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MEASURING PERFORMANCE IN A KNOWLEDGE ECONOMY: LINKING SUBJECTIVE AND OBJECTIVE VALUE MEASUREMENT INTO A "VECTOR-BASED" CONCEPT FOR PERFORMANCE MEASUREMENT[1]

Authors:

Juergen H. Daum

SAP AG, Walldorf, Germany

Peter Bretscher

Ing. Büro für Wirtschaftsentwicklung, Eggersriet, Switzerland,

Abstract

Today, customers or other important stakeholders demand that businesses or non-profit organizations act according to their stakeholders' subjective, qualitative values and criteria. Organizations therefore must take increasingly qualitative, subjective ratings and values into account in managerial decision-making. They need performance measurement systems that are able to handle subjective, qualitative measures and to combine them with quantitative, i.e. financial information. The vector-based concept of performance measurement & visualization introduced in this paper offers a practical solution that can be applied for example in public service organizations or to support R&D management of a software company.

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0. Introduction and Problem Description

As long as demand exceeded supply, management's attention was focused on efficient production processes and efficient resource utilization: the focus was on internal efficiency. This is reflected in traditional financial control-based[2] performance measurement concepts where the emphasis is on costs and return on capital – that is, on efficiency measured in "objective" financial terms.

However, this proven and practical model for evaluating and managing the performance of organizations is falling short today. When supply began to exceed demand in the industrialized economies (beginning in the 1970s), organizations started to compete more and more on quality, differentiation, and customer satisfaction rather than only on cost/financial efficiency. The ability to create a positive "effect" for customers from their "subjective" perspective – and increasingly for other stakeholder groups that today have power over the "license to operate" of an organization – became the critical success and survival factor for any organization, whether business or non-profit (Daum, 2002).

Efficiency is still important today, but it no longer creates competitive advantage. The main driver for competitive advantage today is what we call *external effectiveness*, which is effectiveness from a subjective stakeholder perspective. This becomes obvious especially in the service sector, particularly in public services, where for centuries organizations have been managed only on the basis of budgets and funds. But today, when citizens are expecting more value for the taxes they pay, these organizations need something more than just the budget to optimize their operations and create value for their "customers".

Performance of an organization can no longer be defined and expressed just in financials terms (profit / return on investment for commercial organizations or meeting the budget for a public service organization). As long as performance measurement systems are still based mainly on financial information[3], they are too exclusively focused on financial efficiency and ignore the external effectiveness of an organization.

Instead, we need performance measurement systems that are able to express subjective valuations, experiences, and ratings in a way that an organization is able to combine with quantitative financial information. In addition, the result has to be easy to understand and "manageable" from a managerial perspective, meaning that measurement is scalable (independent of time and location) and that it can be aggregated and de-aggregated so that it can be used across the entire organization, linking different areas of measurement into one system of performance measurement.

The vector-based concept of performance measurement and visualization that we describe in this paper offers a practical solution to this problem.

Requirements for an Alternative Concept of Performance Measurement

Subjective measurement systems based on qualitative "measures" are nothing new. In fact they are at the root of many of our objective quantitative measurement systems to which we have become so accustomed that we sometimes forget that they didn't exist 200 or 300 years ago.

One example is how we measure temperature. Before the advent of today's objective, quantitative temperature measurement systems, people for millennia "measured" and defined temperature by categories like *cold* and *warm* – measures that need subjective interpretation and that are highly

context sensitive ("cold" in Norway probably means something different than "cold" in Italy). It was not until the 17th and 18th centuries when Réaumur (1683-1757), Fahrenheit (1686-1786) and Celsius (1704-1744) introduced the first standard temperature scales based on natural and common temperature reference points (such as the temperature of the human body or the dew point and freezing point of water) that people have been able to measure and compare temperature with an objective measurement system that is based on context and interpretation independent measurement scales. And it was not until the 19th century that Kelvin (1824-1907) developed the Kelvin scale – a measurement concept which no scientist today (e.g. in physics) can live without.

Subjective, qualitative measurement systems are still used today when qualitative criteria are the focus in the measurement or valuation process that require interpretation through third-party experts or external company stakeholders. An example of a qualitative measurement system is the rating of a company's credit worthiness by Standard & Poor's (S&P) with ratings ranging from "AAA" to "D". While S&P probably has internal rules and standard procedures governing how they rate companies, the rating results are nevertheless subjective: they are based on S&P's valuation/measurement methods and on personal qualitative expert judgments by analysts. Because no objective measurement scale for the credit worthiness of a company exists (at least not yet), the S&P rating cannot be compared directly with the ranking of other rating agencies or with the rating of a company's bank. Nevertheless, the S&P rating is widely accepted and provides useful information about a company for capital market participants or suppliers.

Subjective, qualitative measurements are made every day when individual stakeholders, such as customers or investors, value what a company is offering to them. Every customer places a value on products or services according to subjective qualitative criteria. That valuation drives the customer's decision to buy or not to buy at a specific price. Suppose Mrs. Miller is intending to buy a new dress. What might drive her decision to buy it from a designer boutique, where the price is twice as high as at an ordinary department store – even if the production cost of the boutique dress is the same as that of the department store dress? Decisive factors might be that the boutique dress corresponds more with the latest international fashion trends, that its colour is her favourite colour, that it carries the name of a famous designer, that she is treated differently at the boutique than at the department store, and so on – all intangible, qualitative values. But the willingness to pay a specific price premium differs from person to person, as everyone has a different set of personal qualitative (i.e. subjective) valuation criteria. That is also true for investors considering whether or not to invest in a company. Different investors have different strategies and objectives that create a different context for that investment and thus different criteria and different subjective values.

