

Systems Practice

Making Sense of Complex Problems



Frank Stowell and Christine Welch

The Manager's Guide to Systems Practice

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Making Sense of Complex Problems

By Frank Stowell
and
Christine Welch



A John Wiley & Sons, Ltd., Publication

This edition first published in 2012
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John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ,
United Kingdom

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Library of Congress Cataloging-in-Publication Data

Stowell, Frank A.

The manager's guide to systems practice : making sense of complex problems / by Frank Stowell and Christine Welch.

p. cm.

Includes bibliographical references and index.

ISBN 978-1-118-34563-4

1. Problem solving. 2. Systems analysis. 3. System theory. 4. Decision making. 5. Management. I. Welch, Christine Elizabeth. II. Title.

HD30.29.S76 2012

658.4'032-dc23

2012012668

ISBN: 978-1-118-34563-4 (hbk) ISBN: 978-1-118-34562-7 (ebk)

ISBN: 978-1-118-34561-0 (ebk) ISBN: 978-1-118-34727-0 (ebk)

A catalogue record for this book is available from the British Library.

Typeset in 10/14 pt Kuenstler480BT-Roman by Toppan Best-set Premedia Limited
Printed and bound by CPI Group (UK) Ltd, Croydon, CR0 4YY

To
*June, Samantha, Alison and
the memory of Mum and Dad*
FAS

To
Geof and Freda Ford
CEW

Table of Contents

Acknowledgements	ix
Preface	xiii
 PART I: Key Systems Ideas	 1
1 <i>Understanding Things: The Manager's Guide to Systems Practice</i>	
Introducing some basic (but powerful) ideas	3
2 Models and Modelling	19
3 The Practice	33
 PART II: Systems Thinking	 71
4 Thinking about Systems	73
5 Influential Ideas	101
 PART III: The Contributions of Philosophy and the Social Sciences	 129
6 Philosophical and Sociological Influences	131
7 Systems Research	163
 PART IV: Case Studies	 183
8 Pulling it All Together	185
9 Cases	209
Glossary	231
References	235
Index	247

Acknowledgements

This book has been written to support three areas of learning. The first is to provide support for workshops, which we have found to be increasingly popular amongst busy managers looking for ideas that may be useful to them in dealing with their ever present, day-to-day problems. Second, for the student or practitioner who is studying methods of organizational enquiry and finally, for the more advanced learner who wants to know more about the ideas themselves. Some early parts of the text appear tantalizingly easy but as the reader progresses through the chapters, s/he will begin to discover that there is more to these ideas than at first appeared.

We have attempted to describe many, but not all, methods and ideas of Systems practice that we have found to be useful. In this respect the book is ambitious because it attempts to describe several approaches rather than being dedicated to a single method. We have written it in this way because we have spoken with managers, involved in 'real world' situations, and realize that they may require different methods to help make sense of changing situations. The style of text is suited to students too as it is right that they are made aware of the different ways of making sense of complex issues.

In order to achieve our ambition to produce a text that is of practical value but also provides some intellectual support for the ideas within we discussed the many facets of Systems practice with respected colleagues in the Systems community. They provided insight and critical feedback to our idea which has helped structure the text. We would like to acknowledge the contributions of colleagues who have helped us and encouraged us to write this text.

The idea for *The Manager's Guide to Systems Practice: Making Sense of Complex Problems* sprang from the success of the Systems practice for managing complexity network (SPMC). This network begun in 2001 with a three-year EPSRC research grant which had been awarded to Ray Ison (OU) and Frank Stowell (DMU now UoP). (Note: The

spmc web page is currently hosted by the University of Northumbria -spmc- <http://www.northumbria.ac.uk/spmc>.) The network continues to offer one-day workshops for managers and practitioners at various locations throughout the UK and has become self-sustaining.

