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Using Performance Audits as a basis for systems thinking

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Abstract

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In this paper, the author takes three performance audits for which he was the lead investigator, concerned with policing, courts administration and road safety in the ACT, as a basis to explore some issues related to the operation of complex systems.

The paper first considers briefly the multi-layered, non-linear and feedback nature of systems, with reference to some key thinkers such as Forrester (system dynamics), Beer (cybernetics) Checkland (soft systems) and Senge. It then considers some of the characteristics of the feedback loops of information and action in policing, courts administration and road safety. This is then used as a basis for description of some of the difficult problems in understanding such areas and making recommendations for improvement. One of these problems is that of designing performance targets that are simple and meaningful and also assist management to improve performance. Systems thinking can help to shed light on such complex situations and help in the design of performance measures.

Introduction – systems and systems-thinking

Definition of 'system'

Papers often commence with a discussion of definitions, and this one is no different. In this case, it is particularly important, because the word 'system' is so overworked.

A system can be a loose collection of organisations, rules and modes of behaviour that somehow are connected with each other (e.g. writers can refer to different political systems in different nations). It can mean a process or collection of processes (e.g. an organisation might refer to its system to deal with under-performing employees, or a gambler might claim he has a system to beat the casino). It can also refer to an inter-connected set of things that together performs a function (e.g. the cooling system of a

[1] The views expressed in this article are those of the author and are not necessarily supported by the ACT Audit Office.

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car consisting of radiator, coolant, hoses, fan and thermostat; or the circulatory system of the human body, with heart, arteries, veins and capillaries).

In common parlance, it is hard to conceive of any connected set of things and processes that could not be labelled a system. Indeed, one definition is that it is set of inter-related elements. It is hard to see how such a definition is useful.

Several attempts have been made in the literature to define 'system': Bob Williams referred to two of them in a post on the Eval-Sys discussion list.[2] These were the 32 properties that, according to Ackoff, need to be considered in order for a situation to be regarded a system, or viewed from a systems perspective. These are grouped under several categories; the system components; the systems dynamics; the systems behaviour; systems relationships; adaptation and learning; and organisation. Williams also summarised the Checkland view, namely that a situation is a system when it possesses:

- An ongoing purpose (that may be determined in advance - purposeful, or assigned through observation - purposive)
- A means of assessing performance (formal or informal)
- A decision taking process that responds to that assessment (that could be deterministic or considered)
- Components that are also systems (i.e., the notion of sub-systems)
- Components that interact
- An identified environment (with which the system may or may not interact)
- An identified boundary between the system and the environment (that may be closed or open)
- Resources
- Continuity

One can argue about the various merits of these definitions, but I do not think that this is a productive debate. The term 'system' has escaped into the wider English language, and although we may lament the ambiguous use of the term, it is futile to try to corral it now.

Systems thinking

If the noun has escaped, there may still be some merit in trying to work with an appropriate verb. After all, evaluation is about practical action rather than fundamental scientific knowledge. So even if we do not know exactly what a situation is, but we can propose evidence-based action to address it, then we have made a contribution. It is better, therefore, to work with a verb. 'Systematise' will not do as that just means to arrange things so that they are (or look like) a system.

[2] Posting to EVAL-SYS discussion list, 2 February 2006. Retrievable from http://evaluation.wmich.edu/archives/index.html

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The concept is probably better expressed by the somewhat awkward present participle, 'systems-thinking', the term used by Senge.

In this way, we focus on what it is that we actually do to analyse systems and propose corrective action. There are, of course, several different schools of thought here, of which the author is attracted to the work of the following. In the space allowed, this can only be the briefest of sketches of these complex works.

Ways of systems-thinking – Forrester, Beer, Senge and Checkland

This is an extremely simplistic summary of a very complex field. There are many other thinkers in addition to the ones to which I devote a mere paragraph each. Others such as Ross Ashby, Ludwig von Bertalanffy, Russell Ackoff, and C West Churchman are also important, and these are only those that I am aware of from several decades ago; there must be more recent thinkers as well.

