What is a 'Policy Insight'?

What Is A 'Policy Insight'?

David C. Lane[1]
Henley Business School, England

INTRODUCTION

The paper by Kopainsky *et al.* walks the long, difficult road of rigorous socio-technical analysis before arriving at a simply stated conclusion about the adoption of improved maize varieties: that the existence of a strong reinforcing loop around trust creation is crucial. They say, "the social dynamics of trust building has the power to over-ride utility evaluations in the adoption decision" (Kopainsky *et al.*, 2012 p. tba). Certainly some more detailed actions are necessary but ultimately, if the trust mechanism can be put in place, then "adoption of seed from improved maize varieties would become a self-sustaining growth process without the need of further subsidies." This is perhaps the key policy insight from the modelling study. The authors state this clearly; "From a policy implication perspective, effective adoption stimulation policies should thus focus on measures that build trust in seed from improved maize varieties."

[1] Correspondence to: Prof David C Lane, Henley Business School, Whiteknights, Reading, RG6 6UD, England.
E-mail: d.c.lane@henley.ac.uk

Is that it? Should one be surprised that, after so much effort involving conjoint analysis, formulation of ODEs, use of empirical numerical data to perform careful parameterisation, what results feels just a little like … a T-shirt slogan? Is this qualitative description of what is needed for success a 'policy insight'?

The broader point has been made previously; "It may seem paradoxical but the results of a quantitative system dynamics study are qualitative insights" (Lane, 2000, p. 17). So, more generally, should one be surprised that this is what system dynamics produces, that the field seems to advance the view that only policy insights of this nature can legitimately be generated by modelling studies? This Discussant's Comment suggest that this is indeed what constitutes a 'policy insight' from the perspective of system dynamics - but that legitimate discussion around this position is called for.

QUALITATIVE POLICY INIGHTS: A DEFINING FEATURE

A piece in a previous special issue of this journal suggested that the use of participative modelling and the application of modelling to big issues are two defining features of system dynamics (Lane, 2010). In fact, judged from the founding literature of the field, a case can be made for adding a third such feature: the eschewal of point forecasting and the acceptance of qualitative policy insights as the goal for modelling.

The theory of system dynamics is clear on this point. In a methodological piece delivered in 1960 Forrester stated 14 ironically labelled 'obvious truths' (Forrester, 1960). By this means he denigrated the idea that a model should "predict specific future actions"; that optimization should be the goal of modelling and that modelling should inform individual decisions (rather than guiding policies) (*ibid.*, pp. 50-51). Rejecting these ideas folded into his subsequent book on the new approach (Forrester, 1961). Forrester argued that "Industrial dynamics should not be undertaken as a method of forecasting specific future events or of guaranteeing the correctness of any specific decision" (p. 363). Rather the purpose is to impart to those involved in the modelling "a better intuitive feel [which] improves . . . judgement about the factors influencing . . . success" (p. 45).[2]

In fact, this methodological stance can be seen in the first published case about system dynamics (Forrester, 1958) which concerned the inventory oscillation problem that had first provoked Forrester to push forward to create the field (Forrester, 1956). The case is significant because supply chains are still an important topic of study, this work having unearthed the phenomenon known today as the 'bullwhip effect' (Lane & Sterman, 2011).

Of course, the case is covered extensively in *Industrial Dynamics* and in subsequent works – a particularly effective presentation can be found in the book by Lyneis (1980). Reading through these treatments of the problem of inventory oscillations the 'policy insights' that emerge are in line with Forrester's general methodological stance. Less than full attention to the supply line causes over-shoot and under-shoot in stock levels. The rapid restoration of inventory to its desired level only comes at a cost of amplification of variation in orders. These are qualitative statements.

[2] Appendix K of *Industrial Dynamics* considers the methodological difficulties of forecasting in more detail.