The network would not have flourished were it not for its contributors. To this end we wish to acknowledge some of the many contributors and participants who have been a part of the network over the past ten years: in particular, Petia Sice at the University of Northumbria, Monica Shelly and Jacqueline Eisenstadt at the Open University. These colleagues have organized a number of management and practitioner workshops over the years dealing with topics as varied as regional police reorganization, tourism, the NHS computer project and some workshops on urban regeneration. The early chapters in the text have been written by taking into account the response and feedback we have received from these workshops.

In addition to the feedback which shaped the early chapters we also invited comment about some of the early drafts of the later chapters from undergraduate and postgraduate students: their feedback has been reinvested where appropriate in these chapters. Thanks are due to undergraduate and postgraduate students at the Universities of Portsmouth and Northumbria, for feedback received.

We also acknowledge the Stowell and West text *Client Led Design* (1994) from which some ideas have been included albeit refined and developed. Some ideas contained within the text have been the result of various research projects with which we have been involved. These include the work of Donna Champion, who has made contributions to both Client Led Information Systems Creation (CLICS) and to the thinking about Organisational Intervention. Shavindrie Cooray, who took the ideas embedded in CLICS and developed them a step further by exploring and using the ideas of Sir Geoffrey Vickers. The work of Ying Laing and Junkang Feng's research into technical definition has also contributed to the thinking about ways of bridging the gap between client needs and their technical fulfilment.

Susan Smith's research and the management workshops have added to the lessons about using AIM as a means of gaining understanding of the many strands involved in complex decision making. Peter Bednar's work, focusing on socio-technical analysis and contextual dependencies, has also contributed to thinking about user-driven design by providing a framework to explore unique individual perspectives on systems of interest.

The pioneering work and ideas of Sir Geoffrey Vickers, Peter Checkland, Stafford Beer, C. West Churchman and Russ Ackoff have provided inspiration for much of the

thinking behind *The Manager's Guide to Systems Practice: Making Sense of Complex Problems*.

This text has also had the benefit of feedback and criticism from a number of respected colleagues including Stephen Probert, John Martin and Peter Bednar. Members of the Joint Systems Department at DSTL Portsmouth West have helped us by using and evaluating earlier versions of Parts 1 and 2 of the text. We have also benefited from ideas generated through the Community of Practice of business improvement professionals led by Tammi Sinha of Portsmouth Business School and Nigel Ward of the National School of Government.

Finally we would like to thank the enthusiasm of Neil McBride who suggested the need for a text which would cater for new Systems practitioners and for those practitioners and students who wished to learn more about Systems. Thanks are also given to the UK Systems Society Board of Directors, namely Laurence Brookes, Stephen Probert, Pam Hearne, Ian Roderick and Jennifer Wilby for their enthusiastic support for Systems thinking and practice at a time when the use of these ideas has never been more important.

Preface

The idea for this book grew out of many years' experience in using, and teaching others to use, Systems concepts, methods and techniques to address complex problems. The usefulness of Systems ideas has been proven over many decades but anyone wishing to inform him/herself about them is obliged to search through many different sources, each dealing with a different aspect of Systems theory or practice, some of which are no longer in print. When leading workshops for managers, or teaching Systems concepts on undergraduate or postgraduate courses, we have often been asked the question 'What should I read in order to gain an overview of the principles and techniques of Systems?' This has been a difficult question to answer since the available literature has mainly been comprised of books and articles dedicated to particular perspectives or methodologies.

This book is therefore intended to meet the needs of three groups. First, managers who attend professional development workshops to explore useful Systems techniques require a primer with which to consolidate the skills and knowledge they acquire for practical purposes. Secondly, members of academic communities (staff and students) need a text that provides both a practical and a theoretical guide to Systems ideas. The third group are people already well versed in Systems as a framework for thinking about complex issues, who wish for a reference work with which to add to their knowledge. These might be members of the UK Systems Society, the Systems Practice for Managing Complexity Network, the International Society for Systems Science or one of the many Systems Societies from around the world. The text is therefore divided into four sections which are intended to satisfy the beginner, who may be attending a one-day workshop (Chapters 1–3), the learner who wishes to understand how the various ideas from Systems can be brought together as problem-solving methods (Chapters 4 and 5); and the advanced learner who wishes to understand the theory behind the practice and the origins of modern Systems thinking and practice (Chapters 6 and 7). A fourth section (Chapters 8 and 9) provides case studies that can be used in a classroom situation.