I. The Concept of Vector-Based Performance Measurement & Visualization

Since supply exceeded demand in the industrialized economies, subjective, qualitative factors, the intangibles, become at least as critical as the quantitative, objective (financial) factors in managerial decision making, because in a supply rich economy customers and other stakeholder have a choice: they can choose between various offers, and that means they are able to invest in a company or buy something that is more in line with their personal, subjective qualitative value scale than other offerings. This doesn't mean that the quantitative, objective measurement that the financials provide (e.g. costs, price – all measured in monetary units that allow objective comparison independent from context and subjective interpretation) become irrelevant. It is still an important measurement of performance. But it covers only one dimension: the dimension of economic/financial efficiency. Missing is the dimension of external non-financial effectiveness from a subjective stakeholder perspective. Only if we take both dimensions into consideration are we able to assess the true performance of a company, a business unit, a product line, or even of a public service organization. We consider the vector-based approach to performance measurement & visualization as a good method to do that in a systematic way and allow aggregations and de-aggregations (mathematical operations) on the compound result, which we define as the total or compound performance.

The Basics of the Concept

The intention of the vector-based concept for performance measurement is to combine subjective, qualitative measurement of performance with objective, qualitative measurement of performance in such a way that total or compound performance (the compound of qualitative and quantitative performance) can be easily calculated and visualized. The solution is the concept of vector-based measurement and visualization of performance (Bretscher, 1996, 1998).

The basic principle of the concept is simple (see diagram 1):

- one dimension (the *x* axis) represents the objective, quantitative dimension of performance
- the second dimension (the *y* axis) represents the subjective, qualitative dimension of performance
- The third dimension (the length of the vector = *v*) represents the absolute total performance, the compound result of qualitative and quantitative performance.

  It can be calculated as: $v = \sqrt{x^2 + y^2}$

  The gradient of the vector can provide users with additional relative performance information. It can be calculated as $\alpha = \arctan(y/x)$.

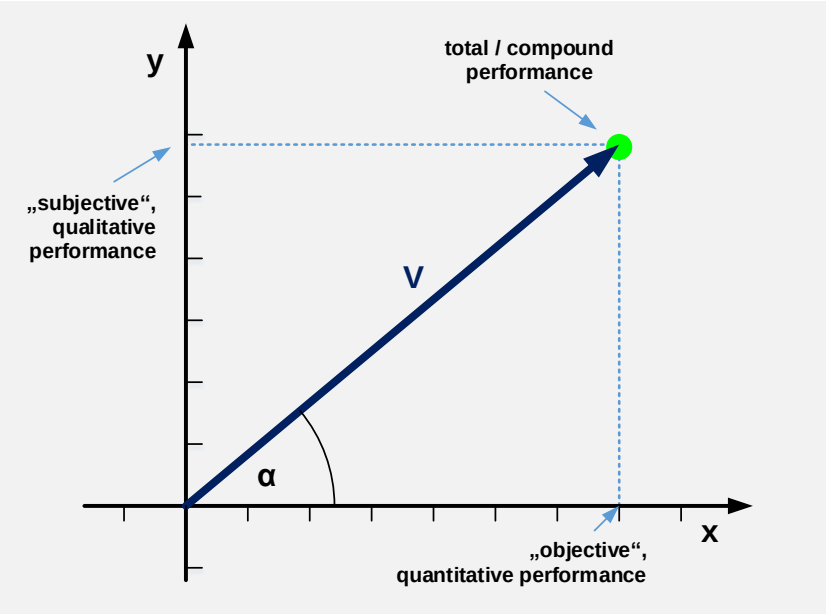

Diagram 1

Here is an example of a simple managerial application for measuring and visualizing performance of a company, business unit or product group (see diagram 2):

- The ***x-axis*** **displays financial results** (explicit values measured in monetary units representing e.g. profit or return on investment). It gives an indication of how efficiently an organization is using its resources from an economic/financial perspective.
- The ***y-axis*** **displays value created from a customer perspective** (implicit values measured e.g. according to a relative customer satisfaction scale or based on regular surveys and industry benchmarks). It gives an indication of how effective an organization is in satisfying customer demand.
- The **vector represents management's total performance** (measured according to a relative scale that includes length and gradient angle). The length of the vector gives an indication of the total performance achieved (including qualitative, subjective customer value *and* financial results). The gradient angle of the vector can give a relative indication about created or destroyed potential for financial performance for the future ("sustainability/potential indicator"): the steeper the vector's gradient, the larger the value-added created from a customer perspective compared with financial results achieved. This could be a sign that the company or the business unit has created significant customer value but has not yet been able to leverage it from a financial perspective. The opposite case (the vector's gradient is low) would signal that while the company or business unit is still producing good financial performance it has created not very much true customer value or has somehow destroyed customer value (which could mean that its products are overpriced) – a fact that might result in declining financial results in the future.

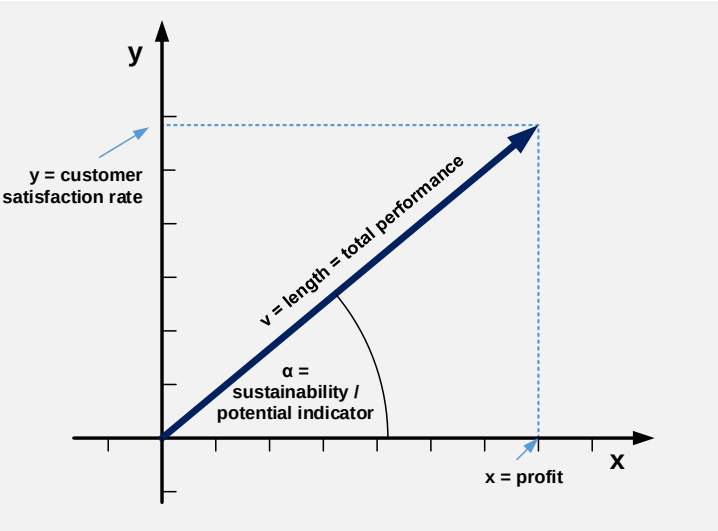

Diagram 2

Whereas the approach depicted in diagrams 1 and 2 requires a direct rating of both dimensions (of the subjective dimension e.g. by a customer survey or by systematic product use value analysis), the approach depicted in diagram 3 allows values to be determined for the second axis indirectly: they are derived via the vector from the values of the other dimension.

