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Limitations of Performance Measurement Systems based on Key Performance Indicators

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ABSTRACT

Measuring performance is a key to optimize business processes. However, many of them cannot be easily measured due to their non-deterministic or qualitative nature. So, to fit in common performance measurement systems (PMS) that normally use numeric parameters (KPIs), artificial and simplifying measures have to be used that are complicated and costly to create and evaluate. Using a literature review, this paper documents the dominance of PMS that rely on KPIs and a lack of those that also incorporate non-numeric, generic indicators that better address qualitative problems. Combined with the discussion of different viewpoints to PMS properties as well as the demand for better transparency and comparability of business processes, the necessity of deployment for a refined PMS using additional indirect indicators is derived. It would be able to assess hidden performance problems and hence to reveal additional business process improvement possibilities.

Keywords

KPI, Indicator, Process Performance Management, Performance Measurement System, Business Process Management

INTRODUCTION

Measurement is the carrier to monitor and control according to the Business Process Management (BPM) approach (as discussed e.g. in Bucher and Winter, 2007). Numeric Key Performance Indicators (KPIs) evaluate business processes and allow the tactical management of an enterprise to judge if value will be delivered (Chennell et al., 2000). The restriction to quantify performance in so-called performance measurement systems (PMS) makes it difficult to *assess hard-measurable* or business processes that are rather *qualitative* in nature and better could be described by e.g. success factors, soft goals, milestones, complexity, relations, dependencies or maturity (e.g. Bierbusse et al., 1997; Kueng and Krahn, 1999; Ittner and Larcker, 2003 or Zigon, 2007).

Anderson et al. (1994) as well as Jeanes (1996) found a significant positive correlation between customer satisfaction and financial performance. Recent research of Raschke and Ingraham (2010) indicates strong evidence that for example a high business process maturity in key processes of the production environment positively affects business performance and hence lead times, inventory and holding costs which ultimately reduce cost of goods sold and increase the gross margin. Additional improvements that can be read out by other additional *indirect* indicators are likely to contribute to process success and outcome as well and hence, to contribute to business performance. It is the paper's goal to emphasize *disadvantages* in business performance in case of the restriction to the use of KPIs in PMS.

There are two main reasons to expand the scope of the assessment of business processes to additional indirect indicators:

(1) The evaluation of relevant IS theories according to this context (e.g. Porter's five forces, the principal-agent-theory and the organizational information processing theory) led to *additional* requirements that a business and hence its business processes need to become more transparent and comparable irrespective of their functional domains in order to be assessable and hence optimizable. Subsequently, results, constraints and properties of processes would be more visible.

(2) Out of business needs, an enterprise should be able to evaluate their processes' efficiency and to rate their effectiveness in *any* given business process without restriction to a specific process domain, performance system or measure constraint, which would be the case when only using numeric KPIs (Pidun and Felden, 2010). It should also not be forced to use many isolated models for the analysis and assessment of its processes to overcome this restriction. The contribution of this paper is the proof that state-of-the-art PMS are not able to fulfill these additional requirements and business needs. In contrary, a need for a PMS framework solution which is able to reveal additional performance potential is derived, by integrating additional non-numeric concepts for assessing business processes.

Proceeding with the description of the state of the art, then the used research design is proposed. In the investigation course part, the discussion of the PMS and completive concepts follows. Finally, the conclusion and outlook part frame this paper.

STATE OF THE ART

In this state of the art section, currently used concepts of PMS approaches and completive concepts are discussed. Out of these examinations, three different viewpoints to the state of the art are derived. Finally, the research gap is being postulated by raising research questions which are the basis to the investigation course.

Performance Measurement Systems

The definition and perception of what performance measurement should stand for is not cohesive in the literature, and so the subject of research has to be better specified. The terms *performance* and *success* in combination with measurement are often used synonymously in most publications and have to be reviewed in detail. Most authors agree on the need for a performance measurement framework in principle (e.g. Franco-Santos and Bourne, 2005, Sheu and Wacker, 2001), but the scope remains different. Neely et al. (1995), Bourne et al. (2002) and Miles (2008) prefer the definition of performance measurement as a process of quantifying action rather than building a framework for future systems. Similarly, Lönnqvist (2004) suggests defining a performance measurement system as a set of measures used to determine the status of attributes of the measurement objects.