The aspiration displayed in this theory and in this case has behind it a modesty which is appropriately pragmatic. It is in line with the Ackoff view that a system cannot be 'captured' in a way that allows meaningful optimization. As discussed below, Ackoff argued that this is because a social system cannot be tied down and modelled in a way that captures all of its complexity and detail. Hence the idea of optimization is absurd and needs to be rejected. System dynamics adopts a very similar position. That is why policy insights are qualitative statements about modes of behaviour, appropriate performance indicators and effective leverage points. It is learning about things like this that is important, not the intricacies of the model or the seductive calls of its seemingly pseudo-accurate numerical output (Forrester, 1971a). Modelling tries to improve the mental models of those managing the system. When they improve their understanding of dynamic complexity they return to the real system itself – with all of its complexity and detail now operating – and are better positioned to continue learning about how it works. In the title of his paper Sterman (1994) expresses beautifully what is going on: they are 'learning in and about complex systems'.

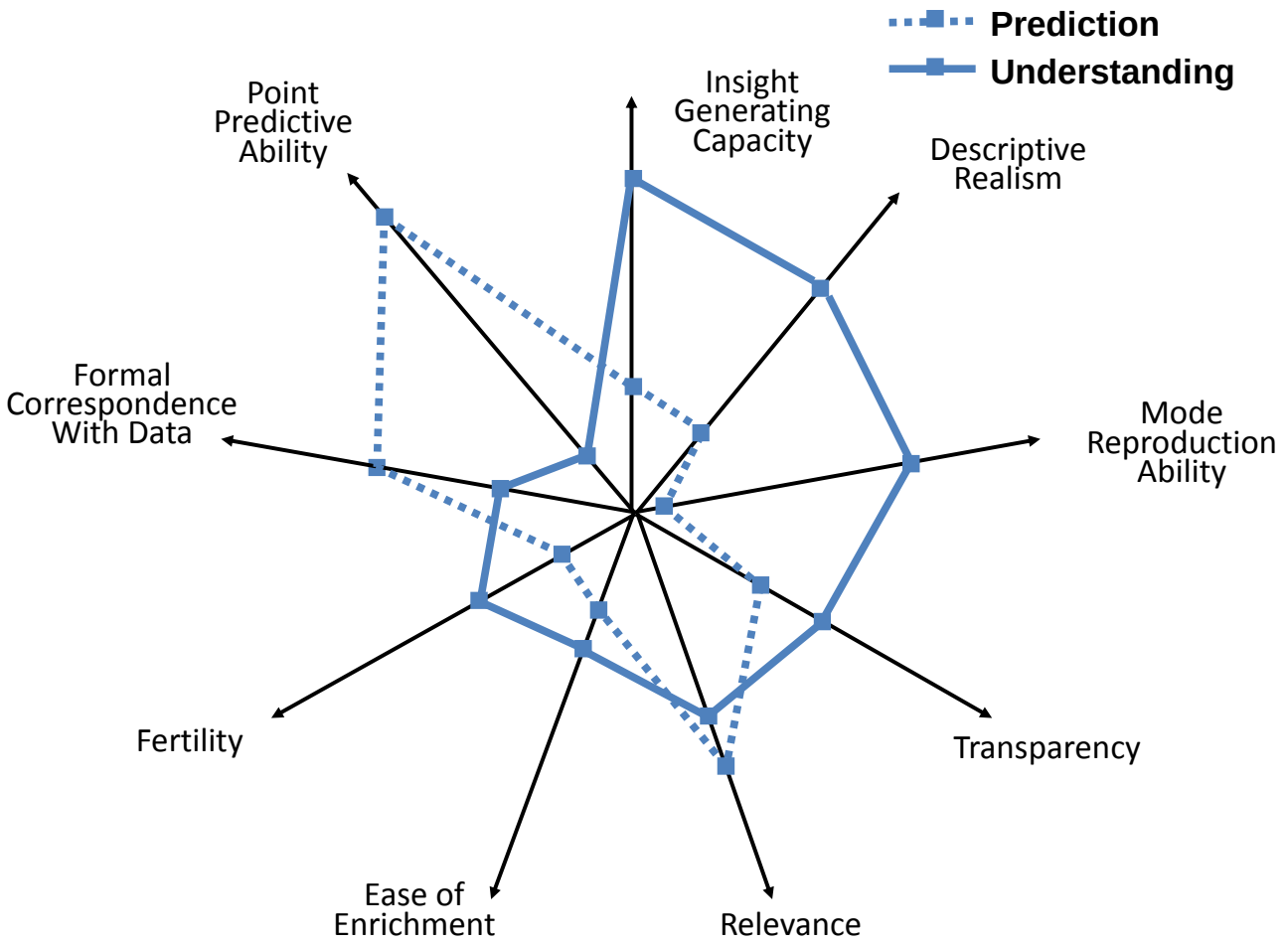

Fig. 1: Nine model characteristics comparing and contrasting modelling approaches aimed at understanding with modelling aimed at prediction. From Randers (1980).

