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The 3E Methodology for Developing Performance Indicators for Public Sector Organisations

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Abstract
Measuring the performance of organizations in both the private and public sectors is an ever-growing phenomena and this is increasingly true of academic universities and research institutes. The results can have major financial and reputational consequences. Methods have been developed for generating performance indicators particularly in the private sector but these have limitations, especially when applied to public sector organizations which often have a diversity of missions, values and stakeholders. This paper describes a new methodology for constructing a set of indicators that was developed as part of a project to evaluate the performance of the Chinese Academy of Sciences (CAS). The methodology has several important
characteristics: it works from the mission and values of the particular organization rather than a predefined template; it has a logical and transparent method for moving from high-level missions down to low-level indicators; and it is based on discussion and agreement with stakeholders at all stages. The methodology is illustrated through the CAS study but it is generalisable to any organization. It has a sound theoretical base from Soft Systems Methodology.

Introduction

Evaluating the performance of organizations across the public and private sectors is assuming

ever greater significance, not least within the academic world where numerous rankings and league tables of universities and research institutes often have significant reputational and financial consequences. Most of the existing quantitative evaluation methods are based on two ingredients: a set of indicators (or performance measurements) and methods for combining them into a single overall scale. The latter often involves some form of weighting system dependent on the nature of the indicators. Currently, formulation of most indicator systems uses a combination of experience, opinions of expert panels, and sometimes statistical methods such as regression. However, such a strategy has no guarantee of producing a suitable indicator system for a particular evaluation, especially when no similar evaluation has been conducted before. Thus it would be very useful for evaluators to have some frameworks or procedures that can help them to formulate a suitable indicator system for a particular evaluation.

Such frameworks do exist, particularly in the industrial and business world, for example the Strategy Map (Kaplan and Norton, 2004), which has been used to develop performance measurements in particular instances. However, they tend to make some pre-supposition about the structure or processes of the organisation. For example, in the case of the Strategy Map there is a vertical dimension consisting of Finance, Customer, Internal, and Learning and Growth perspectives while the horizontal dimension is structured in terms of shareholder value. This does not fit well in the public sector: the missions of public sector organizations are often very different from each other, and so are their organizational structures, values (which are very important in public organizations), cultures and governing roles. Furthermore, funding and capital distributions are diverse and certainly different from the business sector.

Moreover, such frameworks tend not to have a structured method for deriving specific performance indicators in a logical and coherent way. It is often easier to derive the top level indicators by using these frameworks, but then further down the relationships become rather ad hoc – they often seem sensible but one can always ask "why this and not that?”.

This suggests that what is needed is a methodology with a sequence of logically structured procedures that can help develop an indicator system suitable for a particular organization no matter what its purpose or activities. The methodology that we have developed has two principal strengths:

- It provides a means of moving from quite high-level organizational missions and objectives to all levels of managerial activities in order to develop very detailed performance indicators in a rigorous and transparent manner.
- It does not necessarily follow the current organizational practices (which may well benefit from significant change and improvement) but allows for a particular view of the purpose of the organization to be articulated and then follows through the logical implications of that view.

There are already some attempts that try to address this aspect, for example, Casu et al (2005) and Meng, Mingers and Liu (2007). However, these examples are quite case dependent while this study attempts to address this issue at a higher level.

A 3E Framework for Evaluation

We will first describe a generic model for the evaluation of organizations. At its most general, an organization can be seen as a human activity system, that is a system of people and resources that exists to conduct some purposeful activity (Checkland, 1981). If it has a purpose (although there may be debate about that purpose) the system must produce or

generate some output which could be products, services, or information and knowledge. In order to do this it will require resources and the outputs it produces will have effects, desirable and undesirable, on its environment and wider systems.
To evaluate its overall performance we may ask three questions (Checkland, Forbes and Martin, 1990):

- Does the system actually produce the outputs that it is supposed to (*Efficacy*)?
- Does it produce them in a manner that is not extravagant in using resources (*Efficiency*)?
- Are the outputs appropriate for the wider system (the "owner" of the system) and the system's environment (*Effectiveness*)?

This is illustrated in Figure 1.

Fig.1 Overall evaluation framework

Therefore, logically an organization can be evaluated in terms of these three categories of criteria, and for each one there will need to be some measure(s) of performance (the indicators) as well as some standards as to what would constitute acceptable performance (Behn, 2003). Thus the indicators that are generated will belong to one of the three E-categories:

- E1-efficacy – concerns WHAT the system produces;
- E2-efficiency – concerns HOW the system produces it;
- E3-effectiveness - concerns WHY the system produces it.

