17th International Conference of the Systems Dynamics Society
20 – 23 July, 1999
Wellington, New Zealand.

Operational Research from a Critical Viewpoint

Çağlar Güven
Middle East Technical University
Department of Industrial Engineering, Ankara 06531, Turkey
Phone:+ 90 312 210 2275/Facsimile: +90 312 210 1268
cguven@ie.metu.edu.tr

Operational research can be thought to represent a first systems approach to address systemic issues of human activity. The story of how it prospered initially; how it later hesitated and went through much self questioning; and how despite steady advances on the technical front, it now finds itself constantly being pushed into a narrow niche and therefore into irrelevance, has been widely told and discussed. This paper brings together arguments of what has happenned to operational research and why, from a standpoint that looks into the philosophical underpinnings and implications of OR methodology. It attempts to review and evaluate the shortcomings of OR as we know it, and the challenges it has to face up to, if OR is ever to make sensible use of the mathematical tools it has produced.

Introduction

Operational research started life with the self-declared mission of using the methods of science to solve management problems. It is arguably the first disciplined approach to address systemic issues of human activity. Despite a spectacular start during World War II and its aftermath, the promise of OR remains largely unfulfilled; present day managers do not feel they owe much to OR, nor do they speak with OR that much. Churchman wrote in 1994 that

> "..very little knowledge of how humans should manage their affairs has been added to what we knew at the outset... even if management science is thought to serve the management of large corporations in developed countries, it has failed: no one knows with any solid degree of confidence how to run a corporation ethically, or even selfishly, whatever that means" (Churchman 1994).

OR is finding itself being pushed into the sideline; into marginality and obscurity, in fact, into irrelevance. Not unexpectedly, it has been argued at much length that OR itself is to blame for this state of affairs and several practitioners have criticized OR ending up with similar but also dissimilar verdicts and recommendations. Notable among these are Ackoff (Ackoff 1979, 1987), Dando and Bennet (Dando *et al* 1981),

Checkland (Checkland 1983), Rosenhead (Rosenhead, 1989) and Corbett and van Wassenhove (Corbett *et al* 1993), among many others. No clear concensus emerges as is to be expected, with some writers calling for a return to the tested and true practices that OR has forgotten, and others pointing out the need for radical reform. The intention here is not to review any of this, except to say that recurring arguments point to the failure of OR in keeping its original promise of taking a truly systems view of human affairs.

The concern of this paper is to discuss briefly the basic conception that OR has of human activity and the underpinnings of the way OR obtains knowledge and understanding of that activity; as this is what the succes or failure of OR practice must surely hinge upon. This is discussed in the next section. The analysis will not be complete in our view if the emerging socio-historical backdrop to OR practice is not also taken into account, and if the presuppositions that OR has long endorsed are left unquestioned. These are discussed in the section that follows.

The activity taking place under the umbrella term of systems thinking such as "soft systems" or "critical systems thinking" obviously overlaps with the subject of this paper and some of the present arguments are therefore anticipated by the many strands of systems thinking. However, no attempt will be made to discuss systems methodologies from the viewpoint of this paper. We shall conclude with a brief discussion of what, if anything, OR can do.

The philosophical basis of OR

The spirit of OR as it was conceived at the outset was best reflected by Blackett when he wrote:

> "... many more useful quantitative predictions can be made than is often thought possible. This arises to a considerable extent from the relative stability over quite long periods of time of many factors involved in operations. This stability appears rather unexpected in view of the large number of chance events and individual personalities and abilities that are involved in even a small operation. But these differences in general average out for a large number of operations, and the aggregate results are often found to remain comparatively constant." (quoted in Checkland 1983).

This is firmly in the spirit of positivist science as applied by a scientist to the study of human activity. It carries strong stipulations such as that reality is knowable through observation; but more crucially for OR, also that the justification of knowledge deduces from a coherence in the way different elements stand in mutual relation of interdependence and of consistency. That is, we know reality because it manifests itself as a *system*. Positivist OR believed in the existence of reality as a thing in itself, existing out there independently of the knower. Furthermore OR's positivist slant would have us believe that the world is made up of a plurality of realities, to which reason and observation can be applied piecemeal, the systems view notwithstanding. This is of course in line with the tradition of Newton and Darwin that set off the spectacular successes of empirical science and accounts to good measure for the initial success of OR also.