This book is therefore an ideal resource for busy managers whose time is scarce. It provides a rapid introduction to straightforward yet powerful techniques that enable users to address real world problems. When time presses, we need methods that can take us rapidly to the heart of a messy situation, without losing sight of the bigger picture. Systems theory and practice is predominantly a framework for thinking about the world, in which holistic views are maintained. In this it contrasts with some familiar techniques of management science, in which problem situations are broken down into their constituent parts with resultant loss of coherence. However, we do not see Systems thinking as a rival to the techniques of management science but rather as complementary tools within the manager's armoury.

'Systems' as an academic discipline has evolved over decades with contributions from many respected writers and researchers. Works by these influential men and women have been discussed throughout the text, and in particular in Chapters 4 and 5. There are many institutions of learning in which Systems is taught both inside and outside the UK, and thousands of individuals hold degrees and higher qualifications in this field. However, as this text makes clear, the strength of this discipline lies in its foundation for practice. Studying Systems is never simply an opportunity for intellectual stimulus but the foundation for addressing 'wicked' problems which have otherwise eluded efforts to find a workable solution. Systems is essentially about interconnectedness. When managers adopt such a framework for thinking, it becomes possible to seek resolution to problems without causing adverse 'knock-on' effects elsewhere in an organizational setting.

In designing this text, we have endeavoured to give our readers an overview of the whole 'family' of Systems approaches. The basic building blocks of Systems thinking (emergence, hierarchy, communication and control) are common to a range of different ways of conceiving situations and problems. We can, for instance, distinguish between 'hard' and 'soft' approaches. The former accepts an assumption that the problem domain can be clearly defined, and therefore that solutions can be found by applying suitable tools of analysis. The latter, on the other hand, is useful in messy and/or fluid situations in which it is difficult or impossible to give a definitive description of the problem to be addressed from the outset. Soft approaches empower analysts to explore situations using tried and tested techniques in order to clarify, describe and define the particular issues to be addressed.

Systems ideas have developed over time, incorporating influences from a number of different fields. Some of the founding Systems thinkers worked in biology, for instance, recognizing the interconnectedness of nature. Many key Systems ideas owe their origins to observation of living organisms, and a number of writers on Systems have used

analogy with the structures and processes inherent in living things within their approaches to modelling. Other influences underpinning Systems ideas arose from studies in mathematics, physics or engineering. It is one of the strengths of our field that we draw upon concepts from diverse sources, including fundamental areas of knowledge that have been studied for decades. Systems is a meta-discipline, reflecting and benefiting from the complementary nature of human knowing. We begin to explore these influences in Chapters 4 and 5 of the text and in later chapters, especially Chapter 6, we go on to examine philosophical principles underpinning Systems ideas in greater depth.

Not only does Systems theory and practice derive from many sources, it has also generated a range of opinions about the nature of human problems and the ways in which they need to be addressed. Nowadays we can choose from different groups of tools, techniques and methodologies that share a basis in key systemic concepts but differ in the types of tools they offer. These are explored and illustrated in the second part of the book. A further dimension to the field of Systems thinking is the way in which it has influenced other disciplines. While there are many people who regard themselves as Systems practitioners, using the tools and ideas set out in this book to address real world problems, there are many others who make use of Systems ideas in other ways. Systems as a school of thought can be found embedded in a range of subject disciplines including geography, archaeology, sociology and economics. A detailed discussion of all the applications of Systems concepts is beyond the scope of any one text. However, we have endeavoured to provide pointers within the text and links to further reading that we hope will encourage interested readers to journey further into related fields.

