

# ANALYSIS OF TRANSPORT PERFORMANCE MEASUREMENT SYSTEM

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Performance measurement is the ongoing monitoring and reporting of program accomplishments, particularly progress towards preestablished goals. Program or agency management typically conducts it. Performance measures may address the type or level of program activities conducted (process), the direct products and services delivered by a program (outputs), and/or the results of those products and services (outcomes). A „program” may be any activity, project, function, or policy that has an identifiable purpose or set of objectives. All high-performance organizations, whether public or private, are, and must be, interested in developing and deploying effective performance measurement and performance management systems, since it is only through such systems that they can remain high-performance organizations.

The language of performance measurement includes terms such as effectiveness, efficiency, outcomes, outputs, productivity, quality, and inputs. In one sense or another, all of these terms represent measures of performance, but each measures different aspects of performance.

Article deals with analysing the following issue: 1. Definition of performance measurement. 2. Differences between transport performance measurement and transport performance management. 3. Performance management cycle. 4. Characteristics and types of transport performance indicators. 5. Performance indicators for road, maritime, rail and aviation safety. 6. Performance measurement process.

**Keywords:** *performance measurement, performance management cycle, transport performance indicators, performance measurement process*

## 1. INTRODUCTION

Transport performance measurement is clearly important to the process of business strategy. The overall strategy process can be viewed as three inter-relating stages. Setting direction requires an organisation to develop a view as to where it is trying to get to in the long-term and will result in the setting of a vision or mission for the organisation together with overall strategic goals or priorities. Following on from this, the second stage involves putting plans together – planning how the overall strategic goals will be achieved. The third stage, checking progress, involves checking that the plans are being delivered, that they are producing the results expected and that progress is being made in terms of the overall strategic direction set. Effective performance measurement lies at the heart of this strategy process. Appropriate performance measures allow managers to monitor performance at both the strategic and operational levels; they allow managers to control and manage organisational performance; they allow managers to identify where and how performance needs to be improved.

## 2. DEFINITION OF PERFORMANCE MEASUREMENT

Performance measurement means the regular measurement, and reporting, of the performance of programs, organizations, or individuals. Performance measurement is based on two main principles. Firstly, it concentrates on program outcomes, or actual results, rather than only on the quantity of service that an agency provides. Secondly, in defining outcomes, performance measurement focuses

on the needs of the customers or citizens served. Performance measurement, in the form of units of measurement called indicators, provides decision makers with better information. With this information they can make better decisions – and show why they made those decisions. Using performance measurement, transport organizations can demonstrate their commitment to providing quality service. Performance measurement has many applications and can be used by different organizations and different levels of government.

The system used by management to control the activities of an organisation is commonly referred to as the management control system (Anthony, 2001) [1]. A management control system typically comprises several different types of control tools or sub-systems. Samuelsson (1996) [7] classifies the different types of control systems into three main categories: formal control systems, organisational structure, and less formalised control systems. As Ax stated (2001) [3], the branch of performance measurement should be considered a „hard“ and formal control tool and may therefore be grouped along control tools with similar characteristics, such as budgeting, target costing, and benchmarking. The literature does not provide any unitary definition of performance measurement. Ax (2001) [3] states that the concept of performance measurement derives from the fact that every firm achieves a variety of different performances. The measurement could be related to just about any activity or part of the firm, such as financial results, product quality, or customer satisfaction. Mossberg (1977) [5] defines a performance measure as a number or any other quantity, which in a concentrated form provides information about a firm's performance. Performance measures could therefore be of a financial nature as well as non-financial nature, such as number of complaints and delivery time (Anthony, 2001) [1]. According to Simons (2000) [8], systems of performance measurement involve a number of performance measures used to systematically measure the performance of the firm. The systems are the formal, information-based routines and procedures used to maintain or alter patterns in organisational activities.

