (1952) *Design for a Brain*, London, Chapman and Hall.
- ASHBY, W. R. (1957) *An Introduction to Cybernetics*, London, Chapman and Hall.
- ATKINSON, A. A., BANKER, R. D., KAPLAN, R. & MARK-YOUNG, S. (1997) *Management Accounting*.
- ATKINSON, A. A. & SHAFFIR, W. (1998) Standards for Field Research in Management Accounting. *Journal of Management Accounting Research*, 10, 41-68.

- AULIN, A. (1982) *The Cybernetic Laws of Social Progress: Towards a Critical Social Philosophy and a Criticism of Marxism*, Oxford, Pergamon Press.
- BAIMAN, S. & DEMSKI, J. (1980) Economically optimal performance evaluation and control systems. *Journal of Accounting Research*, 19 (Supplement), 184-220.
- BAIMAN, S. & EVANS, J. (1983) Pre-decision information and participative management control systems. *Journal of Accounting Research*, 22, 371-395.
- BALE, L. S. (2005) Gregory Bateson, Cybernetics, and the Social/Behavioural Sciences.
- BARABÁSI, A.-L. (2002) *Linked: the new science of networks*, Cambridge, Mass., Perseus Pub.
- BATESON, G. (1967) Cybernetic Explanation. *American Behavioural Scientist*, 10, 29.
- BATESON, G. (2000) *Steps to an ecology of mind*, Chicago, University of Chicago Press.
- BAXTER, J. & CHUA, W. F. (2003) Alternative Management Accounting - whence and wither. *Accounting, Organisations and Society*, 28, 97-126.
- BEER, S. (1959a) *Cybernetics and Management*, New York, John Wiley.
- BEER, S. (1959b) What has Cybernetics got to do with Operational research. *Operational Research Quarterly*, 1-21.
- BEER, S. (1966) *Decision and Control*, Chichester, John Wiley and Sons.
- BEER, S. (1975) *Platform for Change*, Chichester, John Wiley.
- BEER, S. (1979) *The Heart of The Enterprise*, Chichester, John Wiley.
- BEER, S. (1981) *The Brain of The Firm*, Chichester, John Wiley.
- BEER, S. (1983) A reply to Ulrich's 'Critique of pure cybernetic reason: the Chilean experience with cybernetics'. *Journal of Applied Systems Analysis*, 10, 115-119.
- BEER, S. (1985) *Diagnosing The System for Organisations*, Chichester, John Wiley.
- BEER, S. (1989a) I am the Emporer and I Want Dumplings. *Systems Practice*, 3.
- BEER, S. (1989b) The Viable Systems Model: its provenance, development, methodology and pathology. IN ESPEJO, R. & HARNDEN, R. (Eds.) *The Viable Systems Model: Interpretations and Applications of Stafford Beers' VSM*. Chichester, John Wiley and Sons Ltd.
- BEER, S. (1994a) *Beyond Dispute: The Invention of Team Syntegrity*, Chichester, John Wiley.
- BEER, S. (1994b) Death is Equifinal. IN HARNDEN, R. & LEONARD, A. (Eds.) *How Many Grapes Went into the Wine*. Chichester, John Wiley.
- BEER, S. (1994c) Preface to 'Autopoeisis -The organisation of the Living'. IN HARNDEN, R. & LEONARD, A. (Eds.) *How Many Grapes Went into the Wine*. Chichester, Wiley.
- BEINHOCKER, E. D. (2006) *The origin of wealth: how evolution creates novelty, knowledge, and growth in the economy*, Boston, Mass., Harvard Business School Press.
- BERGOE, K. (2009) Analysis of The Performance of Nordic Banks 2000-2009. IN BANKS.XLS, N. (Ed.) London, Fox-Pitt Kelton.
- BERRY, A., BROADBENT, J. & OTLEY, D. (1995a) Accounting Systems and Control. IN BERRY, A., BROADBENT, J. & OTLEY, D. (Eds.) *Management Control: Theories, Issues and Practices*. Basingstoke, MacMillan.
- BERRY, A., BROADBENT, J. & OTLEY, D. (1995b) The Domain of Organisational Control. IN BERRY, A., BROADBENT, J. & OTLEY, D. (Eds.) *Management Control: Theories, Issues and Practices*. Basingstoke, MacMillan.

- BERRY, A., BROADBENT, J. & OTLEY, D. (1995c) Procedures for Control. IN BERRY, A., BROADBENT, J. & OTLEY, D. (Eds.) *Management Control: Theories, Issues and Practices*. Basingstoke, Macmillan.
- BERRY, A. J., BROADBENT, J. & OTLEY, D. (1995d) Approaches to Control in The Organisational Literature. IN BERRY, A. J., BROADBENT, J. & OTLEY, D. (Eds.) *Management Control Theories: Issues and Practices*. Basingstoke, MacMillan.
- BERRY, A. J., COAD, A., HARRIS, E. P., D, O. & STRINGER, C. (2009) Emerging Themes in management control: A review of recent literature. *British Accounting Review*, 41, 2-20.
- BERRY, A. J. & OTLEY, D. T. (1980) Control Organisation and Accounting. *Accounting, Organisations and Society*, 5, 231-244.
- BIRNBERG, J. G., LUFT, J. & SHIELDS, M. D. (Eds.) (2007) *Psychological Theory in Management Accounting Research*, Oxford, Elsevier.
- BIRNBERG, J. G., TUROLPOLEC, L. & YOUNG, S. M. (1983) The organizational context of accounting. IN EMMANUEL C, O. D., MERCHANT K (Ed.) *Readings in Accounting for Management Control*. London, Chapman and Hall.
- BOULDING, K. E. (1956) General Systems Theory - The Skeleton of Science. *Management Science*, 2, 197-208.
- BRANNICK, T. & ROCHE, W. K. (1997) *Business research methods: strategies, techniques and sources*. Dublin, Oak Tree Press.
- BRIERS, M. & HURST, M. (1990) The Role of Budgetary Information in Performance Evaluation. *Accounting Organisations and Society*, 15, 373-398.
- BRODY, T. (1993) *The Philosophy Behind Physics*, Berlin, Springer Verlag.
- BRUNS, W. & WATERHOUSE, J. (1975) Budgetary Control and Organisation Structure. *Journal of Accounting research*, 177-203.
- BUCHANAN, M. (2001) *Ubiquity*, New York, Crown Publishers.
- BUCK, R. (1956) On the logic of general behavioural systems. IN FIEGEL, H. & SCRIVE, M. (Eds.) *Progress in Theoretical Biology*. Washington DC, Spartan Books.
- BUCKLEY, W. (1968) *Modern Systems Research for the Behavioural Scientist*, Chicago, Aldine Publishing Company.
- BUNGE, M. (1977) The GST Challenge to the Classical Philosophies of Science. *International Journal of General Systems*, 4, 29.
- BURNS, T. & STALKER, G. (1961) *The Management of Innovation*, London, Tavistock.
- BURRELL, G. & MORGAN, G. (1979) *Sociological Paradigms and Organisational Analysis*, London, Heinemann.
- BURTON, R. M. & FORSYTH, J. D. (1986) Variety and the firms performance: an empirical investigation. IN BURTON, R. M. & OBEL, B. (Eds.) *Innovation and Entrepreneurship in Organisations*. Amsterdam, Elsevier.
- CANNON, W. (1932) *The Wisdom of the Body*, New York, Norton.
- CAPRA, F. (1982a) *The Tao of Physics*, London, Flamingo.
- CAPRA, F. (1982b) *The turning point: science, society, and the rising culture*, New York, Simon and Schuster.
- CAPRA, F. (1997) *The Web of Life: A New Synthesis of Mind and Matter*, London, HarperCollins.
- CAPRA, F. (2002) *The hidden connections: integrating the biological, cognitive, and social dimensions of life into a science of sustainability*, New York, Doubleday.

- CESCAU, P. & RIVERS, R. (2007) Unilever's Growth Strategy. *Unilever Investor Seminar*.
- CHAPMAN, C. S. (1997) Reflections on a contingent view of accounting. *Accounting, Organisations and Society*, 22, 189-205.
- CHECKLAND, P. (1976) Science and Systems Paradigm. *International Journal of General Systems*.
- CHECKLAND, P. (1980) Are organisations machines? *Futures*, 12, 421-4.
- CHECKLAND, P. (1981) *Systems Thinking, Systems Practice*, Chichester, Wiley.
- CHECKLAND, P. (1986) Review of 'Diagnosing the System'. *European Journal of Operational Research*, 23, 269-270.
- CHENHALL, R. (2003) Management Control Systems design within its organisational context: Findings from Contingency based research and directions for the future. *Accounting, Organisations and Society*, 28, 127-168.
- CHENHALL, R. (Ed.) (2007) *Theorising Contingencies in Management Control Systems Research*, Oxford, Elsevier.
- CHENHALL, R. (2003) Management Control Systems design within its organisational context: Findings from Contingency based research and directions for the future. *Accounting, Organisations and Society*, 28, 127-168.
- CHUA, W. F. (1986) Radical Developments in Accounting Thought. *Accounting Review*, 61.
- CLAERBOUT, J. (2009) Editorial. *Computing in Science and Engineering*, 11, 5-7.
- CLEMON, B. (1984) *Cybernetics: A New Management Tool*, Kent, Abacus Press.
- COLLIS, J. & HUSSEY, R. (2003) *Business Research: A practical guide for undergraduate and post graduate students*, Basingstoke, Palgrave Macmillan.
- CONANT, R. & ASHBY, R. (1962) Every Good Regulator of a System Must be a Model of that System. *International Journal of Systems Science*, 1, 89.
- COOPER, D. & HOPPER, T. (Eds.) (2007) *Critical Theorising in Management Accounting Research*, Oxford, Elsevier.
- COVALESKI, M., EVANS, J., LUFT, J. & SHIELDS, M. (2003) An integrative perspective on budgets and budgeting. *Journal of Management Accounting Research*, 15, 3-49.
- COVALESKI, M. A., DIRSMITH, M. W. & SAMUAL, S. (1996) Managerial Accounting Research: The Contributions of Organizational and Sociological Theories. *Journal of Management Accounting Research*, 8, 1-35.
- COVALSKI, M. A., EVANS, J. H., LUFT, J. L. & D, S. M. (2003) Budgeting Research: Three Theoretical perspectives and criteria for Selective Integration. *Journal of management Accounting Research*, 15, 2-49.
- CURWIN, J. & SLATOR, R. (2002) *Quantitative Methods for Business Decisions*, London, Thomson Learning.
- DAFT, R. L. & MACINTOSH, N. (1978) A new approach to the design and use of management information. *California Management review*, XXI, 82-92.
- DAFT, R. L. & MACINTOSH, N. B. (1984) The nature and use of formal control systems for management control and strategy implementation. *Journal of Management*, 10, 43-66.
- DE RAADT, J. (1987a) Ashby's Law of Requisite Variety An Empirical Study. *Cybernetics and Systems*, 18, 517-536.
- DE RAADT, J. D. R. (1987b) Ashby's Law of Requisite Variety An Empirical Study. *Cybernetics and Systems*, 18, 517-536.
- DECI, E. (1975) *Intrinsic Motivation*, New York, Plenum.

- DEMING, W. E. (2000a) *The new economics: for industry, government, education*, Cambridge, Mass., MIT Press.
- DEMING, W. E. (2000b) *Out of the crisis*, Cambridge, Mass., MIT Press.
- DEMSKI, J. & FELTHAM, G. (1978) Economic Incentives in Budgetary Control. *The Accounting Review*, 53, 336-358.
- DENT, E. & UMPLEBY, S. (1998) Underlying Assumptions of Several traditions in Systems Theory and Cybernetics. *Cybernetics and Systems*, 513-518.
- DERMER, J. (1988) Control and Organisational Order. *Accounting, Organisations and Society*, 13, 25-36.
- DERMER, J. & LUCAS, R. G. (1986) The Illusion of Managerial Control. *Accounting, Organisations and Society*, 11, 471-482.
- DOWNING BOWLER, T. (1981) Review of General Systems Theory: Its Scope and Applicability.
- DUNK, A. & NOURI, H. (1998) Antecedents of Budgetary Slack. *Journal of Accounting Literature*, 17, 72-96.
- EMERY, F. & TRIST, E. (1965) The causal texture of organisational environments. *Human Relations*, 18.
- EMERY, F. & TRIST, E. (1973) *Towards a Social Ecology*, Harmondsworth, Penguin.
- EMERY, F. E. (1969) *Systems Thinking, Systems Practice*, Penguin.
- EMMANUEL, C. & OTLEY, D. (1985) *Accounting for Management Control*, Wokingham, Reinhold.
- EMMANUEL, C., OTLEY, D. & MERCHANT, K. (1990) *Accounting for Management Control*, London, Chapman and Hall.
- ESPEJO, R. (1989) The VSM Revisited. IN ESPEJO, R. & HARNDEN, R. (Eds.) *The Viable Systems Model: Interpretations and Applications of Stafford Beer's VSM*. Chichester, John Wiley and Sons Ltd.
- ESPEJO, R. & HARNDEN, R. (Eds.) (1989) *The Viable Systems Model Revisited: Interpretations and Applications of Stafford Beers VSM*, Wiley.
- FERREIRA, A. & OTLEY, D. (2009) The design and use of performance management systems: An extended framework for analysis. *Management Accounting Research*, 20, 263-282.
- FISHER, J. (1995) Contingency Based Research on Management Control Systems. *Journal of Accounting Literature*, 14, 24-53.
- FLAMBOLTZ, E. (1983) Accounting budgeting and control systems in their organisational context. Theoretical and empirical perspectives. *Accounting, Organisations and Society*, 8, 153-169.
- FLOOD, R. (1993) *Beyond TQM*, Chichester, John Wileys and Sons Ltd.
- FLOOD, R. & JACKSON, M. (1991) *Creative Problem Solving: Total Systems Intervention*, Chichester, Wiley.
- FLOOD, R. & ROMM, N. (1997) *Critical Systems Thinking: Current Research and Practice*, New York, Plenum Press.
- FLOOD, R. L. & CARSON, E. R. (1988) *Dealing with Complexity: An introduction to the Theory and Application of Systems Science*, New York, Plenum Press.
- FORRESTER, J. W. (1961) *Industrial Dynamics*, Cambridge, Mass., M.I.T. Press.
- FORRESTER, J. W. (1968) Industrial Dynamics - After the First Decade. *Management Science*, 398-415.
- FORRESTER, J. W. (1969) *Urban Dynamics*, Cambridge MA, MIT Press.
- FORRESTER, J. W. (1971) *Global Dynamics*, Cambridge MA, MIT Press.

- FORSSELL, D. (Ed.) (2008) *Perceptual Control Theory: Science and Applications. A Book of Readings*, Hayward CA, Living Control Systems Publishing.
- GIGLIONI, G. B. & BEDEIAN, A. G. (1974) A Conspectus of Management Control Theory 1900-1972. *Academy of Management Journal*, 17, 292-305.
- GLEICK, J. (1998) *Chaos: Making a New Science*, Heinemann.
- GOGUN, J. A. & VARELA, F. (1979) Systems and Distinctions; Duality and Complementarity. *International Journal of General Systems*, 5, 31.
- GORDON, L. & MILLER, D. (1976) A contingency framework for the design of accounting information systems. *Accounting, Organisations and Society*, 1, 59-69.
- GOVINDARAJAN, V. K. (1988) A contingency approach to strategy implementation at the business unit level: Integrating administrative mechanisms with strategy. *Academy of Management Journal*.
- GRANLUND, M. & LUKKA, K. (1998) It's a small world of Management Accounting practices. *Journal of Management Accounting Research*, 10, 153-179.
- GRAY, B. (1990) The Enactment of Management Control Systems: A Critique of Simons. *Accounting, Organisations and Society*, 15, 145-148.
- GRIBBEN, J. (2002) *Deep Simplicity*.
- GROSCH, H. (1973) Chilean Economic Controls. *New Scientist*, 57, 626-627.
- GUBA, E. G. & LINCOLN, Y. S. (Eds.) (1998) *Competing Paradigms in Qualitative Research*, Thousand Oaks, Sage.
- HALDANE, A. & MAY, R. (2011) Systemic Risk in Banking Institutions. *Nature*, 469, 351-355.
- HANLON, J. (1973) Chile Leaps into a Cybernetic Future. *New Scientist*, 57, 363-364.
- HANSEN, S., OTLEY, D. & VAN DER STADE, W. (2003) Practice Developments in Budgeting: An Overview and Research Perspective. *Journal of Management Accounting Research*, 15, 95-116.
- HARNDEN, R. (1989) Outside and then; an interpretative approach to the VSM. IN ESPEJO, R. & HARNDEN, R. (Eds.) *The Viable Systems Model: Interpretations and Applications of Stafford Beer's VSM*. Chichester, John Wiley and Sons Ltd.
- HARTMANN, G. H. (2000) The appropriateness of RAPM: Towards the further development of theory. *Accounting, Organisations and Society*, 25, 451-482.
- HAYES, D. C. (1977) The Contingency Theory of Management Accounting. *The Accounting Review*, LII, 22-39.
- HEDBERG, B. & JONSSON, S. (1978) Designing Semi Confusing Information Systems for Organisations in Changing Environments. *Accounting, Organisations and Society*, 3, 47-64.
- HEIMS, S. J. (1991) *Constructing a Social Science for Postwar America: The Cybernetics Group*, Cambridge MA, MIT Press.
- HERTOG, J. (1978) The role of information and control systems in the process of organisational renewal: roadblock or roadbridge? *Accounting, Organisations and Society*, 3, 29-45.
- HESFORD, J. W., LEE, S.-H., WA, V. D. S. & M, Y. S. (Eds.) (2007) *Management Accounting: A Bibliographic Study*, Oxford, Elsevier.
- HEYLIGHEN, F. & JOSLYN, C. (2001) Cybernetics and Second Order Cybernetics. IN MEYERS, R. A. (Ed.) *Encyclopaedia of Physical Science and Technology*. 3rd ed. New York, Academic Press.