Positivism went through many twists and turns, to flourish fully after World War I, when it was asserted most famously in the practice and the philosophy of science, of a group of scientists and thinkers known as the Vienna Circle. Logical positivists as they came to be known, dominated scientific methodology until mid-century, and at the height of their enterprise, sought to construct a single unified axiomatic system of inquiry that demanded that all true knowledge had first to survive empirical verification by appeal to objective observation. Anything else was to be dismissed as meaningless. This brand of positivism believes our thoughts and experiences to be a reflection of an independent reality and was challenged later on from a neo-Kantian position that questioned the possibility of objective observation. It has lost most of its philosophical credibility, and was softened by the efforts of Karl Popper who introduced a critical perspective into inquiry, recognising the inevitable subjectivity of observation and research, and admitted the intersubjective decidability of justification. His hypothetico-deductive method, that relies on the primacy of falsification rather than verification, was not however developed into a truly critical system, and can still be regarded as positivism under a different guise. Most working scientists, including many social scientists would still regard themselves as positivists.

Owing to the contingent nature of its commission, OR has never been as preoccupied with establishing generalisations as scientists are, and the heated conflicts over positivism therefore, do not appear to have touched it at the time. Instead OR was happily busy convincing itself that its method was no different than the method of science, whatever that was. Indeed the similarity of the OR method as explicated by Ackoff to the "observation-hypothesis-testing" triad of natural science is obvious, if we admit of instrumental hypotheses (Ackoff 1962). This was in spite of the different demands on OR that were being made by two outlooks, positivistic on one hand and systemic on the other, that are at the root of OR. It is startling to realise now that the pioneers of OR did not for a long time, seem to have thought much of the tug of war that these two influences would play over the way OR is done. Indeed the rationale of the systems outlook, when taken to its logical conclusion, cannot admit of a plurality of realities that stand side by side and that can be conquered one by one; but must regard truth in the spirit of Hegel who says: "the true is the whole". If reality is one big and indivisible whole, extending through both space and time, there can be no ground from which a detached view can be taken of the world, or of human affairs. The conflict between the two outlooks appears insuperable.

At issue here, is the question whether it is possible at all, in the course of scientific inquiry, to demarcate the domain of science from that of practice, that is the normative domain of human conduct. Positivist science believes that this is possible and determines to leave out of the field of scientific inquiry, all action related to practice. This may be reasonable enough for natural sciences, but for OR it leads to the elimination from consideration of its subject proper, human action that involves choice. In fact the issue is basic to all social science. In a line extending from Max Weber to Herbert Simon, it has been argued that means-oriented rational action, which is instrumental in purpose, is different from ends-oriented practical action, and is legitimate subject for scientific inquiry. This is in fact the choice of technique problem. To use system concepts, it is equivalent to setting the boundaries of inquiry so as to protect science against the intrusion of value judgements. It is manifestly foreign to systems thinking in which the means-ends distinction cannot be meaningful, since all means are ends as all ends are means depending on where we set

the boundaries. Hence raising artificial boundaries around scientific inquiry will inevitably lead to what Churchman calls an *environmental fallacy* (Churchman 1979).

Shutting out value judgements in OR implies ethical relativism (Churchman 1970); people will know what is good for them and OR will get on with "objective" social engineering. But this cannot really assure any measure of objectivity, given the inescapable subjectivity of research. All research is implicated in action. Not only is research itself action in and on existing situations, especially of human practice, but it also always has consequences. Inquiry inevitably intervenes in social situations. To the extent that it recognises this, will it be possible for OR to acquire a critical footing.

The critical outlook for inquiry involves not much more than an uncorrupt administration of the systems approach that draws on historical, social and cultural resources beyond the analytic and the scientific. This is different from the functionalist and therefore uncritical systems view of early OR, which in the first place suffers from objectivism in that it privileges instrumental reason over practical, and in the second place, tends to regard the practical sphere of institutions as being related systematically within an overall structure so that explaining one entity will entail showing how it connects up with the rest; rather than emphasising the developing character of these structures and relationships in time. The critical outlook does not only seek a better knowledge of the world but proffers a different sense of what knowing is and what it does. It recognises foremost that the constitutive categories of human experience are subject to social-historical formation and determination, and seeks to attain knowledge that is both theoretical and practical. Its project is inevitably problematic. It is to be evaluative of the justice and happiness of society. But such ideas cannot transcend reality and must somehow be implicit in practices that constitute social reality. Critical inquiry must locate moral reason in human practice. This is indeed a task which OR mostly prefers to shun; although it has been perspicuously discussed by Churchman almost thirty years ago (Churchman 1970). It is also the reason why, as we shall propose shortly, OR has lost much of its relevance.