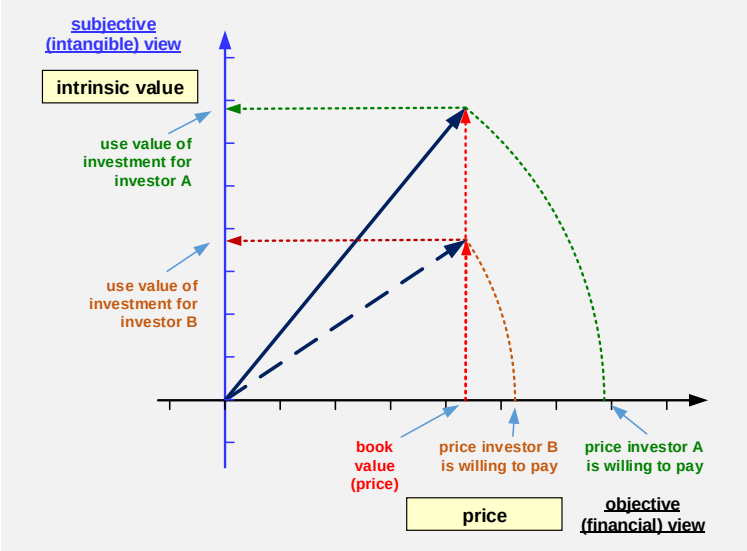

Diagram 3

In this case the vector (i.e. its length and direction/gradient scale) is not defined by a value on the *x* axis and one on the *y* axis but by two values on either the *x* or *y* axis. The value for the other axis is then derived from the vector. A possible application for this variant is the valuation of enterprises by different investors with different investment strategies: values on the *x* axis represent book value and the price/market value a specific investor is willing to pay. The entries on the *y* axis that are derived from the two values on the *x* axis show then the different subjective use values the investment represents for different investors.

This application example draws attention to the difference between price and value. If this difference is not recognized, there is a tendency to confuse cause and effect. But in reality price is always – sometimes with a time lag – dependent on the subjective value a potential buyer attributes to a product or good (see also the application example for enterprise valuation later on).

Vector Aggregation and Drilldown Analysis

The vector-based concept for performance measurement & visualization of total performance also allows users to easily aggregate performance of various sub-entities (such as groups of customers, market segments, business units, or corporate functions) into a "sum" of performance for the whole entity (such as a company). Analysis and assessment of quantitative and qualitative values starts on the sub-category level per sub-category. The concept of vector-based performance measurement & visualization allows users to aggregate objective and subjective values of these sub-entities into the total performance of the whole entity. We call this the bottom-up approach. One example is separate valuation of the different business units of a company according to the profit (*x* axis) and customer use value (*y* axis) they have generated. The results of the single business units would then add up to the total performance of the company (see diagram 4 - For simplification, the cost/use value of the center is neglected here.)

The top-down approach starts with a vector representation of the performance of an entire entity such as a company, bank, business unit, or region. This total performance is then de-aggregated into the contributions of the various sub-entities (business units, branch offices, product groups, countries, and so on) creating a specific vector profile for each sub-entity (see diagram 4). Through a drilldown analysis of the performance of an entity, the components of its total performance become visible on a sub-entity level and can be targeted with managerial interventions.

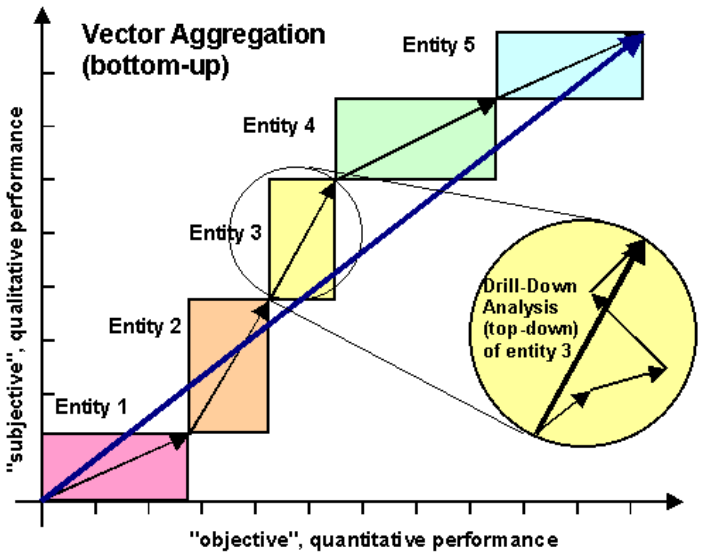

Diagram 4

II. Benefits of the concept:

IIa Helps managers to keep tabs on all relevant aspects (subjective and objective) of the decisions making process:

In the decision making process, managers have to take into account objective, quantitative information – usually financial information such as price, cost, revenue or profit, but also subjective, qualitative criteria – that is, information about the likely qualitative effect of their decisions for customers, investors, or other stakeholders. They need to structure these different types of information and make valuations and weightings in order to take a rational decision that takes all relevant aspects into account. Because people cannot keep all these different parameters in their head, they need instruments that support them in structuring decision relevant information and to maintain an overview. In traditional managerial decision making, often the only instrument available are financial/accounting instruments that structure and visualize financial information – representing just the cost, price, profit or revenue dimension of a decision. The concept for vector-based performance measurement & visualization represents an instrument that allows companies or non-profit organizations to do that with subjective, qualitative information as well (such as focusing on effectiveness from a stakeholder perspective) and to combine it with objective, quantitative measurement (focusing for example on economic/financial efficiency) for performance reporting and decision support.