In an exemplary approach, DeToni and Tonchia (2001) try to classify existing PMS into models that are strictly hierarchical, Balanced Scorecard (BSC) models, frustum models (aggregated measures without link to financial performance), models combining internal and external performances and value chain related models. Pun and White (2005) divide them by their purpose into self-assessment and improvement facilitation, and Franco-Santos et al. (2007) even exclude public and no-profit sector literatures in their research for a definition of business performance measurement (BPM) systems and still count *seventeen* different definitions. So, reliance on a single definition would not lead to the desired results.

Completive Concepts

Despite of critical discussions concerning the possible restriction in the meaning of the term *measurement* to numeric indicators (e.g. Lönnqvist (2004) as well as Pidun and Felden (2010) propose *assessment* as more adequate to also include other indicators), the term performance measurement system (PMS) is accepted as common wording of the artefacts in discussion. They normally refer to frameworks that describe *how* a system is performing, not to models defining or offering an approach for directly *analyzing* them. Neely et al. (1995) in particular differentiate performance assessment as process of quantifying the effectiveness and efficiency of an action and performance measurement being the metric used to quantify the effectiveness and efficiency of an action, either in terms of the actual status or the end result of the action. We synonymously use the terms effectiveness in this paper to describe to what extent customer's requirements are met at all (outcome) and efficiency to describe how economically the firm works with their given resources (success). This definition is similar to

(1) Drucker (1966) who describes effectiveness as the outside (customer) contribution of a manager’s efforts; them being assessed by results, as well as

(2) a common distinction between doing the right things (effectiveness) and doing things right (efficiency).

KPIs primarily measure process *performance* (i.e. the success of a process) whereas a certain process *quality* is not sufficiently addressed - by means of its capability to meet the customer’s requirements under all possible constraints (Actano, 2010). So when reviewing literature on PMS, there are visible differences in their viewpoints between

(1) design recommendations for a performance measurement system

(2) existing performance measurement systems and their constraints and

(3) descriptions of the measures/indicators attached to them.

We propose to spotlight findings and problems grouped to this nested set of viewpoints. They are discussed in detail in the investigation course section.

Research gap

The main question that arises out of these observations is why quantizing and the exclusive use of numeric indicators should be a necessity, or, more provoking, seems to be a dogma in PMS that has never been questioned yet. It might be hard to find, to calculate and control numeric measures for qualitative performance problems that only can be quantized insufficiently, like customer satisfaction, milestone achievement, inherent complexity or maturity. Though, numeric indicators seem to remain the main and in most cases, the *only* indicators in today's PMS.

So we raise following research questions:

- Can principal limitations of PMS be found and articulated throughout the literature?
- Can the dominance of PMS using KPIs be proved?
- To what extent can PMS fulfill the additional requirements for business processes?
- How could a PMS solution look like that overcomes these obstacles?

INVESTIGATION COURSE

This section consists of five parts explaining the research design of this contribution: First the empirical research through a literature review, second, the reflexion over the introductory three different viewpoints to the PMS and finally the findings, in which part the research questions are processed by matching the found properties, functions and limitations of PMS to the principles to make business processes more *comparable* and *transparent* that result from the discussion and application of relevant IS theories (additional requirements).

Literature review

To gather information on the matter, we decided to perform a literature review. It was carried out from January to November 2010 based on 70 sources discussing performance measurement approaches, their application, advantages, problems or distinctive features out of online and printed journals, books and practitioner reports. They were reviewed using the systematic review scheme according to Denyer and Tranfield (2009). Used databases were Emerald, Springerlink, EBSCO Source Complete and Google Scholar, including reverse citations where possible. Literature that compared and reviewed PMSs on their part could also be identified and was taken into account for a meta-review.

Recommendations for PMS' design

There can be different approaches of building a PMS from design to review.

Wisner and Fawcett (1991) offered a nine-step rulebook: define the firm's mission statement, identify strategic objectives, clarify functional area roles, develop performance measures, communicate strategic objectives and performance goals, assure consistency with strategy, assure the compatibility, use the performance measurement system and periodically re-evaluate. Medori and Steeple (2000) propose another design approach for auditing and enhancing PMS in six stages: define success factors as well as the performance measurement grid of quality, cost, flexibility, time, delivery and future growth, select measures, audit, implement, and maintain. Their framework also contains 105 measures.