Systems ideas have proved their worth to countless decision makers and managers in public and private sector organizations, and the holistic perspective they provide has never been more important than it is today. Successive governments in the UK and elsewhere have recognized the need for 'joined-up thinking' to address the key issues of State – the economy, health and social welfare, international relations and defence. Businesses need Systems ideas in order to design integrated and optimal internal processes and to deal with the interconnected forces in the business environment, including the power of customers, suppliers, competitors and regulators. We have written this text in the shadow of one of the deepest economic and financial crises of the post-War years, and during a period in which wars are ongoing in many different regions of the world. Problems of hunger and endemic disease confront much of the world's population every day. Our scientists are engaged with causes and consequences of global warming. Our politicians and economists struggle to bring stability to financial markets and to the banking system. In our everyday lives, we endeavour to balance our incomes

and expenditure and cater for the needs and desires of the different members of our families. All of these we face in the 21st century and they require us to think holistically, to consider how the various aspects of life interconnect, and to seek for optimal solutions.

In business we try to balance the books, protect our jobs and improve our performance. We can all point to examples of business failure that can be attributed to short sightedness. Many small businesses have failed, despite a popular product, a full order book and an efficient work system, because of cash flow problems. Perhaps the proprietor failed to consider how flows of money into and out of the business were related and balanced. Systems thinking can help us to structure problems, investigate failings and model solutions holistically. Experience has shown us that Systems ideas can be beneficial to modern managers whose prime task is to maintain their company's relationship to its changing and challenging environment.

Structure of the Text

Part I: Key Systems Ideas

In **Chapter 1**, the reader is introduced to some of the most fundamental concepts involved in working with systems. We unravel some of the confusion surrounding the use of the term 'system' in everyday speech. We discuss how a system is defined from the perspective of an observer, who chooses to draw a boundary reflecting that interest and give the system a name. We go on to introduce the reader to some of the diagrams used in Systems modelling including 'Black Box' diagrams, influence diagrams, Rich Pictures and systems maps.

In **Chapter 2**, we build on what we have learnt about modelling, distinguishing between different types of systemic models and showing how they can be used as templates to structure approaches to problem situations. In this chapter, readers learn how to select and use the right modelling methods to address particular management problems. In this chapter we introduce aspects of Systems theory relating to control such as Ashby's Law of Requisite Variety.

Chapter 3 further develops the modelling concepts addressed in the first two chapters, and introduces the reader to the use of methods and methodologies for systemic analysis. In doing so, we discuss work of influential researchers in the Systems field, such as Sir Geoffrey Vickers, Stafford Beer and Peter Checkland. This chapter illustrates how these ideas have been developed and used in significant and complex areas faced by those tasked with managing.

Part II: Systems Thinking

Chapter 4 places emphasis on Systems as a framework for thinking about the world, not just a set of useful tools. Here we talk about the key defining concepts of emergence, hierarchy, communication and control which distinguish systemic approaches from other aspects of management science. Some more of the ideas in Systems theory are introduced at this point, as we begin to look at the impact of Systems approaches in dealing with real world problems. These include socio-technical principles by which work systems may be designed; and paradigms used to reflect upon perceptions of risk and/or failure in problem situations.

In **Chapter 5**, we explore some of the main approaches to problem structuring which use Systems ideas as their foundation. We introduce the reader to some of the modelling techniques of System Dynamics, which deals with the responses of systems to changes in inputs from the environment and the impact upon their outputs. We use Vickers' concept of Appreciative settings to discuss his view of organizations as relationship-maintaining rather than goal-seeking systems. Churchman's discussion of the problem of reductionism is the next step in the discussion. Here it is important for the reader to grasp the role of Systems ideas in promoting learning about problem situations, in contrast to some techniques that may support a premature and uninformed rush towards a 'solution'. The chapter goes on to introduce readers to the Soft Systems Methodology and the Viable Systems Model and builds on ideas touched on in earlier chapters such as Ashby's Law of Requisite Variety as examples of approaches promoting systemic learning and understanding.