Forrester and Industrial Dynamics. Jay Forrester was a pioneer in constructing models of business systems. The idea was to express components mathematically, in terms of stocks, flows, and equations that bring all the elements together and provide for dynamic interaction. This approach was used by Meadows *et al* in the famous 'Limits to Growth' book, which explored the interactions, in terms of price, supply and demand, and population in the context of fixed stocks of natural resources such as minerals, arable land and oil. The approach relies on explicit equations linking the components of the system. So when evidence on these interactions is limited, assumptions are necessary to make the model work. This constraint was at the heart of the criticisms of 'Limits to Growth'.

Beer and Cybernetics Stafford Beer's insight was to consider the nature of communication and control in a complex entity such as a firm or a nation in terms of an analogy with the nervous system. Much of the body's functions operate autonomously without conscious input from the brain. Instead there are self-organising components that provide for control and feedback, and only refer exceptions (e.g. pain) to the higher organisation. These principles were used by Beer in consulting both at the level of the firm, and, in the case of Chile, an entire nation. Beer's view was that there are five different types of organising element, from the controlling entity, such as the Board, to the operators. Beer's insight was that these systems can be recursive, so that within the lower level System 1 (operators) there can be replicated the entire structure of controllers through to operators. For example, a Board may consider the manufacturing division to be 'the operators' but within that division there will also be subdivision of effort and levels of control.

Senge and Systems thinking. Peter Senge's book *The Fifth Discipline* has been a major influence over the last 15 years. The first four 'disciplines' were in a sense conventional, but his emphasis on understanding business problems through a systems–thinking approach (the fifth discipline), had a significant impact. Senge's approach was similar to that of Forrester in that it used diagrams to understand the various loops and influences connecting business issues. However, it was not numerical in nature, and emphasised things such as understanding the different patterns caused by system elements that interact in different ways (e.g. positive and negative feedback). Senge has been such a strong influence that when systems

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thinking is mentioned, people often assume that it is the Senge approach that is meant, whereas there are many other ways of thinking about systems.

Checkland and Soft Systems As the name implies Checkland's approach was non-numeric. Checkland had the idea of trying to define a system by means of defining the 'root definition' of a system. This could be explored by considering not only the conventional (linear) aspects such as an Actor, performing a Transformation for a Customer. One also needed to consider the overall world view, or Weltanschauung, through which the operations of the system should be viewed, who was the Owner of the system (the one who can demolish it) and the overall Environment in which the system is constrained to operate. This is expressed in his famous acronym CATWOE.

What is the systems-thinking difference?

The common features from the above ways of system-thinking include emphases on:

- thinking about the ways in which factors interact with each other, not just how they influence the outcome;
- the nature of feedback, whereby the results influence the inputs; and
- thinking about the nature of the systems boundary: what should be included, and what ignored, when considering an issue.

Relevance to evaluation and audit

Systems-thinking is part of a suite of approaches or techniques that might be used to address real-world problems. Using systems-thinking can lead to a more complex form of analysis that is sometimes harder to explain to clients and other stakeholders. Only if it is going to lead to better understanding and hence better decisions than an alternative approach should it be used.

In many cases, straightforward techniques can be used to give useful information for decision-making. Direct or linear theories, for example program logic, will normally provide good explanations for most of what is going on in a program. From a point of view of trying to make improvements, consulting with stakeholders and with those delivering the program, considering better practice and reviewing processes will often yield immediate improvements. Only when the context is such that simpler evaluation processes do not yield results should an evaluation consider the more complex systems approach.

Performance Measures and Systems -Thinking

In performance audit, we pay serious attention to performance measures. It is one of the first lines of inquiry. We can ask 'How well are you doing? How do you know? How do you measure it?' We can then review performance measures for the normal attributes, for example that they are measurable, relevant to the service delivered, economic to collect, and easily understood.

