W(h)ither Quality Management?

“I know well enough what it is provided that nobody asks me; but if I am asked what it is and try to explain I am baffled.”

St. Augustine
Confessions
RS Pine-Coffin Translation 1961

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ABSTRACT

As it has been presented in the early literature and at conferences (and sadly too often presented and promoted today) quality management reminds one of the fable of the blind men and the elephant. Description of the key features, (leg, tail, trunk etc - or perhaps only the extremities of those features) is excellent, but the extrapolation from them yields nothing like a meaningful picture of the whole. In much the same way that each blind man forms a vision of the whole by examining a part, (or a part of a part), promoters of quality management have written books and articles and presented seminar’s which are either about the parts or are visions of the whole drawn from a knowledge (often most thorough) of one or a few parts. Like the blind men who, in spite of their care, skill and sensitivity, were unable to describe one of natures most extraordinary creatures; the literature of quality management has failed to identify something equally extraordinary - a rigorous and coherent management theory, uniquely appropriate to the needs of the contemporary business enterprise. This paper describes the present state of quality management and argues the need for renewed efforts to find a description which clearly identifies its theory and business relevance.

INTRODUCTION

In the mid 1990’s (manifestly in the 1994, Volume 19, issue of the Academy of Management Review) quality management, for the first time, drew the attention of a critical mass of leading international scholars who began to ask a number of long overdue questions about the theoretical foundations of quality management (did it have any), and to seek empirical evidence to support its many assertions and claims. This paper references much the 1994 and post 1994 literature and describes the need, and the search for the theoretical foundations of quality management. An outsider to the field of quality management would, on the basis of the abundance of literature and the often large and prominent national and international organisations devoted to its promotion, probably take it for granted that it is universally accepted and based on a well
developed, rigorous and coherent theory. After all, quality management has been put forward by a number of its promoters as a management revolution [Deming, 1986] a thought revolution in management [Ishikawa 1985], a revolutionary philosophy of management [Grant, 1994], a new way of thinking about the management of organisations [Chorn, 1991], a paradigm shift [Broedling, 1990], the organizational equivalent of truth [Harrison and Stupak, 1993], a comprehensive way to improve total organizational performance, [Hunt, 1993], an alternative to management by control [Price, 1989], an integrated and interfunctional means of achieving and sustaining competitive advantage [Flynn et al., 1995] and a framework for competitive management [Quazi, 1998]. Furthermore it seems widely accepted that quality of product and service is a sine qua non of competitive business [Williams 1984, Buzzell and Wiersema 1981, Craig and Douglas 1982, Phillips et al., 1983, Garvin 1988, Taguchi and Clausing 1990, Tamimi and Gershon, 1995].

However, notwithstanding those appearances, several decades of vigorous (often - evangelistic) promotion and a burgeoning literature, (Schumpeter’s “a tropical growth” springs readily to mind), quality management is not universally or even widely accepted [Binney 1992, Brown 1993], has no generally accepted definition or agreed content [Little 1994], does not have a theoretical foundation, [Grant et al., 1994, Reeves and Bednar 1994, Wilson and Durant 1994, Watson and Korukonda 1995, Grant 1995], has not found a place in mainstream western management literature [Waldman 1995, Donaldson 1995, Aune 1998, Foley et al., 1997] has failed to deliver promised results [Schaffer and Thomson 1992, Ackoff 1993, Brown 1993, Juran 1993, Eskildson 1994, Ahire 1996], is riven with debate and confusion over the very definition of quality [Juran 1964, Freund 1985, Garvin 1988, Smith 1993, Reeves and Bednar 1994, Dean and Bowen 1994, Hardie 1995, Barden 1997] and largely because there is no theoretical base, presents almost as many faces as there are proponents for its cause [Connor 1997].

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1 Examples of prominent national and international organisations devoted to quality are:
- The World Quality Council
- American Society for Quality
- European Organization for Quality
- European Forum for Quality Management
- Australian Organisation for Quality
- Australian Quality Council
- British Quality Foundation
- World Quality Congress [India]
- Asia Pacific Quality Organisation

2 Addressing the issue of the definition of quality, Reeves and Bednar [1994 pp.419-20] offer the following observation:

A search for the definition of quality has yielded inconsistent results. Quality has been variously defined as value [Abbott, 1955; Feigenbaum, 1951], conformance to specifications [Gilmore, 1974; Levitt, 1972], conformance to requirements [Crosby, 1979] fitness for use [Juran, 1974, 1988], loss avoidance [Taguchi, cited in Ross, 1989] and meeting and/or exceeding customers’ expectations [Gröenross, 1983; Parasuraman, Zeithaml, & Berry, 1985]. Regardless of the time period or context in which quality is examined, the concept has had multiple and often muddled definitions and has been used to describe a wide variety of phenomena. Continued inquiry and research about quality and quality related issues must be built upon a thorough understanding of differing definitions of the construct. Universalistic propositions describing the relationship among various variables and quality cannot be made when the meaning of the dependent variable continually changes [Cameron & Whetton, 1983].... the literature linking quality to outcomes such as market share, cost and profits has yielded conflicting results that are largely attributable to definitional difficulties. Increased understanding of these important relationships will occur only when the quality construct is more precisely defined.

Connor [1997 pp.501-2] illustrates the extent of “the many faces of quality” problem by listing eleven “identifiable approaches” to quality management.

- The TQM element approach, in which organizations use specific methods or tools such as quality teams and statistical process control – typically in the absence of an overall plan or commitment to TQM philosophy.
- The guru approach, in which organizations embrace the teachings of one of the leading quality thinkers-for example, managers attend a seminar, learn about Deming’s 14 points, and begin work on implementing them in their own organizations.
In February 2000 it remains unclear whether quality management is simply a collection of essentially independent techniques, a management philosophy, a coherent management method, a strategy (in the Porter [1996] sense), a theory for managing only the quality of product and service process, or a master theory for managing the entire enterprise – or all of the above. What is clear however, is that whatever else quality management may be, or is claimed to be, it has become a commodity to be differentiated and marketed in whatever way best suits the needs of its promoters [Rura-Polley and Clegg 1999]. One writer has described TQM itself as an industry.

As the following extracts from contemporary literature demonstrate, quality management (among western managers at least, and notwithstanding mounting evidence of “bottom line” benefits) is in something of a twilight zone, precariously poised between acceptance as a valuable, even indispensable, management technique/model/methodology/theory and rejection as a confused (and confusing) collection of slogans, principles, procedures and techniques, and just another in a long

- The organization exemplar approach, in which members of an organization visit other organizations that are known for their success with TQM.
- The Japanese total quality approach, in which organizations examine implementation strategies and techniques used by Japanese winners of the Deming Prize.
- The prize criteria approach, in which organizations use the evaluation criteria for the Deming Prize or the Baldridge Award to identify specific areas for improvement. Just as a variety of approaches are used, there is an abundance of definitions of quality:
  - A “disciplined way of identifying and solving problems in order to improve performance” (Deming, 1982).
  - A ‘conformance to requirements’: discover what the customer wants, train everyone how to accomplish it and then deliver that to the customer on time” (Crosby, 1972. p 116).
  - “A customer – based way of doing business; the user of the product or service can count on it for its intended purpose”, Juran and Gryna, 1980, p.1-2).
  - “Meeting your customers’ requirements 100 percent of the time”, (Houghton, 1994).
  - “An attempt to rediscover the customer. Decisions at every level are driven by the customer’s needs and desires, and quality is defined as ‘what the customer wants’. (Noel, 1995 p.3).
  - And my personal favorite: “Quality is when your customers come back and your products don’t” (Naumann & Shannon, 1992, p.44).

Commenting on the use of quality management as a set of tools and techniques the European Commission [1996, p.27] have made the pertinent point that: “It seems to be clear that simply introducing some tools and techniques will not result in ‘competitive advantage’ for organizations. Tools, procedures and techniques can be easily copied by competitors and do not provide the company with a unique resource.”

Porter [1996] draws an important distinction between operations effectiveness and strategic positioning and identifies quality management with operational effectiveness, not strategy. He remarks:

For at least the past decade, managers have been preoccupied with improving operational effectiveness. Through such programs such as TQM, time-based competition, and benchmarking, they have changed how they perform activities in order to eliminate inefficiencies, improve customer satisfaction, and achieve best practice. Hoping to keep up with shifts in the productivity frontier, managers have embraced continuous improvement, empowerment, change management, and the so-called learning organization. The popularity of outsourcing and the virtual corporation reflect the growing recognition that it is difficult to perform all activities as productively as specialists.

As companies move to the frontier, they can often improve on multiple dimensions of performance at the same time. For example, manufacturers that adopted the Japanese practice of rapid changeovers in the 1980s were able to lower cost and improve differentiation simultaneously. What were once believed to be real trade-offs between defects and costs, for example – turned out to be illusions created by poor operational effectiveness. Managers have learned to reject such false trade-offs.

Constant improvement in operational effectiveness is necessary to achieve superior profitability. However, it is not usually sufficient. Few companies have competed successfully on the basis of operational effectiveness over an extended period, and staying ahead of rivals gets harder every day. The most obvious reason for that is the rapid diffusion of best practices. Competitors can quickly imitate management techniques, new technologies, input improvements and superior ways of meeting customers needs. The most generic solutions – those that can be used in multiple settings – diffuse the fastest. Witness the proliferation of OE techniques accelerated by support from consultants.