Machland and Raymond (2008) offer three criteria that a PMS should focus on: management support sophistication, IT sophistication as well as alignment and scope. Smullen (1997) counts five basic requirements to a PMS: acceptable, suitable, feasible, effective and aligned between non-financial measures and financial goals.

DeToni and Tonchia (2001) remember to integrate a PMS into the enterprises' ecosystem of accounting system, manufacturing planning/control system and the strategic planning. Finally, Machland and Raymond (2008) state that multidimensional, balanced or integrated models surely can be developed from PMSs including various types of indicators, as well as being managed in a coordinated way. They do not mention a *restriction* to numeric indicators in principle.

Obstacles to PMS' implementation

The decision to apply a specific PMS in an enterprise does not necessarily mean successful implementation. Some compilations on key obstacles to PMS implementation exist; Bourne et al. (2002) e.g. postulate in their work two main drivers of success (benefit from the project and top management commitment) as well as four main barriers (effort required, data accessibility, consequences of measuring and disruption by new initiatives).

Kaplan and Norton (1996) go in a slightly different strategic direction when claiming their four found obstacles as: vision and strategy non actionable, strategy not being linked to department, team or individual goals, the strategy being not linked to resource allocation as well as the feedback being tactical and not strategic.

More detailed information about significance and severity can be extracted by clustering the particular reasons for bad implementation throughout the regarded literature:

(1) The problem of the top management no longer being focused or *committed* to the PMS is been seen as one of the heaviest roadblocks by Bourne et al. (2000) and Franco-Santos and Bourne (2005). In contrary, striving for *perfection* is also been seen as obstacle going in the opposite direction in Bourne et. al (2003).

(2) The unreflected usage of operational targets and goals *unlinked* to strategy, culture, or departments or diverging with time is mentioned in Kueng and Krahn (1999), Bourne et al. (2000), Chennell et al. (2000), Ittner and Larcker (2003), Franco-Santos and Bourne (2005) and Franco-Santos et al. (2007). Franco-Santos and Bourne (2005) also mention a certain lack of refinement and *review* loops. Especially the used *measures* are subject to critical review in the literature.

(3) The problem of unadapted *relying* on generic frameworks or measures that are poorly defined and might not actually contributing to the specific economic results is discussed in Bierbusse and Siersfeld (1997), Schneiderman (1999), Bourne et. al (2003) as well as Ittner and Larcker (2003).

(4) Having a large number of measures *diluting* the overall impact is being seen an obstacle by Brown (1996), Bierbusse and Siersfeld (1997) and Bourne et al. (2003).

(5) *Resistance* to measurement and change are seen as key blocking factor by Bourne et al. (2000 and 2003) as well as Franco-Santos and Bourne (2005).

(6) Bierbusse and Siersfeld (1997), Kueng and Krahn (1999) as well as Lönnqvist (2004) mention the fact that redesigning or gathering data would have generated extra *cost* not being linked to the potential value (of a parameter that should indicate economic efficiency). Finally, one of the most important obstacles is

(7) The need or unwillingness to quantify results in areas that are more qualitative in nature, intangible or hard-measurable (Bierbusse and Siersfeld (1997), Kueng and Krahn (1999), Bourne et al. (2000), Ittner and Larcker (2003), Lönnqvist (2004), Moxham (2009) and Rehage (2009)).

Restriction to numeric indicators

By far most of the reviewed PMS are *exclusively* using numeric measures as indicator of performance, success or value and are considering measures (also: metrics or data) as necessary or sufficient requirement for a performance system. Stalk and Hout (1993) explicitly demand the measure to be *quantitative* (and close to the customer). Though Tangen (2004) remembers to remove old performance measures that are no longer of interest to the business performance system, all in all the basic concept of applying only a numeric measure is *not* questioned.