Another way of looking at this is to ask how the system might fail? The transformation might not actually produce the output (efficacy); it might produce it uneconomically (efficiency); or the output might not actually satisfy the aspirations of the owner (effectiveness). It is also possible to have a fourth E: ethicality – is the transformation carried out in an ethical and sustainable manner?

These basic ideas are not new and are in fact drawn from a well-established approach to problem structuring known as Soft Systems Methodology (SSM) (Checkland, 1981; Checkland and Poulter, 2006; Checkland and Scholes, 1990) which will be described in more detail at the end of the paper. There are similar, although not identical, formulations already in existence. The public sector has traditionally used economy, efficiency and effectiveness (Goddard, 1989) but this has weaknesses: it ignores efficacy (is the output actually produced?); economy can be seen as part of efficiency, and as Midwinter (1994) argues, the emphasis tends to be on economy with effectiveness barely being considered.

Johnsen (2005) suggests efficiency, effectiveness and equity where equity may clearly be an explicit requirement of public organizations but not of private ones. We would suggest that equity could be seen as part of the wider agenda mentioned above of ethicality or sustainability. Moreover, for Johnsen effectiveness is the relationship of the outcomes to the inputs but this is easily confused with efficiency. It is better to relate the outputs to the objectives of a wider system. This is clearer and brings in three levels of analysis – the

system as a whole and what it does (efficacy); the processes within the system (efficiency); and the wider ownership systems (effectiveness).

Our 3E measurement framework is not only a realisation of the common principle of performance measurement: - measurement of processes + measurement of outcomes (here E1-E2 for the former while E3 for latter), but also a tool to develop structured indicators for sub-processes at a micro level. In fact the main advantage of the approach advocated here is not simply the clarity and coherence of the categories of PI, but the fact that it includes a rigorous and systemic method for generating indicators of hierarch structures appropriate to any particular organization without simply mapping the processes as they are currently configured.

Methodology for Developing a 3E Indicator System

The core of our method is to continuously ask and answer the questions: *what to do*? *why do it*? and *how should it be done*? with all the relevant stakeholders, following carefully structured and constructive procedures. We summarize the proposed procedures in the following five steps:

1. Determine the overall mission of the organization (or part of it). This may already be agreed and available, or it may need a process of discussion and debate among a variety of stakeholders to reach a consensus or accommodation. Resulting from this, the main functional areas or primary activities of the organization need to be agreed. As part of this step the objectives of the evaluation itself should be specified as this will inform the focus and boundaries of the process.
2. For each key activity a definition of *what* is to be done, and *why* it is to be done in terms of higher level systems is produced. Often it should connect to the "what to do" question in the higher level activities.
3. The activity is then broken down into a set of sub-activities or actions which together should logically ensure that the overall purpose of the activity is achieved (the *how*). They may or may not be the same as the current practices in the organization. Consensus, or at least accommodation, needs to be reached among the relevant stakeholders. Also the inter-connections with other key activities should be considered. At this point the performance criteria, E1-E3, are specified together with their measures or indicators and appropriate standards or levels.
4. It is often the case that initially the level of the activity is too general to be able to identify all the necessary indicators. When this happens steps 2) and 3) should be repeated for any sub-activity for which this is felt necessary. Then 4) is repeated recursively until all activities result in satisfactory PIs.
5. A complete set of indicators can then be extracted from the activity models and classified in different ways, for instance in terms of the general type of activity involved, or according to the area(s) of the organization.

For those familiar with SSM, it is clear that these steps bear similarity to parts of the seven steps in SSM analysis, and this will be elaborated further later.
These steps have been illustrated in the following flow chart which will be explained in more details below:

Fig.2 The main steps to develop performance indicators

We will use as an example a project undertaken for the Chinese Academy of Sciences (CAS) to illustrate these procedures (Mingers, Liu and Meng, 2009). CAS was founded in 1949 to develop capacity in natural science and technology. In 1998, the Knowledge Innovation Programme was launched to enhance its innovative capability, competitiveness and sustainability. At the end of 2004, it encompassed over hundred science and technology units including 89 research institutes, universities and libraries; and employed 33,000 researchers (Suttmeier, Cao and Simon, 2006). CAS is concerned to monitor the performance of its institutes and to ensure that the resources invested in it is properly used, and to this end has its own internal Research Evaluation Centre (REC). A requirement from the REC is to have an indicator system for evaluating the basic research conducted in CAS. Since the research institutes are basic units of research activities of CAS, we were asked to develop indicators for the basic research performance of a generic research institute in CAS.