For further discussion of this matter see Beckford [1998 pp 14-17]

Spencer [1994 p.446]

During the past few years, American managers have been inundated with articles, books, and seminars describing the “quality revolution.” Total quality management (TQM) has been described as a new way of thinking about the management of organisations (Chorn, 1991), a comprehensive way to improve total organisation performance ad quality (Hunt, 1993), an alternative to “management by control” (Price, 1989), and, ultimately, as a paradigm shift (Broedling, 1990). Proponents of this new paradigm depict customer-oriented organisations that are organised around processes, run by teams, and conducted more like ballets than hockey games (Slater, 1991). They advocate a humanistic, systems approach to management (Brocka and Brocka, 1992) while espousing the need for fundamental cultural changes at all levels of organisation (Broedling, 1990).

To date, many corporate managers have invested heavily in total quality efforts, whereas others have waited for “hard” evidence that it works. Similarly, some academics have climbed aboard the TQM bandwagon, both through their consulting efforts and in their own institutions, but others dismiss it as a fad or as a repackaging of well-worn ideas.

In summary, TQM is a systematic approach to the practice of management, requiring changes in organisational processes, strategic priorities, individual beliefs, individual attitudes, and individual behaviours (Olian & Rynes 1991). It is not a cut - and - dried reality but a amorphous philosophy that is continuously enacted by managers, consultants, and researchers who make choices based on not only on their understanding of the principles of TQM but also on their own conceptual frameworks concerning the nature of organisation.

Reeves and Bednar [1994 p. 420]

There clearly is a need, then, to position TQM in relation to well – established theoretical and conceptual constructs rather than consulting – oriented frameworks, which might be all right for the short run, but fall short of building TQM as a discipline in the long run. We believe this is something that needs to be done to prevent TQM from sharing in the same fate as other management fads that have, over the years, reigned at the height of their glory and finally disappeared into oblivion.

4 These and later criticisms of quality management, particularly those relating to the plethora of often quite different descriptions and interpretations, should not be taken to deny that there has emerged a general agreement in a good amount of the literature on its key characteristics [Seraph et al., 1989, Greene, 1993; Sherwood, 1993; Easton, 1993; Mann and Kehoe; 1994 European Commission 1996]. However, although such agreement is an important advance it does not tell us whether those characteristics represent the descriptions of a collection of techniques, or a theory of management.

Shin, Kalinowski and Gaber [1988 p.10] ask:

Is the TQM age over? Is it indeed a passing management fad? Or, is it a revolutionary concept making fundamental contributions to the improvement of quality and business performance? Despite the potential benefits of TQM articulated by quality gurus and consultants, and despite anecdotal success stories, the high failure rates (60%-67%) quoted in the literature have made many companies believe that TQM has not been delivering on its promises.

Why then has TQM been failing? Even though some critics argue that TQM is a faddish concept created on a flimsy footing, many published reports proved otherwise. It is generally accepted that when TQM has failed, it is not because there was a basic flaw in the principles of TQM, but because an effective system was not created to execute TQM principles properly. Nevertheless, since the implementation of TQM requires unwavering organizational commitment, substantial time and effort, and drastic changes in organizational culture and business practices, it is important for companies to clearly understand what it takes to succeed and achieve high performance.
Quality certainly seems to mean different things to different people depending on their expectations and background. Conformance to specifications [Gilmore 1974, Levitt 1979], conformance to requirements [Crosby 1979], fitness for use [Juran & Bingham 1974], value [Feigenbaum 1951], loss avoidance [Taguchi 1979], and meeting and/or exceeding customers expectations [Groenroos 1983, Parasuraman et al., 1985] are some of the many definitions proposed in the literature. Garvin [1984, 1987] discusses eight dimensions of quality including: performance, features, reliability, conformance, durability, serviceability, aesthetics and a perceived quality. Definitions and descriptions of TQM abound in the literature and probably there are as many of them as the number of authors or the number of organisations that have implemented it [emphasis added]. One can get some sense of this ambiguity by looking at the emphasis of TQM, which seems to vary depending on the author: it could be process control and process variation reduction using a set of principles [Deming 1982], a trilogy consisting of planning, control and improvement [Juran 1986] zero defects [Crosby 1984, customer orientation [Feigenbaum 1963], integration of functional activities [Gunarsakaran et al. 1994], prevention of defects through systematic analysis [Ishikawa 1986]. Dean and Bowen [1994] aptly describe the total quality movement as “a sort of Rorschach test, to which people’s reactions vary as a function of their own beliefs and experiences. TQM is inherently cross-functional. In a single article on TQ, it is not unusual to find references to marketing, product design, operations and human management. Management theory as a field is multidisciplinary, but individual theories and articles tend to be discipline bound. Second, given its mission to improve organisational performance, TQ is almost completely prescriptive in orientation.

Deming’s well-known 14 points, for example, are actually imperative statements, such as “drive out fear.” Management theory, in contrast, is concerned with understanding, not just improving organisations. Some management theories are prescriptive; others simply describe relationships among organisational characteristics.

When management theory is prescriptive, its prescriptions tend to be contingent (i.e.; sensitive to variation in the organisational context). TQ recommendations tend to be context independent and therefore, implicitly universal (Spencer, this issue). There is little attention in TQ devoted to the boundary conditions for TQ applicability and uncertainty. Our choice of the word Jungle in the title is intended to reflect this state of disarray in TQM and is inspired by Koontz’s classic article on the “Management theory jungle” [Koontz 1961]. Two important exceptions, however, do need to be noted: first, unlike in management, it is the lack of theory – rather than an overabundance of it- that seems to be responsible for the lack of conceptual clarity in TQM; second, in TQM one does not see the signs of “jungle warfare” that was characteristic of management theory in the 1960’s. Rather, what we do see is a state of passivity and peaceful coexistence of muddled and multiple definitions. Should this passivity persist, it is likely to lead to a continuation of status quo and preempt discussion, debate and ultimately, resolution. This phenomenon, which can be considered the other extreme of the jungle warfare, is – or should be – as disturbing.

Grant [1995. p. 14]

TQM is not simply a set of highly effective tools and techniques; it is a revolutionary philosophy of management that challenges both conventional management practice and the theory that underlies it. Fundamental to TQM’s theoretical challenge are assumptions about human nature and behavior that are very different from those explicit in organizational economics and implicit in much of conventional management theory. To develop the theoretical implications of TQM, the task is not only to surface its underlying assumptions, but also to put management and organizational theory on a firmer foundation by making their microfoundations more explicit. Accepting the substance of those descriptions of the present state of quality management and being as a consequence deeply concerned at the possibility of its demise, this paper begins from the premises that a and perhaps the principal reason for the present difficulties confronting quality management is its lack of a theory and concomitantly a lack of rigour, coherence and consistency in its description and application. As Sitkin et al. [1994, p. 556] have observed:

Much of the TQM research to date has been broadly focused on descriptions of practice rather than on the development of a coherent middle-range theory of use to managers and scholars.

This may explain some of the TQM failures reported in the popular press in
recent years. (The Economist, 1992; Fuchsberg, 1992a, 1992b; Mathews & Katel, 1992). Perhaps if TQM had been implemented first in more non routine situations (e.g., uncertain environments such as R&D) rather than in more routine ones (e.g., manufacturing), the movement may have encountered difficulties early in its history rather than diffusing as it has. Although the idea of a universally applicable TQM approach may have been instrumental in fostering its acceptance, it also may be a root cause of many of today's TQM problems.

As it has been presented in the early literature and at conferences (and sadly too often presented and promoted today) quality management reminds one of the fable of the blind men and the elephant. Description of the key features, (leg, tail, trunk etc - or perhaps only the extremities of those features) is excellent but the extrapolation from them yields nothing like a meaningful picture of the whole. In much the same way that each blind man forms a vision of the whole by examining a part, (or a part of a part), promoters of quality management have written books and articles and presented seminars which are either about the parts or are visions of the whole drawn from a knowledge (often most thorough) of one or a few parts. Like the blind men who, in spite of their care, skill and sensitivity, were unable to describe one of nature’s most extraordinary creatures. Much of the literature of quality management has failed to identify something equally extraordinary - a rigorous and coherent management theory, uniquely appropriate to the needs of the business enterprise. Though we are yet to get a clear view of that species of quality management, sufficient sightings have been made (in some literature and in a number of enterprises – not all of them Japanese), most often through the mists of corporate obfuscation and a dense growth of irritatingly shallow and often misleading literature, to warrant further expedition; this time via a previously unexplored route which has such features as philosophical method, rigour, theory and the complexities of the modern enterprise.

To continue the exploration metaphor, the expedition proposed by this paper would not be breaking entirely new ground, rather it would follow a course considered and set by a growing number of authors who have also expressed concern at the lack of theory and addressed the task of establishing a theoretical foundation for quality management [Anderson et al., 1994, Anderson et al., 1995, Cole and Mogab 1995, Grant et al., 1994, Ackoff 1993, Dean and Bowen 1994, Ahire 1996, Harrington and Mathers, 1997, Aune, 1998, Handfield and Melnyk, 1998]. To some the journey started by those writers will appear impossible; to others it may seem irrelevant or, at best,

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5 Einstein [quoted in Kaku 1998 p. 346] took a similar view to that taken here when speaking of the universe: “Nature shows us only the tail of the lion. But I do not doubt that the lion belongs to it even though he cannot at once reveal himself because of his enormous size”

6 Though the author would not claim to meet the definition of the “true scientist” referred to by Mautz and Sharaf [1961, p.5] a central motivation for this essay is nicely captured by the following excerpt from their classic on auditing.

