A pull approach to performance measurement systems design

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Abstract

The literature covering the design of performance measurement systems (PMS) is extensive. Empirically based cases showing how to identify and present the information to support decision-making in the best way is however not as commonly described. The purpose of this article is therefore to close this gap and to propose a novel methodology, the Pull approach, for designing performance measurements. It will provide a description of the Pull approach, position it into context in the literature and exemplify how the methodology could be used by presenting industrial case studies.

Keywords: Operations strategy, performance management, KPI

Introduction

The upbringing of this paper was an industrial need to design more effective performance measures. Measures that really measure the right things, resulting in information that is needed for decision making on all organizational levels. The literature covering the design of performance measurement systems is extensive. However, how to identify and present the information to support decision-making in the best way is not as commonly described. The purpose of this article is therefore to close this gap and to propose a novel methodology for designing performance measurement or indicators.

This article will provide a description of the Pull approach, compare it to similar or alternative approaches in the literature, and illustrate how the methodology is used through a number of industrial cases. Finally, reflections and conclusions will be done as well as a description of planned future research.

Methodology

There are several performance measurement system (PMS) design methods presented in the literature. A literature review of methods for PMS design was carried out, with the purpose to position the Pull approach in comparison to alternative methods.

Further was case study methodology used to structure and carry out the industrial case studies. Three different cases from the same industrial company are presented in this article. The cases illustrate and evaluate the use of the same methodology for different kind of performance measures and at different hierarchical levels. Case A was the first case, conducted during a welding line installation. In Case B the methodology was used in a project implementing an equipment scanning weld quality. In Case C the methodology was instead used to identify cost of poor quality measures.

The Pull approach workshop has elements of action research. However, the social context is limited to one company and the democratic aspects that, while being important to create a good work environment, are limited by the organization of the company.

Literature review

The literature covering performance measurement systems and their design are extensive. Yadar and Sagar (2013) describe the historical development of performance measurement and management (PMM) frameworks, focusing on the years 1991-2011. In the first half integrated and balanced PMM systems were developed, such as balanced score card (Kaplan and Norton, 1992). In the second half more dynamic multi-stakeholders perspective have been more in focus e.g. the Performance Prism (Neely et al, 2001). Yadar and Sagar (2013) emphasize the need of validating frameworks empirically and to apply it in a practical context. They further state that there is a limited mechanism available to help transform information into value-adding activities. Ravelomanantsoa et al (2018) present a state of the art of different approaches for performance measurement systems design. The approaches are compared based on their characteristics of being recommendations, structural architectures, procedural architectures, generic performance indicators, methodological support tools or reference models. They state that a complete methodology cannot stop at the PMS design but must be implemented in the company information system. They identify a gap in this area since only a few approaches take this step into account.

Ravelomanantsoa et al (2018) also point out that none of the approaches take the form of the performance indicator into account. They thereby identify another gap regarding data visualization and the influence the cognitive impact might have on the decision-making.

When it comes to the design of a PMS it is important to not start by asking “What should we measure?” (Neely and Bourne, 2000). Before the PMS can be designed, the levers that different stakeholders can pull in order to achieve the organizational goals must be identified as well as the cause and effect relations between these lavers. Then the right performance measures (PMs) can be designed based on the understanding of the priorities of the organization and the actions needed to achieve the goals. For the design of individual PMs several authors recommend using the performance measurement record sheet developed by Neely et al. (1997) which consists of 10 elements that needs to be addressed for each PM. However, the gap regarding data visualization identified by Ravelomanantsoa et al (2018) can also be found in this framework since none of the elements are addressing the presentation of data.

Boyer and McDermott (1999) define strategic consensus as the level of agreement within an organization regarding the relative importance of cost, quality, delivery and flexibility to the organization’s operational goals, as well as the relationships between

these competitive priorities and operational policies. Their case studies revealed that operators and managers in the same firms exhibited significant inconsistencies in their manufacturing priorities, indicating a lack of strategic consensus. That is also in line with Marinho and Cagnin (2014) who show that in practice the notion of stakeholder involvement, mutual experimentation and learning, and of a common vision is still neglected. Further Goh (2012) identifies stakeholder involvement and engagement in the process of an effective public sector performance measurement system as one of the key factors. A Pull approach can be one way to facilitate the discussions necessary to enable this stakeholder involvement and strategic consensus.