Step 1: We start the process at the level of CAS as a whole. At this top level, CAS does not itself do research but is responsible for monitoring and controlling the work of its constituents which actually do carry out the research. Although our focus is a generic institute we need to look at the higher level in order to consider E3, effectiveness, in terms of the institute's owner, namely CAS. This could be done from existing documentation but it is often better, especially in terms of commitment to the results, to engage in a process of discussion and debate.
A mission statement on basic research in the form of *what-how-why* for CAS was agreed as follows:

CAS as a whole
1. To improve the originality, significance, reputation and sustainability of CAS basic research in the natural sciences. (What)
2. By developing the research capabilities and infrastructure, and by improving resources utilization of CAS. (How)
3. In order to benefit Chinese social and economic development and to enrich human knowledge. (Why)

Step 2: From this top level it was then possible to discuss and agree a mission statement for a generic basic research institute as follows (again in the what-how-why format):

Generic Institute
1. To enrich the world's knowledge in a particular scientific domain with original and significant research.
2. By identifying potential areas of discovery, developing the capabilities to undertake appropriate research, carrying out the research and disseminating it through prestigious channels.
3. In order to enhance the reputation, resources and sustainability of CAS and the Institute.

All the stakeholders were involved in the discussions. In mission statements such as these it is helpful for clarity to focus only on a single aim in terms of "what to do", and to specifically relate this to the aims of the higher level statement. If several different things need to be done, then each will need such a statement to proceed. Note that the "why" part of the statement refers back to the "what" part of the higher level statement.

Step 3: The next step is to think about how to achieve "what to do", in this case "To enrich the world's knowledge …", via a sequence of connected actions. It is possible to just follow the practices already being carried out in CAS, but it will be a chance for CAS to rethink its management procedures if we first logically construct a most reasonable sequence of actions to achieve the goals, and then have discussions and feedback with the stakeholders of CAS to reach an agreement. If eventually a different management model is agreed, then we will develop this indicator system via the new model, although then some data may not be available. Through this step, we reached the following system of activities (Figure 3):

Figure 3 Activity model for a generic basic research institute

In this model it is considered that there are seven activities necessary for achieving the stated purpose of "enriching the world's knowledge with original and significant research". In general, not more than nine activities should be considered at each level. More detailed activities can be further considered at a subsequent level. As well as that we can see that the 3Es are used to monitor and control this system. Efficacy and efficiency are considered to be at the internal or operational level as they are concerned with producing the desired output. Effectiveness is at the strategic level as it concerns whether or not the output is actually the correct one given the aspirations of the wider system.

Step 4: Since at this stage, it is not clear what are suitable indicators for measuring these activities, steps 2 and 3 are repeated for each of the seven activities in turn. Thus for each activity we agree a what-how-why statement and then a model of activities.
For example, the following what-how-why statement was agreed for activity 1 – in Figure 3 ("identify potentially significant areas of discovery"):

Activity 1:
1. To identify potential research opportunities for the institute that are significant and original having regard to the necessary resources and capabilities.
2. By effective external scanning and by improving internal discussion and communication.
3. In order to decide which opportunities to enrich the world's knowledge in the scientific domain of the Institute.

Possible actions to achieve what to do –"To identify potential research opportunities…" were discussed and feedback were sought again. The information was then used to generate the system of activities shown in Figure 4 after discussion with CAS.

Figure 4. Activity and sub-activity models for "Identify potentially significant areas of discovery"

Figure 4 shows five activities concerned with "identifying potentially significant areas" (1.1 – 1.5) and also shows a further level of resolution – sub-activities for activity 1.1 "Scan external environment" (1.1.1 – 1.1.5).