There is nothing as irritating to a true scientist as obscure and opinionated thinking. He longs to see everything as it actually is. [Daniel Sommer Robinson, 1947; The Principles of Reasoning, New York: Appleton – Century – Crofts, p.220] One of the great thinkers of our time has expressed a similar thought. “What then impels us to devise theory after theory? Why do we devise theories at all? The answer to the last question is simple: Because we enjoy “Comprehension”….There is another more subtle motive …This is the striving toward unification and simplication of the premises of the theory as a whole” [Albert Einstein, 1950 “On the Generalised Theory of Gravitation” Scientific American, Vol. 182, p.13] For years auditing [read quality] has been so busy getting itself established and accepted that it has had little time for such introspection. But as it becomes more and more mature, this excuse becomes less and less valid. There is indeed something incongruous about a profession with no visible support in the form of a comprehensive and integrated structure of theory” [emphasis added].

We believe that there is a theory of quality management, but it is not Deming’s 14 points, Jurans ten steps, Crosby’s 14 steps or Tribus’ 11 principles – they are better described as assertions or sets of hypotheses which for the most part are not linked or associated in any obvious way either with each other or business behaviour. Which is not to say that many of those hypotheses have not subsequently been given considerable corroborative support and shown to directly contribute to the aim of business.
Many believe quality management (i.e. managing a business enterprise in a way which ensures that the quality of its product service satisfies the customer) to be a completely practical subject.

To them quality management is a set of practices and procedures, methods and techniques, a way of doing, with little or no need for the explanations, descriptions, reconciliations, arguments, corroboration, coherence and rigour associated with theory.

To date proponents of quality management have been signally successful in ignoring theory and have given almost exclusive attention to applications and to immediate day-to-day problems – whatever works well has been adopted and vigorously promoted; what is not readily applicable has had little appeal and given little or no attention: quality management is a practice in search of a theory.

[Handfield and Melnyk, 1998, Korukonda et al., 1999]

METHOD AND THEORY

When confronted with problems, whether they are of an abstract or practical nature, (and quality management faces both) it is ever interesting, almost always illuminating, and sometimes humbling, to look to the past. Whilst the view that “there is nothing new under the sun” can be emphatically rejected, it is nevertheless true that earlier, often quite distant, works, sometimes in seemingly unrelated fields or disciplines, can stimulate new insights and provide valuable and authoritative support for the most modern of issues.

After Karl Popper [1959] there is perhaps some basis for the argument that the modern large business enterprise is so complex that it can only be managed on a piecemeal basis. Though not a view supported in this paper such a notion does have merit and should not be totally neglected. Interestingly it is suggested [Freedman, 1998 p. 623] that J. M Keynes believed that “economics by its very nature is not meant to provide grand unifying themes.”

For the purpose of this paper discussion is restricted to the business enterprise.

Though this point doesn’t really need further support, let alone a somewhat lengthy quote from a work on economics written more than 60 years ago, it seems shameful not to take this earliest opportunity to introduce the reader to Joseph Schumpeter and his wonderfully incisive mind and razor sharp prose. Discussing the importance of theory Schumpeter [1953, pp.18-19] noted:

But while the performance of economic theory was never up to the mark, that is, never what it might have been, it was at the same time beyond the grasp of the majority of interested people who failed to understand it and resented any attempt at analytic refinement. Let us distinguish carefully the two different elements that enter into this resentment. On the one hand, there were always many economists who deplored the loss of all those masses of facts that actually are lost in any process that involved abstraction. So far as application is concerned, resentment of this type is very frequently quite justified. On the other hand, however, there are untheoretical minds who are unable to see any use in anything that does not directly bear upon practical problems. Or, to put it less inoffensively, who lack the scientific culture, which is required in order to appreciate analytic refinement. It is very important for the reader to bear in mind this curious combination of justified and unjustified criticism of economic theory, which will be emphasized all along in this book. It accounts for the fact that criticism of economic theory practically always proceeded from both people who were above and people who were below the level of economic theory of their time.

For further discussion of the nature and importance of theory see Kuhn’s [1962, pp. 12-13] account of the transformation of the paradigms of physical optics. Of particular relevance to the development of quality management is the following:

...anyone examining a survey of physical optics before Newton may well conclude that, although the field’s practitioners were scientists, the net result of their activity was something less than science. Being able to take no common body of belief for granted, each writer on physical optics felt forced to build his field anew from its foundations. In doing so, his choice of supporting observation and experiment was relatively free, for there was no standard set of methods or of phenomena that every optical writer felt forced to employ and explain. Under these circumstances, the dialogue of the resulting books was often directed as much to the members of other schools as it was to nature. That pattern is not unfamiliar in a number of creative fields today, nor is it incompatible with significant discovery and invention. It is not, however, the pattern of development that physical optics acquired after Newton and that other natural sciences make familiar today.
Quality management, at least as it is described here, is one such modern issue which the now rarely cited 1890’s “magisterial treatise” [Blaug 1994, p.356] of Keynes [John Neville the father not John Maynard the son] can provide some useful insights; especially in relation to the importance of identifying and understanding the roots of many of quality management’s current problems. Though he was addressing the scope and method of political economy, the arguments, advice and warnings of John Neville Keynes [1890 pp. 6 - 9] are pertinent to our concerns over quality management and germane to the quest to identify and understand the root causes of its present difficulties. 10 With the occasional substitution of “quality management” for “economics” and “political economy” and “management methodology” for “science” Keynes is disconcertingly modern and deserving of a lengthy reference.

Economics is not in any way peculiar in requiring that its method should be discussed. The logic of other sciences is, however, for the most part sufficiently dealt with in general works on logic or methodology. There are special reasons, partly to be due to extrinsic causes, why the logic of political economy needs a more detailed consideration.

In the first place, economic science deals with phenomena that are more complex and less uniform than those with which the natural sciences are concerned; and its conclusions, except in their most abstract form, lack both the certainty and the universality that pertain to physical laws. There is a corresponding difficulty in regard to the proper method of economic study; and the problem of defining the conditions and limits if the validity of economic reasoning becomes one of exceptional complexity. It is, moreover, impossible to establish the right of any one method to hold the field to the exclusion of others. Different methods are appropriate, according to the materials available, the stage of investigation reached, and the object in view; and hence arises the special task of assigning to each its legitimate place and relative importance.

Another reason for discussing the true principles of economic method in some detail is that fallacious reasoning are more common in political economy than in most other studies. This is due only in part to the difficulty and complexity of the subject matter with which the science is concerned. It deals with phenomena, which, while encompassed with difficulties, are matters of every-day observation; and every-day discourse. A not unnatural consequence is that people think themselves competent to reason about economic problems, however complex, without any such preparatory scientific training as would be universally considered essential in other departments of inquire. This temptation to discuss economic questions without adequate scientific preparation is all the greater, because economic conditions exert so powerful an influence upon men’s material interests…. Broadly speaking, the general tendency of popular economics is towards rash generalisations and fallacious arguments post hoc ergo propter hoc. This is frequently combined with an imperfect analysis of fundamental conceptions; leading to confusion of thought and the selection of false propositions as self-evident postulates; and where deductive reasoning is employed, its results are often applied without regard to the condition requisite for their valid application.

To this it must be added that the sharp distinctions drawn by opposing schools, and their narrow dogmatism, have unnecessarily complicated the whole problem. The subject has become involved in heated controversies that have not only made it wearisome to unprejudiced persons, but have also done injury to the credit of political economy itself.

However, even if one accepts the advice of Keynes and identifies with the pitfalls he described it must be asked: does our concern with theory, scope and method, rigour and coherence matter; and if so why and who cares anyway? Does it really matter if quality management is unable to be linked directly and unambiguously with the aim of the business enterprise or supported and explained by a theory and as a consequence lacks rigour and coherence - is the effort worth the candle? 11 To answer those questions and more clearly establish the rationale for this paper, it is useful to express those comments as four propositions.

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10 In the light of later criticisms of the works of Crosby, Deming and Juran for their lack of reference to other literature it is of interest to note that Walter Shewhart [1931] makes reference to both J N and J M Keynes.

11 For further discussion of this question see Boaden [1997].
First, that the issue of whether quality management can be postulated as “strong” or “weak” i.e. as a theory or a collection of practical and independent management aids is of fundamental importance to determining how it will be viewed by management and how it should be described, presented and implemented. In the absence of theory all facts and issues are likely to seem equally relevant and no promoter or user of quality management can take its foundations for granted.

Second, that very many (we believe most) of the difficulties now confronting quality management have occurred because the question of whether it is a management philosophy, theory of management, a management methodology or simply a collection of very practical aids has thus far either gone unasked, or if asked, has been ignored or unsatisfactorily answered.

Third, that quality management (indeed any management aid) draws its relevance and establishes its efficacy from the contribution it makes to enterprise management and as a consequence it should display unambiguous links with business behaviour – preferably a widely accepted theory of business behaviour.

Fourth, that, though some would wish to deny it, quality management does deal with abstract ideas; does have its foundations in the most basic types of learning and does have a notional structure of postulates, concepts and precepts – seen in that light quality management is an intellectual study worthy of being called a “discipline”. [Mautz and Sharaf 1961].