Pull approach description

Given the theoretical arguments previously described, regarding the need of empirical studies as well as strategic consensus, visualization and stakeholder involvement, the remainder of this paper will be devoted to the Pull approach. The background of the methodology is an industrial need to design more effective PMs. The Pull approach is summarized in Figure 1. The Pull approach emphasizes a collaborative attitude and is preferable done as a workshop. When deciding on participants in the workshop, the aim should be cross functionality since it will bring knowledge both from push and pull perspectives.

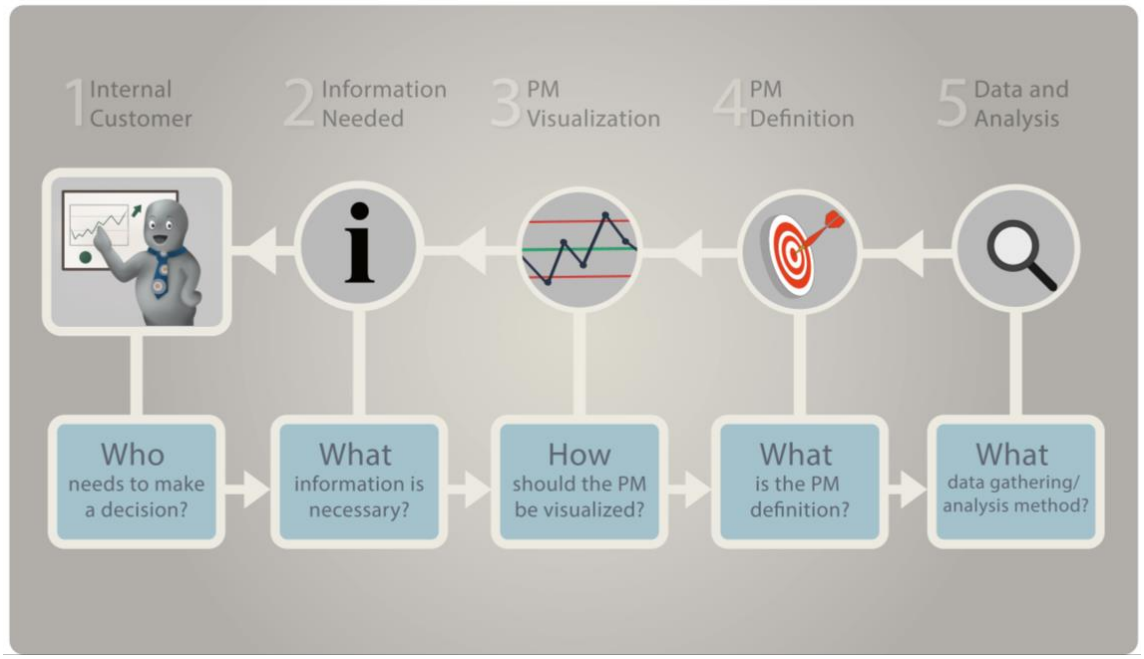

Figure 1- Illustration of the Pull approach used in the case studies.

The Pull approach was originally designed as an alternative to the technology push that the industrial researcher saw in her organization. The performance measures were designed based on the available measurement technology, not based on an actual need for certain information to make important decisions. The Pull approach turned around that logic and instead promoted the organization to start with identification of the stakeholders, the internal customer of information (Ericson Öberg, 2016). That can be compared with the explanation by Martin (1994) where technology push is mainly driven by internal research and development activities and market pull is driven by external market forces (that in this case would represent the stakeholders).

The first step is to identify who needs to make a decision, since the performance indicators or information should assist in the decision-making. The next step is to decide what information is necessary for that decision-maker and how it should be presented to convey the information in the best way. When this is clear it is time to define in detail what properties to measure and their definition. Finally, the requirements on data gathering and analysis method can be defined, e.g. level of automation. When those steps have been conducted for all internal customers it is easy to see what is in place and where there are any gaps. The gaps can be compiled into an action list with responsible persons and dates.