The subtle intertwining of the strands of this intellectual position is nicely captured by Randers (1980). In exploring the distinctive aspirations of system dynamics he considered modelling used for

understanding and compared this with modelling used for prediction. His particular interest was in comparing system dynamics with econometric modelling. Randers used nine dimensions for his comparison. The comparison is reproduced in Fig. 1. Three dimensions are of particular relevance here. First, 'Point predictive ability' tests whether a model can predict with precision future events or effects. The chart expresses the field's lack of interest in this measure. Instead, the concern is with 'Mode reproduction ability': whether a model can generate a broad range of very different behaviour modes, as opposed to being tuned to one set of output measures. In what is arguably a rather biased race, system dynamics wins through. Where these lead is 'Insight generating capacity'. This measure concerns the ability of an approach to increase client understanding, to change people's mental models. Here the style of the approach and the iterative way in which it is employed results in a high 'score' for system dynamics.

This chart powerfully demonstrates the way in which the different parts of the system dynamics worldview fit together, its sensible aspirations expressing not just a realistic view of the limitations of modelling but also a highly ambitious aspiration for what system dynamics can accomplish practically in the world of policy making.

ASIDE: EXTERNAL SUPPORT

Whilst the pursuit of qualitative policy insights is, I would argue, a defining feature of system dynamics, the field is not alone in the concerns behind that aspiration. The development of system dynamics, in particular its historical breaking away from mainstream OR/MS, has been considered elsewhere (Lane 1994; 2007). However, it is worth noting here that also within OR/MS severe doubts were raised about the over-mathematicised, optimising, impractical style of work that was coming to the fore. Whilst a number of these critiques are discussed in Lane (2010), the work of Ackoff is particularly noteworthy.

Ackoff can lay claim to being in at the founding of OR/MS, one measure of this being his co-authorship of one of the very earliest texts in the field (Churchman, Ackoff & Arnoff, 1957). This is why his subsequent questioning of how some of the field's key assumptions had developed has been described as 'apostasy' (Kirby & Rosenhead, 2005). Ackoff was highly critical of the implicit 'predict and prepare' approach of OR/MS and its focus on supposed objectivity and optimal solutions. He criticized objectivity as an impossible goal, arguing that conflict among stakeholders often derived from their different values and goals. Since these are inherently subjective, any pretence to 'objectivity' would necessarily suppress vital aspects of the situation under study. As mentioned earlier, he found the concept of optimality impractical and irrelevant. Impractical because it excluded aesthetics and de-emphasised means whilst emphasising the utility of ends, and irrelevant because social and organizational systems were subject to rates of change which in short order made any optimum out-dated. This stance was expressed across a number of papers (e.g. Ackoff, 1977, 1979, 1981).

What we see here is the discussion of concerns very similar to those raised by Forrester and used to craft the methodological stance of system dynamics. Not all of these relate to the question of policy insights specifically, of course but there other points of contact with these ideas and the ideas of

system dynamics. Ackoff saw his concerns as a call for a much more engaged form of OR/MS. Today his critiques are seen as a key step in the foundation of 'problem structuring methods', a suite of approaches more interested in the 'socio' part of socio-technical systems and much more concerned with creating learning and 'insight' (Rosenhead, 1989).

DIFFICULTIES WITH 'POLICY INSIGHTS'

So, the founding literature of system dynamics establishes that models produce 'policy insights' and that these are qualitative in nature. However, sound as the underlying methodological reasoning is, the position produces difficulties.

