8 Developments in Material Flow Management: Outlook and Perspectives

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Material flow management offers enterprises numerous advantages and success potentials. However, practical implementation of this approach is still a slow-going process. There are still a number of obstacles impeding a broader utilisation and application of material flow management. In terms of overcoming these hindrances, further developments are already foreseeable which speak in favour of a successful dissemination of this approach. In order to depict a development path for material flow management, existing obstacles and pending developments are summarised in the following.

8.1 Existing Obstacles to Material Flow Management

There are several obstacles blocking the widespread dissemination of material flow management in corporate practice. The following points demonstrate the necessity for further development of material flow management:

- Already existing value-added chain structures influence stakeholder actions, which in turn affect these structures. This reciprocal interaction significantly restricts the objective-oriented design options of the individual stakeholders. Efficient material flow management requires co-operation on the part of all stakeholders.

- In the scientific and academic discussion, material flow management is often equated with co-operation, based on the simplified concept that companies want to co-operate in a cross-level optimisation of material flows in regards to sustainability. It must be noted, however, that enterprises do not enter into co-operations on a cross-company level unless there are company-specific reasons to do so. Enterprises are market participants and thus natural competitors which, in the absence of political pressure or expected benefits for themselve, do not co-operate for the purpose of designing ecologically sounder material flows.
- The interaction of several organisations requires management. Material flow management offers the impression that the stakeholders are reciprocally managed. However, there is not one sole material flow manager, but rather a co-operation of several organisationally independent managers who aim at optimising their own benefits. The lack of cross value-added chain management for optimising the benefits for all involved parties prevents companies from positively opening up to material flow management.
- On their own, single enterprises are unable to meet the requirements of a sustainable material flow management, i.e. simultaneously managing economic, ecological and social objectives.
- Some material flow management approaches have yet to be tested in practice. The formulated objectives and criteria specify strict requirements which are viewed as mandatory. The practical application of these approaches gives rise to information and co-ordination problems between stakeholders as well as on an individual company level.
- Material flow management is sometimes seen as a separate company task. To attain better acceptance of this promising approach, material flow management has to be more comprehensively integrated into company processes.
- Examining physical material flows alone is not sufficient for reaching an efficient co-operation between several stakeholders. By not taking organisation and information flows into account, co-operation options are only utilised to a limited extent in corporate practice.

8.2 Required Developments in Material Flow Management

The results of the presented research projects as well as the shared conclusions arising from the meetings of the "Material Flow Management and Recovery Systems" working group aim to eliminate existing obstacles preventing the application of material flow management and identify areas

that still require research and development in this field. Based on the recent findings, the following development areas can be summarised:

- Standardised data collection and evaluation with ERP system interface
- Industry-specific solutions
- Supplementation of supply chain (value-added chain) evaluations with information flow analyses
- Business models for a culture of innovation
- Dissemination and networking of research results.

8.2.1 Standardised Data Collection and Evaluation with ERP System Interface

To be efficient in the long term, cross-company material flow tracking requires a systematic supply of data. Based on the existing project and institute specific solutions, a standardised solution for securing data collection, availability and quality needs to be developed. A combination of the various findings promises successful further development of already implemented data evaluation methods and, for corporate practice, provides a better overview of the available problem solution approaches and methods.

The method to be standardised must enable simultaneous tracking of material flow quantities/volumes, values and costs and, depending on the company size, provide an interface – as direct as possible – to existing ERP systems. An integrated consideration of ecological, economic and social aspects should be further developed and secured.

8.2.2 Industry-specific Solutions

An integrated data supply should be provided along both the physical value-added chain as well as the product realisation path (from the product concept to design up to realisation). When further developing material flow management approaches, the competitive situation has to be taken into account as well, particularly in regards to a global perspective in the case of cross-border material flows. As a result of competitive pressure, industry consolidation and transparent markets, standards and open forms of co-operation already exist in some industries, while others still urgently require industry-specific solutions, success examples and intensified research and analyses in order to gain better access to the possibilities and opportunities offered by material flow management.

8.2.3 Supplementation of Supply Chain (Value-added Chains) Evaluations with Information Flow Analyses

For the most part, material flow management approaches up to now have examined the physical layer (material and substance flows) in great detail, while only partially taking into account the corresponding internal and cross-company information flows and organisational structures. Information flows control and map the material flows, thus forming the key to more efficiently designing value-added chains. They shape the perceptive and problem awareness of the decision-makers. A special future potential is detected in the optimisation of information flows and organisational structures that correspond to the actual material flows. Here, increased transparency and the resultant design tools can contribute to improving the exchange of information between stakeholders and thus the efficiency of the value-added chain.

8.2.4 Internal Business Models for a Culture of Innovation

Scepticism towards new scientific developments and innovations can often be found in corporate practice. Enterprises could utilise many of the available material flow research results for economic, ecological and social improvements. However, companies are either unfamiliar with these results or reject them. To extensively disseminate these efficient approaches in enterprises, attention thus needs to be focused on the question of which internal business models are required in companies in order to facilitate the acceptance of new management approaches. What information and communication processes, which organisational process and structure models can facilitate efficient, innovative material flow design in companies? Which elements of corporate culture and what competencies are required for employees and managers? Only a refurbishment of existing, traditional business models can trigger new innovation impetuses in corporate practice and thus increase the implementation probability of new approaches and methods.

8.2.5 Dissemination and Networking of Research Results

Research results should provide input for corporate practice, which requires numerous dissemination activities for getting the results to the decision-makers in the companies. More punch is added by networking and harmonising the research results in order to prevent a confusion of tongues and a maze of terminology and ensure that innovative companies are not put off by the multitude of similar approaches and tools. Therefore,

research funding should proactively allow for and explicitly demand, to a greater extent, the dissemination of research results beyond the scope of the companies participating in the projects, both on a domestic and international level. The same applies to the exchange, mutual co-ordination and further content development of material flow related research projects.

8.3 Summary

On the whole, the material flow oriented projects within the scope of the "Material Flow Management and Recovery Systems" working group demonstrate a high potential for sustainable developments, i.e., new paths that lead to economic competitive advantages and are also ecologically and socially sound in the long-term. In this context, a series of tools was tested in practice and scientifically further developed. Those material flow management concepts that are based on "classic" tools such as input-output balances or performance indicator systems, but which at the same time enable integrated processing of all material flow data across the individual material flow levels by means of conventional ERP systems appear to be particularly promising. With regards to quantities/volumes and costs, the comprehensive transparency of company-internal and cross-company material flows is a key success factor for material flow management. Supplemented with accompanying ecological information, such a data basis can facilitate the optimisation of material flows in a way that leads to actual competitive advantages. In addition to the systematic supply of data on both an internal and cross-company level, material flow management that consistently examines the information flows that are controlling the material flows is another important factor for the future. The tested approaches demonstrate new options and promising methods. However, the real success lies in widespread practical implementation at the company level. Here, a vast number of potentials are still unused.

The path to the future leads from material flow management towards integrated material and information flow management (flow management).