### **3. DIFFERENCES BETWEEN TRANSPORT PERFORMANCE MEASUREMENT AND TRANSPORT PERFORMANCE MANAGEMENT**

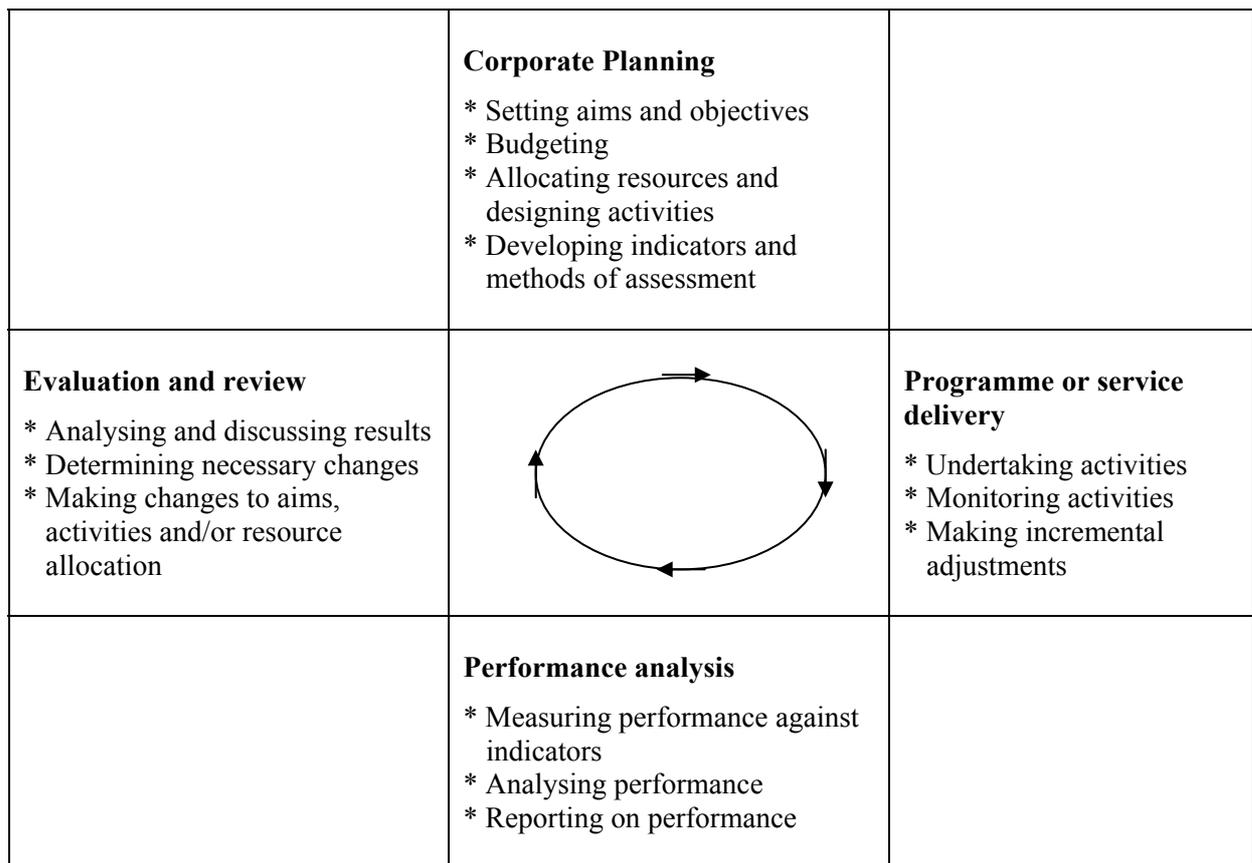
The terms “performance measurement” and “performance management” can often seem to be interchangeable. These terms need special attention to clarify their use. The terms will be recognized as referring to two processes, but with performance measurement forming part of the total process of performance management [6]:

\* **Performance Measurement** – can be defined as those processes that are utilized to measure the performance of a transport organization - particularly in relation to its achievement of pre-determined outcomes and objectives

\* **Performance Management** – can be defined as all of those processes (including performance measurement) that are utilized to capture the results of performance measurement and feed them back into the planning processes that then guide the organization to make the necessary changes to its activities and modes of operation and (if necessary) make changes to its strategic outcomes and objectives. The two terms are not interchangeable, but rather form an integrated part of a total performance management cycle.