After this step, some indicators can easily be seen. For example, for activities 1.1.1-1.1.5, the following indicators were developed:

E1 Efficacy: Number of potentially significant areas discovered
Plus more detailed indicators for each activity: 1.1.1 satisfaction assessment of current information system, 1.1.2 funding to support necessary activities, 1.1.2 facilities utilization, 1.1.3 new academic organization position, 1.1.3 number of conference attending, 1.1.3 number of organized conferences, 1.1.3number of academic visitors, 1.1.3 number of presentations, 1.1.5 reports or proposals list potential significant scientific opportunities
E2 Efficiency: Amount of outputs/ resources used (e.g., time, money, administrators)
E3 Effectiveness: Do the areas discovered lead to good opportunities for research

The above analysis and feedback have to be carried out until all the actions have been measured using 3E indicators. In the work with CAS the final model had went down to four resolution levels and included over 70 activities.

Step 5: Then an indicator system is formed based on all the measures of performance that have come out from the various activities. Some of them are shown in Table 1 where the number by each indicator shows which activity in the model it came from. This enables its chain of functions to be easily determined. Sometimes the same indicator may be derived from several activities – the more time it appears the more important it is.

The above indicator system has been used as the framework for basic research evaluations in CAS. More detailed discussion about the use that was made of the indicators in CAS can be found in Mingers et al (2009). In this indictor system, some of the indicators can be seen as primarily concerned with efficacy – is new knowledge actually produced (SCI publications, research grants etc.) while others concern the higher level of effectiveness – does the research actually contribute to the reputation and sustainability of CAS (citation numbers, important prizes and positions in major academic organizations).Interestingly, the indicators did not only cover direct scientific research and communications but also issues of internal management and sustainability. In other words, the indicators did not simply cover research but also the overall management and well-being of CAS institutes.

Theoretical Base of the Methodology

Our method has drawn on Soft Systems Methodology (SSM), a systems-based approach to problem structuring and taking action in soft, complex situations. This has been developed over 30 years of engagement with real-world problem solving (Checkland, 1981; Checkland and Poulter, 2006; Checkland and Scholes, 1990) and is now one of the most well-know systems methodologies (van der Water, Schinkel and Rozier, 2007).

SSM begins with the idea that organizations are systems of purposeful activity that continually bring about change or transformation. Actors undertake activities that produce some output, which could be a physical entity, a service or information, for a notional customer. The system operates on behalf of an owner, who has the power to terminate the system, within an environment not under its control (see Figure 5). These elements are known by the acronym CATWOE – Customer, Actors, Transformation, Weltanschauung, Owner, and Environment.

Figure 5. Elements of a system of purposeful activity

SSM recognizes that different stakeholders may well have different views (*Weltanschauungen*) about the nature and purpose of a particular organization and so it builds

models to reflect these varied viewpoints. These models consist of a *root definition* which is a concise description of what the system is, and an *activity model,* which is a model of the activities necessary to achieve the transformation specified in the root definition. The mission statements above are actually cast in the form of a root definition from SSM, which provides a useful structure in terms of *what* to do, *how* to do it, and *why* it should be done, thus explicitly bringing in the three levels of analysis mentioned above.

The aim of SSM is to use these models to facilitate a debate among the various participants and stakeholders with a view to bringing about some agreement or accommodation about potential changes to improve the problematic situation. It is important to be clear that, epistemologically, the models in SSM are not models *of* the world as such but models of concepts or ideas that are thought to be relevant to improving the problematic situation.

Traditionally, SSM consists of seven stages although these are seen as both cyclical and iterative.

1. Recognize the complex and unstructured problem situation
2. Explore the situation and the intervention to find out about the issues, the prevailing culture, and the political dimensions
3. Identify purposeful actions or activities that may be relevant to the situation and describe them in root definitions each with a CATWOE.
4. Articulate these into sets of linked activities (activity models) needed to achieve the purpose described in the root definition. This includes consideration of monitoring and control activities through the 3Es. Where necessary, expand the activities into further levels of detail.
5. Compare the models from 3 and 4 with the understanding of the situation from 1 and 2 in order to identify ideas for change and improvement.
6. Through a process of discussion and debate gain agreement for changes that are both desirable and feasible.
7. Implement the agreed changes.

It can be seen that the method for developing performance indicators described in this paper mainly involves stages 3 and 4 of SSM. We now illustrate the methodology with another case study within a university setting.

Case Study: Foreign Language School of Hunan University[1]

Scientific research, as one of the three main functions for higher institutions, is increasingly recognized in China. Nowadays more emphasis is placed on scientific research rankings which, to some extent, can influence the funding and position of a university. Academic schools are the basic units of a university. Thus it is vital to study how to evaluate and manage the scientific research level and scientific research achievements of these schools, in order to invest the limited resources to those of potentials.

