Towards consistent performance management systems

Simme Douwe P. Flapper, Leonard Fortuin and Paul P.M. Stoop

Eindhoven University of Technology, Eindhoven, The Netherlands

Introduction

The success and continuity of an organization depend on its performance, which may be defined as “the way the organization carries its objectives into effect”. This requires that “all noses are pointing in the same direction”, as every person in the organization contributes to the company objectives via his or her activities. A good manager keeps track of the performance of the system he or she is responsible for by means of performance measurement (PM). His/her staff carrying responsibility for certain activities within the system, need PM to see how well they are performing their tasks. This also holds for the employees actually executing the various process steps. So performance indicators (PIs) are important for everyone inside an organization, as they tell what has to be measured and what are the control limits the actual performance should be within.

Clearly there should exist relationships between the PIs used by the different functions in an organization and the target values (or ranges of values) set for these indicators. However, when looking at organizations it becomes clear that often (too many) PIs are created on an ad hoc basis where no or hardly any attention is paid to the relations between the PIs. This practice may among others result in sub-optimization. Also in literature not much attention is paid to the relations between PIs, except for some general considerations, (see, e.g., Wisner and Fawcett[1] and Doumeingts et al.[2]).

The purpose of this paper is to present a systematic method for designing a consistent performance management system (PMS) to be used in practice where explicitly attention is paid to the relations between PIs. By a consistent performance management system (PMS) we mean a system that covers all aspects of performance that are relevant for the existence of an organization as a whole. Such a system should offer management quickly insight into how well the organization is performing its tasks and to what extent the organizational objectives are realized. The method consists of three main steps:

The authors wish to thank the business unit IES of the Dutch KEMA company and especially Mr R.L. Otter, for providing a concrete case study.
defining PIs; and
(3) setting target values or ranges of values for PIs.

Within this context a new classification scheme for PIs is presented, based on three intrinsic dimensions of every PI namely:

(1) the type of decision that is supported by the PI;
(2) the aggregation level of the decision; and
(3) the type of measurement unit in which the PI is expressed.

How to use this method is illustrated for the control of projects by a consultancy firm. Finally attention is paid to how to maintain and redesign a consistent PMS.

A new classification scheme for PIs

Many different PIs are used in practice. Hereafter an overview of PIs mentioned in the literature is given, subdivided according to some of the most well-known existing classifications for PIs:

- Financial versus non-financial. There is a general awareness that the traditional financial PIs alone no longer suffice to determine the company's health, and that other types of indicators are needed as well. See, for example, Andersson et al.[3], Kaplan[4], Kaydos[5], Keegan et al.[6], McNair et al.[7].

- Global versus local. Thereby very restricted definitions of global and local are used: global PIs are for top management, and local PIs for managers at lower levels. See, for example, Edson[8]; Fry and Cox[9], Maskell[10].

- Internal versus external. Internal PIs are used to monitor the performance of an organization on aspects that are relevant for its internal functioning, whereas external PIs are introduced to evaluate the performance of the organization as experienced by customers or to evaluate the performance of suppliers, where customer and supplier can also refer to different parts of one organization. Also the related subdivision into input (supplier), process (internal) and output (customer) can be found in literature. See, for example, Azone et al.[11], Fortuin[12], Kaplan[4], Keegan et al.[6].

- Organizational hierarchy. The vertical relations between PIs are often based on the organizational structure of a company. The hierarchy functions in a natural way to aggregate PIs at a certain level into a smaller number of indicators at the next higher level (a bottom-up approach). See, for example, Keegan et al.[6], Son and Park[13].

- Area of application. This classification is department oriented: R&D, operations, sales and marketing. The idea behind this classification is
that each department requires its own PIs. See, for example, Azzone et al.\[11\], Edson\[8\], Fortuin\[12\], Kaydos\[5\].

Note that the first classification of PIs primarily focuses on what is or may be measured, whereas the other classifications primarily focus on where what is or may be measured or used. Although the above overviews may be very useful as sources for potential PIs, most of them do not help much to get insight into and to establish relations between PIs, however. That is because the overviews do not tell much about the PIs themselves, i.e. about their “intrinsic dimensions”, which do not depend on where and by whom the PIs are used. Hereafter a new classification of PIs is introduced, involving three intrinsic dimensions (see Figure 1).