IIb Makes subjective and objective views comparable and communicable – independent of time and location (= increased transparency across the entire organization)

The vector-based concept for performance measurement and visualization provides a value logic that allows managers to include subjective views, experiences, and values and to link them to objective measures in decision making processes - even when the holders of these subjective views, experiences, and values are not personally present or involved in the decision making process (which is a normal situation in larger organizations, where decisions and decision-relevant information have to be passed on to the next hierarchical level in written or electronic form).

IIc Due to its mathematical foundation, aggregations and de-aggregations are easily possible (linking the strategic overview with the operational view):

Compared with other techniques that are used to present qualitative, subjective values for decision making for instance, the vector-based concept provides the benefit that calculations (aggregations and de-aggregations) are easily possible so that the whole picture across different sub-entities and sub-domains remains visible at any point in time. It can show the objective and subjective aspects of results for single sub-entities (such as projects or business units) and for the whole entity (such as a company). Prioritization in managerial decision making, such as for optimizing resource allocation across R&D projects or business units, can be done with the whole picture in mind so that not only total efficiency (resource perspective) but also total effectiveness (customer or market value generated by investment) will be increased.

IId Represents an efficient and effective management information management concept / it is easy to understand from a managerial perspective:

Today's knowledge economy is confronting managers with difficult trade-off decisions under increasing time pressure. The vector-based concept for performance measurement and visualization provides them with a decision support and management information management concept that presents management/decision-relevant information in very concentrated form and in an easy-to-understand and easy-to-digest way – far beyond the possibilities of the classical concepts: requiring fewer paper, fewer pages, and works with more graphics/charts that help to establish a common understanding in a management team of a situation and its various subjective and objective aspects. The result: less interpretation uncertainty, better and more consistent decisions.

IIe Assumptions behind decisions and the history of the decision making process become transparent:

Managerial decision-making always involves subjective ratings, valuations, and experiences. Because the vector-based approach offers a systematic way to rate and measure qualitative, subjective criteria, it makes the subjective criteria behind a decision transparent and allows the development of the values of these assumptions to be tracked over time to modify decisions and optimize the intended effect at a later point without the need to communicate again all the details to people involved in the decision process.

III. Practical Application Cases of the Concept

Application in public services: How the vector-based concept for performance measurement can support the "New Public Management" in Switzerland

Governmental authorities are facing a major challenge in administrating or managing their public service operations. In contrast to the commercial sector, public service organizations usually do not generate revenues through their operations. Their customers, the citizens, do not pay directly for public services such as education, infrastructure maintenance, police and justice, defense, and so on. Revenues of public service organizations arise instead from fund allocation: the government or governmental agencies allocate funds (i.e. a part of their tax income) according to their current policies to the various public service departments. Because there are no revenues from customers that can serve as a proxy for success, the traditional public service management regime makes it difficult or impossible to determine the efficiency and effectiveness of a public service operation and how well it is performing.

Overcoming this problem and establishing public services as modern, customer-focused and efficient service organizations is the objective of the New Public Management (NPM) initiative in Switzerland. The Swiss NPM concept is attempting to shift the focus on the effects of governmental activities on society, such as in healthcare or education, by centering public service management on these key questions:

- How should our politics affect the citizens? (effects)
- What contribution/performance of the public service administration is required to achieve these effects? (activities and their performance)
- How much does it cost? (costs)

Thus the main intention of the Swiss NPM concept is to show the relationship between effects, performance, and costs and to use the resulting insights for optimizing public service management. NPM will adapt public service management in Switzerland to today's citizen demands while balancing this with today's financial possibilities. It is expected that NPM will lead to more efficient use of available funds and resources and that they will be invested or deployed where they are needed to create specifically desired effects for society. With that approach, effects and performance will move to the center of attention – not just the costs (funds) that a public service organization is spending.

The basic assumption is that optimal results will become possible when effects, activities, and their performance and costs are all taken into account. If one of these three parameters is changed, the change will affect the entire system of the NPM's "magic triangle" (see diagram 5). If the budget, a specific fund, is reduced, certain activities can no longer be performed: performance will decline. If the government or the Kanton-Verwaltung changes the effect-goals, activities and performance levels of public services need to be changed as well.

Because NPM takes into consideration not just costs and funds but also effects and performance, it enables qualitative targets (effects to be achieved, performance targets) to be defined along with traditional financial targets (budgets or funds available to be spent). This creates the foundation for a more "customer-centric", i.e. citizen-centric public service management and makes it possible to delegate tasks and responsibility to the level at which the corresponding competence is available. This principle of devolution is an important building block of the Swiss NPM concept. The expectation is that the integration of tasks, competencies, and responsibilities on each level will lead to more clarity, productivity (efficiency *and* effectiveness), and flexibility. The Swiss Regierungsrat has therefore defined as a major objective of the NPM initiative: "Flexibility in resource allocation and responsibility will be delegated as far as possible down to the expert basis" (Kanton Basel-Stadt, 2003).

To control and manage a large public service organization under these conditions (three dimensions instead of one financial dimension, and that across many organizational levels) requires something other than the traditional budget-based or fund-based management instruments public service organizations have used for centuries. We believe that the vector-based concept for performance measurement and representation provides appropriate instruments for executing the new policies in Switzerland as they have been outlined in the NPM concept.

For instance, the NPM concept structures the activities of a Kantons-Verwaltung into 140 "product groups" for which effect goals, performance targets, and financial budget have to be defined and controlled. The vector-based approach combines information from cost accounting with non-financial performance and effects into a multidimensional coherent performance measurement system that links all organizational levels into one system of measurement. This makes the complexity manageable and puts every product group and every public service department into the context of the whole system/organization.