The critical agenda for OR was partly anticipated in the social sciences when Weber proposed interpretive *understanding* as a second object of knowledge alongside *explanation*. The interpretive tradition however has not always been at odds with positivism since understanding can take place at different levels such as the objective, the subjective or the intersubjective and in fact social science does not often lay claim to criticalness. The fact for critical OR is that all levels of understanding are relevant. When OR became aware of such demands it sought and found a theoretical basis for inquiry in the critical theory of Jürgen Habermas (Checkland 1981). It first focussed on Habermas' early theory of cognitive interests that develops the Kantian notion of practical reason pointing out the need to consider emancipatory interest alongside the instrumental and the intersubjective. More importantly for OR however is Habermas' later work on communicative action that offers a universalist model of what Habermas calls communicative ethics. This forms an attempt to rationalising justice claims by appeal to idealised conditions of unhindered social discourse. The prospect for rational justification of a universal justice, let alone morality, is questionable to say the least and although Habermas' theory proposes to derive a minimal set of criteria for justice, it does not claim that such criteria will lead to a universal set of moral priciples. Such caveats however are less important for OR, the

theory does provide firm footing for critical OR, if OR is not to get lost in free floating ethical relativism. The critical outlook enjoins OR to strive for an ideal speech situation removing all hindrance to free discourse, especially those imbedded in the presuppositions of power relations and politics. Indeed inquiry will be critical to the extent that it transcends individual interests and pragmatism by recourse to reflection; and discourse is governed not by control motives but by a search for consensus. This is an enjoining for a critical democracy that does not place instrumental reason above the practical and that trusts reflective vigilance as its sole guarantor.

The social context of OR

Critical thought is not a particularly well defined concept. It applies variously to circumstances ranging from logic to inquiry, from politics to social theory. The uniting concern in all cases however is the idea of liberation by self reflective thought, from systemic deceptions that are immanent to thought and that obstruct cognition. Habermas' critical theory inherits and succeeds the thought of the Frankfurt School of philosophers who set out before World War II with an agenda to complement Marxist thought with the critical edge it squandered when Marx decided to envisage his work as a "science" of the laws of capitalist evolution. Critical thought in this respect goes back to follow from the critical insight of early Marx which Ulrich (1983) puts as follows:

> "He was the first to recognise clearly that the conditions of possible knowledge cannot be located entirely within the (self reflective) knowing subject but are rooted in the empirical and historical structure of social practice, particularly in the contingent material conditions of work.."

It is this social context, now so decisive for OR's future, that we discuss next.

Both the Marxist and the liberal projects are the products of enlightenment. OR has always been a firm believer in enlightenment and we complement here the discussion of the previous section by arguing that this is one of the causes that is pushing OR into marginality. Enlightenment took start when Newton put an end to Aristotelian science. It was not long before Aristotelian ethics followed when the rejection of Greek teleology deprived conceptions of truth and reality from their long established grounding. With no teleology at hand, morality had no recourse to a universal reference and therefore enlightenment thinkers set out to rationalise morality as they rationalised science. The idea of enlightenment was that good practice would derive from good theory. This uncritical position has been the animating force behind modern science with the unavoidable result of intruding on and colonising human lifeworld by "enforcing a false (because impossible) identity between system and lived experience", on the strength of instrumental reason (Agger 1985). Instrumental reason has pushed human practical needs of communal engagement and self evaluation as optional extras on a forced agenda of consumer choice and market exchange, and in doing so, monopolised not only capital but also information and dialogue chances (Agger 1985). Habermas explains that this has resulted in the banishment of justice and politics by reducing decision making to pragmatic

instrumentality. The significance of this notion for the social context of OR can be deduced by two arguments.

The first argument concerns the unfolding effects of late capitalism now that the socialist experiment has foundered. The liberal market economy animated by instrumental reason and with newly found vigour now displays ever higher levels of efficiency but also insecurity and uniformity. It necessarily engenders a globalisation of its logic, offering a single set of rules that further sweeps away all remaining societal and subjective structures of human practice. This process goes hand in hand with a rationalised morality that is reduced to individual rights and culminates to no more than privileging market choice.

The second argument which might prove overwhelming in the future is predicated on the renewed realisation that the finite resources of the earth will not support an indefinite expansion, especially as such expansion ordered by unchecked instrumentality has by all indications now crossed the point of revocable or sustainable attrition of the environment (Meadows 1992). If OR counsels the appropriation of the earth's resources even when it appears warranted, it will eventually have hastened inevitable declines in economic production and the suffering that will follow. This is a manifestly weighty issue that invites questioning the ethnocentric conception of the world that is fundamental to western culture.