The first difficulty is that offering such policy insights is frequently not satisfying to clients in real world situations. My experience with system dynamics modelling, an experience shared by a number of leading management consulting firms with whom I have worked, has shown me that clients frequently feel short-changed by such 'policy insights'. There is something of the Sirens' Song about a forecast, a precise statement of what will happen. There seems to be an urge to possess a glimpse of the future and that urge is not fulfilled by qualitative statements. Yet, bizarrely, the urge for something more precise very quickly transforms itself as clients ask to know in detail the consequences of a policy and then treat with distrust an attempt to provide such detail. It seems that few things are more desired than an ability to know the future - and few things are more strongly derided than a forecast of that future.

These remarks are certainly broad-brush and strongly reflect personal experience. However, the problem identified is usefully illuminated using the philosophy of scientific method; "The confusion of inductive and deductive modelling leads to paradox situations: models are built following the inductive approach—with high demands concerning the applicability of the results—when the best that can be hoped for are some general insights into system's behaviour" (Größler, 2008, p. 469). Again, there is pressure for specificity, an example of what Forrester describes as, "system dynamics being drawn into attempting what the client wants even when that is unwise or impossible" (Forrester 2007, p. 363).

This problem also fits well with the experiences that form part of the second difficulty: that this idea of policy insight can be very difficult to convey, that such insights are rapidly taken to be forecasts no matter how strong the statements to the contrary.

The most bewildering example of this returns the discussion to the workshop theme of sustainability because it concerns the widespread misunderstanding of the conclusions of *World Dynamics / The Limits To Growth* (Forrester 1971b, Meadows *et al.*, 1972).

These works did not forecast. This was perfectly clear to me when I first read them. Their qualitative insight can be put in various ways. It might be taken as: 'nothing grows forever; all reinforcing growth processes must eventually encounter limits to their growth'. Alternatively, Randers (2000) beautifully expresses the insight in terms of sustainable harvesting levels of renewable resources. A version given by Forrester when he summarised the basic insight was:

> "Limits are inevitable. If we evade one and continue growing, we will run into another. We don't have the option to grow forever … Our only option is to choose our own limits, or let nature choose them for us"
>
> (Forrester, quoted in Meadows, 2007, p. 193).

Unfortunately, such policy insights are largely missing from the general discourse about these works that exists today. On publication they were the subject of serious – albeit sometimes acrimonious – debate (e.g. McCutcheon, 1979). But since then a curious legend has grown up about these books. If one was to rely only on that legend one might be forgiven for thinking that these works proposed a precise headcount for humanity on 5th September 2014, or a price to the closest cent for Aluminium in 2026, or that humanity was condemned to irresistible collapse, the knell of Doomsday firmly 'calendarised'. As Bardi – who described this phenomenon in considerable detail - puts it; "In the late 1980s, all that was remembered of the LTG book … was that it had predicted some kind of catastrophe at some moment in the future." (Bardi, 2008). A similar situation followed the publication of the 20 year-on update (Meadows, 1992): insights were ignored and the work was claimed, inaccurately, to have made ridiculous but precise forecasts.

Perhaps this situation has something to do with resistance to ideas which challenge cherished shibboleths, or which challenge existing power relations. On that second note, Bardi offers a striking comparison with contemporary climate change denialists and the interests that he argues lurk behind this view.[3] However, my feeling is that this is 'merely' the most striking example of the general problem: people have difficulty understanding the non-predictive nature of system dynamics models.

IS THE POSITION ON 'POLICY INSIGHTS' SUSTAINABLE?

So can the field of system dynamics maintain this qualitative view of what constitutes a policy insight? A similar message does not seem to have proved to be sustainable in the field of OR/MS. Certainly North American OR/MS researchers have ignored Ackoff's message, continuing in hot pursuit of optimisation and precision - even though today insiders are critical of this approach on the basis that it separates OR/MS from real problems (Sodhi & Tang, 2008; Lane, 2010).