In many areas, of which policing, courts administration and road safety form one group, those who are in charge of delivering services, will often say that while they

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respect the intent of performance measures, things are different and difficult in this area. Among other things, performance measures may:

- displace activity: effort is directed to meeting the measure, potentially displacing activity that is more effective in achieving the overall goal (known as 'gaming the performance measure');
- only measure the volume of activity rather than the effectiveness or quality of that activity, as the volume is known but the quality may not be so easily measured;
- need undue effort to collect data that are not seen as relevant to local management;
- in some cases be perverse, that is that action to achieve the performance measure is harmful to overall objectives (e.g. a performance measure on accuracy of budget-setting may lead to wasteful expenditure at the end of the financial year in order to make expenditure match the budget); or
- be set at the wrong target level.

These are well-recognised issues for performance measures. For example, the setting of achievable but demanding targets is a feature of a good performance measurement system.[3] If the target is set too low, then the organisation has little incentive to deliver additional output in that area, even if it is quite possible and advantageous to the achievement of the final objective.

In the following we consider some examples of performance measures considered in recent performance audits, and then consider what is going on from a systems perspective. This can help in both overall understanding of the issue and in devising better approaches to performance measurement.

Policing and Road Safety

The ACT Audit Office has done two audits in recent years that touched on road safety. One was an audit of the arrangement by which the ACT acquires policing services from the Australian Federal Police (AFP). In 2006, we completed an audit of the contribution of the ACT Department of Urban Services to road safety.

The policing audit, among other things, discussed the development of performance measures for policing. Here we take this issue, focusing on performance measures related to road safety, and discuss it from a systems perspective.

Performance measures can address inputs, activities, outputs and outcomes. Early policing agreements between the ACT and the AFP had had many different measures that covered all of these aspects. The AFP had concerns about this and sought to simplify the agreement so that there were fewer performance measures that focused on the higher level issues of outcomes. For example, measures such as number of roadside breath tests administered were dropped as they were seen as potentially distorting operational priorities. Instead, the agreement used measures that were

[3] Smith, Graham *Risk Management and Evaluation – Linkages and Contrasts*, paper presented to AES Conference Auckland 2003.

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labelled as outputs (but were really outcomes) such as numbers of road deaths. Other performance measures include the proportion of people who self-report to driving over the speed limit, over the alcohol limit, or without a seatbelt, as determined by an independent survey of the ACT population. This issue can be diagrammed as in Figure 1 below.

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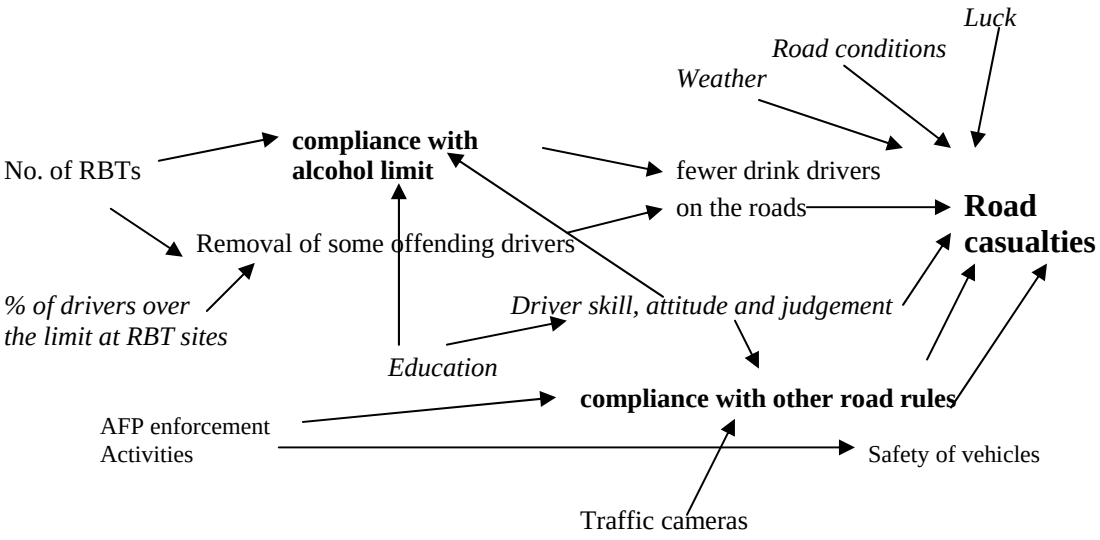
Figure 1 Road Safety: Systems linkages and performance measures