### **4. PERFORMANCE MANAGEMENT CYCLE**

In an integrated cycle, performance is measured and monitored according to predetermined objectives. This information thus is a feed back into the system to make incremental changes during program delivery as well as to measure overall achievements against the agreed objectives. Following this, a management process evaluates the results and makes decisions about: the reasons for failure/success; whether or not to pursue (and try to improve) current implementation processes or make changes, what significant lessons have been learned; and whether or not to maintain (or alter) the organizational objectives.



*Figure 1. Performance management cycle [6]*

Transport performance measurement and management cycle provides a holistic environment for performance measurement in transport organization – but it must be recognized that we often don't live in an ideal world (see Figure 1). There are a number of common obstacles to be encountered when trying to apply such a neat model to transport organization [6]:

- \* It is likely that the four phases identified are not absolutely distinct and may not always occur in such a linear sequence.
- \* Aims and objectives are often not clearly set and are commonly subject to highly politicized decisions.
- \* Resources are limited and their availability will often determine the aims and objectives.
- \* Key performance indicators are often set by funding bodies and are designed to facilitate an audit process rather than true measurement of achievements towards aims.
- \* Key performance indicators are often badly designed and are either too broad, too narrow, or difficult to measure.
- \* Despite the pre-determination of program delivery, programs can be altered or (sometimes) ceased before completion.
- \* Monitoring can prove to be impossible, inappropriate or ineffective.
- \* Incremental adjustments to program delivery can have significant and unexpected results.
- \* Results of performance measurement can be collected in different ways – making comparison or “benchmarking” difficult or impossible.
- \* Reporting of performance can be delivered in such a manner as to “paint an inaccurate picture”.
- \* Interpretation of results will vary depending on the perspectives of stakeholders.
- \* The potential for change is limited by the possibilities known and available to the stakeholders.
- \* Suggestions for continuation or change may be ignored.

An effective performance management is impossible, but these obstacles should not necessarily cause us to abandon its pursuit. In developing performance management processes for transport

organizations, it must be recognized that transport organizations are aiming to not only “get better” at delivering programs, but also transport organizations are aiming to “get better” at performance management itself. The lessons learned through transport organizations own experience, and from the experience of others, should help transport organizations develop and improve transport organizations systems.

## 5. CHARACTERISTICS AND TYPES OF TRANSPORT PERFORMANCE INDICATORS

For an indicator to be considered as a good one, the following characteristics should obtain:

1. The variable in question should be relevant to the purpose for which the indicator is required.
2. The variable should be clearly defined.
3. The measurements should be reliable, i.e. the same measurement taken by two different people should give the same value for the indicator.
4. The measurements should be as precisely defined as required.
5. The measurements should be readily available, i.e. the cost of collecting the measurements as regularly as required should not outweigh the usefulness of the indicator.
6. The measurements should be available within a reasonable time frame, i.e. the measurements should still be useful for the purpose of the indicator at the time when they become available.

Input, output, and efficiency indicators are relatively familiar to program managers. Governments regularly use them to track program expenditures and service provided. Indicators of outcomes are much infrequent even though they are more helpful in determining the consequences or results of the program. It is important to recognize the differences between the following categories of information:

\* **Inputs.** Input data indicate the amount of resources you applied in delivering a service.

\* **Outputs.** Output data show the quantity of work activity completed. A program’s outputs are expected to lead to desired outcomes, but outputs do not by themselves tell you anything about the outcomes of the work done. To help identify outcomes that you should track, you should ask yourself what result you expect from a program’s outputs.

\* **Outcomes.** Outcomes do not indicate the quantity of service provided, but the results and accomplishments of those services. Outcomes provide information on events, occurrences, conditions, or changes in attitudes and behavior that indicate progress toward achievement of the goals and objectives of the program. Outcomes happen to groups of customers or to other organizations who are affected by the program or whose satisfaction the government wishes to attain.