Part III: The Contributions of Philosophy and the Social Sciences

Chapter 6 takes the interested reader deeper into ideas underpinning Systems theory and practice. This chapter explores the origins of some Systems ideas and their relationship to other areas of scholarship such as science, social science and hermeneutic philosophy. The discussion contained in this chapter, though quite demanding, will give valuable insights to those who desire a deeper understanding of the foundations of systemic perspectives.

Chapter 7 deals with the nature of Systems inquiry as Action Research, i.e. research in which inquirers are themselves part of the field of investigation. This chapter we believe will be valuable for any reader wishing to expand their thinking about the nature of problems and problem solving and the role of research in expanding human knowing. Action Research is focused on the creation of a productive learning circle (or spiral) relating to a focused area of inquiry. Checkland's FMA model is discussed as a

useful mnemonic to guide inquiry and to illustrate how this cyclical process unfolds in practice.

Part IV: Case Studies

In **Chapter 8**, we set out two case studies in which we elaborate and illustrate the application of some specific systemic approaches in practice. Ideas used in the case studies include Soft Systems Methodology, CLICs, Dynamic Modelling and the Viable Systems Model.

Chapter 9 contains further case studies which can be used as self-learning tools or material for discussion in formal classroom settings. Two full-length and four short cases are provided, all of which relate to common management problem situations from contemporary settings.

How to Use this Book

It is our intention that those who have worked through this text should be able to:

1. Gain an understanding of the practice of Systems thinking.
2. Define and distinguish between so-called hard and soft Systems thinking and associated methods.
3. Discuss the importance of boundary setting in defining fields of inquiry and relevant systems, including the impact of differing worldviews (*Weltanschauungen*) among stakeholders.
4. Use appropriate tools for systemic inquiry into business organizations and their environments, e.g. Rich Pictures, influence diagrams, concept maps.
5. Model Systems behaviour using systemic concepts such as: *boundary, owner, actors, transformation, control, communication, resources*.
6. Synthesize practical recommendations from the analysis of organizational situations in terms of planning and control, innovation and creating value.
7. Appraise inquiry into complex systems and an holistic appraisal of strategic decision making, the challenges of strategic management and the management of change.
8. Through the application of various Systems tools appraise prior knowledge, critically analyse and synthesize strategic issues facing organizations; evaluate alternatives, and make appropriate recommendations for change and its implementation.
9. Appraise the challenges of strategic management and the management of change.

10. Integrate and critically evaluate the concepts, main framework and theories of Systems thinking, including the paradoxes in their applications in different contexts.
11. Gain insight into the basis of organizational models and differentiate between reductionist and holistic models and the underpinning concepts behind them.
12. Appraise prior knowledge, critically analyse and synthesize strategic issues facing organizations and make appropriate recommendations for change and its implementation.
13. Demonstrate awareness of the interconnected nature of business structures and relationships, using suitable models and examples.

Although the text has been created as a coherent whole, each of the four parts has a distinct purpose. Those who are new to Systems ideas may wish to read quickly through the first part, in order to gain a general overview of the power and purpose of the concepts and tools set out in Chapters 1–3. Having done so, those who wish to make use of these ideas may benefit from a second, more reflective reading of the chapters.

Many readers will then feel equipped to try out Systems tools and techniques within their own areas of management. In doing so, they will find that they have become Action Researchers in their own right – creating productive learning spirals about the problem situations they seek to address. When reflecting upon the outcomes of these endeavours, some people will begin to desire a deepened understanding of this framework for inquiry. Part II of the book is intended for them, but is also useful as a text for those in formal study settings who are preparing both for assessments and for later professional practice using Systems methodologies. The case studies contained in Part IV will also provide useful material for discussion and reflection among managers and students falling into these categories.

The material in Part III is clearly intended for those readers whose appetite for Systems ideas has been whetted by considering and applying the concepts they have learned from Parts I and II. This material will require careful study and it may be beneficial to scan it quickly before going over these chapters again more thoroughly. Experienced managers and practitioners, and postgraduate students in Systems or Management, will clearly find these latter chapters interesting and rewarding.