Some collected examples of Performance Measurement Systems using numeric indicators are, sorted by their relevance and distribution in practice and literature:

- *Balanced Scorecard* (BSC) by Kaplan and Norton (1996), discussed amongst others by Ghalayini et al. (1997), Kueng and Krahn (1999), Bourne et al. (2000, 2003), Lin et al. (2002), Ittner and Larcker (2003), Beatham et al. (2004), Lönnqvist (2004), Tangen (2004), Craciun and Criveanu (2005), Folan and Browne (2005), Garengo et al. (2005), Pun and White (2005) as well as Neely et al. (1995)
- *Performance Prism* by Neely et al. (2002), discussed by Bourne et al. (2003), Ittner and Larcker (2003), Lönnqvist (2004), Tangen (2004), Folan and Browne (2005), Garengo et al. (2005) and Pun and White (2005)
- *SMART/Performance Pyramid* by Lynch and Cross (1991), discussed by Ghalayini et al. (1997), Bourne et al. (2003) , Tangen (2004), Folan and Browne (2005), Garengo et al. (2005) as well as Pun and White (2005)
- *Results/Determinants Matrix* by Fitzgerald and Moon (1996), discussed by Lin et al. (2002), Bourne et al. (2003), Folan and Browne (2005) and Garengo et al. (2005)
- *Performance Management Questionnaire* by Dixon et al. (1990), discussed by Neely et al. (1995), Ghalayini et al. (1997) and Bourne et al. (2000)
- *Supportive Performance Measures/Performance Measurement Matrix* by Keegan et al. (1989), discussed by Neely et al. (1995), Bourne et al. (2003) as well as Folan and Browne (2005)
- *Sink and Tuttle* Model by Sink and Tuttle (1989), discussed by Tangen (2004) as well as Folan and Browne (2005)

Other PMS with lower distribution are: *Dynamic Performance Measurement System* by Latintnen (1996), *Skandia's Intellectual Capital Navigator* by Edvinsson (1997), *Integrated Dynamic Performance Measurement system* by Ghalayini et al. (1997), CMMI by Kneuper (2003), in this context discussed in a previous version by Kueng and Krahn (1999), *Integrated Performance Measurement System* by Bititci et al. (1997), *Ambite Performance Measurement Cube* by Bradley (1996), *Integrated Performance Measurement Framework* by Rouse and Putteril (2003*), Intangible Success Factors*, introduced by Lönnqvist (2004), *Brown's Process-oriented Framework*, introduced by Brown (1996) and the *Organizational Performance Measurement*, introduced by Chennell et al. (2000).

The only PMSs that could be identified as not exclusively using numeric indicators were

- *EFQM* by Moll (2009), discussed by Kueng and Krahn (1999), Beatham et al. (2004), Lönnqvist (2004), Craciun and Criveanu (2005), Folan and Browne (2005) as well as Pun and White (2005)
- *Process Performance Measurement System*, introduced by Kueng and Krahn (1999).

Alternatively, they consider qualitative aspects of performance through the definition of descriptive goals and recommend the use of secondary scores or indicators that state to what extent the goals are fulfilled.

Findings

As a first result of the investigation, principal properties and limitations of PMS actually can be collected and *clustered* to specific viewpoints.

One of the main restrictions to these PMS is that business processes that cannot be measured easily are likely to be either *left out* or subject to costly design of artificial measures that suit in the numeric framework. Closely related to the collection of constraints, there is evidence that the design of PMS in the present investigation is still predominantly driven by numeric parameters; seventeen out of nineteen reviewed PMS rely on measures or KPIs.

Testing the evaluated properties and limitations of PMS against the three introductory commands of transparency, comparability and domain independence of business processes, following findings can be concluded:

A definitely positive aspect to *transparency* is that the mere existence of a PMS in an enterprise drives towards improved process definition and documentation. Transparency would even increase if the measures would be correctly linked back to department goals, strategy, financial aspects or culture, like demanded by many reviewers. The same is true for the demands of better *accessibility* of measures and results as well as for systematic pruning of obsolete measures. Both points are affecting a better *comparability*, too.

Given a PMS that is self-contained in an enterprise ecosystem, its measures, results and hence business processes can of course be compared to each other and a change over time and between different objects of measurement will be visible in case their definitions do neither change significantly in the rendered time or scope nor differ much between departments or divisions. *Comparability* may also increase if structured review loops are performed to ensure consistence of measures, or not too many measures are in place that could dilute the overall picture and impression.

Moreover, most PMS are able to support the assessment of the entire business performance and are as such not restricted to specific *functional domains* unless they intentionally differentiate between local and global optimization. This contradicts the historical isolated and ad-hoc usage of KPIs without PMS frameworks, e.g. in production or finance.