Underlying those propositions is the belief (conviction) that a thorough and objective examination of the contemporary business enterprise will show that managing to achieve quality is a specialized field, that it warrants the type of critical study suggested here and that its description as a rigorously derived and coherent theory of management, is a challenge worthy of sustained effort by the best minds.

Support for the belief in the importance of theory can be found in Shewhart, who in his classic (and too seldom visited in the original) *Economic Control of Quality of Manufactured Product*, gave theory a prominent, indeed central, place. Viewed in much the same way Shewhart did as he sought an understanding of the “Fundamental Principles Underlying the Theory of Quality Control”, quality management demands deep intellectual effort through which its underlying

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12 Gillies and Rigby [1995, p.28] observe:
   While Total Quality Management (used by 73 per cent of respondents) was the third most highly utilised tool during the five-year period from 1989-93, it has slipped to fourth position in 1994. It is projected to rank seventh in 1995.

13 A similar view has been expressed by De Cock [1998, p.144]:
   In these linguistically sophisticated times, it has become generally accepted that our accounts and understandings of the world make a difference to the way that the world is and might be (Parker, 1995; Van Maanen, 1996). Now that it has become in vogue to attack or even dismiss Total Quality Management (TQM) (e.g., Boje & Windsor, 1993) and Business Process Re-engineering (BPR) (e.g., Willmott, 1995) the time may have come for redefining and reconceptualizing their meanings so that they are not totally lost from the repository of potentials. Little is gained by satisfying the continuing demand for management fashions to sustain the impression of management progress and rationality, but we miss out if we dismiss TQM and BPR as just glitzy rhetoric’s that create a subjective experience in fashions followers (cf. Abrahamson, 1996).

   “…disciplines are exacting. All maintain rules of conduct and are self policing. All gain strength and acceptance by working honourably within their bounds and knowing when transgression upon other realms counts as hubris or folly.”


Of course auditing has not reached the advanced stage which many of the sciences have attained. Yet it has reached a stage of maturity at which it will do well to pause for a bit of introspection and to take stock of its presuppositions, aims, and methods. It is our hope that some of the “broad and cultivated minds” now active in our own circle will be encouraged by this work to consider aspects of auditing that have not yet been given sufficient attention.

Referring to J M Keynes, *General Theory of Employment Interest and Money*, Blaug [1997, p. xvii] has said: “…everyone thinks they know what Keynes said but no one reads him any more”. The same might well be said about Shewhart.
theory may be discovered, comprehended and used by business enterprise to much greater effect than has been the case thus far. Which is not to deny that quality management may be properly viewed as an “applied” discipline\(^\text{15}\). However, because an applied discipline draws its basic theory from a number of other fields, some of them pure and some of them also applied, it is not uncommon for that connection with (and dependence on) the more basic or abstract fields of learning to be ignored or lost sight of.

The need for an understanding of theory and fundamental knowledge is increasing rather than decreasing as the information and communication technologies rapidly take over activities and decisions that are routine, and expert systems are able to deal in a routine manner with activities and decisions which only a short time ago were regarded as too complex to be amenable to solution by computer. Those technologies, increasing complexity and accelerating rates of change (much of which results from those technologies) combine to ensure that management is more and more being forced to deal with unique/one off problems, which, by definition, rely for their understanding and solution not on personal experience (or the codified experience of others), training and rules or procedure but on fundamental knowledge and multi – paradigm, multi – discipline thinking. Increasingly the solution to new fundamentally different, and increasingly unique, problems or variations on common problems requires a capacity to reach back from practice into philosophy and theory. As Einstein is said to have remarked: “Problems cannot be solved at the same level of awareness that created them”. Or as Charles Handy \([1995, \text{p162}]\) has commented:

> Many years ago, Professor Robert Katz, in the Harvard Business Review, described the skills needed by the manager. These were technical skills, human skills and conceptual skills. The technical skills could be taught very readily by those who knew them to those who did not. They were the stuff of courses, of books, of exams and apprenticeships. Human skills were more difficult, they could be learnt but not taught, learnt by experience and helped by advice and reflection, what we might call mentoring or coaching.

> Conceptual skills were the toughest of all, he thought and the most necessary because they were the skills that discerned the way, that defined the problems which technical skills could solve, that glimpsed the opportunities and the unsuspected niches. It is no good doing things right – using the technical and human skills – if they are not the right things in the first place. Conceptual skills are what leaders need, the wit to see what needs to be done and the ability to articulate it so that others get excited.

This paper does not suggest that the pragmatism which presently characterises quality management should be in any way diminished. However, it does take the position that there is now an urgent need to correct the imbalance between its practical and theoretical features\(^\text{16}\). That position, which is both a stimulus for, and central focus of, this paper relies not only on the practical view that such a correction will markedly improve the appeal and usefulness of quality management to business, but also on the general principle that the practices, procedures and techniques of all endeavours should be continually tested in both actual practice and against their supporting theory.

As Joseph Schumpeter \([1953, \text{p 42}]\) has put it:

> Factual work and ‘theoretical’ work, in an endless relation of give and take, naturally testing one and another and setting new tasks for each other, will eventually produce scientific models, the provisional joint products of their interaction with the surviving elements of the original vision, to which increasingly more rigorous standards of consistency and adequacy will be applied. This is indeed a primitive, but not, I think, misleading statement of the process by which we grind out what we call scientific propositions.

\(^{15}\) Ishikawa \([1985, \text{p.118}]\) has commented:

> QC can be a theory, but at the same time it is a practical discipline. I urge people who are connected with QC not to become mere theorists or mere practitioners. They must become experts at both.

\(^{16}\) Watson and Korukonda \([1995, \text{p.104}]\) make the interesting and very relevant observation that:

> “The tension between theory and practice – or between analytical detachment and practical relevance – is as old as management thinking. Such a tension is inevitable, necessary, and to some extent healthy. What is disturbing in TQM is not the absence of such tension, but the wholesale embracing of the concept as it stands, ie., devoid of much theoretical content, by academics and practitioners alike” [emphasis added]
If descriptions of quality management continue to ignore or eschew the need to identify its theoretical foundations (or little effort is made toward a serious and disciplined search for them) and quality management continues to be applied (either knowingly or otherwise) as a collection of essentially unrelated procedures and practices while at the same time being described and promoted as something more (e.g. a theory of management) it must inevitably lose respect and support among managers and scholars and soon be forfeit to other models of management [Korukonda et al., 1999]. When that prospect of the possible, perhaps likely, demise of quality management is weighed against the relatively modest intellectual effort necessary to provide it with an historical and management context, intellectual rigour and a theoretical framework (with attendant coherence, and consistency in description and application) there seems little basis for doing other than making that effort.

Preparatory to identifying a set of rules against which quality management can be judged to determine whether or not it constitutes a theory, it is helpful to look again at contemporary quality management literature to see what others have had to say about theory.

Grant et al., [1994, p.30].

TQM, on the other hand, has no explicit theory. Indeed, one of the reasons business schools have been unable to comprehend TQM’s power and potential is that it appears intellectually insubstantial. Deming’s “Fourteen Points,” for example, combine seemingly commonsense principles of management (“institute training,” “institute leadership,” “break down barriers between staff areas,” and “end the practice of awarding business on price tag alone,”) with a number of folksy, yet quirky, maxims (“drive out fear,” “eliminate slogans, exhortations and targets for the workforce”, “eliminate numerical quotas,” and “adopt the new philosophy”). However, we argue that a set of theoretical assumptions does underlie the principles and techniques of TQM. Together, these assumptions constitute a management paradigm that contrasts sharply with the economic model. [emphasis added]

Dean and Bowen [1994, pp. 392-3]

We believe greater research attention should be devoted to TQ for several reasons. First, it has generated a tremendous amount of interest in many sectors of the economy – manufacturing, service, health care, education and government – and in many countries around the world (Ernst & Young and American Quality Foundation, 1992; Lawler, Mohrman, & Ledford, 1992). It is difficult to identify any major organization in which quality issues are not on management’s agenda. Furthermore, many of the leaders of these organizations have begun to question why management research and education have not yet incorporated TQ to any great degree (Robinson et al., 1991). Given its importance in practice, we risk losing our credibility as management theorists by ignoring TQ in our research…..theory development on total quality should benefit both researchers and practitioners.

It should help to stimulate empirical research, as researchers may be reluctant to conduct research based on the consulting – oriented frameworks currently available. TQ researchers also will be much more productive if there is a theoretical base upon which they can draw. The premium on theory development is particularly high for TQ because its interdisciplinary nature means that it often transcends the boundaries of existing theories.

Despite thousands of articles in the business and trade press, total quality remains a hazy, ambiguous concept. The difference among frameworks proposed by writers such as Deming, Juran and Crosby have no doubt contributed to this confusion. Deming’s (1986) framework emphasizes the systematic nature of organisations, the importance of leadership and the need to reduce variation in organisational processes. (Anderson, Rungtusanatham, Schroeder, this issue). Juran’s (1989) framework involves three sets of activities – quality planning, control and improvement – and emphasizes the use of statistical tools to eliminate defects. Crosby (1979) focused on reducing cost through quality improvement and stressed that both high - and low - end products can have high

17 On the cannibalization of quality management see Kirker [1994, p.13].
18 It is interesting, indeed salutary, to compare the way in which the concepts of quality and knowledge have been treated in the literature and to look at who is writing about those issues. See Lincoln, et al., [1998] and Morrow, [1997, pp.364]
quality. Beyond these difficulties, the variety and continuing evolution of techniques being practiced under the rubric of TQ makes it difficult to maintain a clear conception of its meaning. Indeed, the meaning of the term quality itself is still being debated (Reeves & Bednar, this issue). Due to this ambiguity, TQ has come to function as a sort of Rorschach test, to which people’s reactions vary as a function of their own beliefs and experiences. TQ is seen by some as an extension of scientific management, by others in terms of systems theory and by still others as an altogether new paradigm for management (Spencer, 1994). [emphasis added].