Hunan University has a long history but it is now a middle-ranking university in China. The University is determined to recover its past glories: “The target is to build up a distinctive and comprehensive University, which reaches national top research level and marches towards international high ranking university.” This aim should be combined with three main duties for higher education: training talents, scientific research and social service. According to the plan of the University, the main development objectives of college should

[1] Note that the research was actually carried out in Chinese – it has been translated into English for this paper.

be formed by decomposing the objectives from top to bottom and distributing the contributions to subordinated schools accordingly. Here, as an example, we discuss how to develop scientific research management procedures and performance indicators for the School of Foreign Languages.

The School is in the process of setting up a management system for its scientific research. The first step of this process is to develop management procedures and the corresponding indicator system for performance evaluation. The authors were invited to join this project. Based on our experience, the above methodology was proposed. A working group was formed with the School Party Leader (in university schools it is normally the Party Secretary who is in charge of management procedures), the Vice-Director who was in charge of research, one secretary, one interpreter and the authors.

Here we report how this project applied the developed methodology to develop indicators for the school's research performance, by setting up management procedures for the School of Hunan University, finally building a scientific research evaluation system which can serve as a model for the scientific research and scientific research management of the other schools.

Step One: Top level analysis. Although the project aims to build an indicator system for the scientific research of the School, the School is obliged to serve the top level purpose---the goal of the University (E3). In theory the goal of a university should be seen from the university mission statement or the related documents, and it should be confirmed and be described in the "what to do-how to do-why to do" format. However, this turned out to be a messy and difficult job since so many things were stated in the mission statement of the University. The Party Leader had to discuss with several relevant people to clarify what is the University's goal to develop scientific research. In the end it was agreed that the development goal of the University is "to build up a distinctive and comprehensive University, which reaches national top research levels and marches towards international high ranking university.", which is quite different from that of CAS.

Step Two: construct a clear mission statement in the form of what-how-why.:

1. To concentrate excellent research in certain selected fields at least at national, some of them at international level (What).
2. By building strong research teams in these fields and producing research results which are in the first class in China or may be useful in language teaching (How)
3. In order to have a first class foreign language college in China with clear characteristics, and some subjects internationally known (Why).

Step Three: construct more detailed strategies for how to reach the objectives. For instance, one should develop strategies for "..concentrate excellent research in certain selected fields at least at national…" . The procedures will first be proposed by the working group and then discussed with some key members of the School. Thus it provides a chance for the School to rethink its development strategy and management procedure and see whether a proper scientific operational mechanism can be established for supporting the realization of the goal. As the starting point, a procedure similar to the one used in CAS was used as the initial model, as shown in Fig 6, since we thought that the main procedures of carrying out scientific research should be more or less universal.

Figure 6. Initial research activity model for of School of Foreign Languages.

After initial feedback with some key members of the School, it was clear that the emphasis of the research policy of the School was quite different from that of CAS. It turned out that the School mainly emphasized two outcomes from its research – that it should either bring the School good national or perhaps international influence, or that it should be useful in teaching activities either within the School or even nationally, for example, a method for potentially increasing students' vocabulary. At this stage, the School thinks it should first become well-known nationally rather than internationally whereas the CAS aims at the top level of the international research community. After several feed-back and discussion sessions, the following conceptual model (CM) (the detailed HOW) was agreed and introduced:

Figure 7. Agreed research activity top level model for of School of Foreign Languages.

Step Four: Again at this stage it is not clear what suitable indicators for measuring these activities are. Thus steps 2 and 3 were repeated for each of the ten activities in turn. For each activity we agreed a what-how-why statement and then a model of activities.
For ease of comparison we here also use activity 1 as illustration. Here the what-how-why statement was agreed for activity one was –Search for potential research topics in order to suit development of the college. In order to develop further activity models for achieving this, we have to discuss many administrative details with the School.
It turns out that in this School, two administrative staff would be assigned to assist the academic staff to identify potential research topics. This was possible since the School aims at research activities of national level so it is enough for some administrators to browse the relevant research council website or discuss potential needs with its teaching staff. This was not possible for CAS where the academic staff had to search for possible topics by themselves due to the high level of research aimed. Furthermore the assigned staff would also compile the collected information and the school guidance into a handbook. The information was then used to generate the system of activities shown in Figure 8 after discussion with CAS.