- HOEBEKE, L. (1994) *Making Systems Work Better*, Chichester Sussex, John Wiley and Sons.
- HOFSTEDE, G. (1967) *The Game of Budget Control*, London and Amsterdam, Tavistock.
- HOFSTEDE, G. (1978) The Poverty of Management Control Philosophy. *Academy of Management Review*, 3, 450-461.
- HOFSTEDE, G. (1981) Management Control of Public and Not For Profit Activities. *Accounting, Organisations and Society*, 6, 193-211.
- HOFSTEDE, G. (1984) The cultural relativity of the quality of life concept. *Academy of Management Review*, 389-398.
- HOLDEN, P., FISH, L. & SMITH, H. (1941) *Top Management Organisation and Control*, Stanford Cal, Stanford University Press.
- HOLLAND, J. (1995a) *Hidden order: How Adaption Builds Complexity*, Reading MA, Addison-Wesley.
- HOLLAND, J. H. (1995b) *Hidden order: how adaptation builds complexity*, Reading, Mass., Addison-Wesley.
- HOPE, J. & FRASER, R. (1998) Beyond Budgeting Round Table Company Report #2: Svenska Handelsbanken. CAMI.
- HOPE, J. & FRASER, R. (1999) Beyond Budgeting Round Table Case Report: Svenska Handelsbanken Second Visit. CAMI.
- HOPE, J. & FRASER, R. (2003) *Beyond Budgeting: How Managers Can Break Free from the Performance Trap*, Boston, MA, Harvard Business School Press.
- HOPPER, T., OTLEY, D. & SCAPENS, R. (2001) British Management Accounting Research: Whence and wither. Opinions and Recollections. *British Accounting Review*, 33, 263-291.
- HOPPER, T. & POWELL, A. (1985) Making sense of research into organisational and social aspects of management accounting: a review of its underlying assumptions. *Journal of Management Studies*, 22, 429-465.
- HOPPER, T. & POWELL, A. (1995) Making sense of reseacrh into organisational and social aspects of management accountng: a review of its underlying assumptions. *Journal of Management Studies*, 22, 429-465.
- HOPWOOD, A. (1973) *An Accounting System and Managerial Behaviour*, Saxon House, Lexington Books.
- HOPWOOD, A. (1976) *Accounting and Human Behaviour*, Englewood Cliffs New jersey, Prentice Hall.
- HOPWOOD, A. (1978a) Editorial. *Accounting Organisations and Society*, 3, 93-95.
- HOPWOOD, A. (1978b) Towards an organisational perspective for the study of accounting and information systems. *Accounting, Organisations and Society*, 3, 3-13.
- HOPWOOD, A. (1979) Editorial. *Accounting, Organisations and Society*, 4, 145-147.
- HOPWOOD, A. (2002) 'If only there were simple solutions, but there aren't': some reflections on Zimmerman's critique of empirical management accounting research. *European Accounting Review*, 11, 777-785.
- HORNGREN, C. (1972) *Cost Accounting: A Managerial Emphasis*, Englewood Cliffs, NJ, Prentice-Hall.
- HORNGREN, C. T. (1995) Management Accounting: This Century and Beyond. *Management Accounting Research*.
- HOVERSTADT, P., KENDRICK, I. & MORLIDGE, S. (2007) Viability as a basis for performance measurement. *Measuring Business Excellence*, 11, 27-32.

- HOWARD, K. & SHARP, J. (1996) *The management of a student research project*, Aldershot, Gower.
- ITTNER, C. D. & LARCKER, D. F. (2001) Assessing empirical work in Management Accounting: A value-based perspective. *Journal of Accounting and Economics*, 32, 349-410.
- ITTNER, C. D. & LARCKER, D. F. (2003) Empirical managerial accounting research: are we just describing management consulting practice? *European Accounting Review*, 11, 787-794.
- ITTNER, C. D. & LARCKER, D. F. (1998) Innovations in Performance Measurement: Trends and Research Implications. *Journal of Management Accounting Research*, 10, 205-238.
- JACKSON, M. (1985) Social systems theory in practice: the need for a critical approach. *International Journal of General Systems*, 10, 135.
- JACKSON, M. (1989) Evaluating the managerial significance of the VSM. IN ESPEJO, R. & HARNDEN, R. (Eds.) *The Viable Systems Model: Interpretations and Applications of Stafford Beer's VSM*. Chichester, John Wiley and Sons Ltd.
- JACKSON, M. (2003) *Systems Thinking: Creative Holism for Managers*, Chichester, John Wiley and Sons Ltd.
- JACKSON, M. C. (2000) *Systems Approaches to Management*, New York, Kluwer Academic/Plenum Publishers.
- JENNER, R. A. (1998) Dissipative Enterprises, Chaos and the Principles of Lean Organisations. *Omega International Journal of Management Science*, 26, 397-407.
- JENSEN, M. (2001a) Corporate Budgeting is Broken - Let's Fix It. *Harvard Business Review*.
- JENSEN, M. C. (2001b) Paying People to Lie: The truth about the Budgeting Process. Harvard Business School.
- JOHNSON, T. (1992) *Relevance Regained: From Top Down Control to Bottom Up Empowerment*, New York, The Free Press.
- JOHNSON, T. (1997) Reflections of a Recovering Management Accountant. *Assessment for Learning Research Initiative -First Research Forum*.
- JOHNSON, T. & BROMS, A. (2000) *Profit Beyond Measure*, London, Brealey.
- JOHNSON, T. & KAPLAN, R. (1987) *Relevance Lost. The Rise and Fall of Management Accounting*, Boston, Harvard Business School Press.
- JUPP, V. (Ed.) (2006) *The Sage Dictionary of Social Research Methods*, London, Sage.
- JURAN, J. (1964) *Managerial Breakthrough*, New York, McGraw-Hill.
- KAPLAN, R. (1994) Management Accounting (1984-1994) development of new practice and theory. *Management Accounting Research*, 5, 247-260.
- KAPLAN, R. & NORTON, D. (1992) The Balanced Scorecard - Measures that Drive Performance. *Harvard Business Review*, 70, 71-79.
- KAPLAN, R. S. (1984) The evolution of management accounting. IN EMMANUEL C, O. D., MERCHANT K (Ed.) *Readings in Accounting for Management Control*. London, Chapman and Hall.
- KATZ, D. & KAHN, R. L. (1969) Systems Thinking. IN EMERY, F. (Ed.) London, Penguin.
- KAUFFMAN, S. (1993) *The Origins of Order*, New York, Oxford University Press.
- KAUFFMAN, S. (2008) *Reinventing the Sacred*, New York, Basic Books.

- KEATING, P. J. (1995) A Framework for Classifying and Evaluating the Theoretical Contributions of Case Research in Management Accounting. *Journal of Management Accounting Research*, 66-86.
- KLEIN, H. J. (1989) An Integrated Control Theory Model of Work Motivation. *Academy of Management Review*, 14, 150-172.
- KLIR, D. G. (1985) Complexity: Some general observations. *Systems Research*, 2, 131-140.
- KLIR, G. (1991) *Facets of Systems Science*, New York, Plenum.
- KREITMAN, K. (1992) The ECCO System: Foundations for Total Quality Management. *Graduate*. New York, State University of New York.
- KRONER, N. (2009) *A Blueprint for Better Banking: Svenska Handelsbanken and a proven model for post-crash banking*, Petersfield, UK, Harriman House.
- KUHN, T. (1970) *The Structure of Scientific Revolutions*, Chicago, University of Chicago Press.
- LANGFIELD-SMITH, K. (1997) Management Control Systems and Strategy - A critical review. *Accounting Organisations and Society*.
- LANGTON, C. (1996) Artificial Life. IN BODEN, M. (Ed.) *The Philosophy of Artificial Life*. Oxford, Oxford University Press.
- LAPLACE, P. S. (1951) *A Philosophical Essay on Probabilities*, New York, Dover Publications.
- LASZLO, E. (1998) Systems and Societies: The logic of sociocultural evolution. IN ALTMAN, G. & KOCH, W. (Eds.) *Systems.: New Paradigms for the Human Sciences*. Berlin, De Gruyter.
- LATHAM, G. P. & ERNST, C. T. (2006) Keys to motivating tomorrow's workforce. *Human Resource Management Review*, 16, 181-198.
- LAU, C., LOW, L. & EGGLETON, I. (1995) The impact of reliance on accounting performance measures on job related tension and managerial performance: additional evidence. *Accounting, Organisations and Society*, 20, 359-381.
- LAUGHLIN, R. (1995) Empirical Research in Accounting: Alternative Approaches and a Case for 'Middle Range' Thinking. *Accounting, Auditing and Accountability Journal*, 8, 63-87.
- LAWRENCE & LORSCH (1967) *Organisations and the Environment*, Boston Mass, Harvard University Press.
- LAWSON, F. (1920) *Industrial Control*, London, Pitman.
- LEEUEW DE, A. & VOLBERDA, H. (1996) On the Concept of Flexibility: A Dual Control Perspective. *Omega: International Journal of Management Science*, 24, 121-139.
- LEIBENSTEIN, H. (1979) X-efficiency: From concept to theory. *Challenge*, 13.
- LEIDENFIELD, R. (1978) *The Rise of Systems Theory: An ideological Analysis*, New York, Wiley - Interscience.
- LIBBY, T. & MURRAY LINDSAY, R. (2010) Beyond Budgeting or budgeting reconsidered? A survey of North American budgeting practice. *Management Accounting Research*, 21, 56-75.
- LIKER, J. (2004) *The Toyota Way*, New York, McGraw Hill.
- LOVELOCK, J. (1979) *Gaia*, Oxford, Oxford University Press.
- LOWE, E. A. (1971) On the Idea of a Management Control System: Integrating Accounting and Management Control. *Journal of Management Studies*, 1-12.
- LOWE, E. A. & PUXTY, T. (1989) The problem of a Paradigm: A critique of the Prevailing Orthodoxy in Management Control. IN WF, C., LOWE, E. A. & T, P. (Eds.) *Critical Perspectives in Management Control*. London, Macmillan.

- LOWE, E. A. & TINKER, A. M. (1977) The Architecture of Requisite Variety. *Kybernetes*.
- LUFT, J. & SHIELDS, M. D. (2003a) Mapping management accounting: graphics and guidelines for theory-consistent empirical research. *Accounting, Organisations and Society*, 28, 169-249.
- LUFT, J. & SHIELDS, M. D. (2003b) Zimmerman's contentious conjectures: describing the present and prescribing the future of empirical management accounting research. *European Accounting Review*, 11, 795-803.
- LUHMANN (1989) The autopoiesis of social systems. IN GEYER, F. & VAN DE ZOUWEN, J. (Eds.) *Sociocybernetic paradoxes*. London, Sage.
- MACIARIELLO, J. (1984) *Management Control Systems*, London, Prentice Hall.
- MAHER, M. (2001) The Evolution of Management Accounting Research in the United States. *British Accounting Review*, 33, 293-305.
- MALMI, T. & BROWN, D. A. (2008) Management control systems as a package - Opportunities, challenges and research directions. *Management Accounting Research*, 19, 289-300.
- MALONE, T. W. (2004) *The Future of Work*, Boston MA, Harvard Business School Press.
- MANDELBROT, B. & HUDSON, R. (2005) *The (Mis)behaviour of Markets*, London, Profile Books.
- MARGISON, D. (1999) Beyond the budgetary control system: towards a two-tiered process of management control. *Management Accounting*, 10, 230-230.
- MARUYAMA, M. (1963) The second cybernetics: deviation-amplifying mutual causal processes. IN BUKLEY, W. (Ed.) *Modern Systems Research for the Behavioural Sciences*. Chicago, Aldine Publishing.
- MASLOW, A. (1943) A Theory of Human Motivation. *Psychological Review*, 50, 370-96.
- MATURANA, H. & VARELA, F. (1998) *The Tree of Knowledge*, Boston, Shambala Press.
- MCCULLOGH, W. & PITTS, W. (1943) A logic calculus of ideas imminent in nervous activity. *Bulletin of Mathematical Biophysics*, 5.
- MEADOWS, D. H. (2009) *Thinking in Systems: A Primer*, London, Earthscan.
- MERCHANT, K. (1985) *Control in Business Organisations*, London, Pitman.
- MERCHANT, K. & OTLEY, D. (2008) A Review of the Literature on Control and Accountability. IN CHAPMAN, C. S., HOPWOOD, A. G. & SHIELDS, M. D. (Eds.) *Handbook of Management Accounting Research*. Oxford, Elsevier.
- MERCHANT, K. A. (1990) The effects of financial controls on data manipulation and management myopia. *Accounting, Organisations and Society*, 15, 297-313.
- MILLER, G. (1986) Can Systems Theory Generate Testable Hypotheses? From Talcott Parson to Living Systems Theory. *Systems Research*, 3, 73.
- MILLER, J. (1955) Towards a general Theory for the Social Sciences. *American Psychologist*, 10, 513-531.
- MODIS, T. (1992) *Predictions*, New York, Simon and Schuster.
- MORGAN, G. (1981) Rethinking Corporate Strategy: A Cybernetic Perspective. *Nontraditional Approaches to Corporate Strategy*. Los Angeles.
- MORGAN, G. (1982) Cybernetics and organisation theory: epistemology or technique. *Human Relations*, 35, 521-37.
- MORGAN, G. (1997) *Images of Organization*, Sage.
- MORLIDGE, S. (2005) Just 15 Minutes: Unilever Foods Poland DPM Case Study. Unilever.

- MORLIDGE, S. (2009) Money, Time and Variety Engineering: The Application of Cybernetics to the Diagnosis and Design of Financial Performance Management Systems. *System Practice and Action Research*, 22, 235-247.
- MORLIDGE, S. (2010) *Future Ready: How to Master Business Forecasting*, Chichester, John Wiley and Sons.
- NEELY, A. M., SUTCLIFFE, R. & HEYNS, H. (2001) *Driving Value Through Strategic Planning*, Accenture.
- NEISLEN, J. E. & (ED), R. L. (Eds.) (1976) *Neils Bohr Collected Work vol 13: The Correspondence Principle (1918-23)*, Amsterdam, North Holland.
- ONSI, M. (1973) Factor Analysis of behavioural variables affecting budgetary slack. *The Accounting Review*, 535-548.
- ORDONEZ, L. D., SCHWEITZER, M. E., GALINSKY, A. D. & BAZERMAN, M. H. (2009) Goals Gone Wild: The Systematic Side Effects of Over-Prescribing Goal Setting. *Harvard Business School Working Paper*. Boston MA, Harvard Business School.
- OTLEY, D. (1983) Concepts of Control: The contribution of Cybernetics and Systems Theory to Management Control. IN LOWE, E. A. & MACHIN, J. L. J. (Eds.) *New Perspectives in Management Control*. London, Macmillan.
- OTLEY, D. (Ed.) (1989) *A Strategy for the Development of Theories in Management Control*.
- OTLEY, D. (1994) Management Control in Contemporary Organisations: Towards a wider framework. *Management Accounting Research*, 289-299.
- OTLEY, D. (2001) Extending The Boundaries of Management Accounting Research: Developing Systems for Performance Management. *British Accounting Review*, 33, 243-263.
- OTLEY, D. & BERRY, A. J. (1994) Case study research in management accounting and control. *Management Accounting Research*, 5, 45-65.
- OTLEY, D., BROADBENT, J. & BERRY, A. J. (1995) Research in Management Control: An Overview of its Development. *British Journal of Management*, 6, S31-S44.
- OTLEY, D. & FAKIOLIS, A. (2000) Reliance on accounting performance measures: dead end or new beginning? *Accounting, Organisations and Society*, 25, 497-510.
- OTLEY, D. T. (1978) Budget use and managerial performance. *Journal of Accounting Research*, 16, 122-149.
- OTLEY, D. T. (1980) The Contingency Theory of Management Accounting: Achievement and Prognosis. *Accounting Organisations and Society*, 5, 413-428.
- OTLEY, D. T. (1999) Performance Management: A framework for management control systems research. *Management Accounting Research*, 10, 363-382.
- OUCHI, W. (1986) Markets, Bureaucracies and Clans. *Administrative Science Quarterly*, 25.
- OUCHI, W. & PRICE, R. (1978) Hierarchies, Clans and Theory Z: A New Perspective on Organisational Dynamics. *Organisational Dynamics*, 62-79.
- OUCHI, W. G. (1979) A conceptual framework for the design of organisational control mechanisms. *Management Science*.
- PASCAL, R. T., MILLEMANN, M. & L, G. (2000) Surfing the Edge of Chaos: the laws of nature and the new laws of business.
- PHILLIPS, E. & PUGH, D. (2000) *How to get a Ph.D: A handbook for students and supervisors*, Buckingham, Open University Press.