**Wilson and Durant** [1994 p. 137]

Speaking to General Accounting Office (GAO) evaluators in 1991, Total Quality Management (TQM) guru Joseph Juran lamented how woefully inadequate our understanding was of his progeny’s impact. Wrote Juran (1991, p.51): “As far as measuring the [TQM] results that have been achieved, there’s a big information vacuum out there. Hardly anything useful is going on as far as evaluating results.” Unfortunately, little has changed in the interim to negate Juran’s observations substantially. Indeed, a paucity of systematic and rigorous evaluative efforts still exists, thus prompting accusations that TQM is little more than a “religious doctrine” that admonishes the unwashed to “just do it, in the blind hope that results will follow”. (Sims et al., 1992, p. 138). [emphasis added].

….TQM applications are increasingly viewed with skepticism in the private sector, a skepticism influenced by anecdotal and empirical analyses stressing its decidedly mixed results (Mathews and Katel, 1992; Dumas, 1989; Clemmer, 1991; Mathews, 1993). Despite proponent’s warnings not to expect short – term cost savings; many CEOs have grown cynical upon seeing little change in their companies’ earnings statements. What is more, Mathews (1993, p. H1) reports that private sector consulting firms in the 1990s are thriving on the “TQM repair work” spawned by TQM “miscarriages and abortions” crafted in the 1980s.


*We disagree, however, with labeling the 14 points as theory: the 14 points are as Deming claimed, principles of transformation for improving the practice of management.*19 They represent a complex, prescriptive set of interrelated rules of inter and intraorganisational behavior, codified and communicated in the linguistic form of commands. Although they certainly do suggest and advocate a number of concepts, they, themselves, are not concepts, the building blocks of theory (Chafez, 1978: 45). To be sure, there is a theory of quality management underlying the Deming management method, but at this point, this theory is presented in the prescriptive totality of the 14 points. This method, therefore, is more an artifact of a theory of quality management, which has yet to be articulated, rather than a theory per se. The challenge is to engage in systematic research to discover, and if need be invent, this underlying theory of quality management; such a theory to describe, explain, and predict the effects of adopting the Deming management method is imperative for generating scientific knowledge on the 14 points, guiding researchers on the subject matter, and propagating useful practice related to the Deming management method. [emphasis added]

**Raynor** [1992. p. 20]

Discussing theory so unapologetically and focusing on concepts rather than lists is radical medicine indeed. A traditional approach dictates that executives are busy people, with no time for ivory – towered speculation. This view might have some merit were it not based on a faulty assumption: that somehow it is possible to separate the theoretical from the practical. In fact, of course, every aspect of our lives is governed by some sort of principle, whether we realise it consciously or not. We have reasons why we do things. The fancy word for those reasons is theory.

Theory plays a role in everything we do, from what we eat to the way we dress, to the way we run our business and why we think they exist. By relating concepts to examples and avoiding lists, you will de – mystify the abstract. When you can discuss the conceptual issues of quality, you

19 Deming [1982 p. 97] did in fact claim that his 14 points constituted a theory of management. More on that later.
encourage your audience to take advantage of a common intellectual heritage rather than merely plagiarize techniques that may have worked somewhere else.

The importance of theory in everything we do points to a remarkable aspect of what I will dare to call human nature. We need to have a sense of purpose in our lives and in all the tasks we do. If we provided merely a recipe for quality management in the form of prescriptions for success and back it up with nothing more than a coterie of successful quality management firms, we have robbed the transformation of that higher purpose.

In the intellectual life of human beings, the sort of ownership necessary is only possible with ideas, with abstractions. Understanding these abstractions may well require examples and occasionally lists, but never lose sight of what has to inspire every transformation to quality management: a sense of something larger. Selling executives on quality is about shedding light on those aspects of quality management that can serve as the cathedral, which makes working the quarries not so unbearable after all. [emphasis added].

**Foster and Everett [1996 p. 624]**

A variety of models, both conceptual and mathematical, have been cited in the literature naming certain variables as antecedents to quality improvement. Conversely, researchers have identified a variety of variables leading to the failure of quality management efforts. This has resulted in a number of competing quality management models in the literature. Various reasons explain this existence of competing models. First, a generally accepted theoretical framework for testing the effect of key decision variables has not emerged. Therefore, many researchers view the development of models as a necessary step to developing testable research hypotheses (Adam, 1994; Flynn, Schroeder, & Sakakibara, 1994). Second, quality management research has lagged practice, leaving researchers to search for explanations of past observed phenomena. For example, the emergence of reengineering (Hammer & Champy, 1993) has caused researchers to question the fundamental assertions of continuous improvement. As a result, research has emerged treating quality management tools as content variables with no theoretical foundation (Powell, 1995). [emphasis added].

**Terziovski [1998 pp. 85-86]**

TQM appears to cover a great deal of the same ground as management theory. Managers pursuing TQM are concerned with strategy, information processing, leadership and many other topics that are well within the TQM domain.

Even though there is a faddish element in the current attention being devoted to TQM, the issues it encompasses are fundamental to understanding and managing organizations. Thus, the theoretical and empirical focus on these issues will be valuable. Schmidt and Finnigan (1992) studied the theory and practice of TQM in some of America’s leading companies and government agencies. They drew the following conclusions:

a) The world competitive situation makes the examination of TQM a must.
b) TQM is deeply rooted in American organization theory and management practice.

Therefore empirically testing theory on TQM should benefit both researchers and practitioners. It should help to stimulate empirical research, as researchers may be reluctant to conduct research based on the consulting-oriented frameworks discussed in Chapter 2. TQM researchers will also be much more productive if there is a theoretical base upon which they can draw. The benefits of theory development based on TQM is particularly high because TQM’s interdisciplinary nature means that it often transcends the boundaries of existing theories.

Theory testing is likely to serve the needs of practitioners as well. TQM initiatives often do not succeed, mainly due to the lack of theory available to explain the differences between successful and unsuccessful efforts. Moreover, experienced managers recognize that currently available approaches often are organizationally naïve. Management theorists have the capability to develop frameworks that incorporate the accumulated knowledge about organizations and, thus, can better guide TQM implementation. Some of the entrenched beliefs that TQM researchers have to change are provided by Schmidt and Finnigan (1992) who found that American managers still find it hard to accept that:

a) It costs less to make a high quality product than a product of poor quality
b) Increasing the reliability of a process reduces its costs.
c) The relationships between boss and subordinate is not inherently adversarial.
d) Lack of education does not mean lack of intelligence. Furthermore, a great deal can be learned if questions are asked whether prominent quality ideas conform to or contradict established ideas in management and organization theory. Answers are needed to help explain which parts of TQM philosophy; principles, methods and techniques are appropriate, when and why?

Garvin (1988, 1991). Saraph et al., (1989) identify similar weaknesses of the TQM philosophy, claiming that operational measures of quality management in terms of certain critical factors would be highly beneficial to both decision makers and researchers. Although many organisations collect quality data such as defect rates, error rates, rework cost and scrap cost, these are usually measures of quality performance and not measures of TQM practices and principles (Garvin, 1988). [emphasis added]

Those and very many other similarly critical (but not necessarily negative) comments to be found in the English language literature on quality and quality management lead inexorably to the proposition put forward earlier that it is crucial to the credibility and effective application of quality management to establish whether it is a philosophy (as it is very often described), a theory of management (as many, including Deming [1986 p.97] have asserted, or implied), a management method relevant to a particular theory of business behaviour, a unified framework, or a loose collection of principles, procedures and techniques to be applied independently or collectively as circumstances dictate. Unfortunately, it is not a straightforward task to establish what that position is. Certainly the traditional, and until now widely accepted convention among quality management promoters of asserting without supporting argument, is not now tenable. The principal reason why it is not a simple and straightforward task to establish whether quality management is something more than a collection of management aids is that “philosophy”, “methodology” and “theory” are not vague or honorific terms: they have quite specific meanings. As a consequence, before quality management can be described using those terms it must meet a number of well established conditions. Discussing methodology in the context of economics Blaug [1994, p.xii] explains that:

--Connor [1997, p.501] expressed a similar point of view at the commencement of his study of the human dimensions of quality management.

I wanted to find out what this – what to call it? Philosophy, school of thought, administrative approach, set of procedures – has to offer…?

It is surely one of the paradox’s of the work of Deming that he understood so clearly the nature and importance of theory yet put forward his 14 points as a theory – which clearly they are not. Consider the following extract from Neave [1990. p.246 - 249]

Insistence on a foundation of theory is one of the things that marks Deming out from other supposed experts on quality. His teachings are not just a collection of good ideas, or challenging ones, or controversial ones (though they certainly are all of these). They are rather outcomes and logical deductions based on theory. When that is realised, his work is seen to have a unique unity and credibility. Deming points out how grateful he is that he worked for those ten early years in the laboratories of the United States Department of Agriculture, giving him the opportunity to “seek new knowledge and test new theories.” We should say a little about what is meant by the word “theory”. To some it is perhaps merely the opposite of “practice”, and it may thus be given little credit or attention – rather analogously to Ian Graham’s description of common practice as a tiny “Plan” and a huge “Do” rather than a proper PDSA Cycle….