Figure 8. Activity for "Seek for the research topics with development potential"

Figure 8 shows six activities concerned with "identify research topic of potentials" (1.1–1.6). For the activity 1: Define the boundaries of scans, it is clear and logical that the School needs to provide topic key words to the assigned staff for searching, and these key words have to be discussed and agreed by the academic staff. However it is still not all clear where the 3-E indicators come from for activity 1.2. To this end, we provide an example to develop a further level of resolution – sub-activities for activity 1.2. The what-how-why statement is: Provide lists of opportunities and classifications of potential research topics in order to select suitable ones for the School later. Then after several discussions within the working group five activities (1.2.1–1.2.5) in Fig.9 were agreed. After this step, some indicators can easily be

seen. For example, for activity 1.2.1, the following indicators were developed as shown in Figure 9.

Figure 9. Sub-activities for activity 1.2 and indicators for 1.2.2

In the process of building the activity concept models of scientific research of the school as the above procedures, the whole model is divided into four levels consisting of 112 steps.

At this stage, a formal feedback discussion meeting was organized for the working group members and staff representatives from all different levels were invited. The working group introduced the background of building scientific research management conceptual models and the significance of feedback by researcher. Then SSM was briefly introduced and the main working pattern – comparisons between logic and real worlds was emphasized. The proposed research activity models were discussed level by level from top to bottom, and the suggestions were first discussed and then recorded. All of which created a theoretical foundation for the future establishment of scientific research evaluation index system and performance evaluation. The outcomes of the feedback are summarized as follows:

A: A preliminary understanding of the general objective generated by the University and the School has been agreed. It is agreed to be necessary to know the objective and procedure of scientific research. The concern is how to realize those objectives.

B: All agree with the fact that the scientific management is sorely needed judging from the current scientific research management situation in the School and University.

C: Many questions and suggestions were raised about the details of the models. It was then believed that after such feedback and discussions, building management and indicator system now has theoretical justification and scientific support. It should be possible to apply this methodology even in other schools as well. It was agreed that the modified models can be used as the base of developing scientific research management procedures and performance indicators.

Step Five: A complete set of indicators was then extracted from the activity models and classified in different ways, for instance in terms of the general type of activity involved. Table 1 provides an example of representing the indicators further into four parts, namely direct output, academic exchange, sustainable development ability and scientific research management.

	Direct Research Outputs	Academic Exchanges
1	1.3.4.2 Research grants	1.1.3.4 Visitors to outside universities
2	8.4.5 Key subjects of provincial, national	1.5.3 Invited well-known researchers
3	9.2 SCI, SSCI publications	9.5 Numbers of workshops, audiences
	……	……
	Sustainability	**Internal Management**
1	1.1.3.5 Numbers of new research projects；	1.1.1 Numbers of subscribed Journals
2	1.3.4.2 Numbers of research teams	1.2 Research project management satisfactory
3	7.3.4 Young talents introduced；	8.5 Research monitoring system satisfactory；
	……	……

Table 1 E1 indicators from activity models categorised

The developed indicator system can be used to evaluate the research performance of the School. The indicators can be classified in different ways for instance as 3E, into groups of activities, or for different evaluation objectives. Furthermore the relationship of the indicators and the management activities from which they are derived is very clear. .

Furthermore the above research activity models provide a base of structured research performance management framework. For instance, the agreed activities can be used to job-designs of administrative and academic. The intrinsic cause-effect relationship between different levels and different sets of research activities can be used to design managerial procedures later on, and furthermore the derived indicators will be nicely served as the performance indicators of the performance management system. However more research is still needed to explore potential applications of the models in these aspects.

Conclusions

In summary, the methodology provides structured management process for generating consistent and coherent sets of indicators, and it is at the same time transparently open and based on debate and discussion among managers and other stakeholders. Furthermore it is possible to discuss the first level of actions by using other methods like Strategy Maps and then apply our methodology to develop detailed models.

The indicators can also be used for a comprehensive evaluation of the overall performance of the organization. In this case it will usually be necessary to amalgamate the indicators in some way to provide a single figure measure. The structure of our process helps with this. The intrinsic cause-effect relationship between different levels and different sets of indicator is the backbone of the indicator system. Thus one should utilise such characteristics in combining these indicators into a single overall scale. For example, aggregation should be carried out level by level from the bottom up to maintain the structure. As well as this the hierarchical structures of the system help the procedure of weight selection as the higher the position of an indicator in a set, the greater should be its weight in that set.

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