- PICKERING, A. (2010) *The Cybernetic Brain*, London, The University of Chicago Press.
- POPPER, K. (1959) *The Logic of Scientific Discovery*, Oxford, Clarendon Press.
- PORTER, B. (1976) Requisite Variety in the Systems and Control Sciences. *International Journal of General Systems*.
- POWERS, W. (1974) *Behaviour: The Control of Perception*, London, Wildwood House.
- POWERS, W. (1995) The origins of purpose: the first metasystem transitions. *World Futures*, 45, 125-138.
- PRIGOGINE, I. (1985) New Perspectives on Complexity. *The Science and Praxis of Complexity*. New York, The United Nations University.
- PUXTY, A. G. (1993) *The Social and Organizational Context of Management Accounting*, London, Academic Press Ltd.
- RICHARDSON, G. P. (1991) *Feedback Thought in Social Science and Systems Theory*, Philadelphia, University of Pennsylvania Press.
- ROBB, F. (1991) Accountancy - A virtual Autopoietic System? *Systems Practice*, 4.
- ROSEN, R. (1979) Old Trend and New Trends in General Systems Research. *International Journal of General Systems*, 5, 173.
- RYAN, R., SCAPENS, R. & THEOBALD, M. (2002) *Research Methodology in Finance and Accounting*, London, Thomson Learning.
- SAUNDERS, M., LEWIS, P. & THORNHILL, A. (2003) *Research Methods for Business Students*, London, Prentice Hall.
- SCAPENS, R. & ROBERTS, J. (1993) Accounting and Control: A case study of resistance to change. *Management Accounting Research*, 4, 1-33.
- SCHIFF, M. & LEWIN, A. (1968) Where traditional budgeting fails. *Financial Executive*, 50-62.
- SCHODERBECK, P. (1967) *Management Systems*, New York, John Wiley and Sons Inc.
- SCHODERBECK, P. & KAFELAS (1975) *Management Control Systems: Conceptual Considerations*, Dallas, Dallas Business Publishers.
- SCHWANINGER, M. (1997) Integrative Systems Methodology: Heuristic for Requisite Variety. *International Transactions Operational Research*, 4, 109-123.
- SCHWANINGER, M. (2000) Managing Complexity - The Path Towards Intelligent Organisations. *Systemic Practice and Action Research*, 13, 207-241.
- SCHWANINGER, M. (2001) Intelligent organisations: An Integrative Framework. *Systems Research and Behavioural Science*, 18, 137-158.
- SCRIVENER, A. B. (2002) A Curriculum for Cybernetics and Systems Theory.
- SENGE, P. M. (1990) *The Fifth Discipline*, London, Random House.
- SHANNON, C. & WEAVER, W. (1949) *The Mathematical Theory of Communication*, Urbana Ill, University of Illinois Press.
- SHEWHART, W. A. (1931) *The Economic Control of Manufactured Product*, London, MacMillan and Co.
- SIMON, H. (1957) *Models of Man*, New York, John Wiley.
- SIMON, H. (1962) The Architecture of Complexity. *Proceedings of the American Philosophical Association*, 106, 467.
- SIMON, H. (1964) On the Concept of an Organisational Goal. *Administrative Science Quarterly*, 3-22.
- SIMONS, R. (1987a) Accounting control systems and business strategy: an empirical analysis. *Accounting, Organisations and Society*, 12, 357-374.

- SIMONS, R. (1991) Strategic orientation and top management attention to control systems. *Strategic Management journal*.
- SIMONS, R. L. (1987b) Accounting Control Systems and Business Strategy: an empirical analysis. *Accounting Organisations and Society*.
- SIMONS, R. L. (1995) *Levers of Control: How Managers use Innovative Control Systems to Drive Strategic Renewal*, Harvard Mass, Harvard Business School Press.
- SLOAN, A. (1967) *My Years with General Motors*, London, Pan.
- SMITH, M. (2003) *Research Methods in Accounting*, Thousand Oaks, California, Sage.
- SPICER, B. (1992) The resurgence of cost management accounting: a review of some recent developments in practice, theories and case research. *Management Accounting Research*, 3, 1-37.
- STACEY, R. D. (1992) *Managing the Unknowable. Strategic Boundaries between Order and Chaos in Organisations*, San Francisco, Jossey-Bass.
- STACEY, R. D. (1996) *Complexity and Creativity in Organisations*, Berret Koehler.
- STACEY, R. D. (2003) *Strategic Management and Organisational Dynamics*, Harlow, Pearson Education.
- STEDRY, A. (1960) *Budget Control and Cost Behaviour*, Englewood Cliffs NJ, Prentice-Hall.
- STERMAN, J. (2000) *Business Dynamics: Systems Thinking and Modelling for a Complex World*, Boston, McGraw Hill.
- STROGATZ, S. (2003) *Sync: The emerging science of spontaneous order*, London, Penguin.
- SUTHERLAND, J. W. (1975) System theoretic limits on the cybernetic paradigm. *Behavioural Science*, 2, 191-200.
- TIESSEN, P. & WATERHOUSE, J. (1983) Towards a Descriptive Theory of management Accounting. *Accounting, Organisations and Society*, 8, 251-267.
- TRONCALE (1985) The Future of General Systems Research: Obstacles, Potentials and Case Studies. *Systems Research*, 1, 43-84.
- ULRICH, W. (1981) A critique of pure cybernetic reason: the Chilean experience with cybernetics. *Journal of Applied Systems Analysis*, 8, 33-59.
- ULRICH, W. (1983) *Critical Heuristics of Social Planning*, Bern, Haupt.
- UMPLEBLY, S. (1989) The Science of Cybernetics and The Cybernetics of Systems. *Cybernetics and Systems*, 21, 109-121.
- UMPLEBLY, S. (2000) Knowledge Management form the Perspective of Systems Theory and Cybernetics. *Annual Meeting of the Society for the Advancement of Socio- Economics*. Amsterdam.
- UMPLEBLY, S. (2002) Should Knowledge of Management be Organised as Theories or as Methods?
- UMPLEBLY, S. (2005) A History of The Cybernetics Movement in the United States. *Washington Academy of Sciences*.
- UMPLEBLY, S. (2007) Reflexivity in Social Systems: The Theories of George Soros. *Systems Research and Behavioral Science*, 24, 515-522.
- UMPLEBY, S. (2001) Two Kinds of Theory in General Science. *American Society for Cybernetics*. Vancouver, Canada.
- UMPLEBY, S. (2004) What I Learned from Heinz von Foerster about the Construction of Science. *Kybernetes*.
- UMPLEBY, S. & DENT, E. (1999) The Origins and Purposes of Several Traditions in Systems Theory and Cybernetics. *Cybernetics and Systems*, 30, 79-103.

- VAN DER STADE, W., YOUNG, S. M. & CHEN, C. (Eds.) (2007) *Doing Management Accounting Survey Research*, Oxford, Elsevier.
- VICKERS (1967a) *Towards a Sociology of Management*.
- VICKERS, G. (1967b) Stability, control and Choice. IN EMMANUEL. C, O. D., MERCHANT. K (Ed.) *Readings in Accounting for Management Control*. London, Chapman & Hall.
- VON BERTALANFFY, L. (1972) The History and Status of General Systems Theory. *Academy of Management Journal*, 15, 407-426.
- VON BERTALANFFY, L. V. (1968) *General Systems Theory, Foundations, Development, Applications*, New York, George Brazillier.
- VON FOERSTER, H. (Ed.) (1995) *Cybernetics of Cybernetics*, Minneapolis, Future Systems Inc.
- WAEELCHI, F. (1989) The VSM and Ashby's Law as illuminants of historical management thought. IN ESPEJO, R. & HARNDEN, R. (Eds.) *The Viable Systems Model: Interpretations and Applications of Stafford Beer's VSM*. Chichester, John Wiley and Sons Ltd.
- WALDROP, M. M. (1992) *Complexity: the emerging science at the edge of order and chaos*, New York, Simon & Schuster.
- WALLANDER, J. (1999) Budgeting - an unnecessary evil. *Scandinavian Journal of Management*, 15, 405-421.
- WALLANDER, J. (2003) *Decentralisation - Why and How to Make it Work*, Stockholm, SNS Forlag.
- WATERHOUSE, J. H. & TIESSEN, P. (1978) A Contingency Framework for Management Accounting Systems Research. *Accounting, Organisations and Society*, 3, 65-76.
- WATTS, D. J. (1999) *Small worlds: the dynamics of networks between order and randomness*, Princeton, N.J., Princeton University Press.
- WATTS, D. J. (2003) *Six degrees: the science of a connected age*, New York, Norton.
- WEAVER, W. (1948) Science and Complexity. *American Scientist*, 36, 536.
- WEINER, N. (1948) *Cybernetics*, Cambridge Mass, MIT Press.
- WEINER, N. (1954) *The Human Use of Human Beings: Cybernetics and Society*, Boston, Houghton Miffler.
- WHEATLEY, M. J. (1999) *Leadership and the new science: discovering order in a chaotic world*, San Francisco, Berrett-Koehler Publishers.
- WHITTAKER, D. (Ed.) (2009) *Think before you Think. Social Complexity and the Knowledge of Knowing*, Charlbury, Oxfordshire, Wavestone Press.
- WIENER, N. (1948) *Cybernetics*, New York, J. Wiley.
- WILLMER, A. P. (1983) The Contribution of Cybernetics to Management Control. IN LOWE, E. A. & MACHIN, J. L. J. (Eds.) *New Perspectives in Management Control*. London, Macmillan.
- WINTHER, E. K. (1985) *Variety in Systems: Towards a Theory of Organisations*. Pennsylvania, University of Pennsylvania.
- WOODWARD, J. (1965) *Industrial Organisation: Theory and Practice*, London, Oxford University Press.
- YATES, F. E. (1978) Complexity and the limits to knowledge. *American Journal of Physiology*, 4, 210-204.
- YIN, R. K. (2003) *Case Study Research: Design and Methods*, Thousand Oaks, Sage.

- YOUNG, S. (1996) Survey Research in management accounting: a critical assessment. IN RICHARDSON, A. (Ed.) *Research Methods in Accounting*. Vancouver, CGA Research Foundation.
- ZELENY, M. (Ed.) (1981) *Autopoiesis, a theory of living organisations*, New York, North Holland.
- ZELENY, M. (1986) Does the Law of Requisite Variety apply to Social Systems? *Human Systems Management*, 6, 1-3.
- ZIMMERMAN, J. L. (2001) Conjectures regarding empirical managerial accounting research. *Journal of Accounting and Economics*, 32, 411-427.

12 Appendix 1: Cybernetic Concepts: Building Blocks for a Cybernetically Sound System (CSS)

CONCEPT OR TERM	DESCRIPTION	POTENTIAL IMPLICATIONS FOR THE DESIGN AND OPERATION OF FPMS
Control theory: basic concepts	Certain concepts are common to the understanding of all forms of control – whether it be exercised over physical (natural or manmade), biological or social systems.	
Goal	Cybernetics can be described as the science of goal seeking systems. In cybernetic terms a goal is something that is preferentially selected for (Klir, 1991): in an engineering control system the goal will be selected by the designer; in complex natural systems it will be a description of behaviour that has evolved. Simple engineering systems may have only one goal. Goals may be constant or they can vary. Natural and social systems typically have many goals any of which will	In conventional FPMS goals are either assumed to be arbitrarily imposed (by some form of strategic planning process external to the FPMS) or the result of some form of negotiation between participants. From a theoretical cybernetics perspective, which perceives all biological and social systems as forms of viable system , goals need to be relevant to the survival of the system in the short medium and long term. This means they should either be related to a real hard constraint on the organisation (e.g. liquidity) or something that is a good predictor of survival in the long term e.g. market share (see

	<p>vary partly by way of adapting to the prevailing environment. In effect a goal is a form of constraint put on the operation of the regulator, rather than on the system itself.</p>	<p>essential variables). In conventional FPMS, goals tend to be expressed as a single point (e.g. £x) – though it is usually (tacitly) understood that it need not be adhered to literally (i.e. there is an unstated level of acceptable variation around a goal). Budgeting is in effect an exercise in setting constraints, but It is often not clear to what extent a budget, and the details it contains, are meant to be goals, constraints or simply guidelines. Also, no guidance is given as to how conflicts between goals are meant to be resolved. A cybernetically sound system should recognise that goals can be expressed in many ways (more than/less than/between etc.) and that there is likely to be some form of hierarchical relationship between goals to help guide resolution of goal conflict.</p>
Feedback	<p>Feedback is the process by which information about the state of the system is fed back into the system and (potentially) acted upon to change the state of</p>	<p>No system can reliably maintain control without feedback, since without it the system cannot know whether, and what form of, action is required. No system can learn without feedback, since without</p>

	<p>the system in the future (Wiener, 1948). Such systems are described as closed loop. Simple systems with (negative) feedback loops tend to exhibit archetypal patterns of behaviour depending on the way in which the feedback signals are acted upon and the speed of response in relation to the rate of environmental disturbances (see relaxation). Complex systems, such as social or biological systems have many feedback loops, and can exhibit counter intuitive (strange or very stable) behaviour of a form that cannot be inferred from a simple analysis of the structure of the system.</p> <p>In simple systems (mainly man made ones), feedback is often mediated through tangible, dedicated channels of communication. In more</p>	<p>feedback the system cannot know whether its pre-existing repertoire of responses is adequate or effective, and if not, what kind of change is required. The nature and speed of feedback information and the process by which it is acted upon are critical to the quality of control and the effectiveness of learning. In conventional FPMS feedback tends to take the form of reporting based on accounting period ends and variance analysis whereby the actual state of the system at a point in time is compared to a predetermined (usually annual) plan. In an uncertain and probabilistic world such feedback mechanisms are inadequate, from a cybernetic point of view, because of time lags and an over reliance on single data points and arbitrarily predetermined plans. The primacy of fixed plans militates against learning and adaptation. A cybernetically sound system would have multiple (mainly negative) feedback channels operating, and acted upon, in real time. The comparator used</p>
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	<p>complex natural and social systems, where there is a dense network of interconnected components, it makes more sense to think of feedback (and related concepts) as a pattern of behaviour (Ashby, 1957).</p>	<p>needs to be relevant to the goals of maintaining viability, rather than an arbitrarily derived fixed plan.</p>
<p>Feedforward</p>	<p>Feedforward is the process by which information about the anticipated future state of the system is fed into the system and, potentially, acted upon. It relies on some form of a model of the organisation and its environment; without this, potential future states cannot be estimated.</p> <p>Feedforward improves the responsiveness of systems since action can be taken in anticipation of events; the feedback process is thus short circuited.</p>	<p>Feedback is not the only or necessarily the most effective form of control since it relies upon error (Ashby, 1958b, 1957), which, particularly when the time lags are great (as they often are in large complex organisations), can lead to instability and in extreme cases failure. Feedforward (which in formal FPMS systems takes the form of lead indicators, projections or forecasts) is therefore key to the design of CSS. Forecasts are based upon extrapolation of historic trends and assumptions about the impact of planned future actions or events. A set of future actions is called a plan and the process whereby they are produced planning. Given that the environment is subject to change it is important that plans</p>