The basic principle for applying the concept for vector-based performance measurement and visualization to e.g. a Swiss Kantonalverwaltung is very simple: achieved effects and effect-goals ("Wirkung") are presented on the *y* axis, cost-budgets and actual costs ("Kosten") are presented on the *x* axis, and performance targets and actual performance ("Leistung") is presented through the vector (see diagram 5). With that approach it is possible to measure and present the performance of one product group in all three performance dimensions.

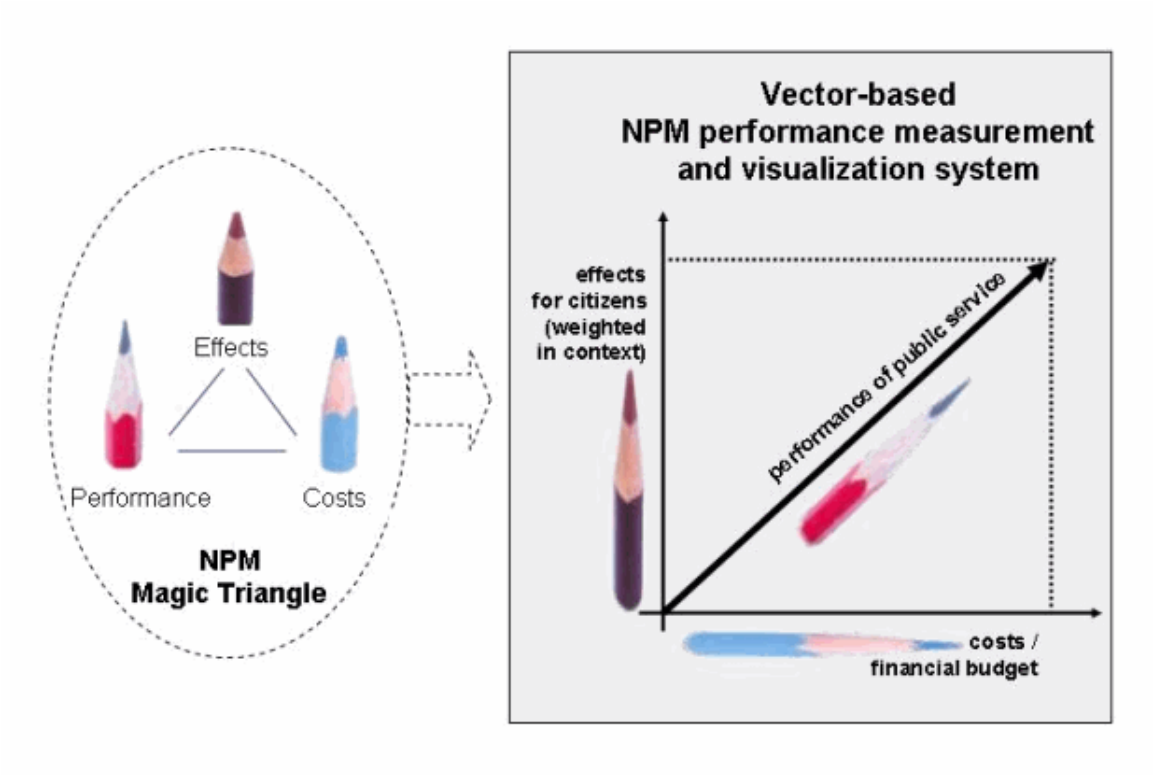

Diagram 5

It is also possible to break down the total performance of the product group into performance contributions of sub-entities (such as organizational units) or to add performance of all product groups up to the overall performance of a department or an entire Kanton. This enables the Kantonalverwaltung to keep tabs on the effects, performance, and costs of the various product groups and departments and to make better trade-off decisions between effects and costs and thus optimize the portfolio of its services from a holistic perspective (see diagram 6).

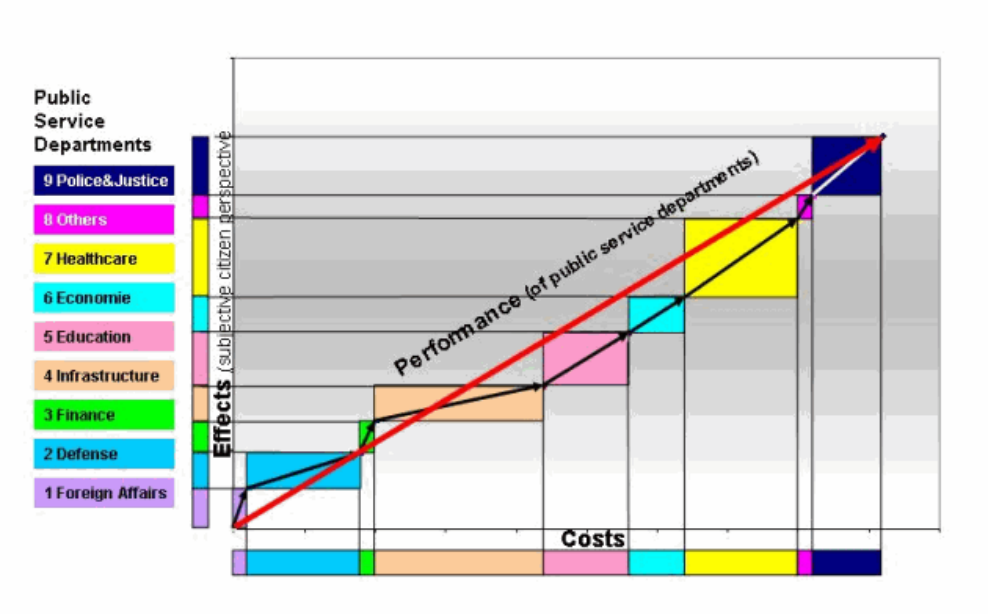

Diagram 6

Benefits for the Kanton-Verwaltung include:

- Public service managers do not need to wade through 300-page budget documents (that is the actual number of pages for the Kanton Basel-Stadt budget, including 140 product groups, 1000 measures and 140 budgets). A few graphs/charts are enough to get an overview.
- The focus is set in the first place on value and performance (effects for citizens and performance of the public service) and then on financial budgets (on how to get and spend funds). This aligns the whole organization with the intended effect of its activities for society and enables management to make better trade-off decisions between tight budgets (efficient use of resources) and benefits (effects) from a citizen perspective.