Critical OR

The arguments of this paper can now be recapitulated. The underlying cause for the marginalisation of OR is that it has chosen from the outset to address issues that are mundane and not inspired, tame and not wicked. It has preoccupied itself with mathematical models and has resisted criticism and objections, always answering from a pragmatic standpoint. Yet as the world continues to get smaller and more highly interconnected, dismissing such objections has become counterproductive, for management now turns on the more contingent and transient particularities of each situation. Put in other words the utilitarian belief that human goods can be measured against each other using a universal quantitative scale is no longer acceptable, for attention to such consequences rather than to action, allows only an incomplete evaluation of the present as it is supposed to evolve into a predetermined future. The mistake that OR has committed is to inadequately probe and unfold the participatory and problematic processes of human systems and to jump with insufficient understanding into the analysis of narrow issues as befits the limitations of quantitative analysis. The process of globalisation and the trespasses of economic neo-liberalism are more likely to be temporary than lasting. To the extent that OR disregards practical reason its counsel will be disregarded; for human systems cannot be self-generating if instrumentality takes precedence. OR's advice has not been able to bring about real change, but only on-course corrections such as allowed by some vestigial freedom. The point of this argument is that uncritical OR will be disregarded because human systems, in ways we are not always able to fathom, set into motion natural, - but perhaps not rational- mechanisms that are capable of resisting uninformed advice.

Even as it attends to practical reason, OR must reconsider its instrumental approach in view of environmental-ecological consequences of human activity. This may call for an altogether new rationality that would concern all applied science. This stipulation also points to a renewed mandate for informed mathematical modelling and singles out OR from among any number of systems methodologies that disclaim such modelling.

These arguments would support the call for a critical OR. The arguments are not extended so far as to suggest a postmodern relativistic stance, nor any judgements are made on such a stance. Before giving up on consensual ethics, OR should strive for a critical outlook especially in view of the social and the ecological backdrop. Critical thinkers such as Habermas are among a few who still believe the possibility of the ultimate justification of moral principles that would govern human practice instead of setting sail *sans* anchor, into scepticism and moral relativity. Modernist critical theory argues that the growth of enlightenment rationality need not lead to loss of freedom and that there is an emancipatory potential in communicative rationality, despite its suppression by the instrumentalism that the same rationality also spawns. The best OR can therefore hope for is to adopt a critical outlook and seek out a morality that may not be altogether human-centred if it is to steer clear of environmental fallacies and be heeded. The difficulties it faces are in finding platforms on which such OR can take place, and more crucially, in steering the right course as it remains faithful to its newly found philosophy and runs the risk of getting lost in speculation; or as it remains faithful to manifest human nature and ceases thereby to be critical.

References:

Ackoff, R. (1962) *Scientific Method.* John Wiley & Sons, New York

Ackoff, R. (1979) The future of operational research is past. *JORS, 30, 93-104*

Ackoff, R. (1987) OR, a post mortem. *OR, 35, 471-474*

Agger, B. (1987) The dialectic of deindustrialization: an essay on advanced capitalism. In Forester, J. (ed) *Critical Theory and Public Life, MIT Press, Cambridge*

Checkland, P. (1981) *Systems Thinking, Systems Practice,* John Wiley & Sons, Chichester

Checkland, P. (1983) OR and the systems movement: mappings and conflicts. *JORS, 34, 661-675*

Churchman, W. (1970) Operations research as a profession, *Man Sci, 17, B37-B53*

Churchman, W. (1979) *The Systems Approach and its Enemies*, Basic Books

Churchman, W. (1994) Management science: science of managing and managing of science. *Interfaces, 24, 99-110*

Corbett, C.J., Van Wassenhove, L.N.(1993) The natural drift: what happened to operations research? *OR, 41, 625-640.*

Dando, M.R., Bennet, P.G. (1981) A Kuhnian crisis in management science? *JORS, 32, 91-103*

Meadows, D.H., Meadows, D.L., Randers, J.(1992) *Beyond the Limits to Growth.* Context Institute

Rosenhead, J. (1989) Introduction: old and new paradigms of analysis. In Rosenhead, J. (ed) *Rational Analysis for a Problematic World*, John Wiley & Sons, Chichester, 1-20

Ulrich, W. (1983) *Critical Heuristicsa of Social Planning*, John Wiley & Sons, Chichester