One can detect 'slippage' within system dynamics itself. The previously quoted comment from Grossler (2008) suggests this. Certainly one sees system dynamics work which appears to be more in the nature of forecasting. Indeed, the term 'policy engineering' has been used for a form of system dynamics which is concerned less with learning, more with solving; offering more quantitative than

[3] It is interesting to compare this with a description of the reaction to *The Limits To Growth* by a range of interested parties: "The other message missed was not that humanity was doomed, but that catastrophe could be averted … Yet few saw it this way. Instead, the book came under fire from all sides. Scientists didn't like Limits because the authors, anxious to publicise their findings, put it out before it was peer reviewed. The political right rejected its warning about the dangers of growth. The left rejected it for betraying the aspirations of workers. The Catholic church rejected its plea for birth control" (MacKenzie, 2012). Note the use of the word 'doomsday' in the title of this piece.

qualitative insights; connecting strongly with optimisation and forecasting activities (see Sharp, & Price, 1984 and Lane, 1999, pp. 514-5). This is perhaps why in 2007 Forrester chose to return to the point, again arguing that a rejection of forecasting is fundamental to the nature of system dynamics (Forrester, 2007, pp. 363-5).

However, it has to be said that the different view, the 'policy engineering' view, is put forward with persuasive vigour. It can be traced back to the work of Coyle (1977) and Lyneis (1980) and subsequent works, particularly those arising in the legal arena and involving the dynamics of project management, have offered a clear statement of why forecasting is a legitimate aspiration for system dynamics with a coherent intellectual case to back it up (Lyneis, 2000; Lyneis, et al., 2001 and Stephens et al. 2005).

If we are not sure of the argument within the field then what are the chances of sustaining a position regarding what constitutes an appropriate policy insight for system dynamics modelling studies?

CONCLUSIONS

The founding literature of system dynamics establishes that models produce 'policy insights' which are qualitative in nature. However, sound as the underlying methodological reasoning is, the position produces difficulties. The quest for qualitative insights is arguably a distinctive feature of system dynamics. Yet for practical reasons it seems a hard position to maintain. Furthermore, in methodological terms there are plausible arguments behind an alternative view.

The paper by Kopainsky *et al.* takes a clear view on what policy insights one should expect from system dynamics. Can we say as much about our field *in toto*? I suspect not. The difficulties discussed here lead to the conclusion that legitimate debate around this position is called for.

The way forward is to take the issue on directly. As we move towards six decades of system dynamics practice we need to re-visit the field's methodology and obtain a deeper understanding of the theoretical case for the qualitative approach to model output. We also need an analysis of the published cases in the field – from the classics up to the present day – which records the nature of the 'output' that the modelling generated, and in what context. Then, perhaps, we may be in a position to provide an answer to the question: what is a policy insight.

REFERENCES

Ackoff, R. L. (1977). Optimization + objectivity = opt out. *European Journal of Operational Research* **1**(1): 1-7.

Ackoff, R. L. (1979). The Future of Operational Research is Past. *Journal of the Operational Research Society* **30**(2): 93-104.

Ackoff, R. L. (1981). The art and science of mess management. *Interfaces* **11**(1): 20-26.

Bardi, U. (2008). Cassandra's Curse: How "The Limits to Growth" was demonized. Posted at http://www.clubofrome.org on March 9, 2008, retrieved on 14th Feb. 2010.

Coyle, R.G., 1977. *Management System Dynamics*. Wiley, Chichester, UK.

Churchman, C. W., R. L. Ackoff, & E L Arnoff (1957). *Introduction to Operations Research*. London, Wiley.

Forrester, J. W. (1956). Dynamic Models of Economic Systems and Industrial Organizations (2003 republication of a 'Note to the Faculty Research Seminar. November 5, 1956' and MIT 'D-memo' zero). *System Dynamics Review* **19**(4): 331-345.

Forrester, J. W. (1960). The Impact of Feedback Control Concepts on the Management Sciences. *Collected Papers of Jay W. Forrester (1975 collection)*. Cambridge, MA, Wright-Allen Press**:** 45-60.

Forrester JW. 1961. *Industrial Dynamics*. MIT Press: Cambridge, MA.

Forrester, J. W. (1971a). "The" model versus a modelling "process" (republished 1985). *Dept. memo D1621-1, system dynamics group, MIT, republished in System Dynamics Review* **1**(1): 133-134.

Forrester JW. 1971b. *World Dynamics*. Wright-Allen Press: Cambridge, MA.

Forrester JW. 2007. System Dynamics—The next fifty years. *System Dynamics Review* **23**: 359-370.