The first applications concerned measures for assessing welding quality in a heavy machinery industry. The industry-employed researcher that developed the methodology realized that the same way of working can be applied for different kind of performance indicators and at different organizational levels. This idea was developed as part of the researcher's PhD thesis (Ericson Öberg, 2016) and it was included in a handbook for designing, implementing, using and revising performance measurement systems (Almström et al, 2017). However, the methodology, the "Pull approach" was not detailed nor put in a perspective of similar approaches to design performance measures, in the handbook or in the PhD thesis. That omission became apparent when the same constellation of researchers that wrote the handbook, wanted to use the methodology in a new research project "SMART PM". There was no comprehensive method description that any of the researchers could use to help the participating industrial companies to focus on the right performance indicators.

Initially the Pull approach was inspired by SIPOC, which is a tool commonly used in Total Quality Management (TQM) and Six Sigma projects to create a high level process map. The elements are suppliers, inputs, process, outputs and customers (Brook, 2010 and Parkash and Kaushik, 2011). The mapping is often done following the material or information flow starting with supplier, but it can also be more lean influenced with a pull approach with the reversed order (Guerorguiev, 2018) or starting with the output (Silverstein et al, 2017). In the Pull approach, the reverse order is used, starting with the information customer, the stakeholder.

Empirical findings

Case A – welding line installation

Case A was the first time the methodology was used. During the workshop conducted by four people, 10 internal customers were identified with more than 60 information need items, see Figure 2 below. The four people attending were industrial the Phd student, the welding specialist, and two manufacturing project managers. Several improvements of the methodology were identified e.g. to limit the scope and include more participants in the workshop.

Figure 2 - Post-its were used in the workshop to capture input from the participants.

Case B – scanning of welds

In this case, scanning of welds showed in Figure 3, six internal customers of information were identified. It resulted in several defined information needs, ranging from preferred parameter settings to improvement project comparisons. One learning was to involve the managers with the budget responsibility for the area, in order to enable the implementation of identified gaps.

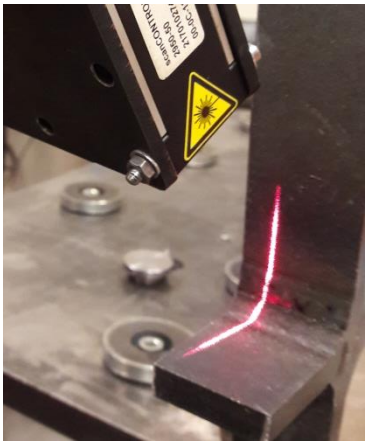

Figure 3 - Scanning of welds to assess quality.

Case C – cost of poor quality

This workshop regarding cost of poor quality, see Figure 4, was not done face to face but online with participants in different countries. It required more preparations in terms of describing the inputs as well as compiling the results. Six internal customers where identified. A conclusion from the workshop was that the same definition and data gathering could be used for several different information needs.