Note: Performance measures used by the AFP are in **bold**
Factors beyond, or effectively beyond, the influence of the AFP are in *italic*s

This picture, which is still a simplified picture of the influences on the overall road safety issue, illustrates the following issues:

- There are many influences on the overall objective, fewer road casualties. Focusing on achieving activity measures such as a target number of RBTs may distort the most effective use of resources.
- There are many factors other than those controlled by the police that influence the road safety outcome.

Factors such as road conditions, driver skill and attitude and vehicle condition (not to mention weather and luck) influence the outcome of road casualties, but are only marginally affected by actions by the police. The policing agreement states the target level of casualties, but it is not possible to hold the police responsible for this in the sense of a normal contractual deliverable.

In the case of the policing audit, the audit view was that performance measures should cover all facets of performance, namely quantity, quality, timeliness and cost. Measures of quantity would help to ensure that the Territory received a reasonable quantity of services.

Audit also felt that quantity measures provide context, when considered with other measures such as quality and timeliness. If questions are raised about the achievement of outcomes, quantity measures such as number of incidents responded to or number of patrols could provide assurance that there was an adequate response. Partly because of this issue, separate reporting on the numbers of police was commenced. This was always an element of interest. For example, budget

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announcements would refer to specific increases in police numbers, even though police numbers as such were not a performance measure.

In the audit of road safety carried out in the ACT Department of Urban Services, the end objective was similar, namely reduction of road deaths and injuries. The same influence diagram, Figure 1, applies, although in this case there are different factors over which the Department has some control over and those over which they do not.

The approach to performance measures in the Department of Urban Services was quite different to that used by the AFP. Departmental performance measures included a strategic indicator related to road deaths, and one activity measure, namely the proportion of vehicles inspected for roadworthiness. Other factors, such as the number of audits of driving instructors and number of speed checks by cameras, are measured but are not formal performance measures.

When considering Figure 1, we see that there are several different influences on road deaths and injuries with many distinct organisations having partial responsibility for the outcome. Focussing on a limited set of measures at the input or process level may not cover all paths to the final outcome and may distort behaviour to the detriment of the outcome. On the other hand, focusing on the outcome may not actually tell us a great deal about what is going on to cause that outcome. It certainly will not assist in providing accountability measures when it is obvious that the one organisation does not have anywhere near total control over that outcome. For example, in the ACT, the number of road deaths spiked in 2005 for reasons that are still not known –it may have been random fluctuation. Despite the fact that this is listed as a key performance measure for the ACT policing, quite reasonably there has been no public discussion or criticism that, in some sense, the police have not delivered on their contract.

What, then, can we do to better understand systems and to provide better performance measures to enable better monitoring and hence better performance? The answer, I believe, is to maintain a carefully balanced suite of measures that cover inputs, processes, activities and outputs as well as outcomes. These should be supported by reference to a system map of influences that will then help to decide at what precise points we need to measure and monitor in order to have an overall picture of the system as a whole.

Courts Administration

The audit of Courts Administration in the ACT also looked at performance of a complex system in which many parties were involved. There was also an explicit boundary-setting issue, one of the main features that make up systems thinking. The Audit Office considers boundaries by defining the scope of an audit to be of one or a small number of government entities. All other relevant parties are considered as context, or as communication with stakeholders. Given our legislation, and the way we wish to complete tasks in a reasonable time, this may the only practicable approach. In our audit of Courts administration, for instance, the audit was focused on an administrative entity, called ‘Law Courts and Tribunals’ that provides administrative support to the Courts. We had no audit mandate on the courts themselves, who enjoy judicial independence. We also did not audit, but consulted,

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other government organisations that are part of the system, such as the police, the Director of Public Prosecutions, Legal Aid and the Victims of Crime coordinator. There are also many non-Government players, such as lawyers, litigants, suspects, and other groups such as Prisoners Aid.