Even more problems arise of the fact that many designers and users of PMS simply *ignore* or avoid to aggregate and redesign difficult qualitative or hard-measurable measures so that they fit in numeric systems. On the one hand, *transparency* lacks because this behavior virtually *excludes* processes and assessment aspects in principle and for any assessment, they are simply not existent. On the other hand, *comparability* will be bad when measures are artificially built or simplified. Especially when using such measures, the *consistence* of definitions over time and scope has to be ensured because the sources of the definition, way of calculation, measurement or results might not be self-explaining or sustained.

This means: To use a conventional PMS adds up transparency and comparability to business processes (and this enhances business *performance* when problems can be seen and improvements can be put in place), even more, if the used PMS is built in a way to overcome the restrictions that can be clustered to the three viewpoints. But it would be even better to add up additional indicators that assess previously excluded or invisible problems to reveal *additional* improvement possibilities.

CONCLUSION AND OUTLOOK

According to the investigation findings, the problems when using conventional PMS can be can examined from three viewpoints and tested on their effect on transparency, comparability and domain independence.

In particular, some constraints in process performance remain invisible when using numeric parameters/KPIs for assessment exclusively, which is the predominant method for the PMS taken into account. Of course the use of KPIs might be *sufficient* for a lot of performance problems, as broad application in the past proved. But at least for enterprises that experience problems with PMS restricted to numeric parameters, there is a necessity for a concept of a PMS (framework) that also integrates assessment methods beyond numeric indicators. It can be postulated for two reasons:

(1) For reasons of better comparability and transparency it should contain more suitable approaches that describe and assess the performance of a process rather than putting a distinctive numeric value on it. So, improvements in process efficiency and effectiveness that contribute to the enterprises' success can *better* be visualized. It would even address process problems that have been invisible to KPIs before, but are accessible to other *indirect* indicators like success factors, soft goals, milestones, complexity, relations or maturity.

(2) For reasons of business resource awareness, it would allow enterprises to directly assess remaining hard measurable business processes and performance problems *without* extra cost of finding and applying above mentioned additional models or defining and maintaining stopgap numeric measures. Moreover, previously *invisible* value-adding additional insights for performance problems are most likely through using uncommon approaches to business process assessment.

So when business performance *increases* by the number of *improvements,* which are more likely to be established in *transparent* and *comparable* business processes, there is a certain danger of *not* revealing problems and not implementing improvements with conventional KPI-using PMS - and hence, to *lose* money by *wasting* business performance.

All in all, a need for an integrated *performance assessment system* beyond numeric indicators using additional *indirect indicators* can be postulated. Deployment and the description of possible contents will be subject to further research based on these and prior findings.

REFERENCES

1. Actano (2010) *Glossary*. Available at http://www.actano.com/20911_EN-What%B4s_new-Glossary.htm#P, last access 4 November 2011
2. Anderson, E., Fornell, C. and Lehmann, D. (1994) Customer satisfaction, market share and profitability: findings from Sweden. *Journal of Marketing*, Vol. 58, 53-66
3. Beatham, S., Anumba, C., Thorpe, T. and Hedges, I. (2004) KPIs: a critical appraisal of their use in construction, *Benchmarking: An International Journal*, Vol. 11 No. 1, Emerald, Bingley, 93-117
4. Bierbusse, P. and Siesfeld, T. (1997) Measures that matter. *Journal of Strategic Performance Measurement*, Vol. 1, No. 2, Emerald, Bingley, 6-11
5. Bititci, U., Carrie, A. and McDevitt, L. (1997) Integrated performance measurement systems: a development guide. *IJOPM*, Vol. 17, 522–534
6. Bourne, M., Neely, A., Mills, J. and Platts, K. (2003) Implementing performance measurement systems: a literature review. *International Journal of Business Performance Management*, Vol. 5, No.1, Inderscience, Geneve, 1-24
7. Bourne, M., Mills, J., Wilcox, M., Neely, A. and Platts, K. (2000) Designing, implementing and updating performance measurement systems, *IJOPM*, Vol. 20, No. 7, Emerald, Bingley, 754-771
8. Bourne, M., Neely, A., Platts, K. and Mills, J. (2002) The success and failure of performance measurement initiatives: Perceptions of participating managers, *IJOPM*, Vol. 22, No 11, Emerald, Bingley,1288-1310
9. Bradley, P. (1996) *A performance measurement approach to the reengineering of manufacturing enterprises*, Ph.D. Thesis, NUI Galway
10. Brown, M. (1996) *Keeping Score: Using the Right Metrics to Drive World-class Performance*. Quality Resources, New York
11. Bucher, T. and Winter, R. (2007) Realisierungsformen des Geschäftsprozessmanagements - Eine explorative Klassifikationsanalyse, In: Oberweis, A. (ed.): *eOrganisation: Service, Prozess-, Market-Engineering*, Iss. 1, Universitätsverlag Karlsruhe, Karlsruhe, 695-713
12. Chennell, A., Dransfield, S., Field, J., Fisher, N., Saunders, I. and Shaw, D. (2000) OPM: a system for organisational performance measurement. *Proceedings of the Performance Measurement –Past, Present and Future Conference*, Cambridge, 2000
13. Craciun, L. and Criveanu, R. (2005) The performance measurement system and key performance indicators*, Annals of the University of Petrosani*, Economics, Vol 5, University of Petrosani, Petrosany, 63-72
14. DeToni, A and Tonchia, S. (2001) Performance measurement systems: Models, characteristics and measures, *IJOPM*, Vol. 21 No. 1/2, MCB University Press, Bingley, 46-70
15. Drucker, P. (1966) *The Effective executive*, Harper & Row, New York, 1966