The application of the concept of vector-based performance management & visualization to support public service management is currently under investigation at several Kantonalverwaltungen in Switzerland.

Application in the software industry: How the vector-based concept for performance measurement & visualization can support the management of an R&D operation:

While R&D investments and activities are major value generators in companies today, they are also among the most risky.

(Lev and Aboody (Lev and Aboody, 2000) report for example that a study in the chemical industry has revealed, that while traditional capital investments (in tangible assets) return after tax just the cost of capital of 7 percent, in contrast to that investment in R&D return 17 percent – thus representing one if not the major source of the added value created by chemical companies. For value creation through R&D and other intangibles see also (Lev, 2001).)

The time span from investment decision to return is quite long (in the pharmaceuticals industry for instance up to 15 years, in the software industry 5-8 years). During this long period, the investment is subject to many risks: the market may change in the meantime, so that new products, once they come finally to market, are not in demand anymore (market risk); the engineers may not meet customer requirements or may produce a defective product (engineering risks); the technology on which the product is based may become outdated at a certain point in time (technology risk) etc. Therefore it is considered as best practice in the software industry, as in other R&D intensive industries, to manage R&D projects as investment projects on a rolling basis through a continuous investment management approach that allows corrections during the development process.

Rather than making only one (investment) decision at the start of the development project, decisions are made at predefined checkpoints whether to continue the project, modify it (change the specifications of the final product, underlying technology or the general scope, for example), or abandon it. Typically this rolling investment management procedure is applied to several project in common – that is, to a portfolio of products that are targeted for instance to one market segment or for all R&D projects of a company.

The major challenge in the decision making process of the product technology board of a software company (sometimes also called R&D portfolio board) is to maintain an overview over all portfolios and development projects and to make good trade-off decisions between costs and effects for customers (customer value, i.e. created revenue potential). But they must also judge the performance of a development manager or development teams (for instance to make a decision, based on clear criteria, about which team or which manager is best suited to lead a new important development project). And that is not an easy task.

Should the performance be measured based on the number of lines of code produced in a certain period of time? While this indicator does show how efficient a development team is in utilizing its resources to produce output, it tells us nothing about the effectiveness of its output – that is, whether the final software product will meet customer demand and be attractive enough for potential new customers. It is obvious that additional, qualitative information is required, such as subjective ratings by a set of pilot customers. Only when both dimensions are taken into account can a sound judgment be made about the performance of a software development team. The problem so far in many software companies is that no concept exists that allows these qualitative aspects to be measured and visualized in detail, connected with the quantitative, financial information, and linked to the performance measurement system of the entire organization. Here too we consider the concept of vector-based performance measurement & visualization as a solution:

The vector-based concept allows a software development department to measure efficiency (*x* axis: e.g. number of coding lines per headcount) *and* effectiveness (*y* axis: e.g. relative rating of customer satisfaction or, if the intended result of the project is a "semi-finished" product that will be used by other development projects, rating of the usefulness of the tool buy other software development teams) in a way that allows an easy to understand visualization of the compound result (the vector).

Because the vector-based concept of performance measurement introduces (often for the first time) a standardized way of rating of qualitative effectiveness based on a standard rating scale,

performance of development projects, portfolios, individual teams, departments, or entire business units can be easily aggregated and disaggregated. This enables a software company to manage and optimize its entire development organization based on clear criteria oriented to customers, markets, costs, and the performance of individual development teams or even individual developers.

The software industry is under considerable pressure to become commoditized. A counter-strategy that for example suppliers of business software are applying is to transform their business model from one of a software supplier (shipment of code) to one of a service provider. The objective is to support customers end-to-end in the process of optimizing their business processes through information systems. Critical in the customer engagement process for management is to maintain an overview over all activities in the customer-oriented value chain – not only from a cost and (short term) revenue perspective, but also from a qualitative perspective that sheds lights on the most critical potential the company needs to create customer value and competitive advantage. The vector-based approach, especially the vector aggregation technique described above, provides these software companies with a powerful strategic tool to maintain an overview over their entire customer oriented value chain across all functions and process steps, both form a financial and intangible/qualitative perspective. This helps management to determine where investments to enhance capabilities (i.e. value potential for the future) are required or where investments will create maximum value (see diagram 7).