\* **Efficiency and Productivity.** These categories relate the amount of input to the amount of output (or outcome). Traditionally, the ratio of the amount of input to the amount of output (or outcome) is labeled “efficiency.” The inverse, which is the ratio of the amount of output (or outcome) to the amount of input, is labeled “productivity.” These are equivalent numbers.

## 6. PERFORMANCE INDICATORS FOR ROAD, MARITIME, RAIL AND AVIATION SAFETY

Among the road safety performance indicators most commonly used are those that relate to behavioural characteristics such as speed levels, the rate of drink driving and the use of seat belts. In addition, a number of infrastructure, vehicle or traumarelated indicators are relevant. These provide a more straightforward means of monitoring the impact of a measure or programme and enable early, target-oriented adjustments of specific interventions. In addition, they allow for a more detailed understanding of the reasons for safety problems than is possible by looking at crash frequency alone. Some EU Member States – usually those that have performed best in reducing casualties – have shown how safety performance indicators can be used efficiently in targeted safety programmes. In fact, some countries have specified certain behavioural characteristics as concrete targets in their national safety programmes in addition to pure casualty reduction targets. Working with performance indicators results in an increase of the understanding of policymaking authorities in the effects of their policies. Experience in some EU Member States show that the authorities using performance indicators are more engaged with their policies if performance indicator data are reported to them regularly. [4]

Safety in the maritime, rail and aviation sectors has a long history and strong tradition based on regulation (initially only national, now increasingly pan European and international) and inspection to assess compliance with regulations. The underlying idea is as follows – the greater the compliance the better the safety performance. Safety is an important design criterion for these transport modes. However, these sectors are organised in such a way that the interaction of many independent actors, both public and private sector, play important roles in achieving high levels of safety. Inspection and investigation reports by government appointed agencies could be considered as the backbone of safety in these transport modes. In such reports, accidents and incidents play a dominant role. A growing interest is observed in all these transport modes to enrich the existing procedures to improve safety. Safety performance indicators are a promising development in this respect. In the maritime, aviation and rail sectors, examples are evident of initial steps to develop safety performance indicators, although these attempts cover only parts of the whole sector. Working with safety performance indicators allows for comparisons both within and between sectors. This is a useful aid to achieving a higher level of safety through a better understanding of the causes of accidents and by more transparent and rational decision-making.

## 7. PERFORMANCE MEASUREMENT PROCESS

All transport high-performance organizations whether public or private are, and must be, interested in developing and deploying effective performance measurement and performance management systems, since it is only through such systems that they can remain high-performance organizations.

Leading transport organizations, whether public or private, use performance measurement to gain insight into, and make judgments about, the effectiveness and efficiency of their programs, processes, and people. These best-in-class organizations decide on what indicators they will use to measure their progress in meeting strategic goals and objectives, gather and analyse performance data, and then use these data to drive improvements in their organization and successfully translate strategy into action.

Implementing and maintaining a performance measurement system represents a major commitment on the part of an organization. Following are some of the basics of philosophy and methodology that facilitate the performance measurement development process. With these in place, an organization can generally establish a successful performance measurement and management system. [9]

**1. Establishing and updating performance measures.** Each organization must create and communicate performance measures that reflect its unique strategy. World-class organizations use performance measurement systems to determine whether they are fulfilling their vision and meeting their customer-focused strategic goals. ***Their performance measures must therefore meet the following criteria [9]:***

***Ensure a narrow, strategic focus.*** The measures and goals an organization sets should be narrowly focused to a critical few. It is neither possible nor desirable to measure everything. In addition, mature performance measurement systems are linked to strategic and operational planning. World-class organizations know where they're headed through effective customer-driven strategic planning. They know where they are by measuring performance against corporate goals and objectives. The organizational strategy, correctly developed and modelled by senior management, provides a framework within which business units, teams, and individuals can implement a performance measurement system.