**Decision type:** strategic/tactical/operational

Here we focus on the kind of decision the PI is meant to support. If a PI is related to a decision having effect on issues with a time scale of several years, such as position in the market, we are dealing with a strategic PI. On the other side of the spectrum, there are decisions that control daily activities; these are monitored with operational PIs. In between we have tactical PIs for looking at performance with a time scale of weeks or months. It will be clear that a strategic PI without related tactical and operational PIs is at the least very strange. The same applies with respect to operational PIs without any
relation to tactical or strategic PIs. So stating explicitly which type of
decision a given PI is related to helps to establish a consistent set of PIs for a
given organization.

Level of aggregation: overall/partial
If we are interested in the performance of a system as a whole, dealing with the
system as a black box, we define overall PIs. If the black box has to be opened
in order to look at the system in more detail, we move from overall to partial PIs.
Partial PIs will often be used for tracing the causes for a significant good or bad
performance. Examples of overall and partial PIs can be found all over
organizations. For example, for a board of management responsible for the
functioning of a company as a whole, returns on investment for the company is
an overall PI, whereas the returns on investment for part of the company is a
partial PI for the board as a whole, but may be an overall PI for one of the
members of the board responsible for the performance of that part. Another
example concerns the availability of a production line as a whole for which an
overall PI may be defined by the manager responsible for the functioning of the
line, whereas the same manager may introduce partial PIs in order to get
insight into the availability of individual machines in this line during a given
period of time. From the above examples it will have become clear that overall
and partial are relative concepts. Also this dimension helps to get insight into
both horizontal and vertical relations between PIs, although in a way different
from the foregoing dimension.

Measurement unit: monetary/physical/dimensionless
Essentially, there are three types of units in which all quantities can be
expressed. There are indicators that express performance in terms of
monetary units: the monetary PIs. In production and inventory management,
but also in systems like banks and hospitals, insight into performance
requires also PIs such as number of products or customers per unit of time
and throughput times; these are physical PIs, with dimensions such as
units/hour, m³, or kg/m². More abstract PIs, often obtained by calculating a
percentage or a ratio, are dimensionless. We label them as dimensionless PIs.
Service level defined as the probability that no shortages occur during the
lead time of a replenishment order is an example of such a PI. Which
measurement unit is used does not only depend on the activities that have to
be controlled but also on the people who are made responsible for the PI. For
example, a financial manager may be interested in the scrap of a production
department in monetary units, whereas a production manager may use the
total number of scrapped products. Clearly the financial target expressed in a
monetary unit should correspond with the dimensionless target set by the
production manager. The above type of relation between PIs is not revealed
by the two other intrinsic dimensions discussed above. For this reason we
included type of measurement unit as the third intrinsic dimension to reveal
relations between PIs.
Organizational variety
Before dealing with the development of a consistent PMS in detail, some remarks concerning the above classification have to be made. The classification of PIs presented here is not meant to replace the classifications given in the literature. That is because they play different roles in setting up a consistent PMS, as will become clear later. It may be that for a given organization there are no PIs corresponding to some of the blocks in the cube presented in Figure 1. This does not necessarily mean that the set of PIs used by the organization is not complete. This depends on how and by whom things are controlled within a given organization. (Remember the scrap example given above.) Nevertheless all persons in the organization responsible for PIs should analyse critically their set of PIs when there are no PIs used that relate to one or more blocks of the cube.

The development of a consistent PMS
The method we propose for designing a consistent PMS consists of the three main steps presented earlier. These steps will now be dealt with in more detail.

Step 1. Defining PIs
From a bottom-up point of view the tasks which have to be executed within an organization are the starting point for defining PIs, whereas from a top-down point of view the starting point for defining PIs are the functions in an organization responsible for the executing of these tasks. Within the context of each function the following three types of PIs can be distinguished:

1. PIs used by others to judge your performance from their points of view.
2. PIs used by yourself to judge your performance with respect to activities you are executing yourself.
3. PIs used by you to judge the performance of others executing activities for you.

Note that the above classification of PIs corresponds with the classifications of PIs denoted under the sub-heading “Internal versus external”.