		<p>change and are not fixed; in other words they should continuously abort (Beer, 1981). In conventional FPMS systems, such as budgeting, plans are held fixed – usually for the period of a year and typically any variance from plan is assumed to represent a control deficiency that needs to be remedied.</p> <p>In a cybernetically sound system feedforward should be used where the speed of the regulatory process is not adequate to maintain stability.</p> <p>The model upon which feedforward is based should be subject to constant validation to maintain/improve its predictive power. To the extent that the assumed future actions do not deliver acceptable outcomes, action plans (and therefore forecasts based on these plans) should be continuously changed.</p> <p>Because no forecast is ever perfect, fast feedback on the performance of the feedforward process (in effect the quality of the model upon which it is based) is important in order to</p>
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		<p>ensure that the process is operating effectively (making accurate enough projections) and is changed to reflect changes in the organisation and the environment</p>
Negative polarity	<p>Negative feedback/forward describes a response to the output of a system that leads to a reduction in an input. Where the output is expressed as an error between an actual/anticipated and a targeted value for a variable, a negative feedback/forward response aims to reduce the gaps between the current/anticipated state and the goal. Stable systems (i.e. ones that are under control) are dominated by negative feedback.</p>	<p>It is important that negative feedback – the correction of deviations – is dominant in any FPMS. It is however important to ensure that the goal is appropriate (i.e. relevant to viability) and that the deviation that is acted upon is real and not the result of random variation. Fixed (annual) plans based on a set of outdated assumptions, of the kind produced by budgeting systems, are often not appropriate and the conventional form of variance analysis treats any form of variation as significant – thus raising the prospect of acting on a random signal and in the process destabilising the system – sometimes described as tampering.</p> <p>Cybernetically sound systems will have many negative feedback loops in place, with mechanisms to filter data to distinguish between signals and</p>

		noise (Beer, 1981, Deming, 2000b, Shewhart, 1931).
Positive polarity	Positive feedback/forward, describes a response to the output of a system that leads to an increase in an input. Where the output is expressed as an error between an actual and a targeted value for a variable a positive feedback response increases the gaps between the current/anticipated state and the goal. Systems dominated by positive feedback/forward are inherently unstable and therefore tend not to survive, however positive feedback/forward is critical to the process of learning and growth in natural systems (Maruyama, 1963).	Any FPMS that is capable of supporting/bringing about change must legislate for positive feedback (although the negative loop must be dominant if the system is not to explode (Beer, 1981). Conventional budgeting is built exclusively on negative feedback (managing, as it does, adherence to a fixed plan within a financial year). A cybernetically sound system will have the capacity for positive feedback to temporarily override dominant negative feedback when a deviation is recognised as beneficial to the system, thereby producing the archetypal logistic or S curve that is characteristic of growth or change in the natural world (Modis, 1992).
Relaxation/Lead time/Latency	Relaxation time describes the length of time it takes a system to recover from the impact of regulatory acts. This may be due to delays in	Most organisations have many different process operating with different lead times, but conventional approaches to FPMS tend to deal in fixed epochs, often determined by the

	<p>receiving information, delays in acting on it or delays between initiating an action and its impact being manifest. If relaxation time is longer than the rate at which environmental disturbances arrive, then perfect stability will never be achieved; in extremis this could lead to the physiological limits of essential variables being breached and the system ceasing to be viable. Indeed it is possible that an appropriate stabilising act will have the opposite effect to that intended if the system changes state in the interim (Beer, 1979). Other terms used to describe the impact of time on effective regulation (in control engineering) are latency and phase shift.</p>	<p>accounting calendar. This leads to relaxation times being artificially constrained and consequently organisational performance (and stability) compromised. The concept of relaxation time demands that cybernetically sound FPMS should be designed around the lead times that exist in the organisation, which can vary over time and between organisations levels (Simon, 1962). Even if decision making is perfect the existence of long lead times can lead to instability and in extreme cases, organisational failure. It also demonstrates how system performance can be improved or made more cybernetically sound – by reducing lead times – either by process improvement (e.g. faster information systems) or by organisational design (decentralised decision making). In other words, management should take place, as far as possible, in real time. Another strategy is to counter lead times through anticipation i.e. projecting and acting upon anticipated future actuals (see</p>
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		feedforward).
System order	System order describes the number of information loops in a system. Simple engineering control systems tend to be first order (usually first order negative feedback systems). A second order system would be one where a second tier provides control signals /goals to the first tier. All systems in the natural and social world have many orders that are responsible for adding additional layers of meaning to sensory inputs (Powers, 1974). See also metasystem and recursions .	A cybernetically sound system should have many orders, with each level (recursion) in the hierarchy having a dynamic relationship with each other (Beer, 1979). Whilst conventional systems such as budgeting are built upon organisational hierarchies, the relationship, once established as part of the (usually annual) planning process, is held fixed for the remainder of the year.
Cybernetics: basic concepts	Cybernetics focuses on the control of exceedingly complex probabilistic systems. The degree of abstraction involved requires the introduction of certain concepts.	
Variable/System	A variable is a measurable quality of a system (Ashby, 1952). Measurement may or may not involve	The concept of a variable provides a generic context independent term to help describe the basic objective of regulation in all its forms: the

	<p>quantification. A system is defined by the process of an observer selecting a set of variables that are believed to be relevant to their purpose.</p> <p>The system in focus is the system as defined by the nature of a specific scientific enquiry.</p>	<p>maintenance of a set of values for a set of variables. For our purposes it allows us to dispense with the clumsy distinction between financial and non-financial measures. Conventional FPMS are focussed (almost) exclusively on financial variables.</p> <p>A cybernetically sound FPMS will be designed to regulate financial variables in the interest of maintaining the viability of the whole system and, in so doing, will reference variables that are not expressed in financial terms.</p>
Environment	<p>An environment is that set of variables whose change (perturbations) impacts the system in focus, and which are in turn affected by changes in the system. The distinction between a system and the environment is made by an observer based on his/her purpose (Ashby, 1952) which in the case of a scientist, is to discover and explain invariances in behaviour. A variable in the</p>	<p>No FPMS can be designed without considering its environment. No two organisations share exactly the same environment, and whilst the structural arrangements of the CSS FPMS may be similar, to the extent that they follow consistent cybernetic principles, how control/adaptation is exercised in practice will be unique to that system. This is because of differing environments and the freedom/capacity for choice designed into those systems. Conventional FPMS implicitly</p>

	<p>environment is called a parameter.</p>	<p>assume that many, if not most, elements can be defined without reference to the environment (or indeed to the purposes of the organisation).</p> <p>Academic contingency based empirical research has attempted to understand how environmental (and other contextual factors) may influence the way in which control systems are applied in practice.</p> <p>A cybernetically sound system will be constructed according to an invariant set of principles, but its specific features will differ between organisations in the interest of developing a good fit (structural coupling) to its (particular) environment. This is partly the result of choices that have been made by the system about how to best compete/survive in that environment.</p>
<p>System state</p>	<p>The disposition of the variables of a system at a point in time (Ashby, 1952). A set of values</p>	<p>System state allows us to talk about an organisation – its current position and its historic and prospective trajectory. The act of management, at its simplest, can be perceived as an exercise in attempting to</p>

		<p>influence the future course of system states.</p> <p>The acquisition and direction of resources is one mechanism by which a FPMS affects the state of the system. A cybernetically sound FPMS would have the capability to change the disposition of resources in a fashion that is consistent with the viability of the organisation as a whole.</p>
<p>Phase space/Line of behaviour/ Field</p>	<p>Phase space is all the possible states of the system (Ashby, 1952). Usually conceived of as an n dimensional geometric space with the axes representing potential values of the variables. A line of behaviour traces the value of variables over time in phase space. A systems field describes all possible lines of behaviour for that system (Ashby, 1952) and is therefore a subset of phase space (which will always be the case since organisation implies the existence of constraints</p>	<p>Many management activities can be economically explained by expressing them with reference to Phase Space – for example the process of making a decision can be seen as a procedure whereby we progressively eliminate unpromising areas of phase space in order to expose the correct decisions (Beer, 1966). Exercising control effectively involves constraining the area of phase space that an organisation or part of an organisation is allowed to operate in (i.e. modifying the systems field). Conversely the release of resources or an act of creativity expands the reality or perception of its field. The notion of flexible Phase Space has</p>

	on behaviour)	<p>been used in evolutionary biology to help explain the interaction and evolution of species – a process that creates epigenic landscapes where one dimension (usually conceived of as peaks) describes evolutionary fitness (Kauffman, 1993) , (Beer, 1981). This notion that has obvious value when used to describe how organisations might interact in either a competitive or co-operative fashion. For example, adaptation can be conceived of as a process of seeking out higher peaks. Incremental change proceeds as a series of small steps up a gradient on an existing peak; radical innovation a leap to an adjacent – possibly higher peak. Changes in the environment are analogous to changes in the landscape; through erosion, avalanche or tectonic upheaval.</p> <p>A cybernetically sound FPMS will, through the appropriate allocation of resources, constrain the organisation from straying into unpromising areas of phase space but give freedom but also guidance in exploring</p>
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		more promising areas.
Full/Partial/Step/Null functions	<p>Full function describes a situation where all variables can fluctuate continuously against each other. Step functions are binary in character. Partial functions lie in between full and step functions and describes the behaviour of variables (or sets of variables) that vary independently of other variables until a value (or threshold) is exceeded in which case they trigger a change in other variables, thus speeding up responsiveness. Without step or partial functions, system states would perpetually wander making it impossible to achieve stability (particularly in large systems that are fundamentally more likely to be unstable) and behave predictably. Null functions are required in order for an adaptation of</p>	<p>Step and partial functions allow organisations to strike a balance between having sufficient stability to make the act of management possible whilst retaining responsiveness. A system with step functions satisfies rather than optimises (Simon, 1957). Any large, stable, complex system will tend to be made up of a set of loosely coupled sub systems that – within limits – are capable of acting independently in response to environmental perturbations. A cybernetically sound system will be comprised of a set of semi-autonomous units, loosely co-ordinated in the interests of organisational cohesion. Partial functions should be the way in which goals are specified.</p>

	the system to be genetically retained (Ashby, 1952).	
Stability	Stability is the name given to any set of transformations (trajectory of systems states) that is closed i.e. it includes certain values (a region of its field) in its repertoire of behaviour but excludes others (Ashby, 1952). It includes conventional notions of equilibrium and homeostasis but also more complex forms of closed transformations, such as limit cycles (oscillation) or even chaotic strange attractors (Gleick, 1998). Stability can be conceived of as a basin of attraction in state space.	Defined in this way, stability is an essential feature of any system that survives. A system (organisation) can be stable without being static or predictable. A cybernetically sound system would be designed such that it is dynamically stable.
Polystability	Polystability describes a system that has more than one zone of stability – basins of attraction accessible to the system (Beer, 1966). The basins can be very deep (resistant to change) or	Complex organisations are almost certainly polystable; i.e. they have many different stable states. These could be conceived of as different management modes of operation (e.g. normal vs. crisis or milk vs. grow). The depths of

	shallow (easy to change).	the basin defines the capacity for change in an organisation and the process of crossing a ridge between basins triggers a change in system behaviour. In a cybernetically sound system, controls would be organised such that variables that need to be held relatively constant (such as those that are the object of regulation) would occupy deep basins of attraction. Other variables (such as those that are pertinent to adaptation) might occupy relatively shallow basins – meaning that the system can quickly adopt new, yet stable, configuration when subject to evolutionary pressure.
Cybernetics: regulatory theory	Cybernetic theory defines those characteristics necessary in a system if it is able to regulate itself adequately.	
Essential variables	Essential variables are those that are critical to survival – the viability - of the system (Ashby, 1952).	The design and operation of FPMS is, in the first instance, concerned with the management of those essential variables that are expressed in monetary terms. At the same time, a FPMS must help facilitate the management of essential variables that are not expressed in monetary terms (such as

		<p>customer satisfaction). This will be done by manipulating other variables in the system – variables that may or may not be expressed in monetary terms (see above).</p> <p>A cybernetically sound system must therefore be designed to be responsive to changes that threaten essential variables – financial and non-financial.</p>
Viability	<p>Viability is the name given to the survival of a system. A system can only be viable if its essential variables are held within physiological limits – i.e. below certain thresholds (Ashby, 1952). A system has to be stable with respect to its essential variables if it is to persist.</p> <p>This implies striking a balance between system stability (dynamic equilibrium or homeostasis) in the short term and adaptivity (controlled disequilibrium) in the longer term. In other words, the system needs</p>	<p>Essential variables are defined as those that are critical for viability. For virtually all forms of organisation, this will include a sufficiency of cash, but what other variables are termed essential will vary between organisations and possibly over time. So, for example, publicly quoted companies it may be important to demonstrate higher than average growth and adequate profit margins in order to maintain a separate existence (not be taken over), variables which are not relevant to the operation of a charity. Viability defines the capacity of an organisation to survive. Adopting viability as the design criterion for a cybernetically sound system means that it is not</p>

	to be in a state of unstable equilibrium (see self-organised criticality)	necessary to make any assumptions about the purpose or goals of an organisation (Beer, 1959a, 1979).
Ultrastability/Homeostasis	Ultrastability is a quality of a system that makes it capable of holding its essential variables within physiological limits over a wide range of unspecified environmental conditions, for which the system was not explicitly designed (Ashby, 1952). An example of ultrastability are the homeostatic mechanisms of the human body, which hold essential variables such as temperature, and salt and carbon dioxide concentrations in the blood within certain tolerances in a wide range of environmental conditions.	Any performance management system that is capable of facilitating the viability of an organisation has to exhibit ultrastability. In other words, those qualities that allow flexibility of response beyond that originally allowed for, are, and have to be, an essential quality of the system. This distinguishes cybernetic systems from the hardwired electromechanical control systems with which they are often mistakenly compared. It also means that the way in which human actors choose to apply or ignore or supplement the formal control system is an important part of the performance management system itself rather than deviant behaviour. Interpretation and the exercise of judgement are what give the system the capacity to adapt to unanticipated circumstances. A cybernetically sound system needs to be ultrastable. This

		requires not only the ability to flex variables within the formal system but also the capacity to incorporate informal interventions; in a manner that does not compromise efficient operation or viability
Multistability	A multistable system is one made up of a number of interconnected ultrastable systems (Ashby, 1952). The whole system is not stable until all its interconnected parts are stable, and if the whole system is stable then all its component parts must be stable. A system made up of interconnected ultrastable systems is more stable than one large ultrastable system since it allows parallel processing of regulatory responses.	This concept provides a cybernetic rationale for decentralisation/divisionalisation. From a cybernetic design point of view, it makes sense to align each ultrastable unit with a set of related environment disturbances (or whatever the organisational unit is attempting to respond/adapt to). In this way, as much of the work of change can be confined to a single unit – thereby protecting the whole unit from perturbation. In addition, since only a subset of the total system has to change, response to external disturbance is speeded up. Another term to describe a multistable system is near decomposable (Simon, 1962). Complexes of environmental disturbances taking place at different scales and at different speeds can be handled by hierarchically arranged

		<p>multistable systems.</p> <p>A cybernetically sound system would be based on an organisational design that ensured, as far as possible, that environmental disturbances could be independently dealt with by appropriately located and interconnected subsystems. This contrasts with conventional FPMS that treats an organisations structure as an exogenous variable.</p>
Homeostat	<p>A machine capable of displaying ultrastability. This is carried out by vetoing states that result in essential variables being out of limits (Ashby, 1952)</p>	<p>A homeostat is a useful shorthand way of describing an arrangement of controls (or regulators) capable of exercising ultrastability. The mechanical model built by Ashby did so by rejecting – by mutual veto -those systems states that are not acceptable. Complex social organisations can be conceived of as a complex of interlocking homeostats (Beer, 1966) which, as they interact, are capable of displaying and regulating complex behaviour. In complex social organisations some homeostats respond to the external environment, others respond to the internal environment, and all respond to</p>

		other homeostats.
Variety	<p>Variety is a measure of the number of states a system can adopt in a given period of time (Ashby, 1957). It is a relative rather than an absolute concept; it varies depending on the perceptual capacity of the observer and his/her purpose.</p> <p>It has been likened to concepts such as momentum - a variable that Newton invented in order to help explain the behaviour observed in the world. In describing the movements of a pendulum (a simple system), Newton ignored variables such as colour since they were irrelevant to his purpose.</p> <p>The variety that a system exhibits is usually greater than the theoretical maximum because of the existence of constraints.</p> <p>A system without constraints would be characterised as</p>	<p>Variety is a versatile measure that allows us to describe and define the qualities of different system characteristics. In FPMS, we are concerned with the variety of the environment, the desired variety of the system (the goal state) and the variety of the regulator (performance management system). Thus, terms often used in a loose descriptive sense in the study of FPMS can be defined more rigorously and situations described and analysed more elegantly and parsimoniously using the concept of variety. For example, complexity can be conceived of as high variety and extreme complexity as more variety than we are able to deal with due to the limited (relatively low variety) capacity of our brain. Flexibility is a term used to describe a regulator with high variety. Uncertainty can be conceived of as a lack of knowledge about the (often future) variety of the system.</p> <p>Controlling social organisations requires management to deal with situations of extreme</p>

	<p>disorganised.</p> <p>In systems, most aspects of variety increase exponentially, which accounts for the extreme complexity of large systems (see Appendix 3).</p>	<p>complexity and uncertainty where measurement is, at best, probabilistic (Beer, 1959a). The design of organisation structures and processes and the actions of management can be conceived of as reducing or constraining variety (e.g. the exercise of management control, specifications or standard operating instructions) or increasing variety (training, empowerment etc.).</p> <p>Just as the potential variety of a system can exponentially explode with size, so variety can be collapsed by the imposition of constraints. This may have positive consequences – for example when used to reduce uncertainty attached to a decision – or negative consequences, as when excessive constraints are placed on a system that needs flexibility e.g. when tight budgets and stretching targets are imposed on a system that needs flexibility to respond to a dynamic environment.</p> <p>Classic management theories mainly focussed on measures to constrain variety through</p>
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		<p>standardisation or the use of economic incentives to modify behaviour (Fayol, Taylor), more recently the trend has been in the opposite direction (Waelchi, 1989) through empowerment for instance.</p> <p>Good management – in the form of a cybernetically sound FPMS - involves loosening and tightening constraints on variety (variety engineering) such that an organisation is capable of sustaining viability in an effective and efficient manner (1979, Beer, 1981)</p>
Regulator	<p>A regulator is that part of a system that intervenes to promote changes in the systems state or system field, in response to or in anticipation of environmental disturbances. Its activities are subject to constraints.</p>	<p>A FPMS can be thought of as a regulator or a set of interconnected regulators, along with their associated information systems. A cybernetically sound FPMS would comprise a set of regulators that contained models of the organisation (see the Conant Ashby Theorem) designed to conform to Ashby's Law of Requisite Variety.</p>
Law of Requisite Variety (Residual Variety)	<p>Ashby's Law of Requisite Variety (LORV) describes the necessary relationship between the variety of the (relevant</p>	<p>The Law of Requisite Variety (LORV) defines the qualities (expressed in terms of variety) a regulator must have in order to be capable of delivering a</p>