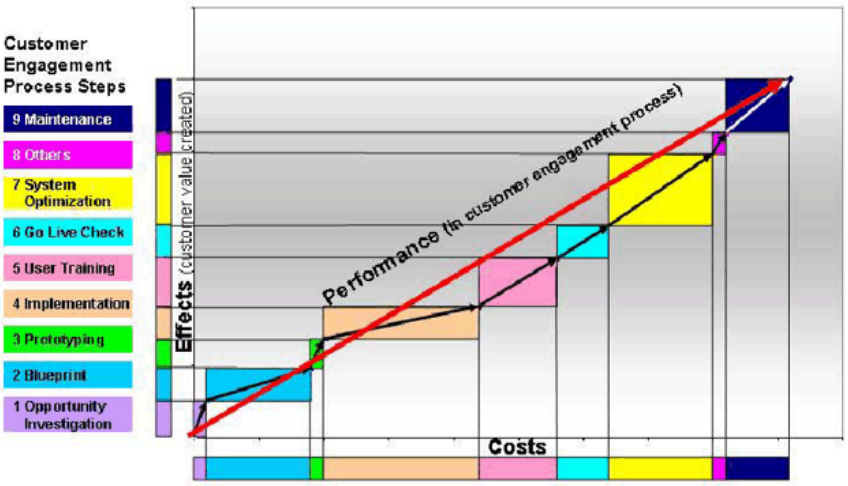

Diagram 7

Other possible applications

Organizations in other sectors, especially companies in service industries, are facing similar challenges in performance measurement and management to those faced by public services organizations or software companies. We are convinced that the vector-based concept of performance measurement and visualization provides all these companies and organizations with

an instrument that can bring more clarity, transparency, and speed into the decision making and reporting process by combining subjective, qualitative information with objective, quantitative information. One of the industries that is actually going through a major transformation that is confronting its players with the challenge to focus much more on effectiveness from a customer perspective is the banking industry.

Application in a bank:

In a bank, the concept can be used to optimize trade-offs between financial efficiency and customer satisfaction throughout the entire organization – something that is regarded in the banking sector as one of the major challenges and success factors at the same time. The vector-based concept would introduce for example in a retail bank an additional performance management dimension, additional to the usual financial performance metrics. Branch performance, for instance, can be visualized easily with the vector-based concept as the compound result (represented through the vector) of effectiveness, which is measured through customer satisfaction (value on the y axis, e.g. based on a yearly general survey or by quarterly surveys of randomly selected customers) and efficiency, which is measured for instance through the cost/income ratio (value on the x axis, based on accounting data). Through vector aggregation and/or de-aggregation of the contribution of branches, areas, and regions to the total compound (qualitative and quantitative), the performance of the entire bank organization can be visualized. It could also be used to break down total performance into the contributions of product groups or functional departments.

Many other possible applications of the vector-based concept for performance measurement and visualization exist, where the concept provides powerful tools for optimizing trade-offs between qualitative subjective parameters and quantitative, objective (financial) parameters and for improving the productivity of an organization, whether commercial or non-profit.

One of these other applications that we have already briefly mentioned is the following.

Application of the concept for valuing an enterprise:

Continuing with the example for applying the vector-based concept to the area of enterprise valuation from before, an additional perspective the vector-based approach could provide is the perspective on intangible asset levels a possible acquirer of an enterprise would require in order to create a "leverage effect" and generate a positive return. To explain this, let us take the example of an acquisition of Cisco and the leverage effect Cisco had been able to realize by leveraging two important intangible assets: its customer base and the capability of the company to integrate the products and employees of an acquired company quickly and successfully into its own value creation system:

Cisco, the network equipment vendor, acquired Crescendo, a small company specialized in so-called network switches, in 1995 (Bunnell, 2000). Cisco paid $97 million for Crescendo, an enterprise that had an annual turnover of only $10 million. Wall Street analysts found this to be hopelessly overpriced. However, Cisco went on to gain a $500 million turnover a year later with the Crescendo products. In the light of this new figure ($500 million instead of $10 million) Cisco's acquisition of Crescendo was cheap. The analysts had overlooked the fact that the combination of Crescendo technology and Cisco sales potential (the Cisco customer base) meant that Cisco was able to immediately gain a much higher sales volume than Crescendo would ever have had in the

foreseeable future. The subjective perception of Wall Street analysts differed greatly from the subjective perception of the Cisco management. Each saw Cisco very differently: in sharp contrast to the financial analysts, who saw Cisco only from the perspective of a financial investor who can only apply portfolio techniques and financial market information to "leverage" an investment, the Cisco management saw the investment opportunity Crescendo represented from the perspective of an entrepreneur who is able to leverage the investment with a strategic enterprise asset a financial investor cannot dispose of: Cisco's customer base and the ability of the organization to integrate a new companies products and employees quickly and successfully.

From such a perspective, the ratings on the *y* axis in diagram 3 wouldn't just represent the subjective value different investors with different strategies would attribute to an investment opportunity like the acquisition of a company like Crescendo. It would also define the level of intangible assets an investor has to dispose of if the investor wants to be able to "leverage" an investment for a given price. The concept of vector-based performance measurement & visualization helps to visualize these different value concepts and set the focus on the difference between price and value that was described on figure/diagram 3.

IV. Implementation steps

For organizations that want to apply the concept, we recommend the following implementation steps:

1. Awareness & Scope Workshop: workshop with the key personnel (sponsor, owner, experts) of the area that has been selected to serve as a "prototype" to test the concept (these persons usually will become members of the project team or steering committee later). The objective of this workshop is to broaden the understanding of the concept, create awareness for its opportunities and limitations, determine the scope of the prototype, and make a final decision about the members of the project team and the governing structure of the project (project plan and milestones, formation of steering committee, etc.). The members of the project team, who might collaborate for certain tasks with other people in the organization, perform the following steps:
2. Object definition: define the objects of performance measurement (projects, departments, process steps … --> what do we want to measure?) and their relationship between each other and the "whole picture" (company, business unit etc.).
3. Definition of measures, metrics, and visualization: define measures and metrics for qualitative, quantitative and compound measurement (--> how do we want to measure in a multidimensional way? What are the relevant/critical dimensions?), define the framework for 2D or 3D visualization.
4. Parameterization: Define rules for quantifying qualitative metrics (--> how do we quantify subjective ratings in such a way that we can later perform mathematical operations with these measures?) for example by introducing a qualitative scale such as 1-5 for qualitative ratings in a survey.