Größler, A. (2008). System Dynamics Modelling as an Inductive and Deductive Endeavour: Comment on the paper by Schwaninger & Grösser. *Systems Research and Behavioral Science* **25**(4): 467-470.

Kirby, M. and J. V. Rosenhead (2005). IFORS' Operational Research Hall of Fame: Russell L. Ackoff. *International Transactions in Operational Research* **12**(1): 129-135.

Kopainsky, B., Tröger, K., Derwisch, S & Ulli-Beer, S. 2012. Designing sustainable food security policies in sub-Saharan African Countries. *Systems Research and Behavioral Science* **29**(6): tbc.

Lane DC. 1994. With A Little Help From Our Friends: How system dynamics and 'soft' OR can learn from each other. *System Dynamics Review* **10**: 101-134.

Lane DC. 1999. Social Theory and System Dynamics Practice. *European Journal of Operational Research* **113**: 501-527.

Lane, D. C. (2000). Should System Dynamics Be Described As A 'Hard' Or 'Deterministic' Systems Approach? *Systems Research and Behavioral Science* **17**(1): 3-22.

Lane DC. 2007. The Power of the Bond Between Cause and Effect: Jay Wright Forrester and the field of system dynamics. *System Dynamics Review* **23**: 95-118.

Lane, D. C. (2010). High Leverage Interventions: Three cases of defensive action and their lessons for OR/MS today. *Operations Research* **58**(6): 1535–1547.

Lane, D. C. (2010). Participative Modelling and Big Issues: Defining features of system dynamics? *Systems Research and Behavioral Science* **27**(4): 461-465.

Lane, D. C. & J. D. Sterman (2011). Jay Wright Forrester. *Profiles in Operations Research: Pioneers and Innovators*. A. A. Assad and S. I. Gass. New York, Springer**:** 363-386.

Lyneis, J. M. (1980). *Corporate Planning and Policy Design*. Cambridge, MA, Pugh-Roberts Associates, Inc.

Lyneis, J. M. (2000). System dynamics for market forecasting and structural analysis. *System Dynamics Review* **16**(1): 3–25.

Lyneis, J. M., Cooper, K. G. & Else, S. A. 2001. Strategic management of complex projects: a case study using system dynamics. *System Dynamics Review* **17**(3): 237-260.

MacKenzie, D. 2012. Doomsday Book. *New Scientist*, **2846**(7-13 Jan): 38–41.

McCutcheon, R. (1979). *Limits of a Modern World: A study of the 'limits to growth' debate*. London, Butterworth.

Meadows, D. H. (2007). The History and Conclusions of The Limits to Growth (edited post mortem by Dennis Meadows from an unpublished original). . *System Dynamics Review* **23**(2-3): 191-197.

Meadows DH, Meadows DL, Randers J. 1992. *Beyond the Limits: Confronting Global Collapse, Envisioning a Sustainable Future*. Post Mills: Chelsea Green Publishing Company.

Meadows DH, Meadows DL, Randers J, Behrens W. 1972. *The Limits to Growth*. New York:Universe Books.

Randers, J. (1980). Guidelines for model conceptualization. *Elements of the System Dynamics Method*. In J. Randers (ed.). Cambridge, MA, MIT Press**:** 117-139.

Randers, J. (2000). From Limits To Growth To Sustainable Development. *System Dynamics Review* **16**(3): 213-224.

Rosenhead, J. (1989). Introduction: old and new paradigms of analysis. *Rational Analysis for a Problematic World: problem structuring methods for complexity, uncertainty and conflict*. J. Rosenhead. Chichester, Wiley**:** 1-20.

Sharp, J.A., Price & D.H.R., 1984. System dynamics and operational research: An appraisal. *European Journal of Operational Research* **16** (1), 1-12.

Stephens, C. A., Graham, A. K. & Lyneis, J. M. 2005. System dynamics modeling in the legal arena: meeting the challenges of expert witness admissibility. *System Dynamics Review* **21**(2): 95**–**122.

Sterman, J. D. (1994). Learning In And About Complex Systems. *System Dynamics Review* **10**(2-3): 291-330.

Sodhi MS and Tang CS. 2008. The OR/MS Ecosystem: Strengths, Weaknesses, Opportunities, and Threats. *Operations Research* **56**: 267**–**277.