Deming notes that a great value of theory comes from the way it sometimes enables us to predict results without experimentation, saving time and money. And, to revisit a familiar theme:

“Any psychologist could have predicted the result of introducing the merit system.”

Models used by statisticians and others constitute theories. According to George Box, however: “No model is correct….” at least in our real world, “…but some models are more useful than others.” Similarly, Deming points out that any theory is correct in its own context, i.e. in its own world. But as regards this world:

“Is the theory helpful to us, especially for prediction?”

And there lies the crux of the matter: prediction. Deming’s whole object is to improve the future. As far as he is concerned, that is the purpose of knowledge. The past is gone. We can learn from it, of course – with the aid of theory….Deming gives is frequent warnings about using experience without theory; in fact, to be blunt about it:

“Experience teaches nothing unless studied with the aid of theory.”
...methodology is not just a fancy name for ‘methods of investigation’ but a study of the relationship between theoretical concepts and warranted conclusions about the real world; in particular methodology is that branch of economics where we examine the ways in which economists justify their theories and the reasons they offer for preferring one theory over another; methodology is both a descriptive discipline – ‘this is what economists should do to advance economics’ – finally, methodology does not provide a mechanical algorithm either for constructing or validating theories and as such is more like an art than a science” [emphasis in original].

Describing the philosophical method Larrabee [1928, pp.61] observes that it:

….can be contrasted sharply with other common ways of handling an issue, such as fighting about it, voting upon it, or compromising concerning it. None of these other methods compels it users to understand the problem in hand. So that the philosopher’s solution, which almost always takes more time in the beginning and looks less promising than the others, generally has the great advantage of being more lasting, because less superficial, in the end. Philosophizing about a thing implies an unusually stubborn attempt to understand it as thoroughly as possible, so as to give it the most thoughtful treatment of which we are capable.21

Phenix [1958 pp. 6-8] extends the Larrabee description by arguing that the philosophical method involves both the accumulation of knowledge and an attitude toward knowledge and that a philosophy comprises four parts: comprehension, perspective, insight and vision.

• **Comprehension** implies the understanding of the whole rather than individual parts alone and as a consequence a philosophy will employ concepts of great generality and facilitate the discovery of relationships between seemingly diverse aspects of its universe and through those connections provide a better comprehension of that universe.

• **Perspective**, calls for a breadth of outlook sufficient to grasp the true and full significance of things by considering propositions in sufficiently broad perspective that “well grounded” judgements can be made. This notion causes each issue to be considered in the light of its aggregate importance and ramifications rather than from one or more limited points of view.

• **Insight**, emphasises the search for basic assumptions which are not only the foundation from which we reason, but like many other foundations they tend to be hidden and their importance often unrecognized. No special subject and (we argue that quality management is a special subject) can expect to make real progress until its basic assumptions, their nature, and interdependencies, weaknesses and implications are uncovered and explicitly examined22.

• **Vision**, as Phenix [Ibid. p 9] describes it “… does not mean unbridled speculation or mysticism. It means that the philosopher has a view that lifts him from purely immediate and common concerns to the wider possibilities of the world ideally and imaginatively conceived”. This capacity to penetrate to the reality of its questions and its implications for the future is essential to defining prospects and establishing goals.

If those are the characteristics to be demonstrated or rules to be satisfied by quality management before it can described as a management philosophy, what are the characteristics which must be displayed before it can lay claim to being a theory?

A theory, is a series of logical arguments that specifies a set of relationships among concepts, constructs or variables [Doty and Glick, 1994, p.231] or as Popper [1959, p.59] has put it: “Theories are nets cast to catch what we call ‘the world’: to rationalize, to explain, and to master it. We endeavour to make the mesh ever finer and finer”. A theory is not just a summary of facts already observed nor is it merely a shorthand way of referring to a diverse collection of facts: it involves concepts from which new and hitherto unknown facts can be inferred. A theory that is merely a summary of the observed facts already known would have no explanatory power whatever. A theory must always explain more facts that it was invoked to explain. The scientific

21 When a similarly rigorous test was applied to the profit maximisation hypothesis Schumpeter [1953, p.77] observed that it emerged “emaciated and barely alive”. Will quality management, when put to the “blowtorch” of the philosophical method, suffer a similar fate, -will it die or bloom?

22 In this respect it is clear that quality management has been signally deficient – its underlying assumptions have not been brought forth for scrutiny and evaluation. So long as those assumptions (in particular that dealing with its relationship to the aim of the business enterprise) remain implicit or unclearly identified, arguments and discussions will continue with little hope of constructive conclusion.
potency of a theory is in direct proportion to the quantity and the range of facts it explains, particularly those that were not known when the theory was proposed.

Kaplan [1964] suggests a theory should satisfy four evaluative criteria.

- **Correspondence**: How well does the theory fit the facts or how closely do predictions drawn from the theory match up to actual events.

- **Coherence**: Is the theory internally consistent and straightforward in its logic? A theory should not depend on its author for drawing out the connections between its component statements; the connections should not be so loose and imprecise that totally opposite conclusions can be drawn from the theory.

- **Parsimony**: A theory should contain no more assumptions than necessary. A simple theory is preferable to a complex theory unless the added complexity (additional assumptions) can account for additional findings not explained by the simple theory.

- **Pragmatism**: How much new research is suggested by the theory? To score highly on this criterion a theory must at least be testable. It must be capable of being put to a test in which only certain results (not any conceivable results) could support the theory.

To those formal and widely accepted criteria another should be added if a theory is to be conveyed to a diverse rather than a knowing audience of fellow scientists who share common values and language. That additional criterion addresses the issue of context and can be described under the heading of communication.

- **Communicability**: Is the theory described in such a way that it can be readily understood by those for whose benefit it has been developed? To meet this criterion a theory will need to have a history and a description of other theories or phenomena to which it relates – an understanding of how and perhaps why the theory developed and who were the major contributors to its development is often an important element in creating, understanding and...

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23 After making the important point that there is no unanimously accepted definition of a theory, Doty and Glick [1994, p.232] remark: theory – building experts seem to agree that there are at least three primary criteria that theories must meet: (a) constructs must be identified, (b) relationships among these constructs must be specified, and (c) these relationships must be falsifiable (cf. Bacharch, 1989; Blalock, 1969; Dubin, 1969; Kerlinger, 1986; Whetton, 1989)

24 Popper, [1963, p.84] in his critique of Marx suggests a way in which our problem with quality management might also be expressed:

“Marxism is fundamentally a method……whoever wishes to judge Marxism has to probe it and to criticise it as a method, that is to say he must measure it by methodological standards. He must ask whether it is a fruitful method or a poor one, i.e. whether or not it is capable of furthering the task of science. The standards by which we must judge the Marxist method are thus of a practical nature”.

Cf. Handfield and Melnyk [1998 p336]:

A good theory should be rich enough to capture the fewest yet most important variables and interactions required to explain the events or outcomes of interest. Why is parsimony so important? Because the power of any theory is inversely proportional to the number of variables and relationships that it contains. The theory should be free of redundancy, and if it could do as well or better without a given element of form or content, that element is an unnecessary complexity and should be discarded (Wallace, 1971). As Popper (1961) (p.142) noted, “Simple statements…are to be prized more highly than less simple ones because they tell us more; because their empirical content is greater; and because they are better testable.

Researchers should be aware that the need to be parsimonious introduces its own set of challenges. By excluding certain dimensions to focus on other more important dimensions, the researcher runs the risk of potentially overlooking or omitting important factors in the development of a theory. Important extensions to current theories are often uncovered by researchers who examine those factors which are either omitted or treated in a very superficial or simplified manner.
establishing credibility. Borrowing from Hempel and Oppenheim [1948, pp. 135-75] it is suggested that in addition to the five criteria described above there are four logical conditions that should be met before a theory can be said to be adequate. Those conditions are:

- The theory must be logically deducible from the set of assumptions used to describe it.
- The assumptions must contain general laws, which are required for the logical derivation of the theory. Here, a law means a relationship that has been subjected to empirical testing has not been rejected and is generally agreed to have empirical validity.
- The assumptions must have empirical content, i.e. there must be at least one proposition deducible from the assumptions, which is in principle testable by experimentation or observation.
- The empirical propositions in the assumptions must be highly confirmed by all available relevant evidence.

Another feature of theory is the circumstances under which a theory can be said to be disproved. To disprove a theory it is not sufficient to show that it is not 100% certain, that difficulties confront it and there is contradictory evidence. As Burnham [1941, pp.228-29] observed when discussing his theory of the “managerial revolution”:

It must be further shown that it is less certain than alternative theories covering the same subject-matter, that there are in its case more difficulties, more negative evidence than in the case of at least some one alternative theory. No theory about what actually happens and will happen is ever “certain”. It can never, whether in the field of physics or history or anything else, be anything except more or less probable than any alternative theories on the same subject, then that is all that can be required; and, from a scientific point of view, we must accept it. The theory of the separate creation of biological species is not made scientifically acceptable by showing, as it can be shown, that there are difficulties with the biological theory of evolution.