	<p>part of the) environment or input into the system, the variety of output of the system and the capacity or variety of the regulator (Ashby, 1957). It can be seen as a generalisation of Shannon 10th Theorem. The law is deductively derived i.e. it is not dependant on empirical verification (See Appendix 4). Residual variety is that variety that is not absorbed by the regulator.</p>	<p>desired outcome (a goal with a specified variety). It purports to provide the answer to the fundamental question posed in the functionalist tradition of MCS research. It confirms the intuitive insight of Contingency Theory – that the nature of a control system depends on contingent factors – but tells us how and why (De Raadt, 1987b).It also recognises that the nature of the regulator is not only contingent on exogenous contextual factors (the environment, the nature of technology and so on) but also on the range and nature of the goal set, which is, to a degree, a matter of choice. Many pathologies of control systems (gaming etc.) can also be explained by recourse to the LORV. It has been argued that the LORV is the root law of organisations (Waelchi, 1989) and as significant to the science of control as the law of gravity is to physics (Beer, 1979). and since it is deductively derived it cannot be repealed i.e. there are logical consequences that cannot be avoided (Beer, 1979, Beer, 1981). See</p>
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		<p>Appendix 4 for a fuller explanation of the LORV.</p> <p>Note that regulation does not have to be active; it can be passive – buffers (such as budgetary slack or balance sheet provisions) provide some regulatory capacity.</p> <p>A cybernetically sound system would be designed with the strictures of the LORV in mind. This means that, amongst other things, the nature of the environment and the variety of the goal set are considerations that inform design decisions.</p>
<p>Law of Requisite Knowledge</p>	<p>Requisite knowledge describes the competence of a regulator to make intelligent selections in the face of environmental perturbances. It is a function of the availability of information and the capacity to make good use of it (Aulin, 1982); which is itself a function of the quality of the regulatory models employed (Conant Ashby Theorem). This introduces an extra term</p>	<p>This demonstrates that, while the LORV cannot be repealed, it is not deterministic. Its operation in practice is influenced, amongst other things, by the competence of human beings within the organisation and the availability or quality of information. In other words, the qualities of the human resources and the scale and nature of uncertainty have to be factored into the design of cybernetically sound FPMS.</p> <p>If a regulator does not have requisite knowledge, then (according to the LORV) this</p>

	into the LORV and has been described as the Law of Requisite Knowledge (LORK)	deficiency needs to be remedied by adding hierarchical levels to absorb the residual variety.
Cybernetic design principles: regulation	Certain principles are important in translating cybernetic theory for the purposes of regulation in complex social systems.	
Regulatory strategies	The LORV prescribes 3 generic kinds of regulatory strategies available if the regulator is not functioning adequately (Ashby, 1957). One is to reduce (constrain or attenuate) the variety of the environment. The second is to increase (amplify, relax the constraints on) the regulator or supplement the capacity of the regulator by adding hierarchical levels. The final strategy is to relax the constraints (increase the variety) of the goal set.	A cybernetically sound FPMS will probably use a combination of all three regulatory strategies.
Redundancy	Redundancy is a measure of the surplus regulatory capacity in a system over and above the theoretical minimum required in order to	Organisations are manifestly made up of unreliable components (people, information systems and processes etc.) operating in a complex and unpredictable environment

	<p>achieve a task.</p> <p>Redundancy could take the form of spare capacity or alternative available arrangements (e.g. fail safe mechanisms). Von Neumann demonstrated that with sufficient redundancy an output of any desired quality can be produced by a system made up of parts with any level of reliability (Beer, 1959a).</p> <p>Redundancy is extensively used in safety engineering and in communication systems to deal with channel failure and noise. It is also a feature of complex biological systems such as the brain.</p>	<p>(Clemson, 1984) .Redundancy is therefore essential to any cybernetically sound FPMS. The amount of redundancy should be driven by the reliability of the components and the uncertainty of the situation that the regulator is faced with. The redundancy may take the form of:</p> <ul style="list-style-type: none"> • redundancy of resources (e.g. budgetary slack see the LORV above), • compensating controls, • alternative decision making processes (Redundancy of Potential Command) • Information redundancy - multiple communications channels, informal controls and so on. <p>Functional redundancy (i.e. a single unit having the capacity to do more than one thing) is more efficient than structural redundancy (Emery and Trist, 1965).</p>
Informal systems	Informal systems are behavioural repertoires that are not part of a formally recognised (organisational) process or the system as	Since no formal system will have the requisite variety to enable a social system to deal with its environmental variety, informal systems and processes are essential in order for the

	<p>designed. Self-regulation and self-organisation often uses informal mechanisms.</p>	<p>organisation to remain viable (Beer, 1966). In effect they modify (attenuate or amplify) the variety provided by the formal structures. An example of what happens if informal processes are not allowed to override formal ones, is the British trade union practice of working to rule (Ackoff, 1991). The converse might also be the case; for example cultural norms might constrain the exploitation of variety in a way that <i>is</i> permitted by the formal system.</p> <p>Indeed, cybernetic theory predicts the more complex the environment and task in hand, the greater the role of such informal practices. This is consistent with the findings of Ouchi and Price (1978) who describes them as cultural or clan controls.</p> <p>Informal systems could be manifest as routines that are not formally recognised or in the way in which formal systems are interpreted or used by the actors. For example, are targets treated as soft (guidelines) or hard (commitments) constraints? A cybernetically sound system</p>
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		should acknowledge and consciously allow for the appropriate use of informal controls.
Model	<p>A model is a simplified representation of a real world system (against which it maps). A good model will be able to make good predictions about (certain aspects) of real world systems.</p> <p>Models may be physical (e.g. as used by engineers to test building for resilience to shocks) or conceptual (such as a map), explicit (a scientific theory) or implicit (the model used by humans to catch a ball).</p>	Conventional FPMS are not explicit about how projections are produced, plans formulated, decisions made and so forth; it is assumed to be the result of (usually senior) management judgement. Models assume a prominent place in cybernetic thinking since prediction (of changes in the environment, the impact of regulatory acts etc.) is central to the process of regulation.
Conant Ashby theorem	<p>The Conant Ashby theorem demonstrates that every good regulator of a system must be a model of that system. In other words, a model – whether it is implicit or explicit, has been built or simply evolved – is essential for effective regulation to be possible (Conant and Ashby,</p>	<p>This theorem describes what qualities a good regulator has – it needs to be a good enough model (a simplified representation) of the organisation that has requisite variety. Better regulation is afforded by:</p> <ul style="list-style-type: none"> ☐ explicit models ☐ tested/improved by feedback ☐ used error anticipation

	<p>1962). Without a model, it is not possible to make sense of feedback, create feedforward or determine what regulatory acts are available or are likely to be effective.</p>	<p>(feedforward) not just error correction (feedback) control A cybernetically sound FPMS should make use of all three strategies.</p>
<p>Heuristics</p>	<p>The regulatory models as used in control engineering are algorithms; mathematical routines that predetermine what action need to be taken given a range of specified inputs in order to regulate a system. Complex probabilistic systems are incapable of being regulated through algorithms since the complexity of the behaviours that need to be regulated go way beyond the computational capacity of any computer conceivable within the laws of physics (Ashby, 1981c). Instead, heuristics are required – simple</p>	<p>This demonstrates that not only is it not necessary to build mechanistic, algorithmically based models for the control of organisations; it is theoretically impossible to manage organisations using them exclusively. Indeed, the process by which evolution proceeds (generate a random mutation then deselect those phenotypes that fail) is an example of how complex intelligent design can emerge from a dumb process using simple. This means, amongst other things, that computer routines (which are based on algorithms) should be used to support – and not to replace – human learning/judgement (which mainly utilises heuristic methods). Only the most simple, repetitive processes can be controlled using algorithms.</p>

	<p>routines (models) which when repeated (and fed with feedback) are capable of providing much greater levels of regulatory control than an algorithm under conditions that cannot be specified in advance.</p> <p>Heuristic processes, if supplied with a memory function and feedback on the success of previous actions, are capable of learning (building and improving a probabilistic model of the environment) – as demonstrated by Beer’s algenode (1981).</p> <p>Heuristics are also used to inject variety into what would otherwise be low variety goal sets (Ashby, 1981b).</p>	<p>More complex tasks, such as decision making, and innovation need to use heuristics.</p> <p>A very simple, but inefficient, heuristic is trial and error. The kind of control exercised in complex social organisations will use more sophisticated heuristics – that is ones that are based on a good model of the world or at least a set of conditional probabilities built up from experience – i.e. through learning. This is essentially the concept of double loop learning (Argyris and Schon, 1978).</p> <p>A cybernetically sound FPMS should be constructed in such a way that heuristic routines are facilitated – by constraining variety, building plentiful, fast feedback loops and providing manifold opportunities for controlled experimentation. Also, heuristics should be used to provide goals with requisite variety – helping managers to interpret what is required in a context dependant way.</p>
Black box	The black box concept describes the exercise of control understanding the relationship between	In complex, probabilistic systems such as social organisations, regulation do not require complete knowledge of

	<p>the inputs and outputs of system (Ashby, 1957); that is without detailed knowledge of the mechanisms involved. Given the exceedingly complex, unknowable nature of the world, this is a necessary and inevitable part of the process of acquiring knowledge. A regulator can itself be a black box, which with relatively simple logic can demonstrate huge regulatory variety (Beer, 1979, 1981). An example of regulation exercised in this way is the interventions of neurologists. Since the workings of the brain are unknowable, inferences and actions have to be made based on the relationship between observable inputs and outputs.</p>	<p>the workings of the thing being regulated, in practice visibility is very limited (a muddy box). A cybernetically sound FPMS would be organised in such a fashion that limited knowledge of, and intervention in, the inner workings of a system is required.</p>
<p>Cybernetic design principles: organisational structure</p>	<p>Organisational structure plays an important role in facilitating cybernetic control.</p>	
<p>Constraints</p>	<p>A constraint is any</p>	<p>The notion of constraints</p>

	<p>quality that limits the variety (system states) of a system. In other words, it delimits that part of phase space that the system can explore. Organisation is a form of constraint, as is a goal, but constraints can take many other forms (laws, taboos, procedures, budgets etc). See attenuation/variety engineering.</p>	<p>provides a parsimonious way of dealing with a variety of phenomena involved in the design and operation of FPMS. Budgets can be conceived as a constraint on input (resource), targets as a constraint on output (performance) The process of control is in effect that of setting out and managing within constraints and FPMS is a name for a particular sort of control system; the availability or lack of financial resources is a major form of constraint in any organisation. A cybernetically sound FPMS would have a set of constraints which was consistent with LORV.</p>
Metasystem	<p>A metasystem sits above other systems. Its role is to perform those tasks that can only be undertaken by a system with a synoptic perspective, such as the management of interrelationships between the systems in order to generate synergies, maintain a level of cohesion and to</p>	<p>Any social system of a size and complexity that requires some form of formal FPMS, will include subsystems that play a metasystemic role i.e. exercise logical oversight. The term allows us to avoid confusing systemic roles with conventional notions of authority and power.</p>

	<p>address environmental variety at a higher level of recursion (Beer, 1979). A metasystem will, by definition, adopt a different perspective on reality and speak a different language to that of individual systems. See system order and hierarchy.</p>	
<p>Response - Adaptation</p>	<p>Response and adaptation are two forms of regulation. Response describes the process whereby a system adjusts its states to maintain viability using its existing models. Adaptation describes the process by which a system adjusts its regulatory models to improve its regulatory response or maintain viability in the face of changes to the environment. To be viable, a system has to strike a balance between response and adaptation (Beer, 1979). Response, adaptation and the</p>	<p>In conventional management thinking strategy is concerned with decisions about the future direction of the organisation and is the prerogative of senior management. It is seen as separate and distinct, in conceptual and organisational terms, from tactics; often simplistically portrayed as the execution of strategy. In fact the terms are relative (Ackoff, 1970a); what is perceived as tactical at one level of recursion is treated as strategic by another. In cybernetics, adaption (strategy) and response (tactics) are both prerequisites for viability; neither takes logical precedence over the other. An organisation has to strike a balance between adaptation and</p>

	<p>balance between the two are all subject to the operation of the LORV. Thus a perfect fit to current environments will prejudice the future and vice versa.</p>	<p>response at every level, and both activities are subject to the operation of the LORV. This facilitates the description, analysis and prediction of sophisticated organisation behaviour in an elegant and parsimonious fashion. A cybernetically sound FPMS would facilitate response, adaptation and the management of the relationship between the two.</p>
<p>Autonomy - Cohesion</p>	<p>Autonomy is the capacity of parts of the system to freely adjust (through regulation or adaptation) to their environment. Cohesion is the quality whereby parts of a system are constrained in order to maintain the coherence and so the viability of the system of which they are part. To be viable a system has to strike a balance between autonomy and cohesion (Beer, 1979). The appropriate balance is subject to the operation of the LORV. Complete autonomy, and no</p>	<p>In conventional management thinking, the need to be directive or the need to empower are usually presented as alternative management philosophies (Beer, 1966). Budgeting, for example, is often characterised as the product of a command and control management philosophy. Cybernetic thinking regards autonomy (freedom from constraints) as essential in order to provide sufficient regulatory variety in order to deal with complex and turbulent environments and cohesion (the existence of constraints) as being necessary in order to preserve the organisation as a whole and to exploit</p>

	<p>autonomy, is both incompatible with system viability.</p>	<p>organisational synergies. A cybernetically sound organisation aims to preserve a balance between the two at every level. The way in which the balance is struck is a function of the purpose, or the management style, of the organisation: freedom is a computable function of purpose as perceived (Beer, 1979).</p>
<p>Organisational closure (autopoeisis)</p>	<p>Under any logical system there will always be classes of statements that are undecidable within the logic within which they have been framed (Beer, 1959a). In these cases resolution can only be made using a higher level (meta) language. This provides organisational closure. In social systems organisational closure is commensurate with the concept of identity – a set of behaviours that, though differential interaction, distinguishes the system from its environment. Biological systems that have the</p>	<p>This principle provides the cybernetic rationale for the existence of an entity that sets policy; policy being shorthand for any class of rules that is determined internally and cannot be deduced from the logic of the situation with which an organisation is faced. Such rules include organisational values, culture, acts of leadership and so on. In essence, such rules define organisational identity. The specification of policy can be regarded as leadership, and may be associated with a small defined group of people (or individual), but can equally be the result of a consensus forming process among a large group. This means that a cybernetically</p>

	<p>capacity to produce themselves (and in so doing define a physical boundary with the environment)</p> <p>demonstrate autopoiesis (self-production); a form of organisational closure, and a definition of what constitutes life (Maturana and Varela, 1998).</p> <p>Organisational closure can be conceived as operating as a homeostat, where what is being maintained is the organisation of the system itself.</p> <p>Maintenance of a separate identity implies the maintenance of a critical set of relationships with the environment; structural coupling.</p>	<p>sound control system – even one managing something as prosaic as the flow of financial resources – has to recognise the need to make value judgements. It cannot be a purely technical exercise based on the management of economic trade-offs, since there will always be circumstances where there is no correct answer.</p> <p>The capacity for social systems to seek and maintain identity is natural, but it is not necessarily healthy for the organisation or its environment. For example, subsystems of a viable system acting to preserve their own identity, as in the case of a self-perpetuating bureaucracy or corrupt public agencies, can be termed pathologically autopoietic (Beer, 1981, 1994c).</p>
Hierarchies	Systems that exhibit any significant degree of complexity, particularly those that have evolved, adopt hierarchical forms, since otherwise they would not be able to evolve sufficiently quickly	A hierarchical structure is a cybernetic necessity for any large or complex FPMS. The degree and nature of hierarchical structuring is determined by the regulatory demands of the situation rather than being, as with conventional

	<p>(Simon, 1962). The evolution of an additional (metasystemic) layer in response to growing system complexity is termed a metasystemic transition (Heylighen and Joslyn, 2001), see metasystem. From a cybernetic control perspective, hierarchies help absorb variety (filter situational variety) and compensate for/supplement or enhance lower level regulatory variety. The compensatory function of hierarchies is subject to the Law of Requisite Hierarchy (Aulin, 1982). Different hierarchical levels deal with different levels of environmental variety and different levels of goals.</p>	<p>FPMS, an exogenous variable or the result of the exercise of organisational power. Amongst other things, it will be influenced by the regulatory capacity (skill/competence/knowledge) of the individual regulatory units, the characteristic of the environment and so on. The key requirement is that regulatory acts (whether in response to disturbances in the external or internal environment) should be taken by an entity with requisite knowledge. In a system that exhibits redundancy of potential command this is not located in one part of the organisation. Different hierarchical levels will have different goals. At an operational level, where actual performance can be measured, goals expressed in financial terms will predominate. At strategic and normative levels goals will relate to capabilities and potentials that cannot be easily reduced to economic measures (Schwaninger, 2001).</p>
<p>Recursion</p>	<p>Recursivity is a feature of hierarchically organised systems, whereby the</p>	<p>In cybernetically sound FPMS, the same functional structures/characteristic should</p>