***Measure the right thing.*** Before deciding on specific measures, an organization should identify and thoroughly understand the processes to be measured. Then, each key process should be mapped taken apart and analysed to ensure a thorough, rather than assumed, understanding of the process; and that a measure central to the success of the process is chosen. In some cases, targets, minimums, or maximums are defined for each measure.

***Be a means, not an end.*** In a best-in-class organization, employees and managers understand and work toward the desired outcomes that are at the core of their organization's vision. They focus on achieving organizational goals, by using performance measures to gauge goal achievement, but do not focus on the measures per se. Performance measurement is thus seen as a means, not an end.

Regardless of size, sector, or specialization, organizations tend to be interested in the same general aspects of performance:

- financial considerations;
- customer satisfaction;
- internal business operations;
- employee satisfaction;
- community and shareholder/stakeholder satisfaction.

Attention to, and establishment of, measurements in these areas is thus a significant part of a successful performance measurement system. In the private sector, the principal measure of successful performance is profit. Public agencies, on the other hand, have no such universal and widely accepted performance measure of success. For public sector organizations, performance must be judged against the goals of their programs and whether the desired results and outcomes have been achieved. Success is often viewed from the distinct perspectives of various stakeholders, such as legislatures, regulators, other governmental bodies, vendors and suppliers, customers, and the general public. Therefore, it is extremely important that the measures of performance used by a public organization be created with as much input and consultation from these constituencies as is feasible, so as to reach as much consensus as is possible regarding what is expected of the organization.

**Determining a baseline and goals.** Once an organization has decided on its performance measures, the next step in the process is to determine a baseline for each of the measures selected. Once data are collected for the first time on a particular measurement, the organization then has baseline data. Determining appropriate goals for each measure after these baseline data are collected can be accomplished in several ways. Most partners use various statistical analysis techniques as well as benchmarking to set goals for future performance.

**Reviewing measures.** An important aspect of performance measurement is its iterative quality. Organizations should continually assess whether their current measures are sufficient or excessive, are proving to be useful in managing the business, and are driving the organization to the right result. This review lets the organization make sure that it is maintaining the right measures. When measures become obsolete, they should be discarded, and possibly replaced with something else.

**2. Establishing accountability for performance.** Establishing viable performance measures is critical for organizations; making those measures work is even more important. Once the performance measurement system is created, then, the next step is to implement it within the organization. [9]

**Empowerment.** Employees are most likely to meet or exceed performance goals when they are empowered with the authority to make decisions and solve problems related to the results for which they are accountable. In many ways, accountability is analogous to a contract between manager and employee, with the manager providing a supportive environment and the employee providing results. The performance goals of an organization represent a shared responsibility among all its employees each of whom has a stake in the organization's success. A critical challenge for private and public organizations alike is ensuring that this shared responsibility does not become an unfulfilled responsibility. Accountability helps organizations meet this challenge.

**Owner identification.** Most managers from best-in-class organizations hold an appropriate individual accountable for each performance measure. Most organizations therefore identify a measurement owner. This is an assigned individual who is accountable and responsible for a particular measure.

**Rewards and incentives.** More than half of our benchmarking partners link pay or rewards to their performance measurement systems. In other cases, managers ensure that performance goals are met by rating individual contributions to performance goals in individual appraisals.

**Culture and communication.** Within most of our partner organizations, failure to meet performance goals results in a comprehensive review of problems and solutions. The culture is based on understanding the reality of human error and striving to improve, employees do not fear admitting mistakes. Periodic meetings allow staff to review progress and strategize about solving problems. Generally, organizations have a formal written plan describing how performance measures will be implemented. In many cases, the plan details the measurements, goals, objectives, and the common alignment to the organizational strategy. In addition, it is a common practice to identify one individual who will be responsible and accountable as a respective measurement owner.