If conclusive, once-and-for-all testing or strict refutability of a theory is out of the question in management because all of its predictions are probabilistic, a theory is not to be condemned because it is as yet untestable; provided it draws attention to a significant problem and provides a

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25 In the case of quality, the communication of its true nature would require a description of those other systems with which it has significant interdependencies, e.g. measurement, standards, economics, psychology and management thought. Given the experiences of the past decade, it is evident that however clearly and rigorously the theory and its principles are described, the true character of quality will not be conveyed if it is described as being free and able to be successfully implemented in a short time by those without experience and formal training in behavioural and cultural change.

26 Attention has been drawn to the importance of these questions by Milton Friedman [1953, pp.3-43] who argues that the empirical validity of the assumptions themselves is irrelevant, since if the conclusion is verified by accurate predictions then the theory as a whole is valid.

It is of some interest to note that among the earlier activities of Nobel Laureate economist Friedman was statistical process control. Friedman was a member of the important Statistical Research Group, Columbia University, Applied Mathematics Panel, Office of Scientific Research and Development, which operated from 1942-1945 under the chairmanship of Harold Hotelling. With H.A Freeman, Frederick Mosteller and H. Allen Wallis, Friedman co-authored Sampling Inspection, which was published in 1948.

It is probably of no interest to anyone beyond this, ideosyncratic author to find that Hempel and Oppenheim were part of the small group who attended Karl Poppers first reading of his paper (not the book by the same name which was produced much later) “The Poverty of Historicism” in Brussels in 1934 [Popper 1986, p.117].
framework for its discussion from which a testable implication may some day emerge. Discussing theories in economics Blaug [1997, p696] comments:

It cannot be denied that many so-called ‘theories’ in economics have no empirical content and serve merely as filing systems for classifying information. To demand the removal of all such heuristic devices and theories in the desire to press the principle of falsifiability to the limit is to proscribe further research in many branches of economics. It is perfectly true that economists have often deceived themselves – and their readers - by engaging in what Leontief once called ‘implicit theorising’: presenting tautologies in the guise of substantive contributions to economic knowledge. But the remedy for this practice is clarification of purpose, not radical and possible premature surgery.

Handfield and Melnyk [1998 p330] express a similar view:

The real test of a theory begins, however, when hypotheses are deduced from the theory. Once a particular set of conjectures or propositions has been selected, the researcher must now put them into empirically testable form. A key requirement of this form is that the researcher must be able to reject them based on empirical data (Popper, 1961). Hypotheses act as the vehicle by which the researcher discards old variables and relationships which have not been able to pass through the screen of falsification and replaces them with new variables and relationships (which are again subject to evaluation).

As it has thus far been presented in the literature and at seminars and conferences quality management has little claim to being a philosophy of management, and even less claim to having been developed via the philosophical method of inquiry and being a theory of management. Such is the inescapable conclusion if the principal literature on quality management is juxtaposed with the description of the philosophical method given by Larrabee and Phenix and the characteristics of a theory described by Kaplan and Hempel and Oppenheim. Which is not the same as saying quality management cannot be shown to be a philosophy of management and satisfy the conditions of a theory. It is simply to say, that the quality management literature (with the several exceptions referred to earlier) has thus far eschewed that task.

Handfield and Melnyk [1998 p330] express a similar view:

The real test of a theory begins, however, when hypotheses are deduced from the theory. Once a particular set of conjectures or propositions has been selected, the researcher must now put them into empirically testable form. A key requirement of this form is that the researcher must be able to reject them based on empirical data (Popper, 1961). Hypotheses act as the vehicle by which the researcher discards old variables and relationships which have not been able to pass through the screen of falsification and replaces them with new variables and relationships (which are again subject to evaluation).

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The principal reason for introducing John Neville Keynes, Schumpeter, Phenix, Larrabee, Kaplan, Hempel and Oppenheim to the literature of quality management and dealing with subjects which would be regarded by most associated with quality as at best dated, if not totally irrelevant, (but not by those who have read and understood Shewhart) has been to highlight the need for criteria against which to rigorously test whether quality management is a philosophy and/or theory of management and to demonstrate that the path from an idea (Schumpeters “vision,” which he argued preceded knowledge) to a philosophy, body of thought, discipline or theory is much travelled and has seldom (perhaps never) been achieved without considerable intellectual endeavour and travail, and never by assertion.27

27 Schumpeter [1954 p.42] uses two works of John Maynard Keynes, *The Economic Consequences of the Peace*, [1919] and *The General Theory of Employment Interest and Money* [1936], to illustrate the vision – analytic effort process:

The process stands out in this case with unsurpassable clearness because we can read a formulation of the vision, as yet analytically unarmed, in a few brilliant pages of Keynes, *The Economic Consequences of the Peace*, (1919). So far as this line of endeavor of a man of many interests was concerned, the whole period between 1919 and 1936 was then spent in attempts, first unsuccessful, then increasingly successful, at implementing the particular vision of the economic process of our time that was fixed in Keynes mind by 1919 at the latest. Other examples, from our field as well as others, could be adduced in order to illustrate this ‘way of our mind’. But it would hardly be possible to find a more telling one. Analytic effort starts when we have conceived our vision of the set of phenomena that caught our interest, no matter whether this set lies in virgin soil or in land that had been cultivated before. The first task is to verbalise the vision or to conceptualise it in such a way that its elements take their places, with names attached to them that facilitate recognition and manipulation, in a more or less orderly schema or picture. But in doing so we almost automatically perform two other tasks. On the one hand, we assemble further facts in addition to those perceived already, and learn to distrust others that figured in the original vision; on the other hand, the very work of constructing the
If the answer to the question of quality management’s true character is that it is the weakest in terms of coherence, i.e., it is simply a loose collection of principles, procedures and techniques such a conclusion should not in any way suggest that quality management is worthless. On the contrary, such a conclusion should send two important messages. 

First, that even in this “weak” form quality management can (and has in hundreds of thousands of enterprises around the world), when properly applied, make major and lasting improvement to the business enterprise. 

Second, that it is incorrect, misleading and downright dishonest to represent quality management as something other than a collection of principles, procedures and techniques.

If quality management is not of the “stronger” form of a unified framework, methodology or theory it is imperative that it be clearly so described and implemented only in ways appropriate to that form. Adoption of such an approach would ensure that quality management is not burdened with being described as something that it is not and making promises it cannot keep. If quality management were shown to be one of the stronger forms, it would be incumbent on its practitioners and promoters to be explicit and clear about the nature of that form and to describe and employ it with the rigour and discipline such a form demands.

One of the not so obvious, benefits of examining quality management from the perspective of theory and method is that it exposes a number of important issues which are otherwise ignored or obscured. For example, an issue which emerges early in the discussion of theory is that it is reductionist. Notwithstanding the remarkable success of the reductionist approach to dealing with complexity over the history of ordered thought, it is not without criticism. The reductionist approach and its concomitant loss of information is often contrasted with synergyism which seeks to explain by adding new information. Whilst this paper recognises the important distinction between those two approaches to understanding complex problems, it is argued that in the process of developing a theory of quality management they should be seen as complementary rather than competitive, and used in series rather than parallel. The distinction between the reductionist and synergystic approaches provides a useful means of explaining a central weakness in the foundation literature of quality management, and suggests an approach to its reconstruction as a theory of management. As mentioned earlier it is a central, though most often implicit assumption of this paper that the extremely narrow field of experience, theory (manufacturing and statistics) and focus (the customer) from which quality management has been developed is a fundamental cause of perhaps all the major problems with which it is presently confronted. As a consequence of that view it seems clear that the narrow field of statistics is incapable of yielding the theory quality management needs to give it an invariate base and anchor to business behaviour. A theory of quality management will not be found by further reductionism, however clever, in its present too narrow field. 

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schema or picture will add further relations and concepts to, and in general also eliminate others from the original stock. 

In his Bibliographic Guide with Suggestions for Study in the Further Development of a Scientific Basis for the Economic Control of Quality of Manufactured Product, Shewhart [1931 p 482] declares:

In the last analysis we must depend upon the use of scientific method – that is, upon human intuition, imagination, reasoning and knowledge. It is perhaps only through the application of this general method that we can hope to attain good data, one characteristic of which is that they be subdivided into rational subgroups. It may be of interest, therefore, to sketch briefly a course of reading which will be found helpful to the student in the application of scientific method to the further development of the theory of quality control. To do so necessarily takes us into the fields of psychology, philosophy, and logic; into the field of psychology because we must get some sort of picture of the way the mind works; into the field of philosophy because we need some hypothesis as to the nature of reality and the function of laws, theories and causal explanations; into the field of logic because it presents what we know about the formal methods available in the theory of deduction and induction.

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Commenting on what he describes as the three pillars of science (matter, life and the mind) and the critical role synergy will play in the advancement of knowledge Kaku [1998, p.12] explains:

The twenty-first century, unlike the previous ones, will be typified by synergy, the cross-fertilization between all three fields, which will mark a sharp turning point in the development of science. The cross-pollination between these three revolutions will be vastly accelerated and will enrich the development of science, giving us unprecedented power to manipulate matter, life, and intelligence.

In fact, it will be difficult to be a research scientist in the future without having some working knowledge of all these areas. Already, scientists who do not have some understanding of these three revolutions are finding themselves at a distinct competitive disadvantage.