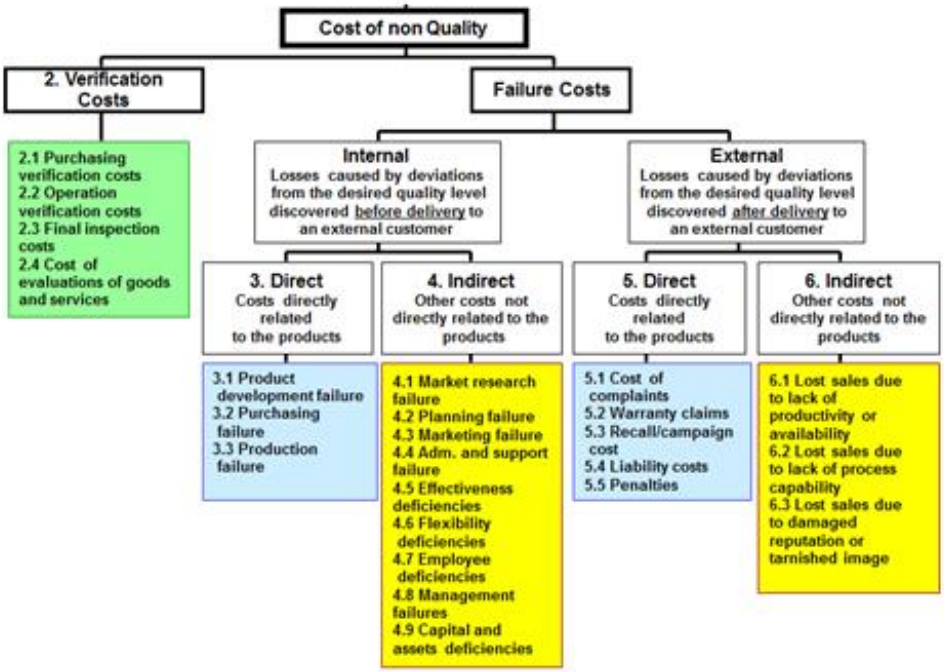

Figure 4 – Cost of Poor Quality items.

How to carry out a Pull workshop

Based on the experiences from the cases a standard procedure has been formulated to be used primarily for our need in the research project SMART PM that involves manufacturing companies of different sizes. However, the workshop is designed to be of use in different contexts and the procedure and the following instructions can easily be adapted as needed.

Preparation for the workshop

Before the actual workshop is carried out, the company needs to identify an area or section in the workshop that will be focused. Next step is to, for the chosen area, define which problem that needs to be solved. Which strategic or operational decision-making needs improvement? What are the current and desired modes? The next preparation step is to decide which stakeholders that should participate. The recommendation is that at least one person from the following functions is to be included:

- Supervisor
- Operator
- Production engineer
- Maintenance

Depending on the problem that needs to be solved or which improvement needs to be implemented, for example representatives from planning, logistics, finance, quality and environment could also participate.

In the SMART PM project, the workshop is led by one or more of the participating researchers and is conducted for at least two hours. If the company wants to use the methodology, the workshop can be led by the problem owner. The time spent depends on how many stakeholders' information need are discussed.

Implementation of the workshop

During the actual workshop, the following steps are carried out:

1. Start by briefly discussing the topic, so that all stakeholders have a common picture of what the problem is or what should be achieved. (about 5 min)
2. Identify who needs to make a decision related to the identified topic, because the information that is needed is developed to support the decision. This step provides a list of internal stakeholders. (about 5 min)
3. Identify the information needed to make the decision. Review all stakeholders' information needs to provide a complete picture of the needs. (about 5 min per stakeholder)
4. Decide on how, how often and when the information should be presented to different stakeholders. Do this for each identified information. (about 5 min per information)
5. When this is clear, it is time to define in detail which parameters / PMs are to be measured and how to define them. (about 5 min per information)
6. Finally, the measurement and analysis method can be defined. How should the information be collected? What equipment is needed to collect the information? Can the information collection be automatic? Make an analysis for each measurement. (about 5 min per information)
7. Compile which actions need to be performed, by whom and at what time, to accomplish the identified change to move from current to desired mode. (about 1 hour)

The time required to complete the workshop depends on how many stakeholders participate and how complex the problem or improvement is (how much information needs to be collected and visualized). A guiding estimation is that it takes 3 hours to complete the workshop.

Expected results

After the workshop we expect to have:

- A clear picture of what is to be achieved
- A case study description with a relatively detailed plan for implementation
- A method that can be used for structured work with information management for decision-making.

Discussion

A lot of the performance measurement system design models described in theory are conceptual and on a high level. As pointed out in literature there is a need for methods supporting the implementation of getting the measurement a part of the company's information system. The Pull approach is a hands-on method that is ready to be used by people involved in performance measurement design in industry. It suits best as a methodological support tool, where also e.g. Six Sigma belongs according to Ravelomanantsoa (2018).