**3. Gathering and analysing performance data.** Data are collected and then analysed for each performance measure to determine if and how well goals are being met. It is very easy for the data

collection and analysis phase of performance measurement to get out of hand. Advanced technology facilitates this tendency: It is tempting to take advantage of the myriad data resources available via Internet and intranet. Best-in-class organizations remember that data collection and analysis are not a research activity conducted for its own sake. Rather, data are collected and analysed to get answers. [9]

**Gathering the data principles. Keep it focused.** Keeping data gathering focused is very much a senior leadership responsibility. This focus ensures that the right data and only the right data are collected, that repetitious or tangential compilations are avoided, and that the questions originally posed by the performance measures are being answered.

**Keep it flexible.** In best-in-class organizations, data are collected from a variety of sources and through a variety of media. Any one system isn't necessarily right or wrong. Although using automation is preferable, world-class organizations also use manual systems when needed and cost efficient.

**Keep it meaningful.** Useful and relevant data can be gathered if the correct measures were set up in the first place. A few basic, well-aligned measures taken seriously are better than a number of complex measures. That's because with simple measures, it's clear what data need to be collected; with well-aligned measures, it's easy to see the data's relevance. On the other hand, it's possible to carry simplicity too far. A recurring challenge to effective performance measurement is to overcome, in the words of one participant, a "long-lived work culture of transactional auditing which causes a focus on checklist-type, as opposed to results-oriented, trending." In other words, data collection must be tailored and thoughtful, not derived from a "one-size-fits-all" master checklist.

**Keep it consistent.** Data collection should be based on a set of agreed-upon definitions. These definitions need to be universally understood by employees, managers, partners, suppliers, and even customers. Data collected within a common framework of understanding can be easily compared and analysed, allowing subsequent evaluations to be "apples to apples."

**Gathering the data responsibilities.** Each business unit and hierarchical level of an organization will have different needs for the data gathered. These differences should be reflected in the collection process. Line supervisors and employees. The data focus for line supervisors and employees relates to daily operations and customer service as these are aligned with the organization's vision and strategic planning. Thus, line supervisors and employees collect operational performance data. These data are often best gathered as part of the employees' interface with the customer.

**Business unit managers.** Business unit managers need data that can be used to measure customer satisfaction, dissatisfaction, or indifference. These data are usually collected via customer surveys administered by a third party or in-house office. Another kind of data in which the business unit manager is interested involves program costs. These data come from the organization's accounting and cost accounting systems that record expenses and revenues. Armed with these data, a manager cannot only react to, but can also institute proactive measures to reduce unnecessary costs.

**Executive management.** Senior managers need to determine whether their organizations are meeting or exceeding the expectations defined in their customer-focused strategic plans. Generally, they target a vital few measures as critical to their responsibilities. Rather than immersing themselves in day-to-day details, executives look for trends.

**Transforming data into information.** Data analysis in performance measurement is the process of converting raw data into performance information and knowledge. The data that have been collected are processed and synthesized so that organizations can make informed assumptions and generalizations about what happened. They can then compare the actuality to what they had expected to happen, decide why there might be a variance, and determine what corrective action might be required. This last set of activities is the subject of the next section reporting and using performance information. As in data collection, the organization must keep this next step perpetually in mind. Though interesting, analysis is not undertaken for its own sake. Following are some principles of data analysis drawn from best-in-class organizations.

**4. Reporting and using performance information.** High-performing organizations do not measure things just for the sake of measurement. [9] Rather, they report, evaluate, and use performance information as integral parts of their performance measurement systems to:

- \* inform various levels of management and employees about performance information;
- \* determine whether corrective action is necessary;
- \* determine whether changes are necessary in the performance measurement system, or the measures themselves, or to the organization's goals.

These same high-performing organizations see performance data as empirical information about the operation of their organizations and their customer or stakeholder requirements and preferences. Whether applied over the longer term or for short-term corrective actions, performance information is reported, evaluated, and used as an underpinning for the continuous improvement of overall management and strategic planning processes.