	<p>same structural features are replicated at different levels, thereby demonstrating the parsimony of natural invariance (Beer, 1979). Recursive systems demonstrate fractal geometry.</p>	<p>be manifest at all hierarchical levels in order for the systems as a whole to be viable (respond and adapt appropriately). Conventional FPMS assume that certain functions e.g. leadership or strategy are reserved for certain parts of the organisation. Cyberneticians regard concepts such as strategy and tactics as relative rather than absolute (Ackoff, 1970a); they are conducted at all hierarchical levels subject to (inter alia) the constraints imposed by higher and lower levels of recursion.</p>
<p>Purpose</p>	<p>Purpose in cybernetic terms is an ex post rationalisation of observed regularities in behaviour. The purpose of the system is what it does (Beer, 1979). Purpose is an interpretation of the behaviour of an autopoietic system seeking to maintain its identity.</p>	<p>Unlike conventional FPMS, the design of a cybernetically sound system is not designed on the assumption that it exists in order to help achieve a purpose; it should be designed to be viable – to maximise the chances of survival. The design process is therefore proceeds from the bottom up (since the primary task is to respond appropriately to current and potential environmental disturbances) and top down (to the extent that essential variables may be specified by higher levels of</p>

		recursion).
Variety engineering	<p>Variety engineering describes the process whereby constraints are manipulated in order to meet the requirements of the LORV, thereby making effective regulation possible (Beer, 1979, 1981). Attenuation describes the process of tightening constraints; amplification the process of loosening constraints. Study of regulation in nature reveals that amplifying and attenuating processes are often found operating in tandem (e.g. the sympathetic and parasympathetic parts of the human autonomic nervous system). Beer speculates that this may be a characteristic of any control systems that cannot be specified. Given the potentially astronomical levels of variety in unconstrained systems, the overall drift</p>	<p>Variety engineering is one of the key tasks of management. The concept of variety engineering provides us with an elegant and parsimonious way of describing a very wide range of managerial actions and activities – formal or informal, conscious or otherwise. Some of this engineering will take place as part of the organisational design process but, given the complex and uncertain nature of social organisations and the environments in which they operate, most will be the result of conscious management actions or it will emerge as a result of the interplay between systems. There is no right balance between attenuation and amplification. It is amongst other things dependant on the nature of the job to be carried out, circumstances and organisational ethos. However, since the environment has a higher variety than any organisation within it, and management has less variety than the organisation it is</p>

	<p>in control systems is to attenuation; the trick is to do so intelligently. There are three forms of attenuation: cognitive, structural and conversational/interactive (Schwaninger, 2000). The act of co-ordination inevitably involves attenuation.</p>	<p>seeking to manage, the overall tendency is to finding appropriate ways to attenuate variety.</p> <p>So, for example, standardisation, which is essential to making mass produced objects of consistently high quality is an example of high attenuation. The act of regulation in an uncertain environment (or continuous improvement of a standardised manufacturing process) requires measures that are variety amplifying – decentralisation of decision making authority, rewards for good ideas etc. From a cybernetic point of view, classical management practices – including budgeting - over attenuate variety in inappropriate ways (Waelchi, 1989). A cybernetically sound FPMS would facilitate the conscious application of variety engineering, which would be applied in a context dependant, dynamic fashion.</p>
<p>Self-organisation/ regulation</p>	<p>Since the variety of any social system is (needs to be) greater than the variety of any designer or</p>	<p>The tendency of social systems to self-organise/regulate, means that the designer of any control system such as FPMS is not</p>

	<p>regulator of that system, any social system needs the capacity to self-organise and self-regulate (1959a, 1966, Beer, 1981). Any stable system (i.e. with a basin of attraction) is self-organising – though its zone of stability is not necessarily good or desirable (Ashby, 1962). Self-regulation described the process whereby stability is maintained through homeostasis. In other words, control is intrinsic to social systems; unlike many simple engineered systems it is not (exclusively) administered externally. In biological systems (including social systems) an external agent can only intervene in the processes that already exist.</p>	<p>working with a blank slate. Indeed, if an organisation is well established, and particularly if it has a strong set of values and behavioural norms, (in other words it has a deep basin of attraction and behavioural repertoires have become habituated) it may be difficult to significantly change patterns of behaviour. The implication for the design of cybernetically sound FPMS is that it cannot be perfectly specified in isolation from an organisational entity. Whilst cybernetic principles of design must hold, the way in which they are applied is likely to differ in different organisations.</p>
<p>Cybernetic design principles: information</p>	<p>Information provides the raw material upon which cybernetic regulation and is itself subject to cybernetic</p>	

	law. Information systems need to be designed with these principles in mind.	
Fact. Data. Noise. Information. Channel Capacity. Transduction	Data is a statement of fact. Data always contains noise, which is a meaningless jumble; it is either irrelevant variety or that variety which is not recognised as relevant, perhaps because of an inadequate model. This is called noise. Data may contain information, which is defined as that which reduces uncertainty, thereby helping to providing a regulator with variety. Information is created when a fact is recognised as something that is amenable to action (Bateson, 2000); that is it changes the state of the system (Beer, 1979). Any channel must be capable of carrying data and noise recognising that this does not flow evenly i.e. it has to allow for surges. The information in and out of system	Cybernetic control is founded on the appropriate use of information. Therefore the design of cybernetically sound systems has to consciously include provision for dampening noise and the transmission and communication of information in real time. Since decision making is constrained by information, a CSS may need to create information by conducting trials (Ashby, 1981a).

	<p>entities is subject to transduction; a transducer translates information into and out of the language of the respective entities – in other words its role is communication. The capacity of transducers needs to be at least as great as that of the channels to which they are connected (Beer, 1979).</p>	
<p>Attenuation of data: statistical filters</p>	<p>All channels will transfer noise as well as signals. In order to make sense of incoming data, there need to be statistical filters; algorithms, based on mathematical principles, which attenuate the incoming signals by stripping out noise and trigger appropriate alerts for management. This needs to take place in real time if cybernetic control is to be maintained. The objective is to spot signs of incipient instability (Beer, 1979, 1981).</p>	<p>Conventional systems, such as budgeting, are based on reporting on a calendar cycle, using techniques such as variance analysis – a technique that ignores variation over time (i.e. evidence of change) and assumes all variation (including noise) against a fixed plan is meaningful. As a result, significant events may be missed (or recognised too late) and inappropriate action taken in response to random noise (tampering) (Deming, 2000b, Shewhart, 1931). In addition, the whole system will become overburdened with data, which is likely to be attenuated</p>

		<p>haphazardly (by ignoring information, aggregation or as a consequence of information overload).</p> <p>Real time monitoring, using statistical filters, is key to cybernetic control.</p> <p>A cybernetically sound information system will operate in real time and employ techniques that filter out noise and so help identify signals that management will need to interpret and act upon. By definition, this means that it is likely that the structure of information provision will not remain static.</p>
Amplification of data	<p>Signals frequently need to be amplified. This may be because the signal in incoming data is weak and needs to be amplified by analysis or investigation, or it is a control signal expressed in a compressed form that needs to be fully expressed before action can be taken. Also, any form of communication, particularly when it crosses system</p>	<p>Conventional FPMS assume that variance analysis will provide enough information to enable appropriate action to be taken. Cybernetics acknowledges that the variety of the system being controlled will always exceed the variety of any regulatory scheme, and that ad hoc investigations will always be necessary in order to ascertain the nature of a situation.</p> <p>Also, feedforward information is conventionally expressed as a single point, which ignores the</p>

	<p>boundaries, needs a degree of redundancy to maintain the fidelity of the message. Finally, in order to understand risk and uncertainty it may be necessary to recognise the likely impact of noise and alternative scenarios.</p>	<p>fact that there is always a level of statistical risk attached to any forecast and that this may be relevant when considering regulatory actions. Looking further ahead, there is an increasing likelihood that variables will interact in unpredictable ways creating outcomes that are qualitatively different from those that can be derived from a model of the existing system (i.e. uncertainty). A cybernetically sound system would therefore explicitly acknowledge the legitimacy of alternative future outcomes and frame regulatory plans accordingly.</p>
<p>Algedonic (pleasure or pain) signal/channel</p>	<p>Where organisational units are arranged hierarchically, one of the roles of the intermediate layers is to filter information so that only that the layer above only receives that which is meaningful in the context of those decisions that need to be taken at that level. Since no process operates perfectly, and filtration necessarily uses</p>	<p>Unlike conventional FPMS, which assume that all regulatory tasks are carried out perfectly by the appropriate level in the hierarchy, a cybernetic system recognises that all parts of the systems are fallible or may not be able to take the correct decision. This is because – at their level in the recursion – they do not have the right information or perspective on which to operate. To allow for this, cybernetically sound FPMS will</p>

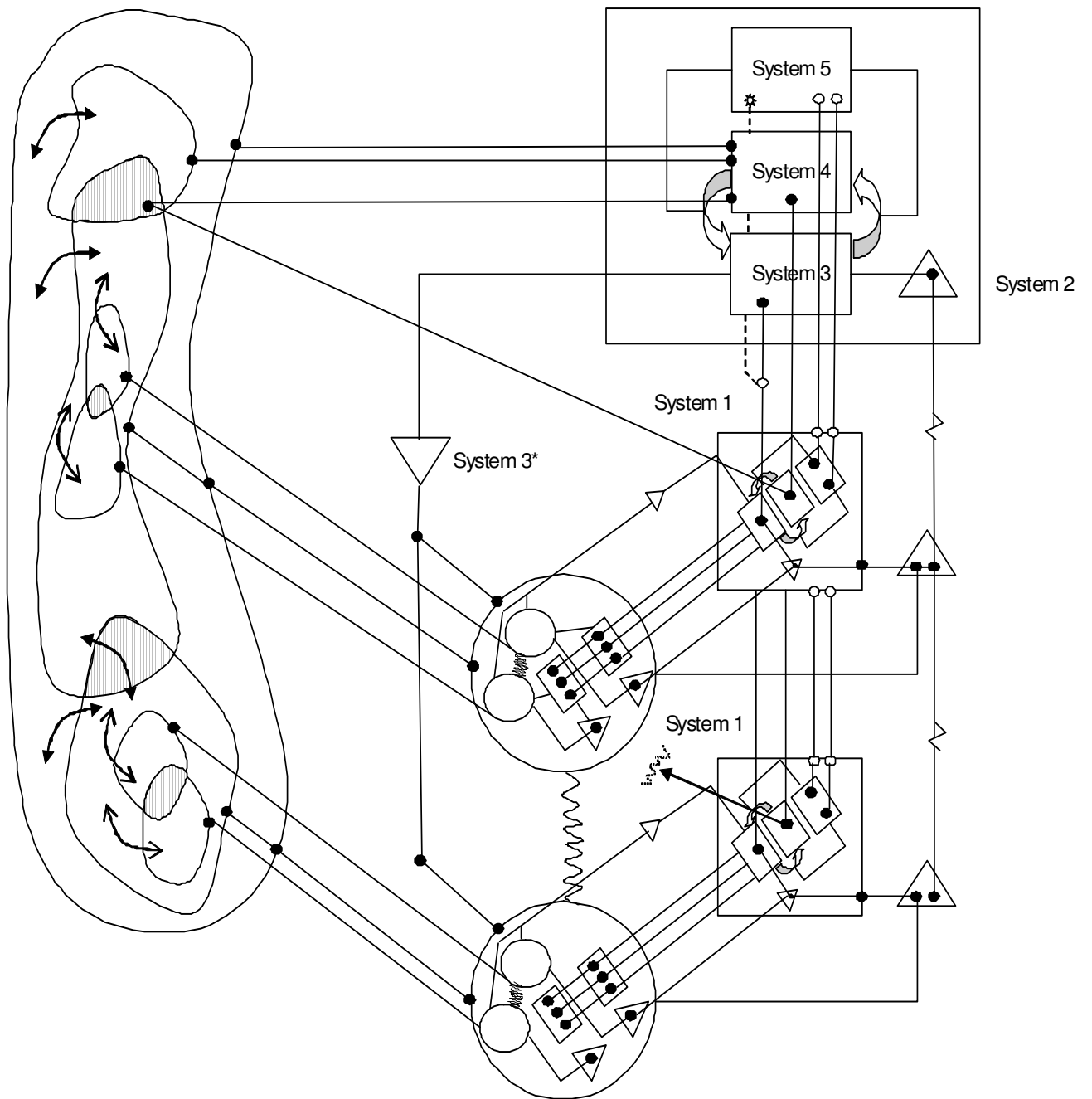
	<p>the model of the lower level system, it is inevitable that meaningful information (from the perspective of the higher unit) will be filtered out. It is also possible that, in an emergency, the filtering process will delay important messages and thereby prejudice the viability of the whole. An algedonic signal (channel) allows extreme or unusual messages to bypasses the routine filtering processes, thereby speeding up reaction time (Beer, 1979, 1981).</p>	<p>incorporate a system override channel, constructed in such a way that any intervention from a higher level of recursion is triggered by an appropriate signal - not the result of managerial whim. In addition, the managerial mode of an organisation might be switched under algedonic control (see polystability). For instance, a severe and swift economic shock, detected as an algedonic signal, might demand a shift in the regulatory response of a scale and at a speed that is not possible using conventional channels (emergency action).</p>
<p>Related concepts in Complexity Science</p>	<p>Recent developments in our understanding of the science of complex systems that is pertinent to the design and regulation of social organisations.</p>	
<p>Edge of chaos – self organised criticality</p>	<p>Some natural systems have been shown to naturally evolve towards a far from equilibrium state on the boundary between order and chaos (Langton, 1996). It has been suggested that, in this realm,</p>	<p>This appears to reflect one of the design principles for a viable system; one dominated by negative feedback but which is locally and temporarily subverted by positive feedback (Beer, 1979).</p>

	<p>spontaneous self-organisation and innovation may emerge, since there is enough novelty to bring about change through random processes, but enough stability to preserve new patterns that emerge (Kauffman, 1993).</p>	
<p>Small worlds, power laws and the fractal structure of nature.</p>	<p>It has been demonstrated that, in nature, systems are neither randomly nor uniformly connected (Barabási, 2002, Watts, 1999). Rather, they tend to form small world structures – islands of dense interconnectivity loosely coupled with each other in a way that radically reduces the length of the longest path between any two nodes. They tend to have characteristic mathematical properties (following a power law). They are also fractal: self-similar at all levels (i.e. recursive). Such systems appear to</p>	<p>This phenomenon appears to be consistent with Ashby’s observations on stability in large systems. He observed that randomly connected systems become exponentially unstable with size (Ashby, 1970). In so far as it appears to be a naturally occurring phenomena in the environment, not just in biological organisations, it provides further justification for the creation of a recursive organisational structure made up of semi-autonomous (loosely coupled) elemental units mapping onto equivalent structures in the environment, as first described in <i>Design for a Brain</i> (Ashby, 1952).</p>

	facilitate globally coordinated behaviour with the minimum of connectivity (Strogatz, 2003)	
Genetic algorithms (global search heuristics)	It has been demonstrated how relatively simple systems, subject to a randomising and selection processes, are capable of generating increasingly complex (but relatively stable) systems with a good fit to their environment (other competitive systems) (Holland, 1995a)	This appears to confirm the Beer's specification for a machine capable of devising regulatory responses a variety capable of matching that of the environment: a heuristic specified by an algorithm (the algedonode). It suggests that adaption in a CSS needs to combine mechanisms to proliferate ideas (explore the space of possibilities) combined with a selection process that helps identify and shape potentially useful strategies. The tendency to converge on local rather than global optima (local peaks in epigenic landscapes) demonstrate the importance of developing innovation strategies whereby progress (in an epigenic landscape) combines many small incremental changes up fitness gradients (continuous improvement) supplemented by a small number of large leaps (discontinuous change) that are informed by conditional

		probabilities but with a random component. It is also consistent with Ashby's prescription for goal setting in an uncertain environment (Ashby, 1981b).
Chaos theory	Chaos theory demonstrates how even a deterministic system that is nonlinear (as are virtually all systems in nature), is capable of demonstrating unpredictable behaviour, because of their sensitivity to initial conditions (Gleick, 1998)	This demonstrates why it is not possible to construct a regulatory system predicated entirely on the ability to predict the future (e.g. a budget system). A viable system needs to be dominated by feedback (mainly negative), supplemented by a repertoire of regulatory responses that allow the system to respond quickly to change.