16. Denyer, D. and Tranfield, R. (2009) Producing a Systematic Review, in *D.A. Buchanan and A. Bryman (Eds.), The Sage Handbook of Organizational Research Methods*, Sage Publications, London, 671-689
17. Dixon, J. Nanni, A. and Vollmann, T. (1990) *The New Performance Challenge: Measuring operations for World-class Competition*, Business One Irwin, Homewood
18. Edvinsson, L. (1997) Developing intellectual capital at Skandia, *Long Range Planning*, Vol. 30, No. 3, June 1997, Elsevier, Amsterdam, 366-373
19. Fitzgerald, L. and Moon, P. (1996) *Performance measurement in Service Industries: Making it work*, The Chartered Institute of Management Accountants, London
20. Folan, P. and Browne, J. (2005) A review of performance measurement: Towards performance management*, Computers in Industry* 56, Elsevier, Amsterdam, 663-680
21. Franco-Santos, M. and Bourne, M. (2005) An Examination of the Literature Relating to Issues Affecting How Companies Manage Through Measures, *Production Planning and Control*, Vol. 16, No. 2, Taylor & Francis, London,114-124
22. Franco-Santos, M., Kennerly, M., Micheli, P., Martinez, V., Mason, S., Marr, B., Gray, D. and Neely, A. (2007) Towards a definition of a business performance measurement system, *IJOPM*, Vol. 27, No. 8, Emerald, Bingley, 784-801
23. Garengo, P., Biazzo, S. and Bititci, U. (2005) Performance measurement systems in SMEs: A review for a research agenda*, International Journal of Management Reviews* Vol. 7, No. 1, Blackwell Publishing, Oxford, 25–47
24. Ghalayini, A., Noble, J. and Crowe, T. (1997) An integrated dynamic performance measurement system for improving manufacturing competitiveness*, International Journal of Production economics* No. 48, Elsevier, Amsterdam, 207-225
25. Ittner, D. and Larcker, D. (2003) Coming Up Short on Nonfinancial Performance Measurement, *Harvard Business Review*, HBS Publishing, Boston, 88-95
26. Jeanes, C. (1996) Customer satisfaction and business results: is there a link?, *Customer Service Management*, March, 46-48
27. Kaplan, R. and Norton, D. (1996) Using the Balanced Scorecard as Strategic Management System, *Harvard Business Review* January-February 1996, Harvard Business Publishing, Boston, 75-85
28. Keegan, D., Eiler, R. and Jones, C. (1989) Are your performance measures obsolete? *Management Accounting*, ABI/INFORM, June 1989, Vol.70, No. 12, ABI/Inform Global, Ann Arbor, 45-50
29. Kneuper, R. (2003) CMMI: *Verbesserung von Softwareprozessen mit Capability Maturity Model Integration*, 1. Edition, d.punkt, Heidelberg
30. Kueng, P. and Krahn, A. (1999) Building a Process Performance Meaasurement System: some early experiences*, Journal of Scientific and Industrial Research*, Vol. 58, No 3-4, National Institute of Science Communication and Information Resources, New Delhi, 149-159
31. Latintnen, E. (1996) Framework for small business performance measurement, *Proceedings of the University of Vaasa*, Research Papers Business Administration, No.77, University of Vaasa
32. Lin, F., Yang, M. and Pai, Y. (2002) A generic structure for business process modeling, *BPMJ*, Vol. 8., No. 1, Emerald, Bingley, 19-41
33. Lönnqvist, A. (2004) *Measurement of Intangible Success Factors: Case Studies on the Design, Implementation and Use of Measures*, Dissertation, Tampere University of Technology, Publication 485
34. Lynch, R. and Cross, K. (1991) *Measure Up: The Essential Guide to Measuring Business Performance*, Mandarin, London
35. Medori, D. and Steeple, D. (2000) A framework for auditing and enhancing performance measurement systems, *IJOPM*, Vol. 20, Nol. 5, Emerald, Bingley, 520-533
36. Miles, J. (2008) *Discovering critical success factors for implementing an automated performance measurement system*: a case study, Dissertation, Edith Cowan University
37. Machland, M. and Raymond, L. (2008) Researching performance measurement systems - an information systems perspective, *IJOPM*, Vol. 28, No. 7, Emerald, Bingley, 663-686