This article contributes to the operations management theory by providing examples and illustrations of established performance measurement theory through the industrial case studies. It further contributes to the industry through the success stories that these cases illustrate. That is also in line with the desire for strategic consensus through collaborative design which cannot be achieved if functions address issues separately. The result in itself is not always the important part but the process to achieve it. The involvement of the stakeholders in the process not only make them reflect upon their own information need, but also give an increased understanding of other stakeholders´ situations.

The initial case studies demonstrated that the Pull approach has the potential to be

suitable for different types of problems and PMs. That flexibility is necessary since organizations will face increased speed of change in information needs for different stakeholders. Further studies and analyses of cases from different companies and contexts are however necessary, which is already planned in the SMART PM project.

Conclusion

Even though the area of performance measurement systems design is well covered in the literature, some important gaps still exist to explore. This paper proposes a novel methodology, the Pull approach, for designing performance measurements to identify and present the information to support decision-making in the best way.

The Pull approach will be further used in the research project SMART PM where the focus is on digitalization of the use phase (measure, analyze, report, and make decisions). Several companies of varying sizes and industry areas will participate to make it possible to analyze the Pull approach's suitability in different contexts.

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References

Almström, P. et al (2017), *Sustainable and Resource Efficient Business Performance Measurement Systems – The Handbook*, Chalmers University of Tehnology, Gothenburg.

Boyer K. K. and McDermott C. (1999) "Strategic consensus in operations strategy". *Journal of Operations Management*, Vol. 17, pp. 289–305

Brook, Q. (2010), *Lean Six Sigma & Minitab The Complete Toolbox Guide for all Lean Six Sigma Practitioners (3rd Edition)*, Opex Resources, Winchester.

Ericson Öberg, A., (2016), *Predictability : an enabler of weld production development*, PhD Thesis, Chalmers University of Technology, Gothenburg.

Goh, S. C (2012) "Making performance measurement systems more effective in public sector organizations", *Measuring Business Excellence*, Vol. 16, No.1, pp.31-42.

Guerorguiev, T (2018), "Improving the Internal Auditing Procedure by Using SIPOC Diagrams", *Journal of Innovations and Sustainability*, Vol. 4, No. 2, 35-43.

Kaplan, R.S. and Norton, D.P. (1992), "The Balanced Scorecard: Measures That Drive Performance". *Harvard Business Review*, Vol. 70, No. 1, 71-79.

Marinho, S.V. and Cagnin, C. (2014), "The roles of FTA in improving performance measurement systems to enable alignment between business strategy and operations: Insights from three practical cases", *Futures*, Vol. 59, pp. 50-61.

Martin, M.J.C. (1994). *Managing Innovation and Entrepreneurship in Technology-based Firms.* Wiley-IEEE. p. 44.

Neely, A., Adams, C. and Crowe, P. (2001), "The performance prism in practice", *Measuring Business Excellence*, Vol. 5, No. 2, pp. 6-13.

Neely, A. and Bourne, M. (2000), "Why measurement initiatives fail", *Measuring Business Excellence*, Vol. 4, No. 4, pp. 3-7.

Neely, A., Richards, H., Mills, J., Platts, K. and Bourne M. (1997) "Designing performance measures: a structured approach", *International Journal of Operations & Production Management*, Vol 17, No. 11, pp. 1131-1152.

Parkash, S. and Kaushik, V.K. (2011) "Supplier Performance Monitoring & Improvement (SPMI) through SIPOC Analysis & PDCA Model to the ISO 9001 QMS in Sports Goods Manufacturing Industry". *LogForum*, Vol 7, No. 4., pp. 1-15.

Ravelomanantsoa, M., Ducq, Y. and Vallespir, B. (2018), "A state of the art and comparison of approaches for performance measurement systems definition and design", *International Journal of Production Research*.

Silverstein, D., Samuel P. and DeCarlo N. (2017), *Innovator's Toolkit – 50+ Techniques for Predictable and Sustainable Organic Growth (2nd Edition)*, John Wiley & Sons, Hoboken.

Yadav, N. and Sagar, M. (2013), "Performance measurement and management frameworks: Research trends of the last two decades", *Business Process Management Journal*, Vol. 19, No. 6, pp. 947-971.