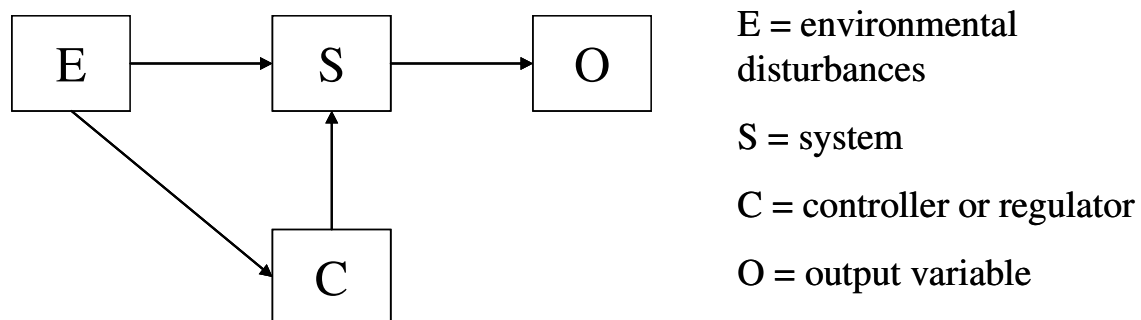
13 Appendix 2: The Viable Systems Model – Detailed Diagram



14 Appendix 3: Ashby's Law of Requisite Variety

The fundamental question Ashby was seeking to answer was what qualities does a regulator require in order to be able to reliably hold output variables within a specified range? specifically the specified range consistent with the survival of the system.

Ashby characterises the problem in this way:



The logic runs thus: environments generate disturbances, and therefore what a good regulator does is block this flow of variety from the environment such that the residual variety reaching the system is within the physiological limits of the variables essential for the survival of the system. What he was then able to demonstrate in his *Law of Requisite Variety* was that there was a necessary, logically derived, relationship between the variety of the environment, the variety of the regulator and the variety of the goal; which can be expressed as:

$$V_c \geq V_e / V_o$$

Where:

V_c = the variety of the controller or regulator.

Ve the variety of the environment (disturbances).

Vo is the variety of the output variable.

The equation is normally expressed in logarithmic terms as follows:

$$\log V_c \geq \log V_e - \log V_o$$

and as: only variety can destroy variety (1957).

This law can be readily demonstrated by conceiving of the task of regulation being like a game expressed in the form of a payoff matrix.

		control system responses					
		ⓐ	C2	ⓒ	C4	ⓔ	C6
environmental states	E1	1	2	3	4	5	6
	E2	2	3	4	5	6	1
	E3	3	4	5	6	1	2
	E4	4	5	6	1	2	3
	E5	5	6	1	2	3	4
	E6	6	1	2	3	4	5

In this game it can be seen that if the desired state of the output variables (or goal) were any single value (say 1) then the regulator would need to have at least the

same variety as the environment (i.e. 6). If the goal were two values (say 1 or 2) then the regulatory variety would have to be at least 3 (shown by the circles in the above diagram).

Time is excluded from this model; it is assumed that the identification of changes in environmental state, the control systems response to this and its manifestation in output variables takes place instantaneously. In practice this is never the case therefore regulation will never be perfect.

The payoff matrix as shown above is of course very simple but the proof holds with systems of much greater (in fact any level of) complexity for example where there are compound disturbances or goals and where there is redundancy in the regulatory responses (i.e. one regulatory act can counter a range of environmental disturbances) in which case the formula is modified slightly:

$$\log V_c - \log V_r \geq \log V_e - \log V_o$$

where V_r represents the degree of redundancy in the control system responses.

Also regulation (the blocking of environmental disturbance) can take many forms; passive - as with the shell of a tortoise (a regulatory strategy that also exhibits redundancy in that it blocks a range of environmental disturbances) - or active, as with the parrying manoeuvres of an expert swordsman. The latter example also demonstrates that the law can be used to describe what needs to be done to defeat a regulator and the potentially fatal consequences of failure!

The Law of Requisite Variety represents a fundamental property of all systems in all domains, and in that it describes a finite limit (a precise constraint) on what it is possible for any kind of system to achieve in any particular set of circumstances it is an insight of great profundity capable of a wide range of application. Beer, for example, (Beer, 1979) has described the LORV as having a status in the study of systems equivalent to the 2nd Law of Thermodynamics in physics. As Ashby says, the law owes nothing to experience or experiment, it is not capable of refutation, nor

does it owe anything to the material world – it is a fundamental property of any kind of system.

For instance it can be used to describe what qualities a mechanical control system must have to achieve a predetermined level of performance, why MCS need more flexibility in conditions of uncertainty, why adding constraints into a linear programming routine reduces the value of the objective function and so on. It not only applies to the process of regulation (where the set of environmental disturbances and the regulatory responses are relatively stable) but also to all forms of adaptation (e.g. Darwinian evolution) where changes in the environment (i.e. the set of disturbances) need to be matched by changes to the set of regulatory responses – e.g. genetic evolution or learning new behaviours – if a system is to survive. It also allows us to examine control system pathologies; for example why people bend the rules to get things done if a bureaucratic process is too inflexible. A control system without requisite variety will be unstable; one with it will demonstrate stability in critical (essential) variables.

Since the LORV is deductively derived it cannot be empirically refuted. Ashby himself regarded it as a generalisation of Shannons 10th theorem, which describes how with sufficient channel capacity (equivalent to regulatory capacity) a signal with any amount of noise (environmental disturbance) could be modified to produce an output signal of any desired quality (output variable).

15 Appendix 4: Variety Calculations

The size of a system: number of elements:

$$n$$

The variety of an element: number of states of any one element:

$$s$$

The variety of states of a system: number of states of a group of elements

$$g = s^n$$

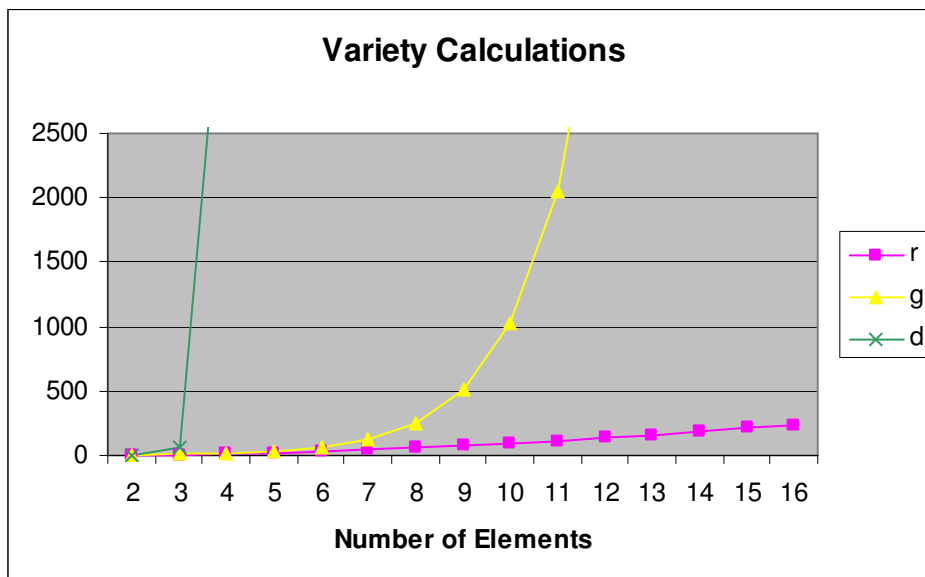
The variety of interconnectedness of system: number of (two way) relationships

$$r = e^*(e-1)$$

The variety of the dynamic potential of a system: number of (binary) states of a group of two way relationships:

$$d = 2^r$$

Example: assuming $s = 2$



16 Appendix 5: Research Instrument

Which statement better describes the organisations structure?

	Description	Cybernetic Principle	Statement A	SCORE					Statement B
				1	2	3	4	5	
1	Elemental Autonomy <i>How is the customer/consumer facing part of your organisation structured? How much autonomy do these business units have?</i>	A CSS should contain a number of autonomous elemental units (S1) tightly coupled with their environments on the horizontal axis which are subsets of the overall organisational environment. They should be structured such that they absorb the maximum amount of relevant environmental variety through self regulation.	<i>Responsibility for dealing with customers is shared within the organisation. These different units involved are responsible for meeting targets/following laid down procedures - responsibility for overall performance sits higher up in the organisation. Numerous customers 'hand offs' sometimes leads to confusion and conflict. Customers are frequently dissatisfied.</i>						<i>Our organisation is made up of a number of business units each of which is responsible for their own clearly defined set of customers /clients /products. Business units are largely free to manage their relationships - there is limited restriction or interference from above or need for consultation with other units. They have most of the resources they need to successfully operate and are held accountable for results.</i>
2	Operational Directorate <i>How are groups of business units managed?</i>	A CSS should have a metasystemic management function (S3), responsible for managing organisational cohesion and collective performance. It does so by actively managing the extant internal environment, made up of the collection of elemental units (S1), with the overriding objective of ensuring that the external homeostatic relationships managed by the elemental units themselves are as healthy as possible. It should do so using 5 vertical channels (see below).	<i>Reporting lines for customer facing units are unclear and confused and support services are provided by units with no clear line of accountability into the customer organisation. As a result decisions which affect the service provided to customers can be slow and confused, often the result of a complex political process. The support needed to provide a good service to customers is lacking.</i>						<i>Related business units are grouped together and subject to the control of higher management who work collaboratively to ensure that structures and processes are in place to ensure that business units are appropriately funded, supported and coordinated, such that the whole is more than the sum of the parts. Amongst other things this involves taking responsibility for continuous alignment of the activities of units, sporadic sampling, continuous resource allocation, accountability and the provision of shared services. On occasion intervention in the affairs of business units is necessary, but this is not part of the normal management routine.</i>
3	Restraint on Command <i>How do business units receive guidance and direction?</i>	A CSS should use Command Channel on the vertical axis which S3 uses to make interventions in S1 affairs. This should be minimally used; as far as possible it should only be used to proscribe and guide behaviour using mechanisms that allow for appropriate local interpretation	<i>There is a high degree of higher level intervention in the work of customer facing processes. This is disruptive and makes the job of providing good service difficult.</i>						<i>Direct orders from above are rare in normal circumstances. Company policies, guidelines, principles and values mean that we have a good idea of how we should act in most situations.</i>
4	Continuous Alignment <i>How are the activities of business units co-ordinated and knowledge shared?</i>	A CSS should have an active, high variety, S2 operating in real time on the vertical axis to routinely co-ordinate S1 activities, in the interests of the elemental units themselves. This should include the maintenance of metadata, operational policies and protocols, and the management of regulatory and performance information and programming.	<i>Collaboration with service units and other customer facing units is difficult because of the lack of processes to facilitate cooperation AND/OR the rigid bureaucratic procedures that need to be followed. As a result, our collective actions are often slow and poorly coordinated.</i>						<i>We are provided with facilities to help us co-ordinate our activities with those of other units and departments. This help includes common information and communication systems, planning and scheduling processes and policies and procedures to help manage routine transactions.</i>
5	Sporadic Sampling <i>How do higher management keep in touch with what is happening on the ground?</i>	A CSS should have S3* mechanisms on the vertical axis that facilitate high variety, ad hoc, investigation of the operational component of elemental units. These are required in order to check adherence to organisational policies (communicated via either the S2 or Command Channels), investigate problems and explore opportunities for synergistic improvements.	<i>Periodically customer facing units may be subject to audit to make sure that we are compliant with laid down procedures and policies, otherwise there is little interest shown in the work of such units. As a result there is little knowledge sharing and opportunities and problems are not readily 'surfaced'.</i>						<i>Sporadically, higher management will arrange for in depth investigations of aspects of the activities of business units, or they may 'come and see for themselves'. This keeps business units on their toes and helps senior management stay in touch. It also helps expose opportunities for improvement.</i>
6	Continuous Resource Bargaining <i>How are resources allocated?</i>	A CSS should have a mechanism to allocate (grant permission to use) resources in real time to elemental units, subject to a negotiated resource bargain for which the elemental units are held accountable. Resource permissions will relate to specific regulatory acts (as prescribed in the Resource Bargain) and the maintenance of elemental operations and the local (elemental) regulatory capacity (both expressed as proscriptions in the Resource Bargain).	<i>Resources are allocated as part of a quarterly/annual process. Making changes between these process is difficult, and as a result opportunities can be lost and resources are often put to poor use.</i>						<i>Business units are allocated funding to cover the costs of operations and support a? certain levels of local initiatives subject to agreed (efficiency) criteria. As and when a need arises business units are able to access additional resources. Such requests are supported by business case.</i>
7	Accountability <i>How are business units held responsible for the resources they have been allocated?</i>	A CSS should have an 'Accountability' Channel on the vertical axis whereby the management of elemental units are able to reassure metasystemic management (S3) that their environmental homeostats are operating effectively within the terms of the resource bargain. Information is provided 'by exception' subject (inter alia) to the filtering of elemental management.	<i>Business Units are required to routinely report against budget. Separately, KPIs are used to target and monitor operational performance. The amount of information provided - much of which is irrelevant - can be overwhelming. This leads to it being ignored/followed up by a large volume of follow up questions and information requests.</i>						<i>Business units are held accountable for the resources they are allocated. Accountability is based on the criteria attached to the funding requests and takes the form of exception based reporting.</i>
8	Development Directorate <i>How is innovation managed?</i>	A CSS should have a metasystemic function (S4), responsible for maintaining and enhancing the regulatory capability of the system. This requires continuous monitoring of trends in the environment, and building models (of the existing and possible environmental and systems states) to help create options for response and adaptation. To discharge this role effectively S4 should exchange information with S3; the managerial subsystem responsible, inter alia, for overseeing current operations and agreeing the resourcing needed to enact the options.	<i>No-one is responsible for regular/structured monitoring of external information, and working out what needs to be done to respond to changes. As a result, changes in trends has little impact on activity within the business. We can therefore be slow to react to opportunities or problems and fail to stop projects which no longer have a contribution to make.</i>						<i>The external environment is continuously monitored and, based on this, options for changes to products, services, technologies and business structures are kept under continuous review. This continuous stream of ideas is translated into implementable projects in collaboration with higher operational management.</i>

Which statement better describes the way the organisation handles information?