38. Moll, A. (2009) Rundum erneuert - EFQM-Modell und Radar-Logik in revidierter Version 2010, *Qualität und Zuverlässigkeit (QZ)* 11/2009, 13-15
39. Moxham, C. (2009) Performance measurement - Examining the applicability of the existing body of knowledge to nonprofit organisations, *IJOPM* Vol. 29, No. 7, Emerald, Bingley, 740-763
40. Neely, A., Gregory, M. and Platts, K. (1995) Performance Measurement system design: A literature review and research agenda, *IJOPM*, Vol. 15, No. 4, Emerald, Bingley, 80-116
41. Neely, A., Adams, C. and Kennerly, M. (2002) *The Performance Prism: The Scorecard for Measuring and Managing Business Success*, FT Prentice Hall, London
42. Pidun, T. and Felden, C. (2010) A Reference Model Catalog of Models for Business Process Analysis, *Proceedings of the Sixteenth Americas Conference on Information Systems*, at http://aisel.aisnet.org/amcis2010/169
43. Pun, K. and White, A. (2005) A performance measurement paradigm for integrating strategy formulation: A review of systems and frameworks, *International Journal of Management Reviews*, Vol. 7, No. 1, Blackwell, Oxford, 49-71
44. Raschke, R. and Ingraham, L. (2010) Business Process Maturity's Effect on Performance. *Proceedings of the Sixteenth Americas Conference on Information Systems*, at http://aisel.aisnet.org/amcis2010/402, last download 27 August 2010
45. Rehage, J. (2009) Zwischen Realität und Wunschdenken*, IT&Produktion* 12/09, Special publication ERP/CRM Wissen kompakt, TeDo Verlag, Marburg, 36-39
46. Rouse, P. and Putterill, M. (2003) An integral framework for performance measurement, *Management Decision* 41 (8), Emerald, Bingley, 791–805
47. Schneiderman, A. (1999) Why balanced scorecards fail, *Journal of Strategic Performance Measurement*, special edition 6, 6-11
48. Sheu, C. and Wacker, J. (2001) Effectiveness of planning and control systems*, International Journal of Production Research*, Vol. 39, No. 5, Taylor & Francis, London, 887-905
49. Sink, D. and Tuttle, T. (1989) *Planning and Measurement in your organisation of the Future*, Chapter 5, Industrial Engineering and Management Press, Norcross, 170-184
50. Smullen, J. (1997) *Balance Scorecards and Activity Based Management: The Practical Application*, FT Pitman Publishing, London
51. Stalk, G. and Hout, T. (1993) How time-based management measures performance, *Strategy & Leadership*, Vol. 18 Issue 6, MCB University Press, Bingley, 26 - 29.
52. Tangen, S. (2004) Performance measurement: from philosophy to practice, *IJPPM*, Vol. 53, No. 8, Emerald, Bingley, 726-737
53. Wisner, J. and Fawcett, S. (1991) Link firm strategy to operating decisions through performance measurement, *Production and Inventory Management Journal*, Third Quarter 1991, APICS, Chicago, 5-11
54. Zigon, J. (2007) *Measuring the hard stuff*, at http://www.zigonperf.com/hardstuff.html