5. Clustering: define clusters for objects that have been selected in step 2 (--> how can we group the most detailed objects into clusters so that we can maintain an overview?) An example would be to group the 140 product groups of a Kantonalverwaltung into a number of clusters that can be handled from a managerial perspective and can be used for aggregation and de-aggregation.
6. Weighting: define weights for each object and cluster to be analyzed from the perspective of the whole picture of the organizational entity involved (--> how important is each object within the framework of the whole entity from the perspective of the customer or another major stakeholder?) For instance, in a public service organization like a Kantonalverwaltung in Switzerland one would weight the importance of the services of the different departments from the perspective of the citizens or from the perspective of the governing party – see diagram 6.
7. Defining the charts/visuals: define the charts/visuals for each application area on the various levels of the organization/in the areas involved (--> which charts do we need to support planning processes, performance reviews, or specific decisions? How are they connected with each other – what is their logical link?).
8. Test and revision: Test the new measurement and the visualizations system (--> are the assumptions we made in line with reality? Does the system work in practice?) and revise it where necessary (iterative process).

Conclusion and Outlook

In today's demand-dominated global knowledge economy, customers or other important stakeholders of businesses and non-profit organizations want these organizations to act according to their stakeholders' subjective, qualitative values and criteria. Therefore, in managing their operations, organizations have to take into account increasingly qualitative, subjective ratings, experiences, and values of customers and external stakeholders, but also of their managers and experts, in order to create value added, i.e. to create positive effects for customers and stakeholders with minimal resource consumption.

The performance of an organization can therefore no longer be defined and expressed just in financials terms (profit/return on investment for commercial organizations, or meeting the budget for a public service organization). As long as performance measurement systems are still based mainly on financial information, their bandwidth is too small so that they ignore vital performance information for successful enterprise management today: information about the external effectiveness of an organization.

We therefore need performance measurement systems that are able to express subjective valuations, experiences, and ratings in a way that an organization is able to combine with traditional quantitative, financial information. In addition, the result has to be easy to understand and "manageable" from a managerial perspective, meaning that it is scalable (independent of time and location), that it can be aggregated and de-aggregated, and that it can be used across the

entire organization, linking different areas of measurement into one system of performance measurement.

The vector-based concept of performance measurement & visualization offers a practical solution for this problem. Discussions with and investigations of various organizations of different sectors – business and non-profit – about the application of the concept in areas such as internal audit, R&D, strategic planning, performance management in public services, customer service management, and many others have already demonstrated its practical relevance. After in-depth tests and experiences from the broader applications in different organizations in the near future, we expect further insights into its practicality and where improvements and enhancements are required.

We are convinced that in the future, organizations will need and use instruments that can handle intangible, qualitative, subjective values in a similar way that financial accounting and financial statements can handle today's financial information. In addition to the financial balance sheet, organizations will need an intangible balance sheet that accounts for intangible values (potential for the future) that has been created or destroyed during the reporting period. And in addition to the financial income statement they will need an intangible income statement that accounts for how efficiently (intangible costs) and effectively (intangible revenues) an organization is utilizing its intangible values and potential.

The concept of vector-based of performance measurement & visualization brings an unprecedented degree of rigor and discipline into the rating, measurement, and handling of qualitative performance measurement in organizations. We therefore regard the concept of vector-based performance measurement & visualization as an important first step in developing systems for the systematic recording, reporting, and visualization of intangible, qualitative, subjective values that set the qualitative and subjective (intangible) dimension into the context of the quantitative and objective (tangible) dimension. This is important because intangible, qualitative aspects can only create value when they are connected to the physical, tangible, and financial world of our economies.

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The Authors:

Juergen H. Daum,

SAP AG, ERP/BSAG, Neurottstrasse 16, D-69190 Walldorf, Germany,

E-Mail: juergen.daum@sap.com, Website: http://www.juergendaum.com/

Juergen H. Daum is an internationally recognized expert, author, speaker, and consultant in enterprise management. He currently acts as the Chief Solution Architect of the Business Solutions Architect Group at SAP AG and advises senior executives, CFOs and finance professionals in finance transformation and enterprise performance management best practice. He is a frequent speaker on enterprise and performance management topics and a frequent contributor of articles for leading journals. He is the author of the book *Intangible Assets and Value Creation* (John Wiley & Sons, 2002).

Peter Bretscher,

Ing. Büro für Wirtschaftsentwicklung, Alpsteinstrasse 4, CH-9034 Eggersriet, Switzerland,

E-Mail: peter.bretscher@bengin.com,Website: http://www.bengin.com

Peter Bretscher founded the Ing. Büro für Wirtschaftsentwicklung in 1988. Its mission is to advise organizations in the design of economic steering and management systems that integrate the intangible perspective. He also is engaged in supporting companies, consultants and other organizations in innovation and project management, in intellectual property and patent management, and in setting up business plans and defining enterprise strategy. Since 1994 he has also taught business engineering und business planning at the Hochschule für Wirtschaft, Technik und soziale Arbeit in St. Gallen, Switzerland.

Keywords:

Subjective, Qualitative Performance Measurement; Intangibles; Vector-Based Performance Measurement & Visualization; Public Services.

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[1] Peter Bretscher has developed the foundations of the vector-based concept that is presented in this article (see Bretscher, P., 1996, 1998) in collaboration with organizations from different sectors. It also has been licensed to consulting organizations and the concept is continuously enhanced and further developed.

[2] A good description of the basics of the financial control concept and the development of the financial control based management system at General Motors in the 1920s can be found in (Sloan, 1963), chapter 8.

[3] According to the experiences of the authors still 70-90 percent of the information found in performance management systems and management reports are financial information.

"***A new Information Revolution is under way.*** [...]
It is not a revolution in technology, machinery, techniques, software or speed.
It is a revolution in CONCEPTS."
Peter F. Drucker, Management Challenges for the 21st Century, p.97