Frank Stowell
Christine Welch
December 2011

KEY SYSTEMS IDEAS

Chapters 1, 2 and 3

The following three chapters are designed to introduce the learner to some simple yet powerful ideas. Following a short introduction to the ideas plus some exercises the ideas can be soon learnt and put into practice. Each chapter in this section contains self-assessment exercises and exercises that will help consolidate what has been learnt. It is worth pointing out that there are one-day workshops available, for example, those offered by the systems practice for managing complexity network (spmc) where opportunities are available to practise the ideas under the guidance of an experienced tutor. For more detail see <http://www.northumbria.ac.uk/sd/academic/ceis/enterprise/spmc/>

Understanding Things: The Manager's Guide to Systems Practice

**Introducing some basic
(but powerful) ideas**

Begin at the Beginning – What is a System?

We encounter the word 'system' often in our daily lives. It crops up in many different contexts – some technical, some social and some philosophical. This text is for people who are intrigued by the concept of 'Systems' and want to clarify and develop understanding of its usefulness. In this text, we will explore use of the word 'System' and related terms such as 'Systems Thinking' and attempt to resolve some of the confusion surrounding these terms. As the chapters progress, we will introduce further aspects of Systems practice, and elaborate upon its usefulness in dealing with the challenges of life in the 21st century.

We will deal with the origin of the word system and its meaning later in the text as we do not need that now, but what we do need is to understand what it means in a practical sense. In everyday conversation we use the term loosely which helps to confuse

understanding. In everyday speech we often refer to a 'system' when we mean a computer system. Many people, when told that one is involved in systems, assume that we mean that we are computer engineers. In other instances, people may use the term generally and speak of a system when referring to a government department. Such generalization is often the case when we complain about the unfairness of something: we blame the system. In recent times we hear newscasters and government spokespersons reporting a failure as being systemic, which seems to mean that no individual is to blame as the failure was a failure of the whole enterprise.

The way that we use the term system in everyday speech is imprecise and relies upon the listener interpreting what the speaker means. If there is plenty of agreement between the speaker and listener it suggests that the conversation is going well and that the speaker and listener inhabit the same area of interest (at least they assume that they do) but there is no guarantee that the system to which the speaker refers is the same one that the listener had in mind. The imprecise way that we use the word can be misleading, often resulting in the participants ending up with completely different understandings of the situation and worse, if we think of such a situation in terms of practitioner and client, what appears to be the right answer but is actually inappropriate to their particular problem.

A useful starting point in the practice of Systems thinking is to consider carefully what we mean when we refer to a system and define what system it is we are talking about. For example, if we were to discuss a transport system we need to decide what transport system it is we are considering. Is it freight? Is it a public transport system or is it a personal transport system that we mean (i.e. motor cars)? Do we include bicycles and other types of personal vehicle, and so on? Even when it seems we are referring to a computer system, do we mean just the hardware and software or are we including the people who are using it too? So let us agree some rules:

- i. Always give the system a name.
- ii. Agree that the name of the system to which the client is referring means the same thing to you!

Like many ideas in Systems, implementing such a simple idea is easier said than done but we have other ideas that can help us and the client to clarify what system it is we are interested in.

Some Simple Tools

Boundary and Environment

Most would agree that in any given circumstances it is wise to take into account as much of the situation as is possible before taking action. We need to see the situation

in its entirety – that is to say to take in the whole, what we call adopting a holistic perspective. Many of us assume that we do this instinctively but often our horizons are limited by lack of experience of a new situation or awareness that things are changing from the familiar to something more challenging. When confronted with a new or a complex situation it is difficult to know where to start. The complexity of the situation itself can be overwhelming and it is not unusual at this stage that we can retreat to the safety of familiar techniques or rely on an individual within the situation to tell us what they think the problem is.