**Report information.** Performance information should be disseminated quickly. Putting useful information into the hands of an organization's decisionmakers promptly and efficiently is critical. Many communication devices can be used to meet this objective, including meetings, reports and newsletters, charts placed in work areas, e-mail, publications, and videoconferencing. Intranets are also being used to give entire organizations access to performance data summaries; this gives them the opportunity to be proactive about issues or adverse trends. Another performance reporting objective is to keep employees at all levels "in the loop," interested, and motivated. To this end, many partners use sophisticated communication systems so that all staff receive performance measurement status repeatedly in many forms.

**Evaluate performance.** Organizational performance evaluations are conducted periodically to best meet an organization's individual management information needs; they are typically scheduled on a monthly or quarterly basis. Depending on the types of activities and the organization, the frequency of evaluation could range from daily or weekly to semiannually. In many cases, organizations use a combination of reviews at various intervals.

**Use Performance Information.** Feed it into resource allocation decisions. There are important linkages among resource allocation, strategic planning, and performance measurement. A high-performing organization's strategic planning process is directly related to and may drive the process for allocating its resources to carry out goals and objectives. An organization's strategic plan is also directly related to what it is that the organization decides to measure in terms of performance and outcomes. However, the relationship between performance measurement and resource allocation is less clear.

**Use it in employee/management evaluations.** Most high-performing organizations have developed some means of linking accountability with incentive compensation or wage increases based on performance. Most best in class organizations link performance measures in some way to pay. People are also empowered and rewarded for making process changes based on performance results. One company provides people with incentives for achieving performance results based on doing things a certain way. Quality success stories are shared two or three times a year. The chair and senior officers review individual and team applications for significant improvement above and beyond the call of normal duty. A percentage of the savings is then shared with award recipients.

**Use it to determine gaps between goals and reality.** Performance results can be used, as discussed above, to determine gaps between specific strategic objectives and/or annual goals and actual achievement. The root causes of these gaps are analysed, and countermeasures developed and implemented. Whenever there is a gap between current results and an organization's objectives, it is an opportunity for process improvement.

**Use it to drive reengineering.** Reengineering using in response to the identification of gaps between objectives and achievement.

**Use it in benchmarking.** Benchmarking is using as a methodology for organizational improvement; developing their performance measurement systems; and validating their operational position; and to maintain world-class performance.

**Use it to improve organizational processes.** Managers are most often empowered to make process changes. One organization used a multivariable testing technique to discover how process improvements can be made. Management set up trial and control processes in such a way that employees could try various process improvements in a controlled manner and selectively identify changes that would improve process performance.

**Use it to adjust goals.** In most cases, if performance goals are not met, corrective action is implemented. Conversely, if goals are exceeded, the "bar is reset to establish stretch goals." One way of adjusting goals and the approach to their achievement is to form partnerships with other entities. Through these partnerships, organizations can combine resources and adjust their part of the overall goal accordingly.

**Use it to improve measures.** One organization displayed performance measurements on bar charts and used raw data in its first year of implementation. In the next, it validated and normalized the

data. In the following year, its bar chart included the normalized data with a trend line, a simple five-year moving average. In the next year, it used a logarithmic trend line to obtain a better fit. Another organization originally used percentage data to measure performance. However, as the volume grew, it became apparent that actual data should be used instead.

## 8. CONCLUSIONS

1. The main objective of performance measurement is to provide information about the effectiveness of a program by establishing the target to be achieved in advance and measuring performance periodically and consistently.

2. If a concrete performance level cannot be established for a certain fundamental target, related measurable indicators are selected and a concrete achievement target is established for each measurable indicator.

3. The measurement could be related to just about any activity or part of the firm, such as financial results, product quality, or customer satisfaction.

4. A performance measurement system involves a number of performance measures used to systematically measure the performance of the firm.

5. Performance measures are tools or indicators of the success in achieving a given goal or objective. Performance measures can generally be divided into output measures, outcome measures, input measures, or efficiency measures.

6. For transport system is recommended to set up and specify a set of relevant transport performance indicators to be used at European and national level as a means of assessing the trends in safety levels and the success of casualty reduction programmes.

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