The new relationship between the three revolutions is an intensely dynamic one. Often, when an impasse is reached in one area, usually a totally unexpected development in another field is found to contain the solution. For example, biologists once despaired of ever deciphering the millions of genes which contain the blueprint for life. But the recent torrent of genes being discovered in our laboratories is being driven largely by a development in another field: the exponential increase in computer power, which is mechanizing and automating the genesequencing process. Similarly, silicon computer chips will eventually hit a roadblock as they become too clumsy for the computer of the next century. But new advances in DNA research are making possible a new type of computer architecture which actually computes on organic molecules. Thus, discoveries in one field nourish and fertilize discoveries in totally unrelated fields. The whole is more than the sum of its parts.

Although, this paper has argued that there is an urgent need to test the hypothesis that quality management is much more than a loose collection of principles, procedures and techniques the fact is, we do not much care where that analysis might lead. What we most care about is establishing, an unambiguous description of quality management or of equal importance, establishing that no unambiguous description can be found. Put more provocatively, we believe that quality management is not worthy of more than passing attention and must be regarded a high risk strategy for business unless and until work of the type suggested by this paper is conducted.

Such analysis is however, unlikely to succeed unless there is a preparedness to (a) overtly and unashamedly acknowledge that most of what needs to be said in the course of that analysis will not be new and (b) expose and reject any cant, unsupported and unsupportable assertions, slogans and general nonsense, wherever they might be found. Discussing much the same issue Giroux and Landry [1998 pp 93] have remarked:

We firmly believe that it is not by rejecting criticism or by responding with truisms and equivocation that the cause of quality will be advanced. We believe that criticism should be encouraged, analyzed and classified to better organize ongoing discourse. Our intention was to

29 The definition of a hypothesis which most resembles the way that term is used here is that put forward by Mautz and Sharaf [1961 p 25].

A hypothesis is in the nature of a tentative solution to the problem at hand. It is the most reasonable explanation the thinker can find to account for the data that first stimulated him to recognise the problem. In developing it, he may have discarded one or more other possibilities, some of which he will return to if his attempts to test his hypothesis indicate that it is unsatisfactory. But at that point, he has settled on a “probably best” hypothesis after careful consideration of the problem, the facts surrounding the problem, and his own accumulated knowledge and experience.

Having arrived at a hypothesis which he believes is tenable, the scientific thinker’s skepticism forbids him from accepting it outright. He must test it before acceptance. This he does first by deducing the implications of his hypothesis. It is not enough that the hypothesis accounts for the original data and the surrounding facts in a realistic fashion. Just what does the hypothesis imply? Are its implications reasonable? Are they compatible with the available facts or are there suggestions in them that cast doubt on the validity of the hypothesis itself? Does it lead to implications incompatible with other knowledge or experience? Thus by intellectual attack, the thinker attempts to destroy the hypothesis he has just created, for if it cannot stand the test of this attack, it well may be too weak to warrant further investigation.

30 Garvin [1988 p 69], one of the very few leading scholars to address themselves to quality in a major way offers a similar sentiment:

To be more than passing interest to managers, quality must have a demonstrated impact on the bottom line. It must be closely associated with such key measures of business performance as cost, market share, and profitability. Otherwise, quality improvement would quickly lose its appeal, for it would lack a strategic rationale.
highlight the risks inherent in diluting the concept of quality within a discourse that is both too
encompassing in its grasp and overly reductive in its applications. We wanted to reduce the
frustration that managers and employees have when confronted by TQM so as to reduce the
chances that they will dismiss it as yet another management fad. On the one hand, we believe
that what happened to the discourse surrounding quality management may reflect a more
general process: the discursive creation of a “miracle cure”. If this is the case, managers should
watch for the warning signs of this phenomenon when they try to select a new management
approach. On the other hand, a better understanding of the historical reasons and of the
discursive processes which have led to the misappropriation of the concept of quality may
prevent managers from becoming discouraged by the failures of so many TQM programs.

SUMMARY

Looking with a critical eye, and with the benefit of hindsight, at a number of the early
commentaries on quality management, some of which have acquired the status of “bibles” (one
hears of people meeting to find the “true meaning” of some word or phrase) it is easy to empathise
with Thomas Hobbes discussing a treatise on conic sections and John Maynard Keynes’ remarks
on Karl Marx’s Das Kapital. Hobbes condemned a treatise on conic sections as “so covered over
with the scab of symbols that I had not the patience to examine whether it be well or ill
demonstrated”. [quoted in Alfred Crosby 1997 p.120]. In a letter to George Bernard Shaw, [quoted
in Heilbroner 1996 p. 295], Keynes commented:

My feelings about Das Kapital are the same as my feelings about the Koran. I know it is historically
important and I know that many people, not all of whom are idiots, find it a sort of Rock of Ages
and continuing inspiration. Yet, when I look into it, it is to me inexplicable that it can have this
effect… I am sure that its contemporary economic value (apart from occasional but inconstrucive
and discontinuous flashes of insight) is nil.

This paper has argued that criticisms not dissimilar to those made by Hobbes and J. M. Keynes
will persist and the confusion, dissatisfaction and rejection currently bedevilling quality
management will continue unless and until it is either explicitly and unambiguously identified and
promoted as simply a collection of independent techniques and procedures or acquires the rigour,
coherence and respectability, provided by attention to its intellectual heritage and theory.

Far too many promoters of quality management have been able to avoid (and for far too long) the
need for definition and rigour and description of the business enterprise by creating (albeit
implicitly in most cases) the impression that quality management is akin to Sylvester’s description
of mathematics [Barrow, 1992, p124]:

Mathematics is not a book confined within a cover and bound between brazen clasps, whose
contents it needs only patience to ransack; it is not a mine, whose treasures may take long to reduce
into possession, but which fill only a limited number of veins and lodes; it is not a soil, whose
fertility can be exhausted by the yield of successive harvests; it is not a continent or an ocean,
whose area can be mapped out and its contour defined; it is as limitless as space which finds too
narrow forms aspirations; it is possibilities are as infinite as the worlds which are forever
crowding in and multiplying upon the astronomer’s gaze; it is as capable of being restricted within
assigned boundaries or being reduced to definition of permanent validity, as the consciousness of
life.

This paper set out to establish that quality management can be mapped and its contours and
boundaries are able to be defined, and has argued that unless and until that exercise is done quality
management will continue to be misunderstood, misapplied and prey to the charlatan.

priesthood.”

32 As Feigenbaum [Dobyns and Crawford-Mason 1991 p89] has observed:
…”quality is fundamentally a body of knowledge…The essence of our ability to ‘make it quicker and
cheaper’ in this country [USA] to ‘make it better’ is largely going to be dominated by the ability of our
universities…to teach quality as a body of knowledge rather than a series of hip-shooting exercises’.
Considering the remarks made thus far on the future of quality management (can quality management survive?) it seems particularly apposite to conclude with Schumpeter’s eloquent and now famous passage on the future of capitalism.

Can capitalism survive? No. I do not think it can. But this opinion of mine, like that of every other economist who has pronounced upon the subject, is in itself completely uninteresting. What counts in any attempt at social prognosis is not the Yes or No that sums up the facts and arguments but the facts and arguments themselves. They contain all that is scientific in the final result. Everything else is not science but prophecy. Analysis, whether economic or other, never yields more than a statement about the tendencies present in an observable pattern. And these never tell us what will happen to the pattern but only what would happen if they continued to act as they have been acting in the time interval covered by our observation and if no other factors intruded. “Inevitability” or “necessity” can never mean more than this. What follows must be read with that proviso. But there are other limitations to our results and their reliability. The process of social life is a function of so many variables many of which are not amenable to anything like measurement that even mere diagnosis of a given state of things becomes a doubtful matter quite apart from the formidable sources of error that open up as soon as we attempt prognosis. These difficulties should not be exaggerated, however. We shall see that the dominant traits of the picture clearly support certain inferences which, whatever the qualifications that may have to be added, are too strong to be neglected on the ground that they cannot be proved in the sense in which a proposition of Euclid’s can.

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BIBLIOGRAPHY

Anderson Eugene; Fornell, Claes and Lehmann, Donald.R. 1993, Economic Consequences of Providing Quality and Customer Satisfaction, Cambridge MA: Marketing Science Institute


Burnham, James 1941 *The Managerial Revolution*, Peter Smith: New York


Handy, Charles. 1990a, The Age of Unreason, London: Arrow


Hawley, J K, 1995. ‘Where’s the Q in TQM?’, Quality Progress, Oct., p.6
Hayes, Robert H and Wheelwright, Steven C. 1988, Restoring Our Competitive Edge, New York: John Wiley and Sons
Huczynski, A A. 1993(a), Management guru’s:What makes them and how to become one, London: Routledge,


Krishnan, R; Shani, A B; Grant, R M and Baer, R. 1993, “In search of quality improvement: Problems of design and implementation”, *Academy of Management Executive*, Vol. 7, No.4, pp. 7-20.


March, James G and Simon, Herbert A. 1958, Organizations, New York: Wiley
Marris, Roger L. 1966, The Economics of Managerial Capitalism, London: Macmillan
Medawar, Peter B. 1984, The Limits of Science, New York: Harper and Row,
Popper, Karl R. 1986, Unended Quest, Glasgow: Collins
Popper, Karl R. 1959, Excerpts from the Logic of Scientific Discovery, London: Hutchinson