		SCORE						
		Statement A	1	2	3	4	5	Statement B
13	Data Capture <i>'What data is captured?'</i>	A CSS should collect, in real time, extensive amounts of data on the actual state of financial variables and those variables which impact, and are impacted by, changes in financial variables and that are relevant to the maintenance of stability, i.e. healthy (internal and external) homeostatic relationships.	Limited information is collected on a monthly/quarterly basis. It is biased towards that required to report on financial performance. As a result it is difficult to spot changes in patterns of behaviour; people rely heavily upon their 'gut feel' for what is going on in the business.					We collect extensive amounts of financial and non financial information in real time, on the performance of our organisation, but also on the external environment.
14	Elemental Information <i>'What information is used to ensure that the business units are operating satisfactorily?'</i>	A CSS should, through S2, provide elemental units with information to facilitate self regulation, (i.e. maintain and improve stability and performance) which includes that necessary for the effective management of interdependencies with other elemental units. A subset of this information will also be supplied to S3 to enable it to discharge its responsibility for the set of elemental units. Such information should be systematically attenuated to provide the minimum amount of information necessary for the effective regulation of financial variables. In addition they should receive information from S2 about their own performance (i.e. compared to a meaningful benchmark) and that of other elemental units to help promote learning (incremental improvement/adaptations).	Business units are responsible for producing their own management information, which is not prepared on a consistent basis to that produced by other business units or routinely shared with other parts of the organisation. As a result it is difficult to compare performance and coordinate activities.					We are continuously provided with information to help us co-ordinate our activities with other units and to monitor our performance, compared to other business units (with who we share learnings) and competitors. This includes exception based reporting which alerts us to unusual patterns.
15	Metasystemic Reporting <i>'What information is used to ensure that business units are using resources appropriately?'</i>	The S3 of the elemental units of a CSS should routinely, through the Accountability Channel, supply S3 of its metasystem with information that provides reassurance that the subsystem is performing in line with expectations and that the terms of the Resource Bargain are being observed. By its nature this will be provided 'by exception' (though at a frequency appropriate to the rate of change in the environment).	Business units provide higher management with financial reports on a standard frequency, and using a standard reporting format. Because this is often unhelpful for decision making purposes, this is often supplemented by demands for extensive amounts of information on an ad hoc basis.					Business units routinely provide higher management with information on performance against criteria contained in resource agreements. The content of report will reflect the nature of the agreements made and reports produced at appropriate times/frequencies.
16	Alert and Alarm <i>'What information is used to alert senior management to issues that may demand swift intervention?'</i>	A CSS should provide a mechanism to systematically identify that information which is exceptional by virtue of its nature, size or recurrent nature, and to channel that information, in real time, to S5 (the leadership function) of the metasystem via the algedonic channel	There are no mechanisms for alerting senior management to extreme or unusual events. As a result interventions in response to problems or opportunities can be poorly informed and slow.					We have mechanisms to ensure that senior management are directly alerted to unusual or persistent data patterns.
17	Environmental Monitoring <i>'What information is provided to keep track of external trends?'</i>	A CSS should routinely monitor environmental trends to inform the production of feedforward information; both short term forecasting (mediated through S2) and S4 planning activity.	Information on the external environment are not routinely collected and analysed other than as part of the annual budget setting/strategic planning process. As a result actions within the business may be out of touch with external reality.					Trends in external variables are continuously monitored and are used to help produce forecasts and guide decision making.
18	Forecast Information <i>'What information does the organisation use to anticipate outcomes?'</i>	A CSS should share through S2, (forecast) information on the projected state of key financial variables (and those variables which impact and are impacted by changes in financial variables) relevant to the maintenance of healthy internal and external homeostatic relationships. The forecasts are based on a model of the existing organisation and prevailing environmental conditions and committed and planned regulatory actions. They should be produced at a frequency at least equivalent to the rate of change in the environment or the system and should cover the time lags associated with regulatory action.	Forecasts are not routinely produced OR forecasts are produced to the end of the financial year, based upon the accounting reporting cycle, using the same data formats used for budgets/reporting of actual performance. As a result they have limited use for decision making.					Forecasts of the immediate future, based on current plans, are frequently produced and used to guide decision making and 'course correct'. Such forecasts use a rolling horizon and are aligned with the decision making cycle.
19	Forecast Risk <i>'How does the organisation estimate the uncertainty attached to forecasts of future outcomes?'</i>	Forecasts prepared by a CSS should be amplified by estimating the uncertainty (unsystematic error) attached to any forecast and which may impact the effective regulation of financial variables.	All forecasts never/do not routinely include an assessment of risk. Consequently it is difficult to distinguish between an error in the forecast and reasonable variation around it, and the business is often surprised by changes in events.					All forecasts include an estimate of associated risk.
20	Bias Measurement <i>'How does the organisation validate the reliability of forecast information?'</i>	The models used by a CSS to forecast future outcomes should be maintained and improved through the elimination of systematic error and the reduction of unsystematic error. This is determined by reference to feedback on actual outcomes (error) within the time lags associated with regulatory acts.	Forecast error is not routinely measured. Management are only held accountable for year end forecast accuracy. As a result it is not possible to quickly detect the needs for changes to the forecasting process perhaps as a result of breaks in trends. Consequently decisions based on the forecast may be wrong.					Short term forecast accuracy is rigorously analysed in order that bias be detected and corrected.
21	Planning Information <i>'What information is used to help develop plans?'</i>	A CSS should, through S4, provide information on potential future states and so inform the process of adaptation (the creation of new options). This should be updated at a rate at least equivalent to the rate of environmental change, cover a horizon equivalent to the time lags of the adaptive acts concerned and be validated by reference to those produced at other levels of recursion (which address different perspectives and timescales).	We produce longer terms plans only when required as part of the budgeting/strategic planning round. Each planning exercise is likely to use different processes/models. There is frequently a difference between what such exercises assume and our shorter term plans (budgets).					We maintain a continuously updated set of models, supported by market research, to help us project into the long term and so build robust plans. Our portfolio of plans is kept under constant review and refreshed when significant changes in the environment are detected.
22	Scenario Generation <i>'What information does the organisation use to assess the range of possible outcomes?'</i>	A CSS should, through S4, produce multiple alternative future outcomes which reflect the potential uncertainty in the environment and the consequences of adaptation.	We produce a single, comprehensive longer term plan. This does not identify risks or alternative courses of action. If reality turns out differently we need to start a search to determine the appropriate course of action.					We build a set of alternative future scenarios to help us build contingency plans and identify early signs of imminent environmental change.

Which statement better describes the way the organisation manages its performance?

	Cybernetic Principle	Statement A	SCORE					Statement B	
			1	2	3	4	5		
24	Requisite Variety <i>Does the organisations performance management system provide enough flexibility?</i>	The regulatory systems of a CSS should, for all variables at all levels and over all time scales, be designed to comply with Ashby's Law of Requisite Variety. This requires that the variety (flexibility) of all control systems (formal and informal) be at least that required to match the variety of the goal set given the variety of the environment. Flexibility takes the form of a sufficiently large portfolio of regulatory acts matched with a level of liquid resources sufficient to enact them.	We have not got the freedom we need to achieve the goals we have been set. The goals are too demanding AND/OR: we have insufficient flexibility and resources to act quickly in response to the market place. Because of this we usually fail to meet some of our targets. It is also common for managers to try to inject some slack into the budget/target process.						Given our current environment, we have sufficient flexibility to meet our goals, which are stretching, but achievable.
25	Limited Goal Set <i>How are organisational goals specified?</i>	In order to comply with LORV, a CSS will limit the number of variables used for goal setting and express them in low variety terms; as thresholds, ranges as a direction or in 'fuzzy' terms. Essential variables (with a range corresponding to the physiological limits) should always be included in the goal set. This will include goals for financial variables arising from the Resource Bargain struck with the providers of funds.	We have a large number of targets which are all defined as single point values. It is difficult to meet all of them, all of the time. Attempts to do so generate a lot of extra work and sometimes involves taking action which is in conflict with the overall goal and purpose of the organisation.						We have a manageable set of goals. They are not too numerous or tightly defined.
26	Goal Hierarchies <i>How are choices made between competing goals?</i>	In a CSS, goals should be hierarchically arranged in order to guide the regulator in making trade offs. This will include (inter alia) those related to essential variables which will always be prioritised against non essential variables, 'constraints' which need to be met (but no more) before 'objectives' are optimised. Since the aim is to maintain the health of the total system, goals for different variables (Financial/Resource and Operational) and goals related to the maintenance of identity ('Normative') capability ('Strategic') and current performance ('Operative') should not be prioritised over each other.	We have to choose which, out of the set of targets which we are given, we prioritise. If financial reward is attached to the achievement of any particular target this takes priority over all others - at least until the target value is reached. Sometimes this means that important objectives are neglected or ignored, particularly if they are difficult to measure.						We need to make sure that we maintain a healthy balance between short and long term, financial and non financial goals. Everyone understands that the need to meet a target should never involve taking action which runs counter to our strategy or will put the organisation or its reputation at risk.
27	Changes to Goals <i>When are goals changed?</i>	In a CSS, goals should be changed only when necessary: where a significant change in the environment demands it, in order to institutionalise an improvement in performance (positive feedback) or in the event of a change in system capability arising from a regulatory action. Specifically, automatic changes to goals on a predetermined arbitrary cycle should be avoided. Relative, directional goals and those related to the (internal or external) Resource Bargain provide appropriate mechanisms to achieve these ends, and 'point in time' goals should be avoided wherever possible.	Goals are reviewed every quarter/year. Goals will almost always be changed at period ends, but very rarely in-between even if there are significant changes in the outside world or in business plans. As a result the difficulty of achieving our targets, and therefore the type of action required to do so, are constantly changing. This can be disruptive.						Goals are changed only when circumstances change, in an upwards or downwards direction. At a high level this may be only every few years; at a detailed level, this may include project specific goals which are very temporary.
28	Continuous System Control <i>How is information used to help manage performance?</i>	In a CSS, regulation will be informed by a mixture of feedback and feedforward (forecast) information supplied in real time and should take account of the impact on all relevant goals and constraints, irrespective of the set of variables under regulation.	We use month/quarter end financial reports to manage the organisation strictly within our budgets/targets. We report on non financial KPIs, which often reflect the need to manage within tight financial constraints.						We use a wide variety of real time information to steer the business towards its goals; financial and non financial.
29	Locus of Regulation <i>At what level in the organisation are performance management decisions made?</i>	In a CSS, regulatory acts will take place at different levels of recursion, at different frequencies and involve regulatory acts of different amplitudes. Decision making should be at the lowest level of recursion where the requisite knowledge exists, consistent with the overriding need to maintain overall organisational cohesion and effectiveness.	Decision making is the prerogative of senior management. Other levels are primarily responsible for implementation. This means that the process is slow and quality can often suffer because senior managers do not have the local knowledge necessary to make good decisions.						Decision making is highly decentralised. Higher management only get involved in those decisions that cannot be taken locally, because of their scale or their strategic significance.
30	Option Generation <i>How are ideas for future actions generated?</i>	In a CSS, options for systemic adaptation should be continuously generated (by S4) at a rate at least equivalent to the anticipated rate of perturbation in the environment. The variety of the portfolio of options should be at least as great as the uncertainty attached to projections of future environmental and system states. The portfolio of options created should be consistent with the strategic posture.	Periodically we are required to produce a list of projects plans for inclusion in the next periods financial plan OR we start to work on our project plans once we have been given our target. As a result we can be slow to formulate an appropriate response to an unexpected threat or opportunity.						New ideas are constantly being generated and worked on, they will include plans to cope with exploit possible changes in the environment (contingency plans). The process is guided by our strategy.
31	Option Selection <i>How are organisational plans created?</i>	In a CSS, options are selected through the operation of the S3/S4 homostat. This needs to be done in time to match the change in environmental variety, taking into account the lags of the regulatory acts. This process involves selecting groups of options, based on the quality of their business cases, and simulating their impact in order to demonstrate their systemic feasibility (coherence and affordability) and to estimate the uncertainty attached to their enactment. Contingency plans may be created to insure against this uncertainty.	We implement those projects included in the financial plan agreed with senior management, but projects are often axed because resources are not available. Occasionally we may run with a project which was not in the original plan, but this is rare and often requires target renegotiation.						The set of plans is kept under constant review, we may stop, start, reschedule or create new projects depending on prevailing circumstances, the availability of resources and any associated risk. There is health competition for resources good projects always stand a chance of being funded, whenever they are proposed.

Cybernetic Questionnaire

Instructions

The purpose of the questionnaire is to determine the cybernetic health of your organisation.

There are 34 questions, organised under three headings: Structure, Information Management and Cybernetic Regulation.

Based on your personal experience, you are asked to rate your organisation (and possibly another organisation with which you are familiar) on a scale of 1 to 5.

Completing this questionnaire should take no longer than 45 minutes

For each question you will find two statements: A and B. Depending on how well they describe your organisations practice put a letter (perhaps X) somewhere between 1 (statement A perfectly describes my organisation) and 5 (Statement B). If you have been asked to rate a second organisation, use another letter.

Wherever possible use the Evidence box on the right to record the reasons for your decision and any caveats or concerns you might have about your scoring (in English please).

Do your best to answer each question, but...

If you believe that you do not have enough knowledge to make a judgement, do not record a score and give reasons in the evidence box.

If the question is not applicable, do not record a score and give the reasons in the evidence box.

You may feel that it is not possible to give one simple answer for the whole organisation. Perhaps different levels (called recursions in this questionnaire – look under the Key tab for a description) need to be given different scores, or the same score but for different reasons. In these circumstances, make a note in the Evidence box.

When completed send the results by email to If you have rated a second organisation please give its name and the letters you have used to rate the two organisations

17 Appendix 6: Data

Svenska Handelsbanken and Peer Banks

	Danske Bank		Svenska Handelsbanken		Nordea		SEB		Swedbank		DNB Nor		Average	
	SD PTP	ROE	SD PTP	ROE	SD PTP	ROE	SD PTP	ROE	SD PTP	ROE	SD PTP	ROE	SD PTP	ROE
4Q02	17.6%	4.9%	9.9%	6.2%	22.6%	6.0%	16.3%	5.3%	18.4%	4.2%			17.7%	5.4%
1Q03	17.0%	4.8%	9.9%	6.1%	20.8%	5.1%	14.9%	5.1%	17.8%	4.1%			16.7%	5.0%
2Q03	11.5%	5.0%	10.6%	6.0%	18.8%	4.6%	15.1%	5.1%	17.9%	4.1%			14.8%	4.9%
3Q03	9.4%	4.9%	10.6%	5.8%	16.9%	4.0%	14.8%	5.0%	18.6%	4.0%			13.7%	4.6%
4Q03	10.7%	4.9%	10.6%	5.7%	17.2%	4.0%	13.7%	5.2%	16.4%	4.1%			13.8%	4.6%
1Q04	10.8%	4.8%	12.1%	5.6%	19.2%	4.0%	18.6%	5.1%	16.7%	4.2%			15.3%	4.6%
2Q04	11.1%	4.8%	12.6%	5.5%	17.9%	3.9%	16.9%	5.0%	17.7%	4.3%			15.0%	4.6%
3Q04	11.0%	4.7%	12.5%	5.5%	13.7%	4.1%	15.6%	5.2%	20.1%	4.4%			13.9%	4.7%
4Q04	14.5%	4.9%	12.6%	5.5%	16.9%	4.2%	15.4%	5.3%	21.3%	4.4%			15.9%	4.7%
1Q05	16.0%	5.0%	12.6%	5.5%	17.3%	4.3%	16.5%	5.4%	20.9%	4.4%			16.5%	4.8%
2Q05	18.0%	5.1%	13.3%	5.5%	20.7%	4.6%	18.7%	5.5%	22.4%	4.5%			18.7%	5.0%
3Q05	18.9%	5.3%	9.6%	5.6%	20.5%	4.7%	16.8%	5.8%	21.0%	4.6%	30.4%	4.2%	19.2%	5.0%
4Q05	20.0%	5.5%	9.1%	5.6%	20.3%	4.9%	18.3%	5.9%	18.8%	4.8%	27.3%	4.4%	18.9%	5.2%
1Q06	20.0%	5.6%	16.6%	5.8%	20.0%	5.1%	19.3%	5.9%	16.2%	5.0%	24.4%	4.6%	19.4%	5.3%
2Q06	19.6%	5.6%	16.3%	5.8%	22.1%	5.3%	19.8%	6.0%	15.3%	5.1%	21.5%	4.7%	19.5%	5.4%
3Q06	18.5%	5.8%	15.1%	5.8%	20.5%	5.5%	18.5%	6.0%	16.5%	5.2%	18.4%	4.8%	18.3%	5.5%
4Q06	18.2%	5.7%	14.6%	5.9%	18.0%	5.7%	19.0%	6.1%	16.8%	5.3%	15.8%	4.8%	17.2%	5.6%
1Q07	17.2%	5.7%	14.4%	5.8%	17.5%	5.7%	20.1%	6.1%	14.7%	5.3%	14.1%	4.8%	16.5%	5.6%
2Q07	12.1%	5.6%	14.5%	5.9%	16.0%	5.9%	20.1%	6.2%	13.7%	5.4%	12.9%	4.8%	14.8%	5.7%
3Q07	7.6%	5.6%	13.7%	5.9%	13.2%	5.9%	17.2%	6.1%	12.4%	5.5%	11.0%	4.8%	12.3%	5.6%
4Q07	8.9%	5.3%	13.9%	5.8%	12.3%	5.9%	14.4%	6.1%	12.1%	5.5%	10.8%	4.7%	11.9%	5.6%
1Q08	15.8%	5.0%	16.5%	5.6%	9.6%	5.9%	16.1%	6.0%	9.8%	5.3%	22.5%	4.4%	14.2%	5.4%
2Q08	17.1%	4.7%	16.8%	5.5%	9.0%	5.8%	15.2%	6.0%	10.5%	5.2%	22.2%	4.4%	14.2%	5.3%
3Q08	26.7%	4.3%	18.9%	5.3%	7.3%	5.7%	20.3%	5.7%	12.3%	4.9%	22.8%	4.2%	16.6%	5.0%
4Q08	98.0%	3.2%	19.6%	5.4%	6.6%	5.6%	20.5%	5.3%	20.9%	4.7%	24.2%	4.2%	27.7%	4.7%
1Q09	100.7%	3.0%	16.3%	5.2%	6.8%	5.4%	23.3%	4.5%	58.3%	4.4%	24.5%	4.1%	32.4%	4.4%
2Q09	102.1%	2.9%	16.5%	5.1%	7.0%	5.2%	23.8%	3.6%	96.3%	4.1%	25.1%	3.9%	36.2%	4.2%

Unilever Poland: Revenue and Coefficient of Variation

	MAT (Zloty 000m)	Coefficient of Variation
Dec 2001	1282.66	15%
Jan 2002	1258.73	17%
Feb 2002	1253.61	18%
Mar 2002	1297.44	22%
Apr 2002	1306.29	22%
May 2002	1276.89	23%
Jun 2002	1285.32	23%
Jul 2002	1298.43	22%
Aug 2002	1294.42	23%
Sep 2002	1285.94	22%
Oct 2002	1312.44	22%
Nov 2002	1321.85	22%
Dec 2002	1290.03	21%
Jan 2003	1312.17	19%
Feb 2003	1330.58	18%
Mar 2003	1275.61	13%
Apr 2003	1286.21	13%
May 2003	1311.95	10%
Jun 2003	1301.26	10%
Jul 2003	1299.58	10%
Aug 2003	1291.09	10%
Sep 2003	1287.18	10%
Oct 2003	1279.50	10%
Nov 2003	1267.47	8%
Dec 2003	1256.95	8%
Jan 2004	1263.42	8%
Feb 2004	1268.94	7%
Mar 2004	1290.37	10%
Apr 2004	1275.21	10%
May 2004	1280.95	10%
Jun 2004	1288.29	10%
Jul 2004	1288.37	10%
Aug 2004	1296.60	9%
Sep 2004	1300.13	9%
Oct 2004	1304.90	10%
Nov 2004	1308.46	10%
Dec 2004	1313.31	10%