We believe that those who are responsible for executing a given task or controlling a certain activity, are able to define a list of candidate PIs for evaluating their performance with respect to these. Thereby it is not necessary to think about relations with other PIs or the company’s objectives; these will be dealt with in step 2. Nevertheless often a top-down approach, where all PIs are deduced from higher hierarchical PIs or organizational objectives, will be used because people will start with defining the PIs that are used to evaluate their performance by higher hierarchical levels in the organization.

In literature several strategies for obtaining PIs are globally described[1,12,14-16]. Most of them involve brainstorming as a starting point. The six sub-steps are:
(1) Brainstorming – uncensored and unstructured generation of candidate PIs. Each participant should write his or her suggestions on cards, one per card, after which the cards should be pinned on a board. Notably in case PIs are defined for the first time or when an existing system of PIs is reconsidered, overviews of PIs given in literature (such as those mentioned in the foregoing section of this paper) may be helpful. After all people executing a given function have defined their sets of PIs, one common set of PIs for this function should be defined from all the following sets.

(2) Clustering – collective removal of doubles. Giving names to potential PIs.

(3) Priority setting – discussion about the relative importance of the candidate PIs, followed by ranking.

(4) Selection – the number of PIs should be reduced as much as possible, so that attention can be focused. See, for example, Keegan et al.[6].

(5) Definition – for each of the remaining PIs its meaning should be carefully written down, and a formula for its calculation should be determined.

(6) Measurement – from the definitions and formulae a list of required data is derived. Answers have to be given with respect to “Which data do we have already?”, “If not, where are they to be found?”, “How can we measure the missing quantities, where can such measurement take place best, and who should become responsible for the measurement?”.

Step 2. Defining relations between PIs
During this step relations between the various PIs are checked or defined. In general two types of relations can be distinguished: relations between the PIs used within the context of one function (“internal” relationships), and the relations between the sets of PIs defined for different functions (“external” relationships). As far as “internal” relations are concerned, these are usually implicitly defined during step 1. So during this step notably attention will be paid to the relations between the sets of PIs defined for different functions.

In order to assist people in revealing relations between PIs, the new classification of PIs as well as the classification of PIs mentioned in the context of step 1 are very helpful. For each PI people using it should state explicitly its values for each of the three intrinsic dimensions as well as the type of the PI according to the classification of step 1, whereas for PIs of type 1 and type 3 it also should be stated for whom it is a PI.

A gain a top-down/bottom-up approach is used. For showing the relations between different PIs, the structure in Figure 2 can be used, where PI 1 is called the “parent” PI, and PIs 2a and 2b are the “children” of PI 1. (Note that there can be more than two children per parent and that each child may be the parent of a number of children.)
It should be possible to link PIs without a parent PI to the company goals. If a vertical relationship is missing, then either this relationship should be put in, or the PI has to be deleted from the list.

The final part of this step is to check whether there are blocks of the cube of Figure 1 for which no PIs have been defined. For each empty block one should check whether there should be a PI in it or not. Again, we want to emphasize that it is not necessary to have all the blocks filled with one or more PIs.

Step 3. Setting target values for PIs
A PMS is not only characterized by its set of PIs but also by the ranges of values triggering different actions. Clearly the latter have to be realistic. Starting from a (range of) value(s) set for a parent-PI, targets are set for the corresponding child-PIs. If targets set for one or more of the child-PIs turn out to be unattainable, the targets set for the other child-PIs belonging to the same parent, or the target set for the parent-PI itself, may have to be changed. So target value setting is a negotiation process, requiring a top-down/bottom-up approach, involving both “employers” and “employees”, “suppliers” and “customers”.

The final responsibility for arriving at a consistent set of PIs for a given function lies with the manager responsible for the performance of the people executing the function.

Case study
The above method to develop a coherent PMS has been used by a Dutch company, working in the field of applied research and implementation of new technologies on a project base, where the duration of a project can vary from several weeks to several years. The goal of the company is profitability based on satisfied customers.
Step 1
The only PIs the company used until recently were profitability and timely completion of individual projects. Due to a changing market situation, the above set of PIs no longer suffices. At a strategic level no longer only insight into the profitability and the percentage of projects that are timely dealt with is required for all projects together, but also for each of the different types of projects that are distinguished by the company based on differences with respect to character (such as a pure research project and a pure implementation project) and type of customer (governmental organization or private-owned company). In a short brainstorm session a group of project leaders generated the following set of ten operational PIs for controlling their projects:

1. The actual total number of hours spent on the acquisition of a project divided by the total number of hours planned for this.
2. The actual total number of hours spent on research or implementation in a project divided by the total number of hours planned for these activities.
3. The total number of hours actually spent on drawing up reports for a project divided by the planned total number of hours for this part of the project.
4. The actual total number of hours spent on meetings in the context of a project divided by the total number of hours for meetings reserved for the project.
5. The actual total number of hours spent by the project manager on managing a project divided by the total number of hours planned for this.
6. The actual total number of hours spent on a project divided by the total number of hours planned to be spent on the project.
7. The actual total number of hours spent by different groups of people in the consultancy firm on a project divided by the total number of hours planned to be spent by each of these.
8. The actual costs of a project divided by the initially set budget for it.
9. The deviation between the actual and the planned duration of a project.
10. The number of concept reports written before the final report is available.

In Table I the three intrinsic dimensions for each of the above-mentioned PIs have been indicated from the point of view of a project manager.

The data required for the above PIs can easily be measured. The different consultants taking part in a project, as well as the project manager, simply have to register daily the number of hours they actually spent on each of the projects they worked on during a given day, and assign these hours to the different
activities for which PIs have been defined instead of just stating the total number of hours they worked on a project as a whole.

Step 2
Because there exist direct relations between the above mentioned strategic PIs and the operational PIs 8 and 9, there is no need to define tactical PIs for the company. There exist no direct relations between the different PIs, notably due to the fractional character of most of them. There do exist direct relations between the numerators (and the denominators) of the different PIs, however, like between the numerators (and denominators) of PI6 and PI1 unto PI5, and the numerator (and denominator) of PI8 and the numerator (and denominator) of the set of PI7s.

Step 3
Because no detail data are available for the different quantities making up the new PIs, forecasts for the duration and budgets for these parts had to be made from scratch. Each of these forecasts are corrected with a factor related to the average differences between actual and planned durations and budgets of projects as a whole, executed in the past.

Here ends the detailed description of our strategy for designing a consistent set of PIs for a given organization. In the next section some attention will be paid to the maintenance and redesign of PMs.

**PMS maintenance and redesign**
Once having defined and implemented a PMS, we have to take care that the PMS remains relevant for a company. For all kinds of reasons a PMS may have to be changed. These changes may not only concern the target values that are set for the different PIs, but also the ordered set of PIs itself. In general two types of changes can be distinguished: external changes, caused by changes in
the external environment of an organization, and internal changes due to
changes in the internal environment of an organization. Examples of external
changes are shorter delivery times and cheaper sales prices realized by
competitors. Examples of internal changes are the arrival of a new machine,
and an internal reorganization of activities. Internal changes are often, but not
always, triggered by changes in the external environment.

Due to external or internal changes, a PMS may have to be changed in three
ways. In case a new PI is required, the method described under PMS design can
be used. Whenever a PI is considered to be deleted, the corresponding PI parent-
child clusters should be checked to examine which other PIs may have to be
deleted as well. Finally, in case the target value(s) for a PI are planned to be
changed, the parent-child relationships should be checked on target value
consistency.

Comments and conclusions
In this paper a concrete, operational framework for (re)designing an effective,
consistent performance measurement system has been outlined and a concrete
implementation of the framework has been discussed. Further implementations
in different kinds of organizations are required to examine the general
usefulness of the framework.

In order to have a consistent performance management system more is
required than a consistent performance measurement system. In this paper the
functions in the organization and the tasks for which they are held responsible
have been assumed to be given. The above does not apply for new companies or
new tasks however. In that case it has to be decided which responsibilities
should be assigned to which functions. Further research is required to answer
this question.

References
1. Wisner, J.D. and Fawcett, S.E., “Linking firm strategy to operating decisions through
performance measurement”, Production and Inventory Management Journal, Vol. 32 No. 3,
1991, pp. 5-11.
2. Doumeingts, G., Clave, F. and Ducq, Y., “ECOGRAI: a method to design and to implement
performance indicators systems using GRAI approach”, in Proceedings International
Dedicated Conference on Lean/Agile Manufacturing in the Automotive Industries, Aachen,
5. Kaydos, W., “Key performance factors”, in M easuring, Managing, and M aximizing
Management Accounting (USA), June 1989, pp. 45-50.