The interaction of the various parties results in issues such as delays in the scheduling and progress of cases being unable to be ascribed to a single cause or a single actor. The systems nature of the problem is indicated by the following interacting factors:

- Scheduling of cases is imperfect because many cases fail to proceed at short notice, because of factors such as prosecution or defence not being ready, or late change of pleas to guilty, or late settlement of civil cases.
- There is reluctance to have penalties for late changes to guilty or late settlement, as despite the fact that this wastes court time, a late settlement or guilty plea is better from a resource point of view than no settlement at all.
- Overscheduling of cases is a potential response to this. However, this can in turn cause resource problems for parties – the courts, lawyers and others – if more cases than predicted do proceed.
- A high degree of oversheduling will lead to some cases not proceeding because the court is not able to deal with the schedule it sets itself, and this will tend to lead to lawyers not taking the schedule seriously and therefore being more likely to be unprepared to go on.
- Out-of-court settlements are more likely when a firm date for a hearing draws near.
- Where lawyers are unable to go on because they are unprepared, the potential court penalties are limited. For example, because of the possibility of miscarriage of justice, it would be rare for the judge or magistrate to force the case to proceed if the lawyer is not ready.

As the audit noted, there is an understanding of systems issues in the Court, together with some frustration that although they are not fully in control, blame for delays and other inefficiencies is primarily directed at Courts.[4] The audit also noted that decisions taken by other ACT Government departments may not take into account the flow-on impact on Court services. The audit recommended that the government consider effectiveness of compliance and other mechanisms (such as costs and fees) to encourage efficiency.

Performance measures for Courts Administration

In the case of courts administration, there is a set of performance measures that includes input, process and output, and so can potentially give a broader picture of how the system in operating.

[4] ACT AGO Report 4 of 2005, p.45

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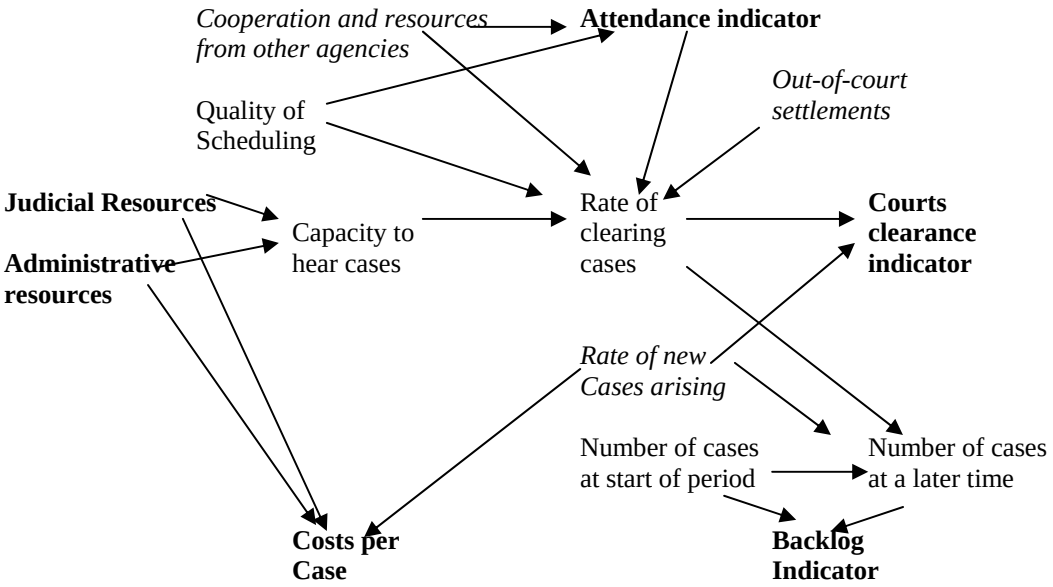
The following lists the indicators used, and discusses briefly their typology in a systems dynamics perspective:

- courts clearance indicator – ration of cases finalised to cases lodged. (Flow indicator);
- level of complaints against criminal justice agencies (Feedback indicator);
- backlog indicator – percentage of cases exceeding benchmark timeframes (stock indicator);
- attendance indicator – number of times parties have to attend court per finalised case (resource indicator);
- judicial resources (resource indicator); and
- cost per case (resource indicator)

The interrelation between these indicators is indicated in the diagram below. As before, this is as a much simplified depiction. In particular, the performance measure on complaints is not depicted, because it is not clear exactly how this is influenced by the factors in Figure 2 below.

Figure 2 Courts administration: Systems linkages and performance measures



Note: Performance measures used by Courts Administration are in **bold**
Factors beyond, or effectively beyond, the influence of Courts Administration are in *italic*s

Figure 2 indicates that the performance measures monitor what is going on at several key points in the Courts system. It does not cover all aspects. In particular, it cannot measure influences on the system from elsewhere, such as cooperation from other

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agencies and the rate at which new cases arise. Even these apparently exogenous factors, can be influenced by actions within the courts system. For example, the speed at which cases are disposed of can have an effect on the likelihood of those with a dispute deciding to take the case to the court system; and out-of-court settlements are more likely when the scheduling is firm.

Conclusion

There are many situations that are amenable to straightforward analysis. For example, when resources are lacking, results are less than expected. If people are not trained, it is more likely than not that there will be problems delivering a service. If rules of good practice are not followed, then it is likely that a program will not be efficiently run. These are the fairly obvious situations that, at the core, are what many audits and evaluations are about. It is not to say that the reviews do not need a great deal of art and craft; they do. The 'answer' as put baldly above, is rarely apparent without a good deal of investigation and analysis, and the stripping away of irrelevant details. Nevertheless, a great deal of progress can be made to many situations without needing to employ a systems approach.

But when the usual methods fail, or analysis is yielding perverse or unexpected results, or perhaps there are unusual dynamical trends involved, than a systems approach may be worthwhile. This will take more time, and more explanation to clients and stakeholders. The systems approach may be needed when there are obvious feedback loops involved that will mean that as simple linear approach will not work. The most obvious example of this is in situations where there is contest or competition; what one party does depends on the strategies that the other party adopts. This is one reason for the Courts system showing complex behaviour.

The systems approach is also a good way of exploring boundary issues. This occurs when the nature of the problem, and the way of thinking about it, depends on how large the system is. For example, analysis of operations within a court system is different to analysis of operations of the entire justice system.

These issues have been widely discussed in the literature. What has not been so widely discussed is the interaction of performance measures with systems thinking, By constructing the interactions and logical flows within a system, one can then check whether the performance measures that are proposed capture most of the interactions and operations of the system. This in turn allows the collection of performance measures to give a more comprehensive understanding of the system, and so the possibility of implementing improvements to such complex administrative issues.

Bibliography

ACT Auditor-General's Report No. 1 of 2004, *Administration of Policing Services*

ACT Auditor-General's Report No. 4 of 2005, *Courts Administration*

ACT Auditor-General's Report No. 4 of 2006, *Road Safety*

Beer, Stafford. *Brain of the Firm*, John Wiley and Sons, 1995

Checkland, Peter. Systems Thinking, Systems Practice, John Wiley, 1981

Forrester J. W. *Industrial Dynamics*. Pegasus Communications: Waltham, MA, 1961.

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Email: aes@aes.asn.au **Website:** www.aes.asn.au

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

Senge P. 1990. *The Fifth Discipline: The Art and Practice of the Learning Organization*. Doubleday: New York.

Sterman, John D. *All models are wrong: reflections on becoming a systems scientist* Syst. Dyn. Rev. 18, 501–531, (2002), also available from http://web.mit.edu/jsterman/www/All_Models_Are_Wrong_(SDR).pdf

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