It is self evident that in any situation of interest we need to make decisions about what to include and what to leave out. Clearly a situation must have a beginning and an end point, and there must be some form of boundary around the system. If we do not do this then the alternative is that we will have to take the whole planet into account, which of course we cannot do; or conversely we slice up the problem into small pieces, but with this comes the danger that we might ignore important areas. One useful Systems idea is a simple yet powerful practical tool to help with this difficulty. The idea behind the 'tool' is the notion of boundary and environment.

What are these ideas and why are they useful? Many may be tempted to ask if they are just a fancy way of packaging up common sense. Well there is nothing common about common sense and the ideas which at first seem simple often have hidden depths which are realized as a user becomes more adept at using them. Despite the fact that, when confronted with a problem, most of us will consider the 'system' and make a mental note about what it seems to comprise, most do not represent it explicitly. We do not provide a clear enough description for the listener to understand and provide critical appraisal of what is being said. Using the idea of boundary we can begin, with those involved, to enrich understanding about the system – the situation of interest. But how do we set about deciding what is part of the system of interest and what is not? The first thing to remember is to beware a quick assessment. A hasty judgement can inhibit thinking, so take care. When you first draw your boundary remember that as you begin to understand what it contains, so will the boundary alter to reflect your richer understanding of the system of interest.

Let us consider an example. Imagine 'A Manufacturing System' is our area of interest. Where should we draw the boundary? We can start by thinking of things to exclude, including service industries and local government and obvious things like the entertainment industry and libraries. But what should we include? Well are we thinking of all aspects of manufacturing or specific areas such as those using metal? Do we wish to include all manufacturing or just those institutions within a given country? We need to decide what constitutes manufacturing. But, I hear you say, we would know the industry we were called upon to examine. This might be true but equally the

practitioner might be asked to look into a changing manufacturing environment in which the company concerned needs to react.

Initially, our boundary and environment might look like Figure 1.1 below:

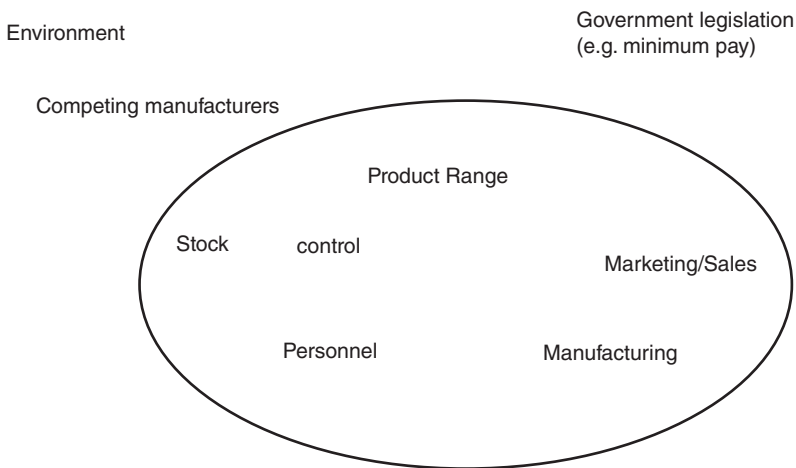


Figure 1.1: Drawing a boundary

This diagram enables us to begin discussions with the members of the enterprise. As more is learned about the situation the boundary might add more sub-systems such as Production Control, Research and Development, Drawing Office and in its environment 'Parent Company' (which may control the policy that determines the market within which the enterprise can trade), Suppliers, Skills Availability and Sources of Capital. We may find as we begin to gain greater insight that one or more systems in our environment might be better placed within the boundary of the system itself or vice versa. For example, the parent company might have a Board member on the Board of the subsidiary, in which case a sub-system relating to that role should be within the boundary. It might be that the R&D department is part of the parent company and should be in the environment (it might be a separate cost centre that is contracted by various parts of the holding company's portfolio).

Following discussions with all concerned, the final diagram might now look like Figure 1.2: