



**Flow Management for
Manufacturing Companies**
**Sustainable Re-organisation of
Material and Information Flows**

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Starting from projects for reducing the impact on the environment in the early nineties we have been dealing with questions of recording, planning and efficiency of material flows for a long time. Initial successes in numerous manufacturing companies proved that material flow adjustment not only, relieves stress on the environment but also leads to clear cost reduction. Within the scope of these projects something else became evident: Most of the companies have trouble to plan an end-to-end efficient material flow due to static organisation structures and the lack of promoted cooperation. Even more apparent are the problems in planning efficient information flows which cross numerous divisions. As material and information flows are in close interaction these problems increase even more.

Due to this background the research and development project "eco-effizienz" was placed. The goal was to develop a close-to-practice management approach which makes it easier for companies to create efficient planning of material and information flows. It became evident from the twelve pilot projects that efficient flows do not only lead to cost reduction and stress relief of the environment, but also increase the competitiveness of the companies in many ways. The current economical situation makes aware of the necessity for fundamental processes of changes in the companies. We would be very pleased if with the flow management we could contribute to an urgently necessary turnaround in management. We would wish that the many experiences, gained in the project, will be used in many ways in the interest of economical efficiency, employees and environment.



We would also like to use this opportunity to express our thanks to everyone, who contributed to this successful project. We are indebted, firstly, to the "Bavarian High-Tech-Offensive" which, in the first place, made this project possible by generous funding. A sincere 'thank you' also goes to all project employees and project partners, who decisively supported eco-effizienz by big personal and time-consuming efforts. Our very special thank you, however, goes to the pilot companies which repeatedly entered virgin territory with this project. The willingness to cooperate, the engagement and confidence of numerous employees in the pilot companies advanced the project. The success of the project is, therefore, essentially thanks due to them.

A handwritten signature in blue ink that reads "B. Wagner".

Bernd Wagner

A handwritten signature in blue ink that reads "M. Strobel".

Markus Strobel

A Flow Management for Manufacturing Companies

A.1 Overview of Flow Management

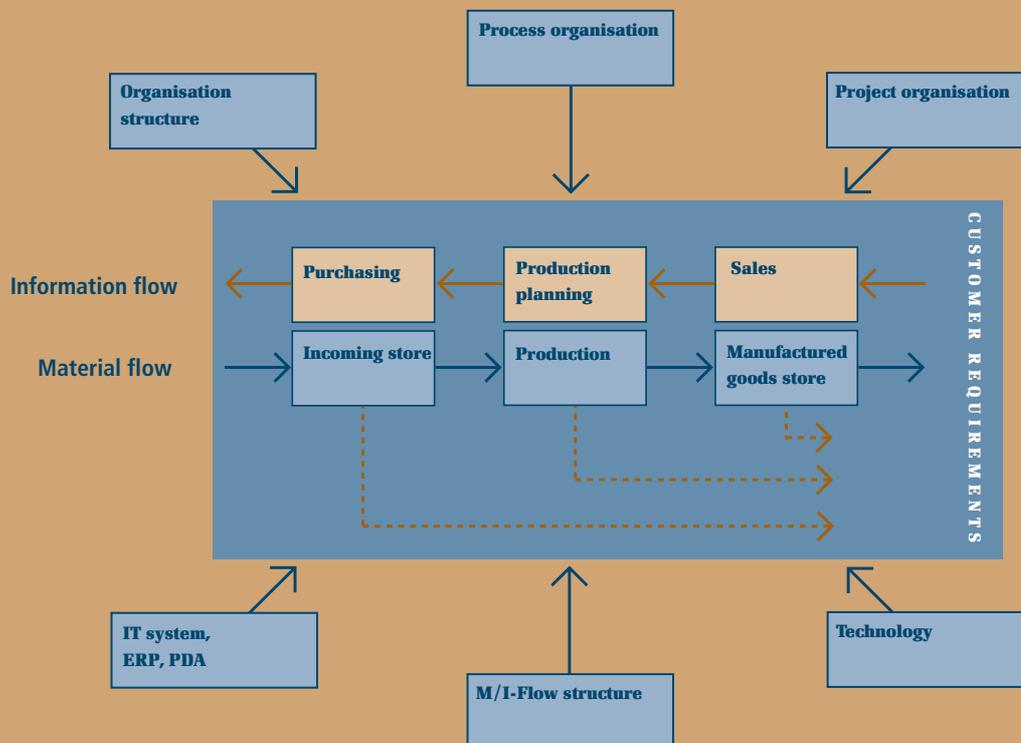
Flow management is a new integral management approach which was, especially, developed for medium-sized manufacturing companies. A purposeful development process is initiated which significantly increases the productivity of the companies by concrete and in practice proven procedures and methods. The essential effects of the flow management arise from a greater transparency, mutual understanding and an improved communication along the material and information flows. An end-to-end recognition of material and

information flows stimulates the employees to question the existing situations and develop scopes for re-organisation. It enables employees to cooperate better, use synergies and simplify, in this way, material and information flows.

Often existing structures and insufficient material data obstruct efficient material and information flows. Within the scope of flow management all relevant structures and planning areas, such as organisation structures, business processes, projects, IT-systems, technologies, etc are systematically aligned with respect to the material and information flows.

A procedure exists, at the same time, with the material flow accounting which improves the data quality of the existing IT-systems and makes quality and value of material flows more transparent. A realtime and

Figure 1: Overview of Flow Management



activity-orientated material reporting focuses on the reduction of material costs as an alternative to one-sided personnel cuts. There is no question about the fact that material costs, at an average of 57% of the total costs, represent a significant portion of the costs of manufacturing companies. The flow-orientated transparency, integration and simplification of structures, involvement and activation of the employees lead to significant increases in productivity and contribute to

- > **reduce costs (especially for material),**
- > **meet customer demands better,**
- > **organise business processes simpler and safer,**
- > **increase flexibility and**
- > **relieve stress on the environment.**

Flow management can be used as a nonrecurring project for increasing efficiency. The approach



develops, however, its real performance only, when it is introduced as a permanent management system.

A.2 eco-effizienz: The Project

The published guideline was drawn up within the scope of the three-year research and development project eco-effizienz. The regional initiative in the Augsburg/Swabia area was sponsored with funds from the Bavarian High-Tech-Offensive (H-T-O). Next to regional research and consultancy institutions numerous companies of the region participated in the project .

Project goal

It was the primary goal of the project, in cooperation with manufacturing companies of various sizes and branches, to develop the new management approach 'flow management'. This is, especially, to facilitate for medium-sized companies to increase their economic power and performance and, at the same time, reduce environmental stress. Flow management, at its core, supports the companies to make complex material and information flows transparent, analyse and purposeful re-organise them. In the duration of the project concrete procedures and instruments were developed, tested and standardised which enable an efficient implementation of the flow management.

Pilot companies

During the two development phases twelve pilot projects were carried out in the following companies:

1. Phase

- > Ciba Spezialitätenchemie Pfersee GmbH
- > Freudenberg Haushaltsprodukte Augsburg KG
- > Rohrleitungsbau Süd GmbH & Co. KG
- > Sortimo International GmbH

2. Phase

- > Ciba Spezialitätenchemie Pfersee GmbH
- > Fujitsu Siemens Computers GmbH
- > Hörauf & Kohler GmbH
- > Industriepark Gersthofen Service GmbH & Co. KG (Subsidiary of Clariant GmbH)
- > Karwendel-Werke Huber GmbH & Co. KG
- > Keimfarben GmbH & Co. KG
- > PCI Augsburg GmbH
- > Schertler Verpackungen GmbH

Project partners

The 'Zentrum für Weiterbildung und Wissenstransfer der Universität Augsburg' [ZWW] (Management Centre University of Augsburg) was in charge of the overall project management. 'Imu augsburg GmbH & Co. KG' (Institute for the Management and the Environment, Augsburg Ltd.) was given the task to carry out the project. Included were the additional partners: 'IHK Augsburg-Schwaben' (Chamber of Industry and Commerce of Augsburg and Swabia), 'Förderverein Kompetenzzentrum Umwelt Augsburg-Schwaben e.V.' [KUMAS] (Promotion Association Competence Centre Environment Augsburg-Swabia, Incorporated Association) and 'Bayerisches Institut für Angewandte Umweltforschung und -technik GmbH' [Bifa] (Bavarian Institute of Applied Environment Research and Technology Ltd.).



International Orientation

The project was orientated, right from the start, as an international development project. High-lights were cooperation initiatives with the USA and Japan. Since then the most important partners in the USA are Harvard University, Tellus Institute and the American Environmental Protection Agency (EPA). The cooperation in Japan concentrated on the Universities in Tokyo, Osaka and Kobe. Meanwhile, the Japanese Ministry for Economy, Trade and Industry (METI) and the Japanese Environment Ministry sponsored seven pilot projects of the companies Canon, Tanabe, Toshiba, Takiron, Nippon Paint, Shiogi Seiyaku and Nitto Denko which tested the in Augsburg developed approach. The material flow cost accounting is currently implemented by numerous Japanese companies because of the good results. Cooperations also were started in Austria, Australia, England, Italy and Switzerland. The international partnerships are to be increased over the following years.

Company network

During the project a network of companies, which met every quarter, was constituted. Goal of the meetings was to exchange, along-side the project, experiences and assure the mutual transfer of knowledge. The pilot companies form the core of the network. In the meantime numerous other companies joined the network. The network will continue to exist also in the future because of the strong interest. New companies can be accepted in agreement with the network partners.

Publication and training

To spread and communicate the flow management numerous publications, reports of methods, newsletter as well as, brief descriptions of pilot projects, in the form of case studies, were published. These documents can be found on the home page www.eco-effizienz.de. Furthermore, seminars about flow management were and are held, regularly, in cooperation with various providers of seminars. The ZWW of the Augsburg University together with imu augsburg holds seminars about flow management and material flow accounting. The current offer of seminars can be found on the websites www.zww.uni-augsburg.de and www.imu-augsburg.de.

Implementation support

Imu augsburg and ZWW committed themselves by a partnership contract to further develop the flow management jointly. Experiences, made by implementation and development of its contents will, also in future, lead to further perfect the flow management. Companies can resort to this know-how and request support for implementation of the flow management by training or consultation.

A.3 Why Flow Management?

A.3.1 What is the meaning of flow management?

The term 'flow management' is, occasionally, somewhat unclear. But this is not about natural stretches of water or avoiding flood disasters. In this case, 'flow' is to be understood as a metaphor with a double meaning: On the one hand, this is to re-organise the complex flow of material and information efficient and purposeful. On the other hand, companies, as a whole, will be made to "flow"; which means that a lasting development process will be installed.

Purposeful re-organisation of material and information flows by flow orientation

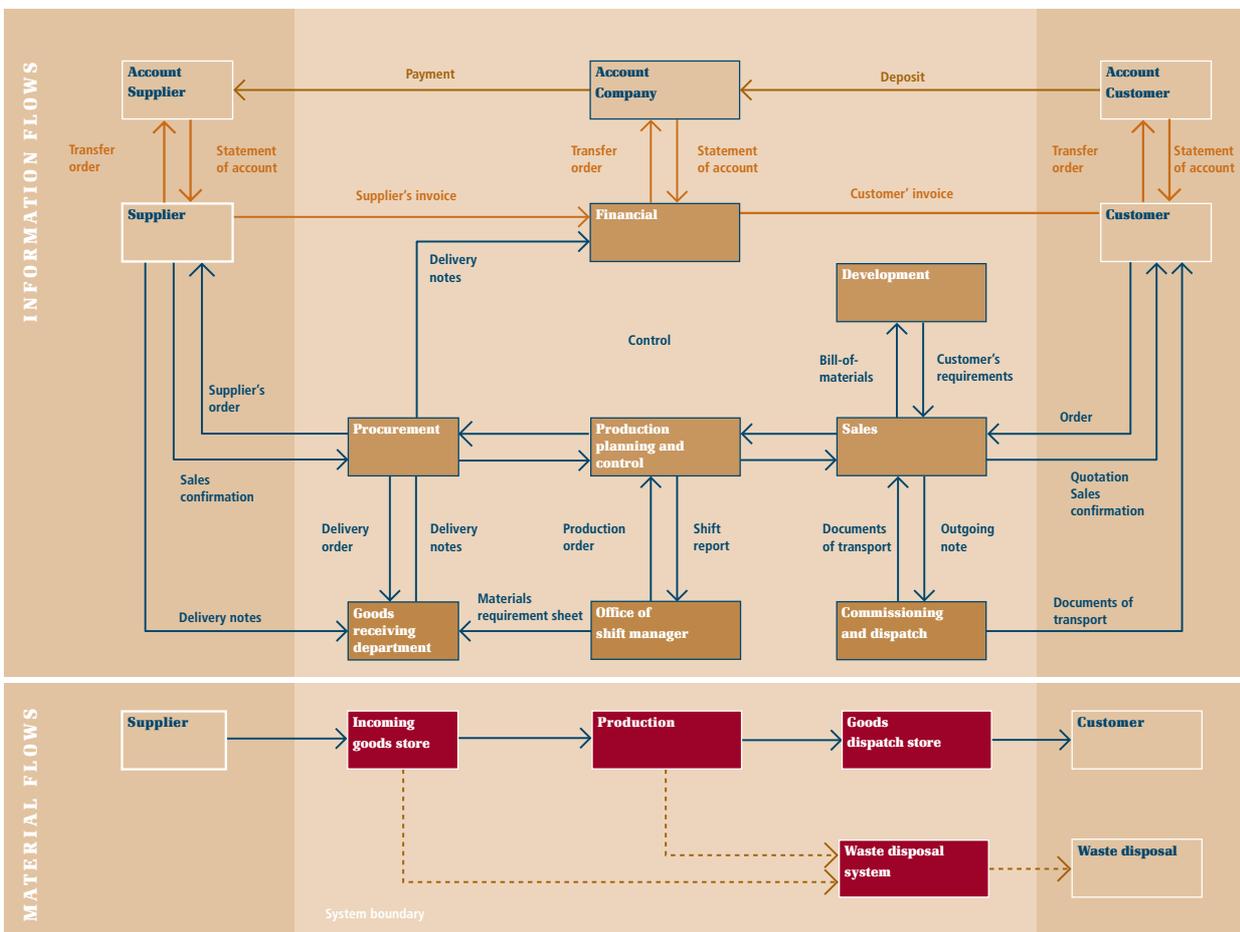
Flow management focuses end-to-end planning of material and information flows from the supplier to the customer. The material flow extends from raw material to finished product or solid waste. The information flow covers all steps from customer enquiry to supplier order. In between, in part, complex material and information flows take place of which nobody in companies, end-to-end, is aware of,

nor for which planning and control is carried out. These flows, however, form the core activity of the company, especially in manufacturing companies. The structure of the material and information flows forms the basic pattern for the depiction of the company. The visualised structure of material and information flows resembles a map which helps to recognise the correlations, plan structures and purposeful set development processes in motion.

Excursion: Flow orientation versus process orientation

Process orientation has, over the past years, become an important slogan in management. Hope is connected to accelerate processes and increase their efficiency by fixing cross-divisional business processes. From the viewpoint of flow management, however, business processes, often, contribute to generate interruptions and interfaces along the material and information flows. The end-to-end company overview, hereby, gets lost. Re-organisation of business processes, especially of complex processes, can be a sensible intensification within the scope of the flow management.

Figure 2: Structure of the material and information flows



Making companies “flow”

Table 1: Comparison of flow and process orientation
Flow management places the installation of a lasting process of changes into the centre. Market environment and other basic conditions are, to-day, subjected to such fast changes that companies must

FLOW ORIENTATION	PROCESS ORIENTATION
The end-to-end view of the company	divides the company into single processes
No overlapping and gaps	Overlapping and gaps are possible
Simple visualisation by flow model	Complex process diagrams
Flexible possibilities for changes	Rigid documentation
Clear responsibilities	Multiple overlapping responsibilities

be in the position to, ever faster, meet from inside the new chances and risks. It is, therefore, important to recognise and remove existing blockages which hamper a regular changing and development process. Egoistic interests, cooperation and communication problems of employees as well as, inconsistency of structures and workflows often block making use of development possibilities. The flow management aims at, regularly, recognising and removing these blockages. This is, therefore, not a matter of setting up a rigid organisation of material and information flows. The ability of the employees is, rather, to be developed to, repeatedly, analyse existing flows and structures and, if needed, to change those in a fast, efficient and coordinated way.

A.3.2 Why a new management approach?

New challenges for medium-sized companies

Medium-sized companies are, increasingly, under significant cost and performance pressure. International competition, short product cycles, unsure markets and difficult access to capital characterise the basic conditions. Many companies are, therefore, forced to continuously lower their costs by increasing efficiency. Increases in efficiency which often go hand in hand with personnel cutbacks lead in many cases to companies losing their performance capability. High flexibility and development dynamics with regard to product design, terms of delivery, services or other customer’s requirements should be maintained and increased as strength of medium-sized companies. To master this area of tension between efficiency and performance capability, therefore, becomes the central challenge for management.

Present management concepts work less and less

The current widespread management concepts originate from a time when the company environment was stable over many years. Existing possibilities for solutions are, therefore, rather orientated on fixing static structures in companies and regulate procedures. Once they have been fixed, structures and procedures are supposed to remain rather unchanged. Management approaches, also, such as the process or quality management hold this danger. In many companies, within increasingly shorter periods, new static structures are set up due to outside requirements. This kind of change goes hand in hand with a significant feeling of uncertainty of the employees and, due to this, with a great loss in efficiency. The management is, therefore, often overtaxed with regard to the required detailed knowledge and expenditure of time.

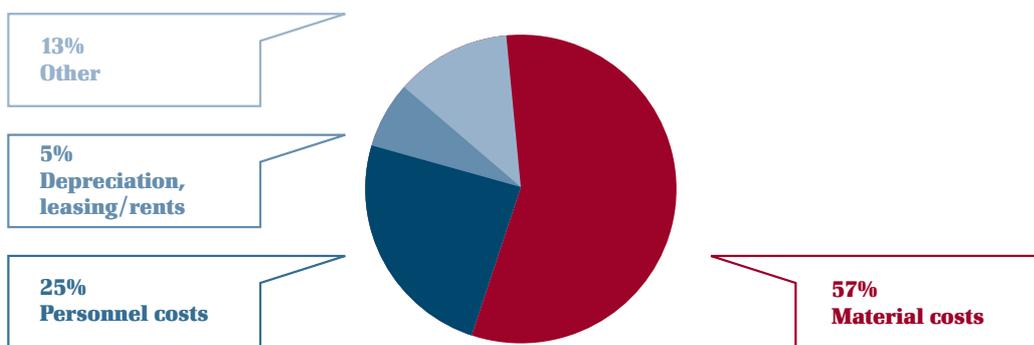
Management competence becomes a factor for success

The area of tension between efficiency and flexibility can only be overcome by a continuous development process. New management approaches must be orientated to organise continuous processes of change and, nevertheless, ensure trouble-free workflows in the company. Important structural elements such as material and information flows, Organisation forms, IT-systems or detailed descriptions of business processes must become a solid part of the development process. This challenge can only be met, if new impulses go out from the management, existing structures are repeatedly questioned as well as, established patterns of thinking and behaviour are recognised and changed. One thing is for certain: The development process will only then be successful, if all relevant employees are actively involved.

A.3.3 Why focussing on material and information flows?

Material and information flows are highly relevant

Material and information flows are of central importance for economical performance and future compliance of manufacturing companies. The purpose of manufacturing companies is the manufacture of physical products. This requires the planning and control of more or less complex material flows. The relevance of material flows, already, results from the size of the material costs. With reference to the total costs of manufacturing companies in Germany, the material costs amount to 57%.



The control of material flows requires, as a rule, extremely complex information flows and the use of corresponding information technologies. Information flows serve the function to coordinate customer's requirements and internal activities and engage suppliers and sub-contractors. Inconsistency in the information flows cause, therefore, additional efforts, dissatisfaction of customers and inefficiency in the material flows. Almost all of the relevant performance indicators (processing time, process safety, innovation capability, customer's satisfaction, etc.) are in direct relation to material and information flows. The cost and turnover situation of the company is, therefore, not lastly the result of a more or less successfully carried out flow re-organisation.

Material and information flows are not, end-to-end, recognised and organised

Despite their central importance, the material and information flows can rarely be, end-to-end, recognised by the involved persons. Instead, only small sections of the flows are observed (see figures 4 and 5) which are in immediate connection

with the respective task. That means the following for the material flow: A stores employee knows the material flow between the receiving department, store and production. Only in very rare cases, however, does he know about the flow in front and after. The task spectrum of the higher levels of hierarchy such as production manager or foreman does not allow a detailed consideration of material flows. The situation of information flows is even more complex. On the level of the information flow processes, files or screen masks are processed. Due to this, an end-to-end overview of the information flow as a whole gets lost. A cross-company responsibility for the material and information (re-)organisation does not exist in most of the companies.

Figure 3:
Material costs take a large portion of the costs

There is not sufficient cooperation alongside the material and information flows

The widely spread thinking in department terms leads to numerous organisational interruptions alongside the material and information flows. In addition, the lack of cooperation willingness contributes to significant internal friction losses. Persistent lines of conflicts have become firmly established between leading personnel, between certain hierarchy levels, between Technics and Finances, between Development and Production etc. The apparently differing interests and views are not brought together, any more, in the in-house everyday life. Coordination problems result from this which contribute to significant inefficiencies and performance losses. Typical symptoms are, for example, weaknesses in decision-making and implementation, regular process errors, high material inventories and losses, long machining and processing times as well as, sinking customer's satisfaction.

Material flows are not known - neither by quantity nor value

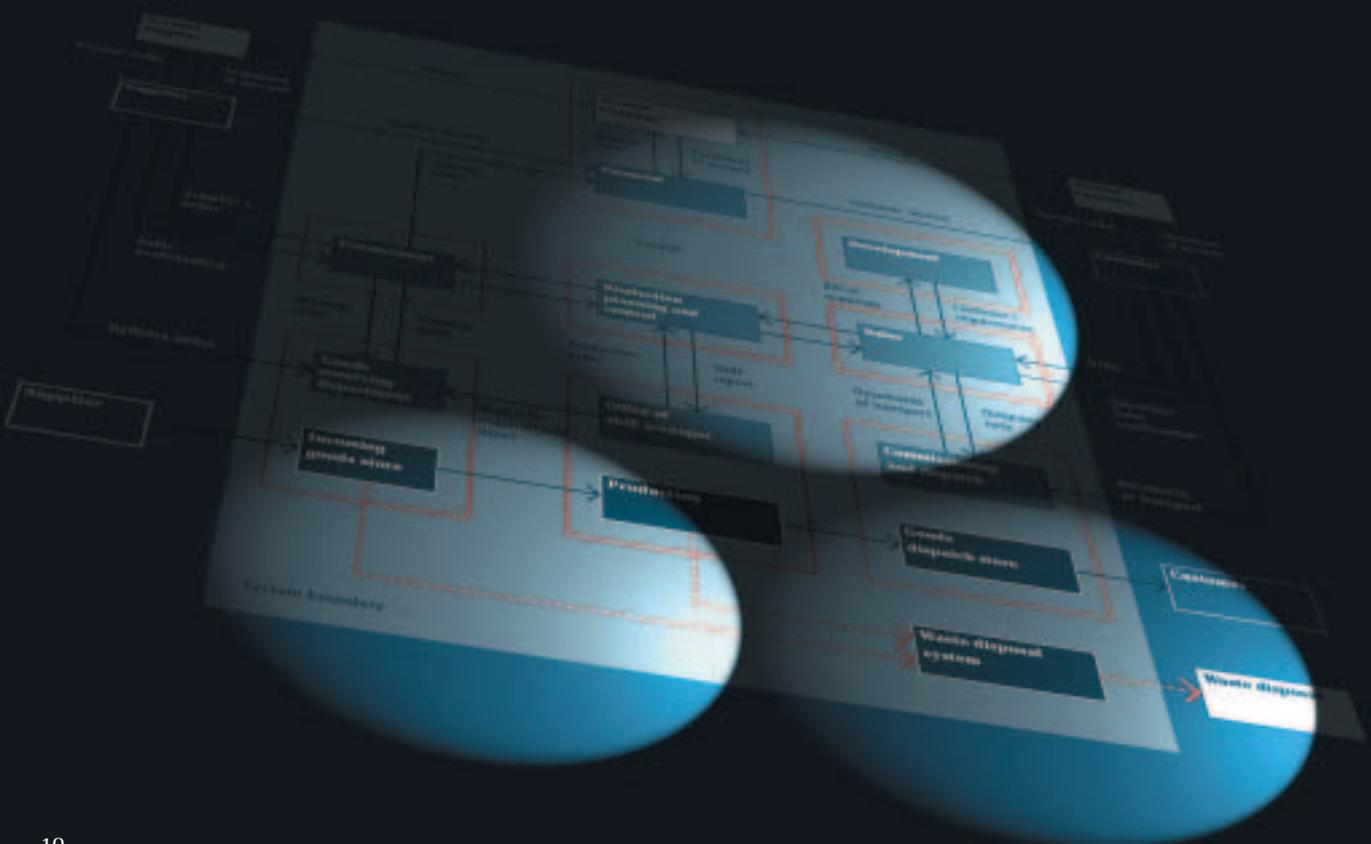
Essential draw-backs for systematically lowering material costs are insufficient transparency of the in-house material flow structure and the costs which are directly connected to the material and energy flows. The internal cost accounting is, in fact, in the position to inform, related to the period, as a sum about the value of the incoming and used materials. However, statements can hardly be made about the usage and whereabouts of the material. This deficit becomes evident, for instance, in allocations of overheads to cost centres which represents an essential element of in-house cost transparency. Although personnel costs and depreciations are attributed to the cost centres in most of the companies, the largest portion of the material costs (especially the direct material costs) bypasses, however, the cost centres and, by this, also the pressure, generated there, for cost reduction. The conventional cost accounting is currently not in the position to present material costs in the required structure and detail. Often, also convincing

reports about the efficiency of material inventories and flows are missing.

Material and information flows hold significant potentials

Significant cost reductions and performance increases can be realised by an end-to-end re-organisation of material and information flows and the respective orientation of relevant company structures. The involvement of the employees is followed by motivation effects which carry on, positive, far beyond the implementation phase. Numerous experiences in the pilot companies confirm the wide useful effects spectrum of the flow management, especially, for medium-sized companies. Behaviour changes as well as adjusted structures and information systems allow, clearly, more efficient, economic and ecologic re-organisation of material and information flows than before. Connected with this, the simplification, reduction and flexibility of material and information flows leads, eventually, to significant useful effects:

Figure 4:
Thinking in department terms interrupts the material and information flow



Cost reduction

- > Material costs and material value losses (destruction, rejects, etc.)
- > Processing and handling costs (production or rather process costs) for transportation and storing procedures, setting-up and cleaning, product processing etc.
- > Administration and IT-costs

Performance increase

- > Optimum inventories and lower processing times
- > Increased process safety at lower process duration (tender preparation, product development, procurement, production planning, dispatch etc.)
- > High adjustment and reaction capability with changing markets

Customer's satisfaction

- > Better service as well as innovation and supply capability to customers and, due to this, better customer relationship
- > Optimised processing, reaction and development times (Product development, supply and logistics concepts, customer's enquiries etc.)
- > Improvement of product quality and supply reliability

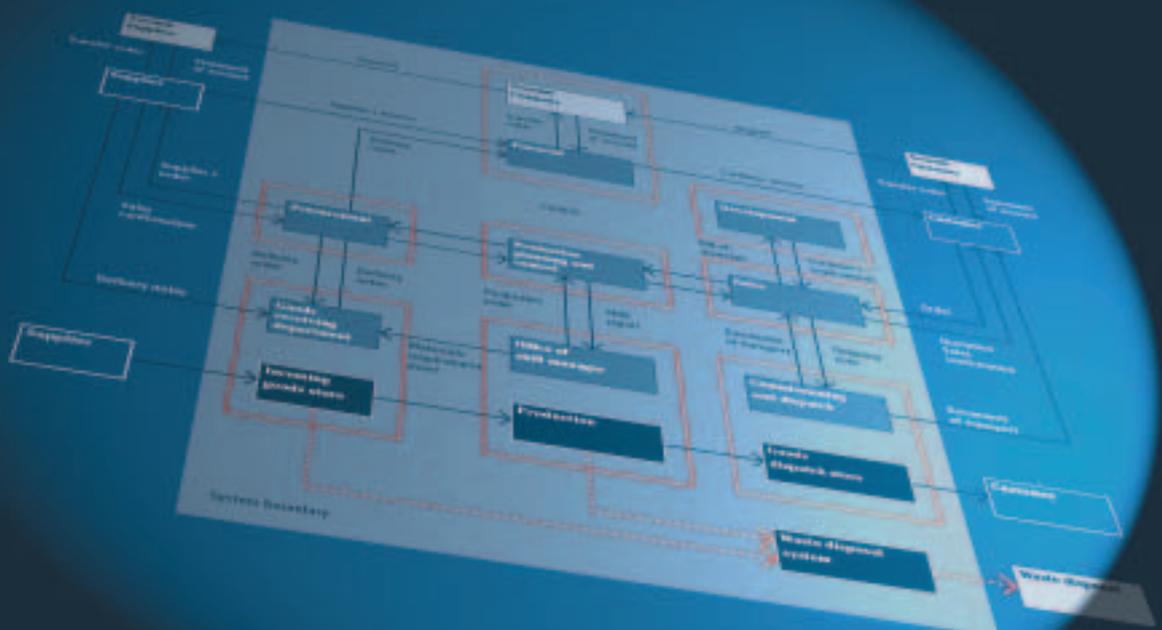
Relief of stress on the environment

- > Reduced use of material
- > Less material losses (waste, waste water, exhaust air)

Management systems

- > Certification of management systems (ISO 9001:2000, VDA 6.2, ISO 14001, EMAS, OHRIS etc.) at less additional expenses

Figure 5:
Goal: Integral design of material and information flows



A.4 What is Flow Management?

A.4.1 Principles of flow management

Flow management focuses on the change of material and information flows. Directly or indirectly, all flows are planned, organised and controlled by employees. A lasting change of material and information flows is, always, followed by a respective personnel and organisation development. Some basic principles for planning and development of organisations became apparent in the pilot projects which exercise a favourable influence on the capability of companies to organise flows efficient. These basic principles are an integral part of the procedure, the methods and instruments of the flow management. They will, therefore, be presented briefly in the following.

Table 2:
Principles of
flow management

PREVENT	PROMOTE
Traditional behaviour pattern	Change of perception
Reclusive point of view	Adaptation of points of views
Partial optimisation	integral re-organisation
Fighting symptoms	removing causes
Standard solution from "Outside"	Ideas/changes from "Inside"
Competition, working against each other	Cooperation and team work
Blockages, resistance, rigid rules	lasting changes
Employees taking orders	Active participation of employees

Changes of perception

Flow management contributes that employees perceive the company and their everyday tasks in an integral way. The new view onto the existing creates a critical distance, facilitates reflection, frees creativity and leads, in this way, to a changed behaviour. Correlations, working mechanisms and structures become transparent and can, only then, be changed. This effect of the flow management is summarised by Klaus-Dieter Reiter (Manager Production and Technology, Karwendel-Werke Huber) as follows: "To-day we look at our company in a different light and also act completely different." Markus Mayer (Controlling, Freudenberg Haushaltsprodukte Augsburg) calls the project, with a similar intention, "A journey into one's own company" and for Horst Adam (Controlling, Sortimo International) flow management is like "A thriller".

"The eco-effizienz project forced all of us not to be restricted in one's thinking. One learns an enormous amount by it. And this was, also, a feedback I got from the project: The employees were truly excited by what can be taken from these models and figures and, especially, how all of it is connected."

QUOTE

Dr. Thomas Schindler, Head Development,
Freudenberg Haushaltsprodukte
Augsburg KG

Adaptation of points of views

The change of perception should not only facilitate the analysis of existing structures and behaviour and enable new behaviour, but also lead to adjust the, so far, differing points of view of the employees a lot more. It became evident in the pilot projects that each division, even every employee, has his own view of the company. The differences in perception cover differing product names right up to the question which division's "Fault" unsuccessful product development projects are – Marketing, Development, Production, Sales, Management? These differences in the points of view often lead to misunderstandings and make the joint search for constructive solutions more difficult. Especially between different departments (Finance, Planning, Development, Sales, Controlling, etc.) but also between different levels of hierarchy (stores or production worker up to the management) a standardisation of perception is of great benefit. The controllers, as an example, went for the first time to Production during the pilot project to get a picture of the processes. The adoption of the points of view will, however, be a permanent task. To be clear about the different perspectives and the possible consequences, this is an important first step.

Integral re-organisation

In many companies the division, department and person-orientated interests, thinking patterns and goals still dominate. Sales, Logistics, Production, Development, etc. each act according to their own logic. This is often even more increased by respective target and stimulant systems. By this, the successful organisation of the company as a whole is easily pushed into the background. Flow management places the company as a whole into the centre and intends to increase the cost efficiency and future-compliance of the company in its entirety. It is taken account of

the integral claim by orientating on material and information flows as well as their respective structures and processes. After all, almost all employees are involved in the perception and re-organisation of material and information flows. An end-to-end and efficient re-organisation of the flow requires the individual interest to take a backseat. Conflicts regarding goals, which were so far artificially created by the definitions of division goals, are, initially, to be made transparent and replaced by a joint constructive finding of goals. In this way, not only cooperation is improved, but also acceptance of goals is increased.

Removal of causes

Many companies tend to, excessively, throw themselves on those problems which at first glance catch the eye. A multitude of un-coordinated single measures and projects are the result. Only rarely are the actions successful. The reason being, that symptoms instead of causes are fought. For example: A smouldering conflict between division heads for Development and Production can lead during introduction of products to bottlenecks in material procurement, to high production rejects or belated deliveries. Projects for re-organisation of procurement, reduction of production losses and acceleration of dispatch could, now, be carried out but all of this would not really solve the problems. Only when the leading personnel start cooperating, instead of proving each others incompetence, the cause is removed.

Changes from inside

In the past decade, because of high market demands, companies have become more "individual". Even small medium-sized companies are often worldwide or Europe-wide leading in their segment. Organisation, structure and workflows were orientated to the special market conditions. Therefore, standardised "solutions", as they are often brought into the company, take less and less effect. The company situation is that specific and the knowledge in the company that large and individual, so that really fitting solutions can only be developed inside, namely by the employees of the company. Development processes with own responsibility of the employees also increase their motivation and acceptance of the solution. In consequence, external help restricts itself to support and moderate the process of finding a solution.

Cooperation and teamwork

Within the scope of the flow management the cooperation capability and communication between the employees are purposeful supported. Complex material and information flows can only then be organised efficient and flexible, if the participants alongside the flows are in close exchange and cooperate well. Initially, blockades and resistances against cooperation have to be removed. Long-standing modes of behaviour, mutual prejudices and apparent conflicts of interests stand in the way of good cooperation. To become efficient, these blockades and resistances have at first to be recognised and then resolved. In many areas teamwork can supplement or completely replace organisation structures.

Lasting changes

It is not the aim of flow management to, only once, check and improve flows, processes and structures. In contrast to creating rigid rules, flow management puts the company into the position to perceive, analyse and change, by themselves, flows, processes and structures. Every new demand or market chance should, ideally, be met rather immediately by internal adjustments. The company, in this way, is permanently on the move. Ideally, these small adjustments should be carried out by the respective employees on their own. It is relevant for permanent changing processes, to carry out the activities in a coordinated way. For each of the changes the respective persons alongside the material and information flows should be involved or at least be informed.

QUOTE

“Our company culture has changed. The employees have developed a different point of view for the interests of our company. In the long term, just this makes the success of a company. At Rohrleitungsbau Süd problems are now recognised much faster. The knowledge, that detection and avoidance of inconsistencies in the material and communication flow holds a large improvement potential ensures faster learning and, due to this, competitive advantages.”

Edwin Ferhadbegovic, Commercial Director, Rohrleitungsbau Süd GmbH & Co. KG

Active employee involvement

The employees play a central role in flow management. Flow management cannot be implemented by project managers, individual management representatives or external consultants. Although these groups may support the development process, deciding, however, is the active implementation of as many employees as possible. In most of the cases the employees know the problems in the company very well. However, often the established decision making processes prevent the employees to present and implement solution approaches. In the long term this leads to frustrations. The more employees actively participate in the process of changes and are respected as important partner of the changes, the more increases the identification with the company and the pending measures. From experience, the active involvement frees not only significant potentials in the employees but also leads to a clear push in the motivation.

A.4.2 Planning levels

Companies are complex, multilayered entities which cannot be organised easily and purposefully changed. To understand a company, various planning levels are discerned within the scope of the flow management. Even though the levels are, of course, interwoven in the everyday life of the company, initially they will here be looked at separately. Of special interest are, also, the interactions between the levels. Weak points and deficits of one level will, of course, also influence the other levels. If, for instance, a clear vision is missing, insecurities in investment decisions can arise and

conflicts between employees can lead to inefficiencies in the material and information flow. It is, eventually, the goal to develop all levels equally strong and coordinated with each other.



Figure 6:

Planning levels of flow management

Buildings, infrastructure and technology

The most concrete and visible level of companies are the buildings, infrastructure and technologies. This level is easily accessible and will, in the first place, be perceived consistently.

Material flows

Buildings, infrastructure and technology are the physical basis of the material flows. But the material flows are only in part determined by this basis. Depending on the degree of automation, the employees of the areas store, transportation, production, technology and dispatch decide about the real structure of the material flows. As a rule, the material flow moves as follows: Material arrives from the supplier, will be transported inside the company, stored and processed, before it again leaves the company as a physical product or residual waste (solid waste, liquid waste, exhaust air, etc). In the following, the term ‘material’ includes: raw materials, auxiliary materials, tools and spare parts, water, energy, etc.

Material flows

Control and planning of the material flows is carried out by numerous information flows. The information flow, as a rule, starts at the customer, coordinates the internal activities between sales, work planning and purchasing and extends to the supplier. In many companies software, from simple table calculation to an extensive ERP-system, supports a significant part of the information flow.

Structures

In a company numerous structures can be found, such as divisions, hierarchy levels, responsibilities, authorisations, working groups, regular meetings, processes or projects, etc. These elements have a strong influence on material and information flows, also, if the connection, at the first go, in most of the companies is not transparent. Because of the high complexity of material and information flows the structures cannot easily be correlated to the flows. Besides unclear correlations, numerous gaps or overlaps can be found. Furthermore, historically grown structures hinder a simple and efficient control of the material and information flows. Instead of supporting flows, they contribute to blockades or interruptions. In so far it is very helpful, to consider perceive the structures with respect to the material and information flows and then reflect, by how much the flows are optimum supported or made unnecessary complicated.

Culture

Material and information flows, as well as also formal structures are greatly influenced by the company culture. The term 'company culture' refers in the context of the guideline, primarily, to how employees associate with each other. This is about leadership, decision-making processes and communication style. In this context also factors such as dealing with power, worry and trust play a big role. The employees, who are tied solid into the company culture, often lose the view on the social manners. The perception of these behaviour patterns and mechanisms facilitate changes. Not last, by inconsistencies in the flows can also be recognised that there are problems in the company culture.

Vision

Uncertainties in the behaviour of the employees and unclear structures often result from an unclear vision and badly communicated strategies and targets. Experience shows, that the clearer and more powerful a vision is and the more it is accepted and implemented by a multitude of employees, the more successful companies are. The purpose of visions is to generate orientation, motivation and joint drive. It is its operative task to supply decision help for everyday decisions. As a matter of principle, every company has a vision. However, rarely are visions clearly formulated and supported by the employees. But once it is attempted to formulate these together with representatives of the company, uncertainties

and inconsistencies soon appear. Often, this first review of the vision is also the incentive to completely revise it.

A.4.3 Development cycles

Flow management supports and controls companies in a permanent, coordinated process of changes. Because of external demands and market conditions companies are permanently changing on all levels. The central challenge of a coordinated process of changes lies in coordinating the various levels with each other, in which the changes take place. All activities, from development of strategies right up to small optimisations in situ, should, eventually, aim in one direction. Only in this way all forces can be concentrated and an economic process of changes be ensured. Flow management bases on three development cycles which are closely linked with each other: Long-term company development (cycle 1), annual management cycle (cycle 2) and continuous development process (cycle 3). The development cycles differ in their chronological relationship and strategic importance. There is a long-term (cycle 1), an annual (cycle 2) and a short-term development cycle (cycle 3), which, each, have their own phase models but continuously link with each other.

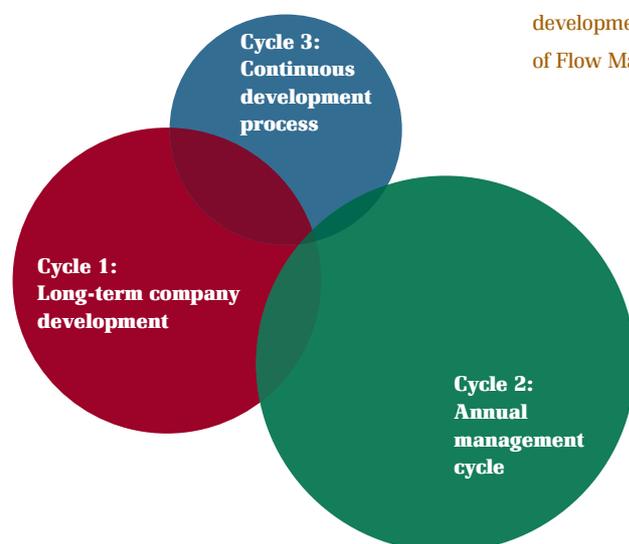


Figure 7:
Overview of
development cycles
of Flow Management

The cycle of **long-term company development** creates and checks in repeated phases over several years (three to five years) the basic orientation of the company.

Central planning instrument of the flow management is the **annual management cycle**. By running, annually, through the four phases: "Modelling", "Evaluation", "Planning" and "Implementation" the current status of the company is checked, evaluated and adjusted accordingly. In this way, the annual management cycle is optimal suited for checking and implementing company goals from the cycle of long-term company development. The annual management cycle is the "motor" for the changes of companies. The current development status of the whole company is documented and analysed by the always returning sequence of the four phases. Such an institutionalisation of changes, also, creates acceptance by the employees, as they are part, and, by this, participate in planning these changes. On the other hand, the regularity of the management cycle becomes a matter of getting used to this change dynamics in the company.

The third cycle, the **continuous development process** creates the possibility for changes in periods of less than a year. The continuous improvement is a supplement to the long-term management cycle and the annual management cycle. This development cycle puts the employees of all hierarchy levels in the position to take on ideas for changes, problems, customer's requests or infrastructure changes and deal with them, target-orientated, in coordination with all persons involved. The phases, connected to other development cycles of continuous improvement, provide for flexible and quick action or reaction to

needs of changes. The speciality of this development cycle is, that also for quick change requirements action, coordinated with all involved, is possible and less than optimum or even contra-productive changes can be avoided. The involvement of the employees into all in-house processes are now recognisable due to the new created transparency of the in-house connections within the scope of the annual management cycle. Due to this, the number of necessary contacts for changing activities can, also, be defined and are accessible, accordingly, for a coordinated action.

The flexible change of a company, according to the actual requirements, will be organised on all hierarchy levels by these three development cycles. The long-term company development clarifies the whole company orientation and, in this sense, gives the employees targets, which are derived from the vision and strategy of the company. Due to this, the targets of the upper and middle management are, jointly, aligned along one uniform line with the targets of all the staff. All further activities and approaches for changes will be assessed by these targets, so that a lasting, targeted and coordinated company development becomes possible.

*"Flow management is like new spectacles,
through which the company is looked at."*



A.5 How does your company benefit from Flow Management?

"We have, already, had all of that.", "What could there be, still, possible to improve?", "For as long as nothing changes for them, we cannot do anything!" - manifest arguments, which put the brakes on the process to a successful development of companies.

Often resistances build up in companies against changes. The possible advantages are ignored. The following scenario 1 clarifies, therefore (again) what processes in companies look like, in which not everything is in motion. Furthermore, it will be illustrated, what effects uncoordinated processes and target conflicts have on the success of the company.

Scenario 1

Typical stagnation in the company

A wholesaler orders from a pharmaceutical company four pallets of sun lotion for an impending heat wave. The responsible sales assistant (order acceptance) sees on the EDP-system, that a sufficiently large quantity of sun lotion is in stock and confirms delivery for 12.00 for the next day. The employee in Dispatch receives the order for picking the sun lotion and goes to the respective storage position. There, he finds out, irritated, that only two pallets are physically there. As he is overloaded, he leaves the order, initially, and processes other urgent deliveries, for which the manufactured goods are in stock. Later on it turns out, that the EDP-Division had installed an automatic re-registration for the last processing step of mass products. The production workers, however, were informed too late about this and they, therefore, posted, again, the manufactured goods manually into the store.

The store worker, who worked on the following night shift, processes the open order and also finds out, that the material is missing. He writes a mail to the employee in Sales and describes the problem. On the following morning the Sales employee orders, that at least the two available pallets are to be delivered; but by express delivery, as the delivery of the pallets had been confirmed for 12.00 that day. The goods still arrive too late.

At the same time the wholesaler is informed, that only half of the ordered quantity will be delivered and the remainder will be delivered three days later. The wholesaler, however, cancels the remaining two pallets

and orders from the competition, as the heat wave is now full on and he wants to supply the pharmacies on time. In order not to lose, yet, more customers, the Sales employee orders to manufacture the missing sun lotion as fast as possible. The production manager refuses to change the running production programme and points out the high setting-up costs, which would be incurred by this. As the Sales employee receives a turnover-related commission he talks to the Sales manager and asks him to put pressure on Production. Sales manager and Production manager have been at loggerheads for a long time already. Only, after the Sales manager involves the Director, the Production manager agrees, gnashing his teeth, to change his production programme and, by this, he annoys his staff in Production planning.

Staff in Production is already frustrated, especially as they were trying for several weeks, within the scope of the new bonus system, to reduce set-up times by various individual measures. The running production of night cream is now interrupted and the set-up time increased.

The change of production causes, apart from the set-up time, also additional material losses. These material losses always occur, when the vessels and pipes have to be cleaned from the adhering cream. These cleaning losses have already strongly increased in recent time. Until recently the cream was scraped from the vessels and pushed down into the filling station to fill as much product material into the tubes. This activity was cancelled due to the new bonus system for set-up costs and a cutback in production staff by two employees. To-day, the cream, which does not run down on its own, is washed out by the cleaning process and gets, in this way, into the effluent. In this way, production material of a high material value is lost. The production workers, however, do not know what quantity and material value they are losing due to this. Material costs, anyway, are not posted to the production cost centre, so that there is no direct responsibility for material cost control and reduction. The increase in material costs, do not otherwise come to anyone's attention.

The environment representative, however, notices that, for some time already an enormous effluent contamination increase by product material and an excessive demand on the existing sewage-works occurred. The authorities have, already, demanded to do something. He, therefore, applies for a sewage-works extension and increases the aftercare cost block.

Flow management as a success system

Flow management is a success system which sets the power for changes of the company sustained into motion. To meet this high demand it is not sufficient to find quick solutions for superficial problems, but it is rather to recognise, on which ways companies can find their individual way to

above average full success. Companies with flow management are aware of their scopes for re-organisation. They know the effect of connections between the characteristics of social systems such as innovation force, motivation, social and specialist competence and the manifold leeways of actions for improvement of company

Figure 8:
Flow management as a successful system

STAKEHOLDERS	STAKEHOLDERS REQUIREMENTS
STAFF	Content employees want a healthy, safe and cooperative work environment which gives the opportunity to identify with the company and fully use their potential.
CUSTOMER	Customers liaise with a company over long periods of time if the supplied product quality and service meet their demands. This requires individual attention to customer's request, a balanced price/performance ratio, supply date fidelity and reliability.
OWNER AND INVESTORS	Owner and investors are interested that by the performance of the company liquidity, profit and a long-term success potential are ensured.
SUPPLIER AND COOPERATION PARTNERS	Suppliers and cooperation partners wish for reliable and fair alliances and partners.
STATE, SOCIETY AND ENVIRONMENT	It is of importance to state and society that the company takes into consideration the government guidelines and develops and lives a future-compliant, social and ecological compatible company policy. With regard to the environment, the concern is to use tight resources carefully and reduce emissions into water, air and ground.

culture, material and information flows, organisation structures as well as infrastructure and information technology. Due to the knowledge about connections of effects, changes of the individual planning fields lead to, that the benefit is increased for all stakeholders. Company and flow management know that the process of

change is no end in itself, but serves the purpose to act in the meaning of the company goals, which arise from the demands of the stakeholders.

BENEFIT OF FLOW MANAGEMENT

Future-compliant vision creates orientation

- > Future-compliant visions, strategies and goals are drawn up
- > living daily according to the vision
- > Vision motivates staff

Information flows are simple and efficient

- > End-to-end perception and re-organisation of in-house information flows
- > Short processing times
- > High planning safety
- > optimised reaction and development times
- > Systematic support of document management
- > organised knowledge development
- > Quick and flexible reaction to changed basic conditions
- > Early identification of customer's needs

Business processes are organised sensibly

- > Company-specific planning
- > Simple, lean, safe, flexible
- > Mutual coordination
- > Process safety

IT-systems are used to advantage

- > High material data quality
- > High material flow transparency
- > integrated material reporting

Material flows are simple and efficient

- > End-to-end perception and re-organisation of in-house material flows
- > Short processing times
- > Optimal inventories
- > Reduction of waste, destruction of materials and rejects
- > Material reduction by substitution
- > Reduction of handling

Organisation structures are coordinated

- > Efficient, unambiguous and, at the same, very flexible organisation
- > Clear responsibilities
- > Structures without overlap/gap
- > Removal of coordination problems

Projects are coordinated company-wide

- > integral concept
- > Mutual coordination
- > Successful project controlling

Material flow accounting creates quantitative transparency

- > Transparency of material flow structure, but also of quantities and costs
- > integrated material reporting
- > localising of weak spots
- > Reduction of processing and handling costs for transport and storing procedures, set-up and cleaning, product processing
- > Increase in flexibility and innovation capability

Culture of cooperation arises

- > Understanding of overall connections increases
- > Uniform points of view, values and language facilitate cooperation
- > Flexibility, creativity and performance power are released
- > Momentum of its own of development process arises

Companies in which everything flows

It becomes possible, with the aid of flow management, to harmonise the workflows in companies in the form of material and information flows with the demands of the stakeholders.

The following scenario 2 shows, how a flow-orientated company is positioned to meet these high demands.

Examples for the project companies

The following table gives an overview of the examples for problems, experiences and successes in the pilot projects. A detailed description of the examples is in suitable places in the individual chapters. The examples, as a rule, are company-specific. The general examples are typical for several companies.

Table 3: Examples from the project companies

COMPANY	EXAMPLE DESCRIPTION	PAGE
In general	unclear strategies lead to inefficiencies and uncertainties	25
Karwendel	database	29
Sortimo	inventory reduction and shorter processing times	32
Hörauf & Kohler	Reduction of internal transportation and handling efforts	33
Hörauf & Kohler	Organisation of dispatch and carriage ordering	35
Rohrleitungsbau Süd	Uncoordinated material orders	36
Rohrleitungsbau Süd	introduction of a new division work planning	39
In general	Use of movement types	45
In general	Topicality of the ERP-system	45
FHP Augsburg	Material posting model shows faulty postings	45
In general	Data consistency	48
In general	Interface problem	48
In general	Congruence of material flow and material postings	48
In general	In-transparency of order posting	48
In general	Completeness of standard bill-of-materials	49
In general	Material value only could not be determined	50
In general	Detail exact material data	51
In general	Inventory clarification	52
In general	Renaming	52
PCI	Inexplicable material gains	52
FHP Augsburg	Results of consistence check (quality check)	53
PCI	Material reporting	54
Rohrleitungsbau Süd	Process contribution accounting	55
Karwendel	Two-stage evaluation	58
Keimfarben	Improvement of data recording	60
Karwendel	Improvement of procurement process	61
Hörauf & Kohler	Improvement of internal capacity utilisation	61
Rohrleitungsbau Süd	New organisation of residual material store	62



Scenario 2

Positive company dynamics by flow management

A wholesaler orders from a pharmaceutical company four pallets of sun lotion for the impending heat wave. The responsible sales assistant (order acceptance) sees in the EDP-system that there are only two pallets of sun lotion in stock, but confirms delivery for the next day 12.00. Since implementation of the flow management an atmosphere of departure is clearly noticeable. Within the scope of a joint vision and strategy development it became clear to the employees, how important it is for the company success to meet short-term customer's requests. Everyone is aware that the company success essentially depends on quality and efficiency of cooperation. The individual bonus systems were cancelled. Instead of it, a bonus is now paid from the company profit, so that every employee feels more responsible for the company as a whole.

In the daily afternoon meeting of the new team for in-house sales services Sales, Work Planning, Costing and Procurement meet regularly. The employee from Sales reports at the meeting the short-term need for sun lotion. Work planning knows that the wholesaler is an important customer and agrees to change the production programme at short notice. Late in the evening a similar product will be produced anyway, so that the night shift, with little set-up and cleaning expenditure, can move the production of the sun lotion in between. "We shall manage" he puts the Sales employee at ease. Since the separation of production into large and small series product change has become clearly simpler. The new plants for the small series cause significantly less set-up and cleaning effort.

Since a while, the production foremen receive monthly information about material losses by quantities and value. The losses can be evaluated by raw materials, plants, batch numbers and products. Initially, the data could, practically, not be used as badly cared for master data and posting inaccuracies distorted the results. The employees in Production can now see, how untidy postings lead to numerous evaluation problems and, since they post more careful. Since a few months, the data quality has increased significantly and the data are now usable. The improved data quality also leads to, that the procedures for procurement, work planning and dispatch are less liable to breakdown. Also

Controlling and Material Accounting have noticed that the effort for cleaning up inconsistent material data has reduced. The gained free time is now invested into long overdue data evaluation and concept developments.

Also in Production things have started to move, since the total costs of a product or batch change (for instance: material losses, personnel costs, stand-still periods) are known. In the daily team meeting of the in-house Sales service, jointly, a production programme is drawn up which takes the cost situation and customer requirements into account. As now also the Sales employees are aware of the problems and cost of short-term product changes, they are trying, already in the talks with the customers to sound out the situation and, in some cases, do not confirm short delivery dates. Furthermore, the batch sizes were again slightly increased, as the material losses caused by additional set-up were higher than the costs for storing and capital lockup. In total, the number of set-ups has been significantly reduced. In cooperation between Development and Sales high-viscose raw materials were replaced, which led to especially high material losses and long cleaning times.

Against the general trend, two new jobs were created in Production which leads to a significant relief of all staff in Production. "By the careful cost-benefit evaluation it was established that the additional use of staff is justified" says the production manager. Due to the new positions, Production is now again in the position to scrape adhering ointment and creams and push into the filling station to fill as much product material into the tubes. The saved material value is significantly higher than the cost of the two additional posts. Due to the two employees holiday planning and deputising regulation have clearly become easier. The mood of the production staff has unambiguously improved which leads to a better posting discipline and a greater engagement in the continuous optimisation.

Due to avoiding washed out product material in Production the effluent contamination was significantly reduced and the cost for the running sewage-works operation lowered. The limits can easily be maintained and, due to this, the cooperation with the authorities could be improved. Now, the sewage-work has even sufficient capacity for the extension of the production. The company receives an environment award for successes in the reduction of effluent contamination and, by this, confirms the positive company image in the public.

The wholesaler receives the four pallets of sun lotion the next day on time. He has in the mean time a good feeling and a lot of trust when he orders goods from this pharmaceutical company. He noticed that the Sales staffs are not only more self-confident and friendlier, but also that the company reaches surprisingly high supply confidentiality, even for short-term enquiries. Not only does he like to order from this company, but does so increasingly more often.

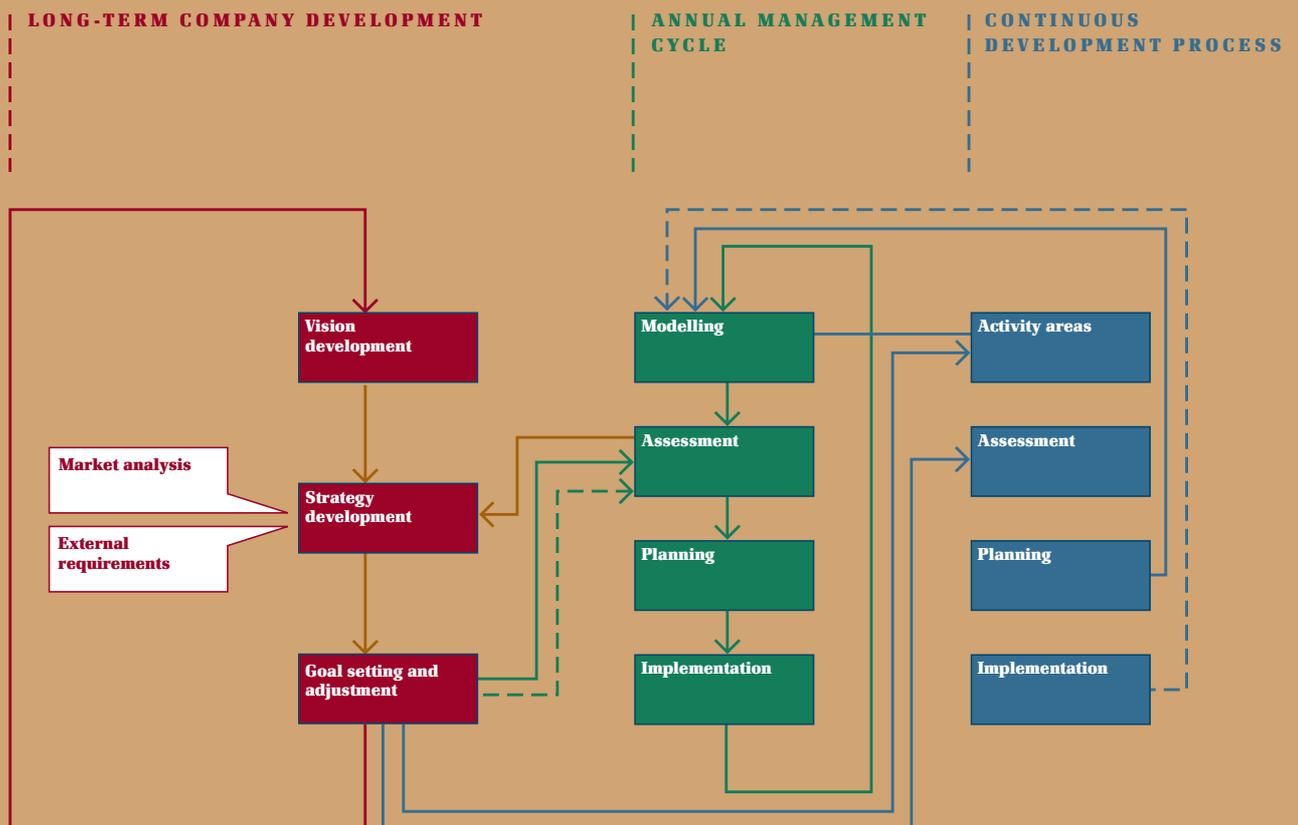
B Flow Management in practice

The three development cycles of the flow management are closely interconnected and are the basis for reaction capability, flexibility, topicality and efficiency of the company performance. The development cycles move along the time horizon long-term, annually and short-term, but are linked synergetic together in the individual phases.

The basic orientation for all changes is determined by the **long-term company development**. Building on the vision of the company management, the necessary strategies will be developed for their appropriation. External requirements as well as market analyses play an important role in the strategy development. On the other hand, the look into the company is the basis for drawing up the strategy. The first two phases "Modelling" and "Assessment" of the **annual management cycle** supply the necessary information of the current development status of the company. The strategies are further defined by the goal determination and adjustment and implemented into concrete targets. These goals serve as orientation for the evaluation

of the results of the modelling phase within the annual management cycle. By the interaction of the two cycles, the demands of the company management meet with the viewpoint of all involved employees at all hierarchy levels and can be harmonised in this way. If needed, the company goals will be adjusted in this negotiation process. The goal setting can also directly show fields of activity which are to be tackled short-term. Within the scope of the **continuous development process** activities for reaching the goal can be clearly defined and fixed. The modelling phase of the annual management cycle provides an optimum basis to describe the fields of activities more exactly and be able to define the necessary actions. In the modelling phase, in-house connections will be visualised and made transparent. All required modification activities and the effects can be given a location in the flow model. In this way the effects of their planned activities and the involved divisions become recognisable for the involved personnel. Coordination with the employees, affected by the planned change, is made possible and it clearly facilitates the effective change.

Figure 9: Phases of development cycles



Once fields of activities are fixed, they will be evaluated, with respect to the result of the change, from the viewpoint of all involved employees in the subsequent evaluation phase of the continuous development process. The fixed goals from the cycle of long-term company development are taken as additional evaluation criterion. If the intended change does not make sense, in the viewpoint of all involved or is it contrary to the company goals, it will be cancelled. Otherwise, the change will be detailed in single implementation steps during the subsequent planning phase. After the change has been planned in detail, on the one hand, the implementation phase will be started and, on the other hand, the flow models will be modified according to the new changes. The success of the implementation will, subsequently, be checked and assessed within the scope of the annual management cycle.

B.1 Long-term company development

The orientation of short and medium-term activities on long-term company development is an important step to overcome short-term excessive desire for action and overtaxing the employees. Only in this way the existing forces can be activated and concentrated in direction of an integral development. Starting with the numerous small measures for adjusting the material and information flows, via investment decisions to setting highlights for product development or company acquisitions, a synergetic cooperation should take place. For this, it must be clear to all involved, where the journey goes to, which ways are to be taken and what resources are available. It is the task of the long-term company development to bring about the clarification process, necessary for this, and to repeatedly update.

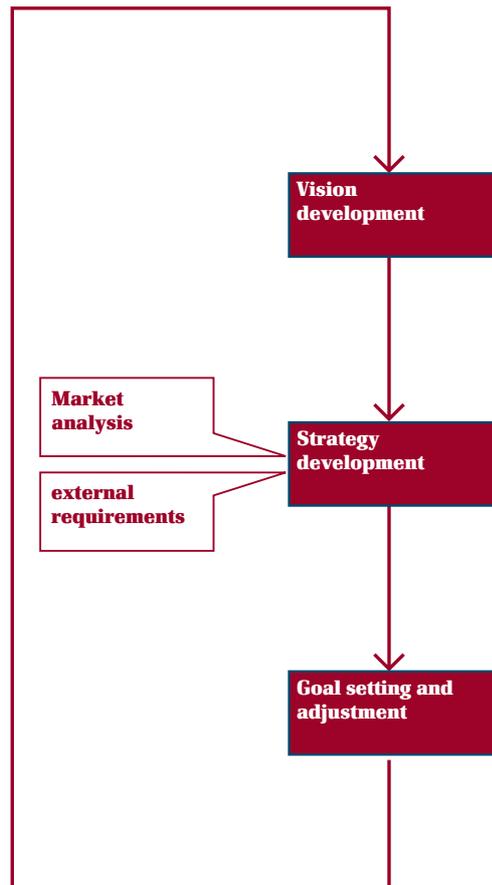


Figure 10: Long-term company development

B.1.1 Vision development

Especially in medium-sized companies clear visions, strategies and company goals are often missing. Occasionally, a real aversion is found for this topic. "If one has visions, one should go to the doctor", is a favourite slogan of the "vision adversaries". This aversion, clearly, is justifiable. In the past years the term 'vision' was falsified or used much too often. Eventually, this is not about well phrased, but hollow statements for image brochures. The presentation of all essential functions and contents show which importance, eventually, the development and implementation has. Often, the function of a vision in the company is compared to the polar star. The caravan, searching for the way in the desert with a landscape continuously changing in sand storms, orientates its journey by the models of the starry sky. However, as the stars are not the goal of the journey, also the vision is not the final goal of the company. It rather serves as an orientation to direct the actions of the employees. The proper vision is to lead from the present time into the future. It defines a "vague" future, which is to be stated more precisely in further development and planning steps (strategy, company goals).

It is the connection to current action and the things which the organisation wants to build up in the future. Therefore, despite all current unpredictability, the view goes to the future. The vision defines a frame of possible environment and company developments to offer a basis for a strategy development. From this, functions arise which can, essentially, be subdivided into strategic and social elements.

Social functions

- > Definition
- > Motivation
- > Identification
- > Integration

Strategic functions

- > Orientation
- > Organisation
- > Differentiation
- > Use

Although the vision should initially be freely developed it makes sense to keep certain categories in the back of the mind. Possible categories can be taken from the below diagram.

- > The business segments, in which the company wants to work, determine the size of the business activity and must, therefore, belong to the essential contents.
- > The size of the company should not be given as a goal, but as an indication for the vitality of a company.
- > Within the scope of the identified business segments also the product lines, to be offered, and the market niches to be opened are to be determined.
- > Furthermore, it has to be decided, on which levels it is to compete with other companies (technology, distribution, price, etc.)
- > Also, it has to be determined, how the company presents itself externally and internally and which image or which association should be decisive for cooperation with stakeholders. In this context also social values and ecological questions should be considered.
- > The vision should, also, integrate the company culture and organisation form.

Figure 11: Categories for vision development



The development of a vision is to be organised like a small project. The first important task of the coordinator is the determination of the persons to be involved in the development of the vision. As a rule, the development takes place in a team composed of the management level, owners and selected personnel which represent various interested groups. The vision should primarily be orientated on personal interests and work highlights of the involved persons. After all, the vision should strengthen the team spirit, mobilise forces and promise a desirable future. The vision development is, therefore, a rather creative activity and cannot be forced into an analytical procedure. The concrete drawing up is carried out in the following steps:

- ① Looking at the past
- ② Looking at the environment
- ③ Looking at the present situation
- ④ Including and coordinating personal points of view.

B.1.2 Strategy development

To state the vision more precisely, namely, the "more concrete definition of the company's future" starts with the strategy development. The task of the strategy is, essentially, to implement the vision or rather make it attainable. If vision is the polar star which provides orientation, then strategy describes the ways, to move into the right direction. Strategy is, therefore, the procedure for attaining the vision. With this, the individual criteria of the vision move within reach. Then, the strategy also serves as a draft for determining the company goals. For example, the four areas of the Balanced Scorecard could serve as

a concrete frame (see figure 12). Basis for the strategy development is, apart from the vision, an extensive knowledge of the internal and external situation (laws, banks and insurances, equity capital providers, etc), as well as the predicted market and technology development. The knowledge of this situation should point out chances and risks on the way to realisation of the vision. The internal knowledge for the strategy development follows from the modelling and assessment (see chapter B 2.1. and B 2.2.) within the scope of the annual management cycle. By this, the current status of the company will be determined and strength and weaknesses deduced. The combination of internal strength and weaknesses and external chances and risks is the basis on which the strategy will be built.

Example: Unclear strategies lead to inefficiencies and insecurity.

A precise company strategy is essential for efficient decision processes. The direct connection between strategy and efficient process planning is a central success factor. In a company with a high new product proportion or a high number of development projects, the strategy has to give clear indications for which products and in which market segments development projects should really be initiated. If such decisions are not based on a clear strategy, then high discontentment of the employees in the company about possible decision finding is to be expected and the lasting market success is endangered.

Figure 12: Dimensions of strategy development

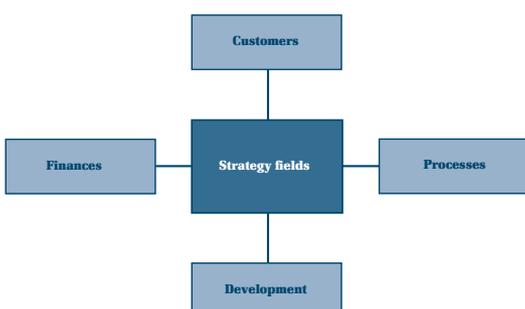
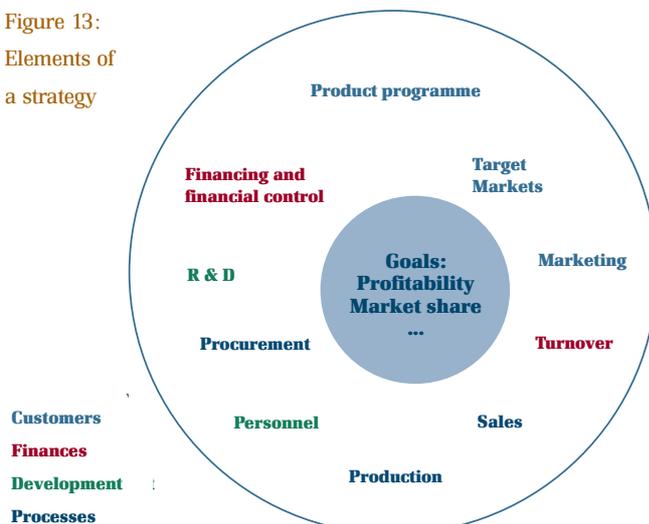


Figure 13: Elements of a strategy



B.1.3 Definition of goals and adaptation

Finally, the company goals put the strategy in concrete terms in a measurable description. The control of the goals answers the question, if the company develops as planned and, by this, is the precondition for the exact control of the development. Areas of the Balanced Scorecard are, again, recommended as goal areas. The BSC-cockpit, depicted below, shows the selected goal variables for all four relevant dimensions. The viewed periods should be between monthly and annually, depending on the business segment.

Table 4: BSC-cockpit (Exemplary performance indexes)

FINANCES			MARKET		
	LQ	VQ		LQ	VQ
Net turnover			Delivery accuracy		
Operative profit			Market share S1		
Return on Sales			Market share S2		
Return on Net Assets			Customer satisfaction		
Operating result per employee			Return		
PROCESSES			DEVELOPMENT		
	LQ	VQ		LQ	VQ
Machine load factor			Turnover new products		
Rejects proportion			Research intensity		
Inventory turnover			Culture (company-orientated)		
Satisfaction			Culture (staff-orientated)		
Complaints frequency			Proportion of staff in projects		

The characteristics of the goal sizes must be suitable to fill the five-year path of strategy implementation with activities.

The definition of respective fields provides, in this way, for a comparison of developments in the current quarter (CQ) and the previous quarter (PQ). In this way, a dynamic goal tracking can be carried out by the respective use of software and, eventually, the concrete implementation of the vision, split into shorter periods, can be initiated. The goal variables should be further differentiated and – depending on the culture of the company – eventually, be broken down to person-orientated goal agreements. Finally, the strategic learning process will be clarified again, which connects the three elements Vision-Strategy-Company Goals.

The reflection of single, measured data (realised goal index) triggers the check of the goal sizes and, possibly, a necessary adaptation process. This cycle can be connected across all three levels (vision-strategy-goals) and ensures, by this, the long-term company development.

“To see the forest despite the many trees – that is flow management.”



B.2 Annual management cycle

Implementing and maintaining the annual management cycle take place according to a rigid phase model, by which a fundamental process of change in the company is to be initiated. The process of change must include all structures and hierarchy levels of the company. The fundamental modelling of all relevant structures is the starting point into the flow management. Already in the **modelling phase**, as many employees as possible should be involved in developing a uniform understanding of the company. During the modelling phase recognised problems should, only to a limited extent, lead to immediate actions. Well meant actionism will, possibly, be without any effect. Instead, in the **assessment phase** the complete situation of the company will be assessed and the central chances and risks identified, after the modelling results are fully available. Only in this way it is ensured, that prime causes and correlations

are recognised and relevant and effective activity areas can be dealt with. During the **planning phase** concrete measures will be, systematically, evaluated according to the activity areas. The employees should play a central role, also, during assessment and planning. The participation of employees facilitates the successful implementation of the measures during the **implementation phase**. As a matter of principle, it must always be checked, in how far the taken actions lead, in fact, to the intended changes.

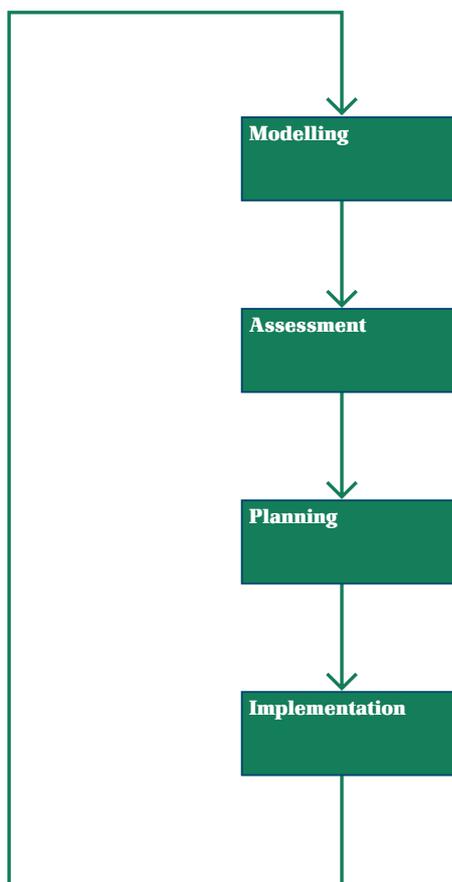
B.2.1 Modelling: Integral perception of material and information flows

"One can see by the model, where the possibilities for improvements really are."

Peter Schlumprecht, Production planning, Karwendel-Werke Huber GmbH & Co. KG

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Figure 14: Phase model of the annual management cycle



Why is it important to model the company?

Companies are almost unlimited complex and can, therefore, not objectively be described or analysed. Every employee of a company has his own perception and, due to this, his own understanding regarding structures and processes of the company. Employees focus the interests of their activity area and it happens, therefore, that complete divisions develop their own cultures, languages and perspectives and, also, pursue their own interests and goals. From this, misunderstandings and coordination problems arise, which lead to goal conflicts, very difficult to resolve.

"This is an eye-opener. We will change this first thing tomorrow morning." (Statement during information flow modelling, which brought to light inefficiencies within the scope of transportation ordering).

Bernd Gohritz, Head Production/Logistics, Hörauf & Kohler GmbH

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Within the scope of modelling essential aspects of the company will now be described in an integral way with the support of special methods. In as much as possible, a person and division-neutral model and material and information flows are shown in their total course throughout the company and also relevant structures such as organisation units, responsibilities, business processes or current projects. It is essential for the modelling to include the experiences and views of the employees in an open discussion circle. Differences in the joint perception of the company can, in this way, be recognised and initial unification processes can, already, be initiated. Beside this, employees have the chance to become acquainted with other activity fields in the company and correlate them with their own tasks. It is, therefore, essential to carry out the modelling within the scope of a cross-departmental working group. The essential positive effects of the modelling are generated by the fact that employees, working alongside the material flow, can in future, also in everyday matters, reach agreements better and can, easier, recognise and use potentials. The modelling was greatly accepted in all pilot companies because of the comprehensible logic and the clearly defined description rules. As a summary, the modelling results in following effects:

- > **Changes in perception and behaviour of the employees**
- > **Integral understanding of the structures and correlations of causes and effects**
- > **Convergence of the points of views between the employees**
- > **Increasing mutual understanding for other employees/departments**
- > **Gap and overlap-free visualising, which is easy to understand**
- > **Simple visual documentation**
- > **Deficits, weaknesses and conflicts are systematically laid open**
- > **Motivation and cooperation willingness increase**
- > **Quick wins**
- > **Basis for integral company assessment**

The basic models of the modelling are the material and information flows. Both models, as a rule, can be drawn up independent from each other. However, it is sensible to combine the models at the end of the modelling phase to better recognise correlations and conformance of material and information flows. Various supplementing models reinforce individual relevant aspects such as organisation units, business processes, projects and the structure of material postings in the in-house information system. In these supplementary models the respective structures are compiled and then entered into the material and information model.

A specific form of the modelling is the material flow accounting. While the basic model and the supplementary models essentially depict structures and connections, the material flow accounting shows all inventory and movement data of materials by quantities and values. The material flow accounting uses the data of existing information systems and aims at increasing the data quality and improving the material reporting. The flow management includes and changes the whole company. To limit the expenses, two simplified starting variants are available at the beginning of the project.

Variant 1: Flow-orientated organisation development

The variant of flow-orientated organisation development serves the purpose, to simplify, on the one hand, the course of the material and information flows and, on the other hand, to better align the organisation structures and procedures to the material and information flows. Furthermore, a sustained innovation process is created by implementing a stable development process on the basis of responsible and goal-orientated employees. This variant is recommended for the start for small companies and companies without ERP-system.



“The potentials are rather evident. What the improvements bring in the end depends on to what extent we can motivate the employees to cooperate. Flow management has given us a tool for this.”

Q U O T E

Klaus-Dieter Reiter, Management Production, Karwendel-Werke Huber GmbH & Co. KG

	Variant 1 Flow-orientated organisation development	Variant 2 Material-orientated efficiency increase
BASIC MODELS		
Material flow model	○	○
Information flow model	○	○
Combined material and information flow model	○	
SUPPLEMENTARY MODELS		
Organisational units	○	
Business processes	○	
Projects	○	
Material postings		○
MATERIAL FLOW ACCOUNTING		
Movement calculation		○
Storage location calculation		○
Product order calculation		○

Table 5: Variants of modelling

The organisational improvements show the concrete requirement for the development of the IT-system. Within the scope of development of the IT-system the material flow accounting can be integrated planned and carried out.

Variant 2: Material-orientated efficiency improvement

The focus of variant 2 is the simplification of the material flow structure and reduction of the material use. The reduction can come from changes on products and packages or from avoiding material losses (solid waste, effluents, exhaust air). Basis for a systematic reduction of material use is material flow transparency by quantities and values.

For larger companies (from approximately 200 employees upwards) with high material costs, complex material flows and high product diversity it is recommended to start with variant 2. The material flow accounting generates a large material flow transparency which, often, leads to quick cost savings. This flow transparency is the basis for organisational improvements.

Example Karwendel-Werke Huber GmbH & Co. KG: Database

To be able to describe the existing operational situation in the company and to initiate the impending changes, within the scope of the project at Karwendel, an Access database was used for support, visualisation and description of the company structures and procedures. Data sets can automatically be changed into material and information flow pictures for a detailed description of procedures. Furthermore, the possibility exists, to flexibly draw up reports for different requirements (Quality Management, Balanced Scorecard) by calling up data from the database. These contain process-specific information such as functions of material and information centres, process tasks, key data, responsibilities or documents.

“The material and information models are perfect for audits; how at one glance it becomes clear who works with whom and how something works. Just imagine you would have to read eight pages in the first place to obtain the same information content.”

Werner Schmid, Factory Manager
PCI Augsburg GmbH

QUOTE

B.2.1.1 Drawing up basic models

B.2.1.1.1 Material flow model

Modelling of the material flows is the basis of the flow management. The material flow model shows the material flow from the supplier via the own site (especially receiving department, store, production areas, dispatch department and environment technology) to the customer, the disposal operator or the environment. Decisive, hereby, is the end-to-end and uniform depicting of all relevant material flows. Material losses in the form of effluent or solid wastes are depicted in the same form like the value adding material flows that go as products to the customer.

QUOTE

"The material flow modelling was a sudden insight for the whole company."

Wolfgang Listle, Head Produktion
Keimfarben GmbH & Co. KG

Modelling method

The following elements are used for material flow modelling:

- > Internal quantity centres
- > External quantity centres
- > Material flows
- > System boundary

① Quantity centres are spatial or functional units at which material is stored or processed. Typical internal quantity centres are

- > Stores,
- > Supply areas,
- > Production areas,
- > Production plants,
- > Environment technical plants (sewage-works, air filters, etc.).

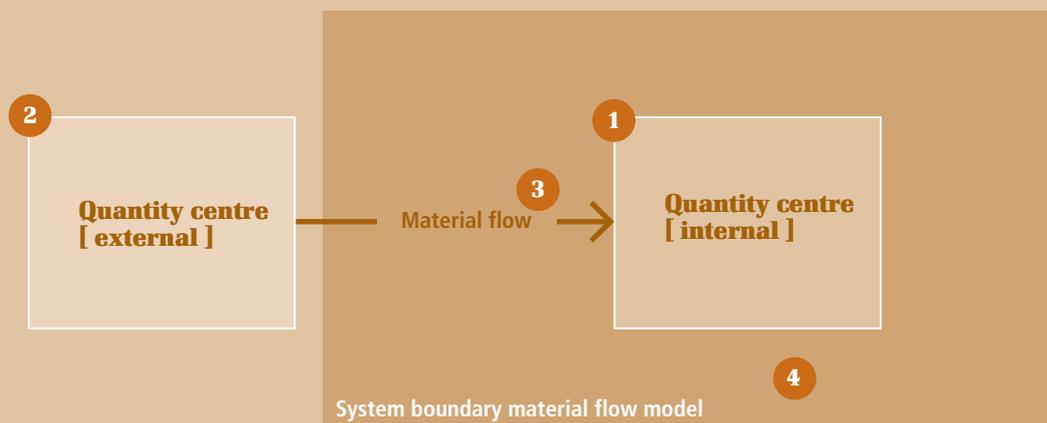
② Typical external quantity centres are

- > Suppliers,
- > Sub-contractors,
- > Customers,
- > Disposal operators

③ Material flows always move between two quantity centres and have a fixed direction. They show that material is regularly moved from one to the other quantity centre

④ Furthermore, a system boundary is needed which determines, what lies inside the investigated planning area. This system boundary separates internal and external quantity centres.

Figure 15:
Elements of a
material flow model



Variants of the material flow modelling

At the beginning of the modelling, the rules for modelling must be clarified to avoid misunderstandings, unclear or non-uniform

statements. For simplifying the modelling rules several modelling modes were determined which each set a specific focus and require differing modelling rules. Table 6 gives an overview of the modelling modes.

Table 6:
Modelling modes

	Description/Rule	Focus/Objective/Benefit
Simple material flow model	The quantity centres will be connected, at maximum, by one material flow.	Easy total overview, suitable for the start, and offering a good decision basis for later extension.
Differentiated production step-related material flow model (I)	More material flows can move between quantity centres; differentiation of the flows takes place according to the production progress (For instance: input material, intermediate product, product, merchandise).	Good depiction of production logics and the production progress; especially as basis for logistics optimisation and for re-organisation of the material flow.
Differentiated production step-related material flow model (II)	Several material flows can move between quantity centres; the differentiation of the flows is carried out by type of material, independent of the form in which the material flows (for instance: raw material, packages, tools, water, energy).	Good depiction of how and what types of material flow through the company. For instance: It becomes also transparent which types of material at what location become solid waste or enter effluent or exhaust air; basis for the increase of material efficiency and for the material flow accounting.
Differentiated organisation-related material flow model	Several material flows can move between quantity centres; the differentiation is carried out according to the organisation form of the material (For instance: Kanban, Pull- or Push or principle of self-collection or supply).	Good depiction of the organisation principles in production and store, especially suited to develop and implement new organisation forms.

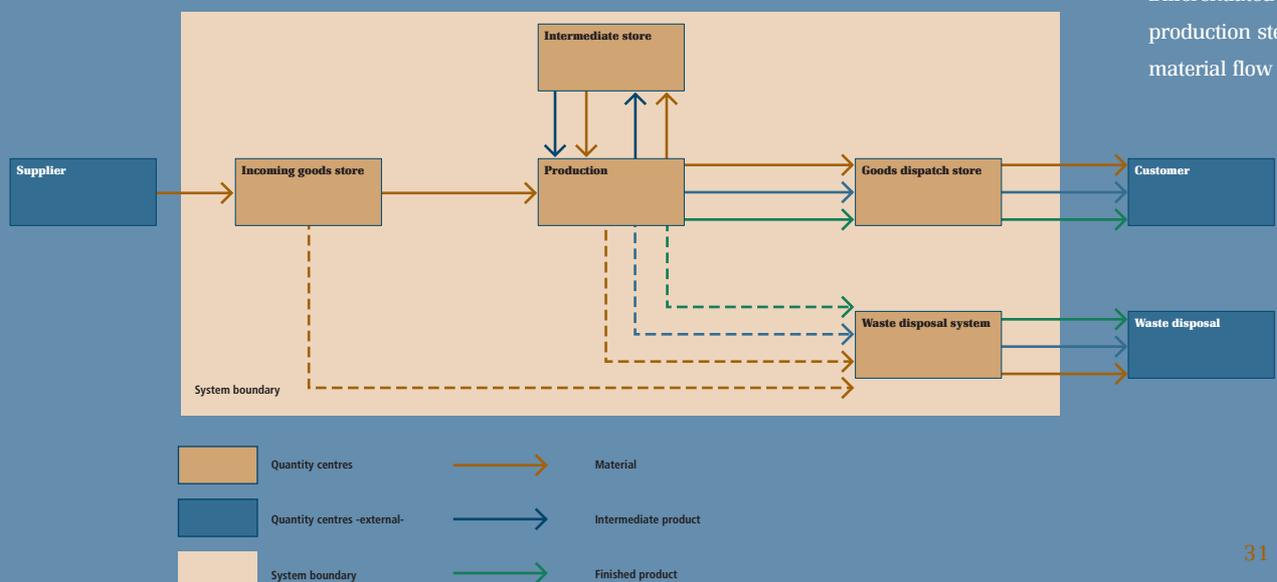


Figure 16:
Differentiated
production step-related
material flow model (I)

Information for carrying out material flow modelling

How detailed the material flow model should be, depends, on the one hand, on the modelling goals and, on the other hand, on the complexity of the material flow. As a matter of principle, it should be started with a rather simple material flow model which shows the essential connections. Should it become apparent during the project that a detailed model is needed, the existing model can either be supplemented or a detail model drawn up for the relevant sections.

It showed in the projects that very detailed material flow models, which have more than 50 quantity centres can neither be depicted nor evaluated. One should, therefore, sensibly restrict oneself to approximately 20 to 30 quantity centres. Principally, only material movements which flow with a certain regularity and are of relevance to the company should be depicted. Special cases and exceptions should initially not be considered, as they only hinder looking at the essential points. It must be checked separately for a certain increasing number of special cases, if a systematic error exists in the organisation of the material flows.

It is recommended to involve employees in the working group for material flow modelling from the areas

- > **Materials management or store management,**
- > **Production, work planning,**
- > **Transportation and logistics,**
- > **Environment, Health, Quality and Safety (EHQS).**

Secondary questions of material flow modelling

- > **Which materials flow in detail? In what quantity and value do the materials flow? Why do certain material movements take place? How often is material transported and how long stored? Questions of this kind will be clarified in detail within the scope of material flow accounting (see chapter B.2.1.3).**

- > **Who is responsible for which quantity centre and who for which flow? Where are the overlaps of responsibility and are there responsibility gaps? Compare with modelling of organisation units (see chapter B.2.1.2.1).**
- > **Which business process does the material flow belong to? Is the material flow organised in the bring (push) or collect (pull) principle? Compare with modelling of business processes (see chapter B.2.1.2.2).**

Exemplary effects of material flow modelling

- > **Several quantity centres such as buffer stores or certain processing steps prove to be unnecessary and can be dissolved.**
- > **Material movements, such as material which does not have to be checked can in future bypass "Quality testing". The consequences: reduced transportation and handling effort.**
- > **By introducing of a new quantity centre "Store for cut-offs" material losses will be significantly reduced.**

Example Sortimo International GmbH: Inventory reduction and shorter processing times

Already during the first inspection of production at Sortimo the high inventory of unfinished parts between the processing stations was noticed. When modelling the material flows, it became evident that two buffer stores existed between each of the two processing stations which were often full. An intermediate store was directly behind the last station and the second in front of the next station. As the intermediate stores were on different floors this situation had, obviously, gone unnoticed. Co-ordination between the two stations did not take place. A determination of the processing times of exemplary parts showed accordingly high values. Because of this, the transfer of machined parts to the following processing station was re-organised and the posting procedures for re-registration in the ERP-system changed. This not only led to a reduction of the processing times but also to clear lowering of inventory.

**Example: Hörauf & Kohler GmbH:
Reduction of the internal
transportation and handling time**

At Hörauf & Kohler, all incoming raw materials went to a special quality test location before they were stored in the basement. But not, by far, for all raw materials a quality check had to be carried out. When asking, why these materials were not directly transported to the materials store, the not very plausible answer was given: "We have always done it like that." Obviously, this situation was immediately resolved in the modelling working group, in agreement with the respective persons, with the consequence that the internal transportation and handling time could be, clearly, reduced by a more efficient material flow.

> More detailed information is available on the website www.eco-effizienz.de. Under the heading "Flow Management" the report 'Methods of Material Flow Modelling' gives detailed information of this topic. Also Visio modelling templates are available for downloading.

B.2.1.1.2 Information flow model

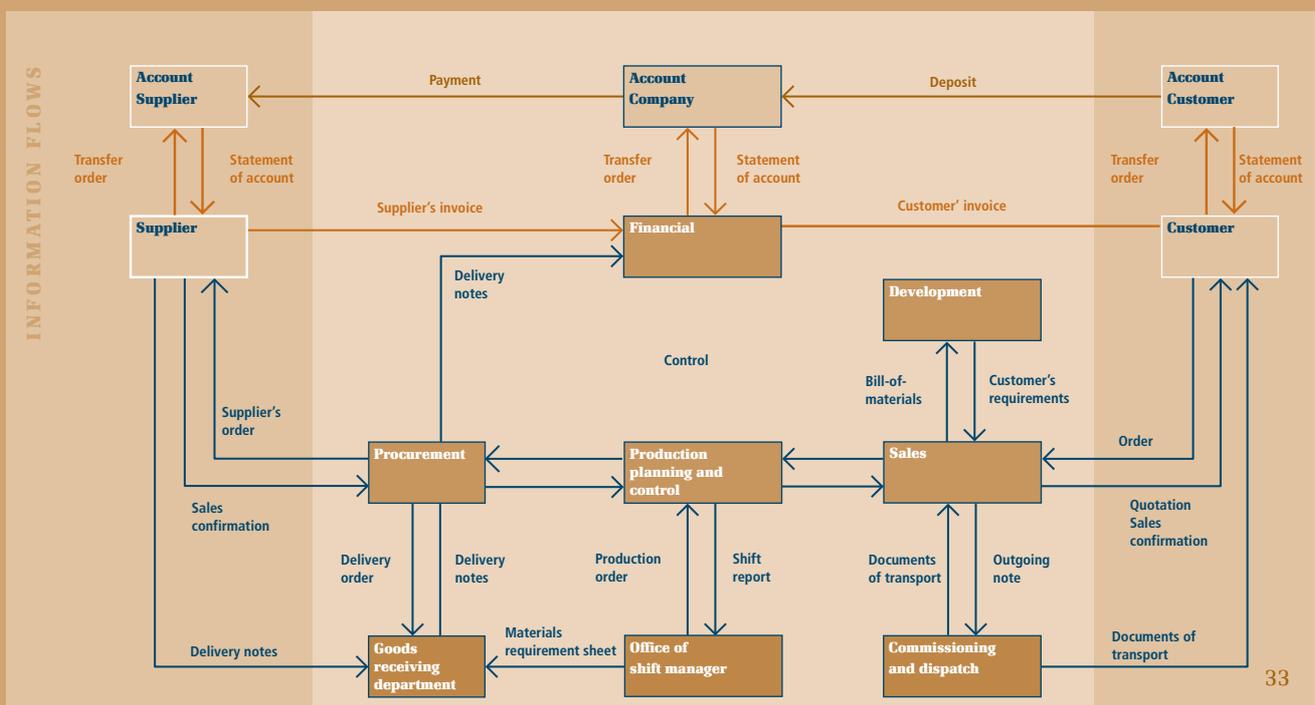
The information flow model is the second important modelling module of the flow management. It can be drawn up on the basis of the material flow model or also independently. In the information flow model all relevant information flows of the company are shown. Just like in the material flow model, initially, only the structure of the information flows is modelled. The information flow model shows the course of the information flow from the customer via the own site (administration and production) to the supplier. It forms, in this way, the classification system for planning and control of the material flows, as well as, the development capability of the company. Complex procedures can comparatively easily be described by the information flow modelling.

"Information goes to one location and nothing comes out again. That is like the Black Holes in the universe. These information holes were, incidentally, removed by the modelling."

QUOTE

Klaus-Dieter Reiter, Head Production, Karwendel-Werke Huber GmbH & Co. KG

Figure 17: Simple information flow model



Modelling method

The following elements are used for the information flow modelling:

- > Internal Information centres
- > External Information centres
- > Comments
- > Information flows
- > Information units
- > System boundary

1 The Information centres are functional or spatial units in which information is generated, deleted or stored.

Typical internal Information centres are

- > Sales
- > Contract acceptance
- > Production planning
- > Procurement
- > Goods receipt
- > Dispatch

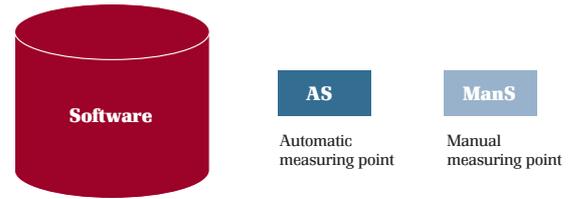
Information centres do not have to be identical with departments or persons. A department or person can also represent several information centres. Therefore, this is not about describing existing organisation structures but about the logic by which information flows or is distributed in the company.

Special forms

A special form of an information centre is the in-house software. Increasingly, it replaces activities which were, up to now, carried out by employees. To depict the full

information flow, in as much as is sensible, all relevant software packages are depicted as independent information centres. Furthermore, the possibility exists, within the scope of the information flow modelling, to attribute the respective measuring points to the material flows and quantity centres.

Figure 18: Special forms of information centres



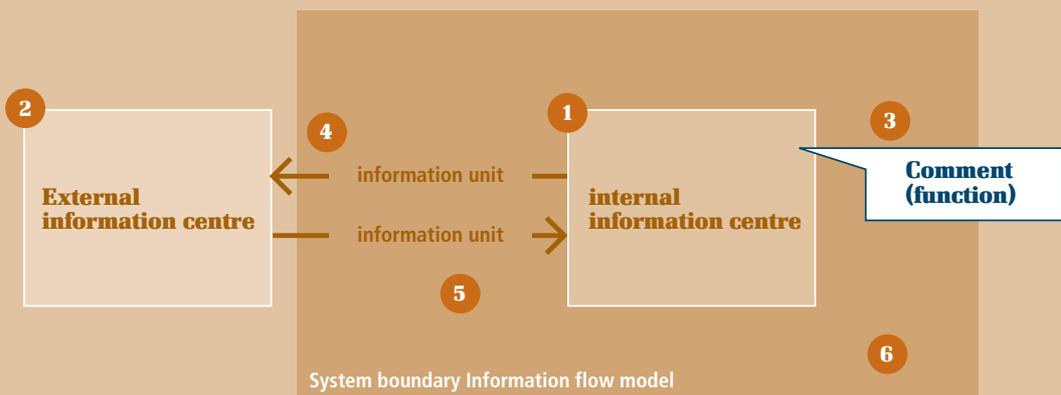
2 External information centres are used for depicting relationships to external organisations. These are for instance

- > Suppliers
- > Sub-contractors
- > Customers
- > Disposal operators

3 Comments regarding information centres: In addition to naming information centres, tasks and functions of the information centres can be, if required, described more exactly and be unambiguously attributed in form of a comment of the information centre.

4 Information flows, always, run between two information centres and have a fixed direction. They show that information units flow, regularly, from one information centre to another.

Figure 19: Elements of an information flow modell



⑤ Information units, which are moved in information flows, are the central element for development of information flow models. Information units specify and define the information which is contained in the information flows. Information units can, for instance, be transmitted from one information centre to another in the form of oral communication, writing or electronic data transfer.

Typical information units are

- > Customer inquiry
- > Quotation
- > Contract
- > Order
- > Goods receipt note
- > Production order
- > Delivery notes or documents of transport

⑥ As in material flow modelling a system boundary is needed which determines, what is inside the investigated planning area. The system boundary separates internal from external information centres.

Information for carrying out information flow modelling

As for the whole modelling, for the information modelling it is not a matter of drawing up a detailed and, exact as possible, graphic. Essential effects of the modelling arise from the fact that employees coordinate better and can recognise and use potentials easier. Therefore, the modelling should take place in a cross-departmental working group. The working group for the information modelling should have members from the following areas:

- > Procurement
- > Sales
- > Production planning
- > Logistics
- > EDP
- > Controlling
- > Quality management

To ensure an as high as possible working productivity, it is recommended to limit the number of working group members to a maximum of 10 persons. In the first modelling step the relevant information centres and the system boundaries will be determined. Only after this, the individual information flows are entered.

Exemplary effects

- > Several information centres show to be unnecessary and can be dissolved or merged.
- > Overloaded information centres will be recognised and respective action strategies developed.
- > The path of information flow will be shortened.
- > The information paths will be checked with regard to efficiency.
- > Surplus and missing information units will be recognised.

Example Hörauf & Kohler GmbH: Organisation of shipping orders

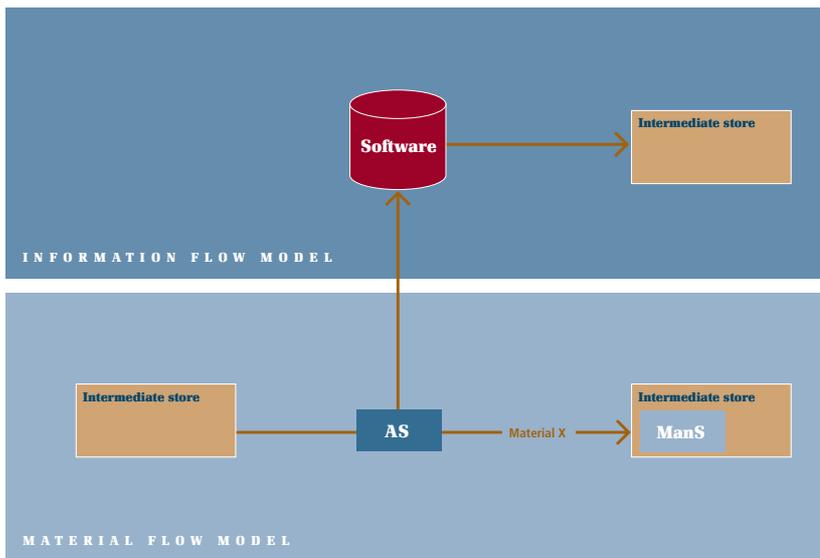
Shipping orders at Hörauf & Kohler were processed by Dispatch according to the sequence of printer printouts instead of urgency or collating orders for the same customer. Furthermore, the ordering was not unambiguously arranged. It was carried out uncoordinated by several departments. The consequence was, that trucks, not fully loaded, called at external companies sometimes several times a day. After a joint problem analysis in the modelling working group it was quickly agreed that, in future, the Sales Division should coordinate shipping orders. The employees of Hörauf & Kohler expect a reduction of shipping costs by five percent due to the new regulation.

> More detailed information is available on the website www.eco-effizienz.de. Under the heading "Flow Management" the report 'Methods of Material Flow Modelling' informs in detail of this topic. Also Visio modelling templates are available for downloading.

B.2.1.1.3 Combined material and information flow model

Because of the fact, that material and information are looked at as independent aspects, the models initially exist unconnected side by side. They can, of course, also be connected to a combined flow model. In two cases it can also lead to a direct connection between material and information flows: On the one hand, the measuring points are parts of the information flows as they generate information about material flows. At the same time, the measuring points can also be attributed to quantity centres or material flows. In this case the automated depiction of material flows is shown. On the other hand, in many companies units exist, which automatically control material flows. In the logic of the flow management they are treated as information centres, but are, at the same time, also part of the material flow. The combined material and information flow model (see figure 21) will later be used for a basic "road map" of the company. Further structures (organisation units, business processes, projects) will be entered during the following steps into this road map. Only the unanimous perception of the material and information flows enables a joint understanding of the company and opens up a lot of planning leeway. Besides the automatic coupling of material and information flows, both kinds of flow are essentially connected by the influence of the

Figure 20: Example for combination of material and information flows on the basis of measuring points



employees. On the one hand, the employees observe the material flow and, then, generate information, which is relevant for numerous activities (for instance: receiving department, material withdrawal, production confirmation). On the other hand, employees interpret information units (withdrawal note, production order)

which, then, lead to material flows. The perception and interpretation of the employees, as well as, clarification of responsibilities and procedures are of great importance for the re-organisation of material and information flows. In the supplement models this aspect is taken into account.

Example Rohrleitungsbau Süd GmbH & Co. KG: Uncoordinated material ordering

The combined material and information flow model revealed very different inefficiencies at Rohrleitungsbau Süd. It was recognised, for instance, that material orders were processed by up to five employees from different areas. This led to double or faulty orders, on the one hand, and to incomplete or completely missing material supplies on the other hand. The consequences were waiting times and/or unnecessary set-up times in production which caused deadline pressure, unnecessary overtime, increased fault rate and an increase of the calculated price. By the end-to-end and efficient re-organisation of the procurement process this deficit could be removed.

B.2.1.2 Adding of model supplements

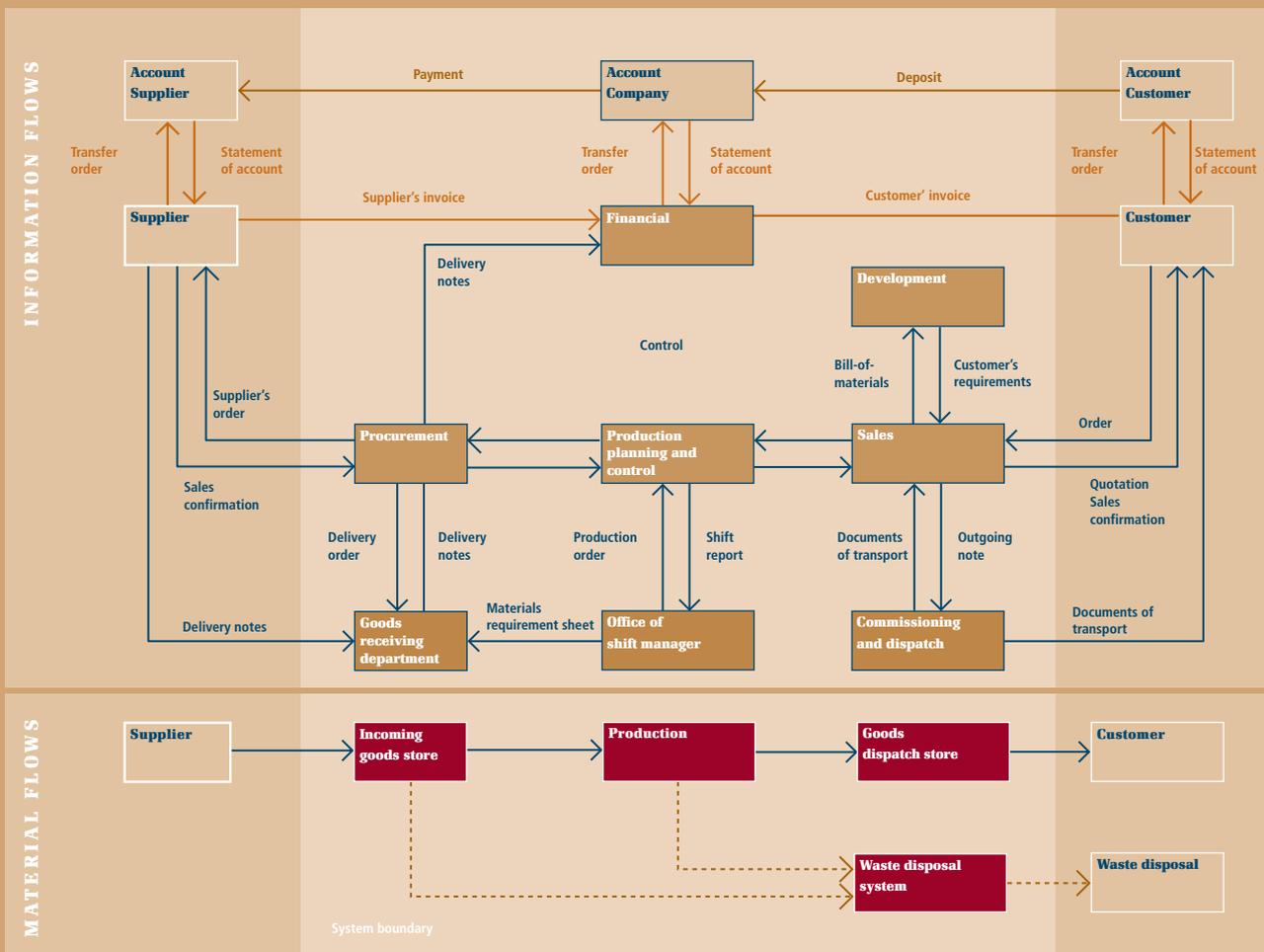
Additional information of the organisation and the IT-system are modelled on the basis of the material and information flow model. The respective structures of organisation units, business processes or procedures, current projects and material postings are compiled and entered into the flow model. In all pilot projects a number of deficits were found in the structures, responsibilities and processes by this mode of modelling, which could be remedied within the planning phase.

B.2.1.2.1 Organisation units

Organisation units, as a rule, grew historically and are, therefore, not systematically oriented on the flows. On the contrary, the way, in which organisation units are structured and which tasks are allocated, often contributes to significant inefficiencies and time delays. Basically, organisation units hamper the flows. Whenever material or information flows are transferred from one organisation unit to another, interfaces are created which quickly lead to coordination problems. Whenever individual organisation units are overloaded or overtaxed, then this influences the whole flow. Still, forming organisation units makes sense to facilitate specialising effects, group forming and clarification

of responsibilities. The depiction in the flow model also visualises, whether the organisation units are horizontally or rather vertically arranged. In a horizontal arrangement care is taken, to place material or information flow sections, as long as possible, within the area of responsibility of one organisation unit. The vertical arrangement, in contrast, aims at a better connection of material and information flows. Both variants have their specific advantages and disadvantages. Also the material and information flow structure between the individual organisation units is of interest to locate good or bad functioning cooperation and communication relationships.

Figure 21: Material and information flow model



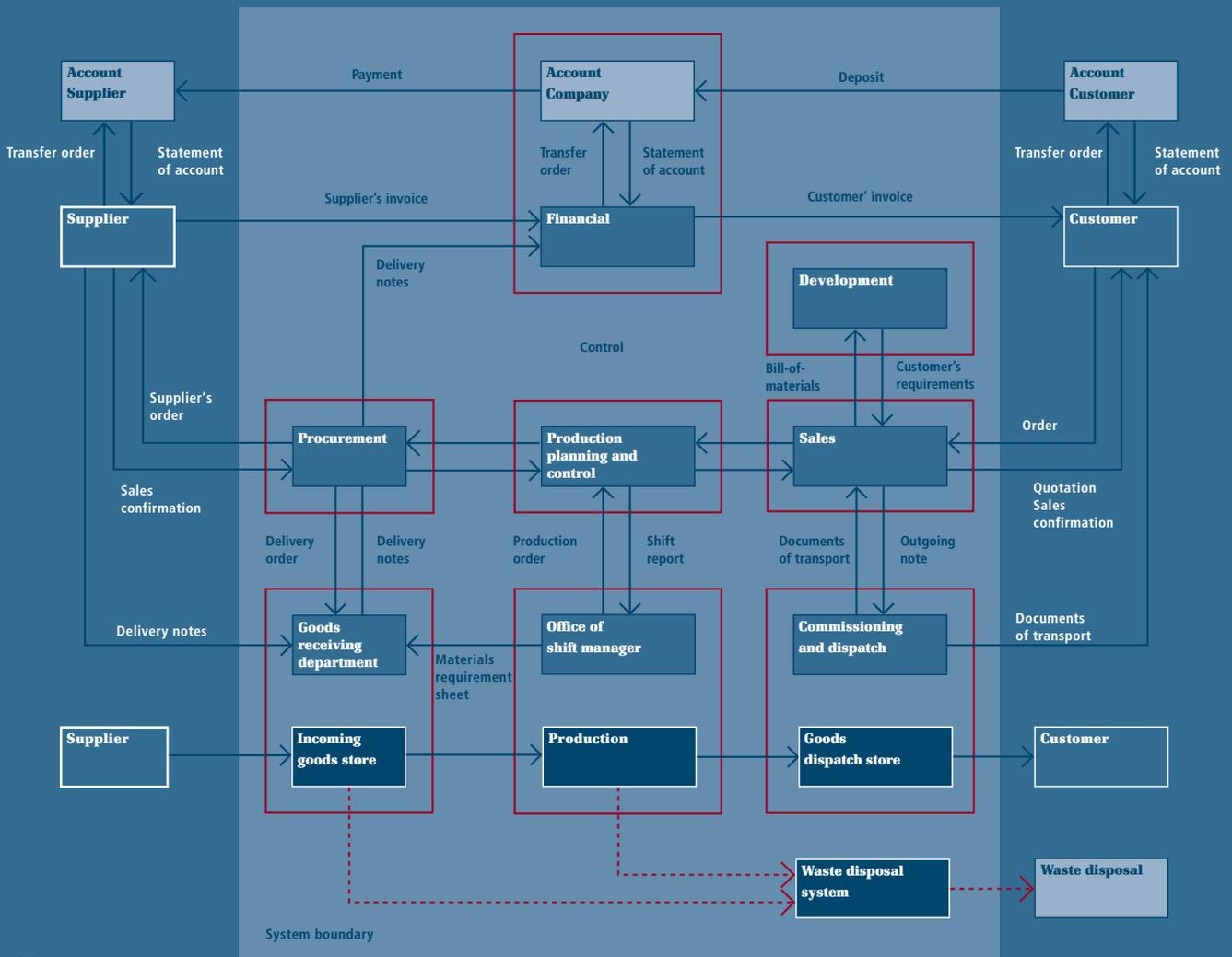
Modelling method

Organisation units are entered, best in colour, into the flow model for depicting the organisation units. Every existing organisation unit is symbolised by a "box". The box contains all internal quantity centres and information centres which are allocated to this organisation unit. An organisation unit should be entered in such a way that it contains, at least, one information centre, as it would, otherwise, not be connected to other organisation units. But an organisation unit can, also, contain very many quantity centres and information centres. In addition, it can be described how the responsibilities for individual material and information flows are regulated in the organisation unit.

Information for carrying out modelling of organisation units

Modelling of organisation units must be carried out, in any case, in a working group of representatives of all organisation units. Only in this way can responsibilities, gaps and overlaps be systematically clarified. An organigram is suitable as the basis for this work. Often a current organigram is not available, especially, in medium-sized companies because of frequent changes and too little documenting capacity. In this case, it can be started by a simple listing of existing organisation units. In the next step, organisation unit by organisation unit is entered into the existing material and information flow models.

Figure 22: Material and information flow model with organisation units



Exemplary effects

In this modelling step, exactly at the responsibility boundaries between organisation units, interesting discussions are starting, already, which point to unclear responsibilities and inefficiencies. It can become evident,

- > **that several organisation units are responsible for individual quantity centres and information centres. The results are coordination deficits or doubled work;**
- > **that centres exist, for which nobody feels responsible, which leads to responsibility gaps;**
- > **that organisation units show an unclear or interrupted relationship to the flow.**

Example Rohrleitungsbau Süd GmbH & Co. KG: Forming of the new department "Work Planning"

Before the beginning of the project, the Technical Office of Rohrleitungsbau Süd GmbH was responsible for processing of enquiries, material procurement, customer care, design, as well as, work planning (bill-of-materials, manufacturing drawings, processing) and the technical care for the production team leaders and, therefore, often overloaded. The result was superficial incomplete work planning. Due to this, there were more, inevitably, questions from the production team leaders which, in answering them, led to time bottlenecks and increased processing times. A large part of these tasks is now taken over by the new formed department "Work Planning", the work procedures of which is now regulated in detail. Two new jobs were created to fill in the new department which are largely financed from the realised cost savings during the project.

> **More detailed information is available on the website www.eco-effizienz.de. Under the heading "Flow Management" the report 'Methods of Material Flow Modelling' gives detailed information of this topic. Also Visio modelling templates are available for downloading.**

B.2.1.2.2 Business processes

The central activity of a company – providing performance/products for the satisfaction of customer's needs – requires a systematic organisation of all the material and information flows. To make these often very complex procedures transparent and possible to re-organise, individual "segments" of the material and information flows are separated from one another and organised in detail. By the sequence of selected material and information flows individual procedures or full business processes are described within the scope of the flow management. Business processes are defined as goal-orientated and a logic sequence of material and/or information flows.

Modelling method

For modelling of business processes, the essential aspects are entered into a process characteristics sheet with the following elements:

- > **Process goals**
- > **Process responsible person**
- > **Process function**
- > **Process performance indexes**
- > **Upstream and downstream processes**

As in the organisation units, the processes are directly entered into the material and information flow model (see figure 23). Every existing business process is, in this way, symbolised by a box. This box separates external and internal quantity centres and information centres which are part of the process. Initially, the marking of the business process in the flow model describes only the process boundary and, consequently, only the question of start and end of the process. For a more exact specification of the business process and description of the process two variants are available:

Variant 1: Process specific flow models

In this variant a specific flow model for every process is drawn up (see figure 24). In this case, only information units are attributed to the individual information flows which are needed within the scope of the process. Short activity descriptions are drawn up for the quantity centres and information centres. This variant offers a relatively simple and clear process description. In this way, however, a process logic, conditions and time sequences can, hardly, be depicted.

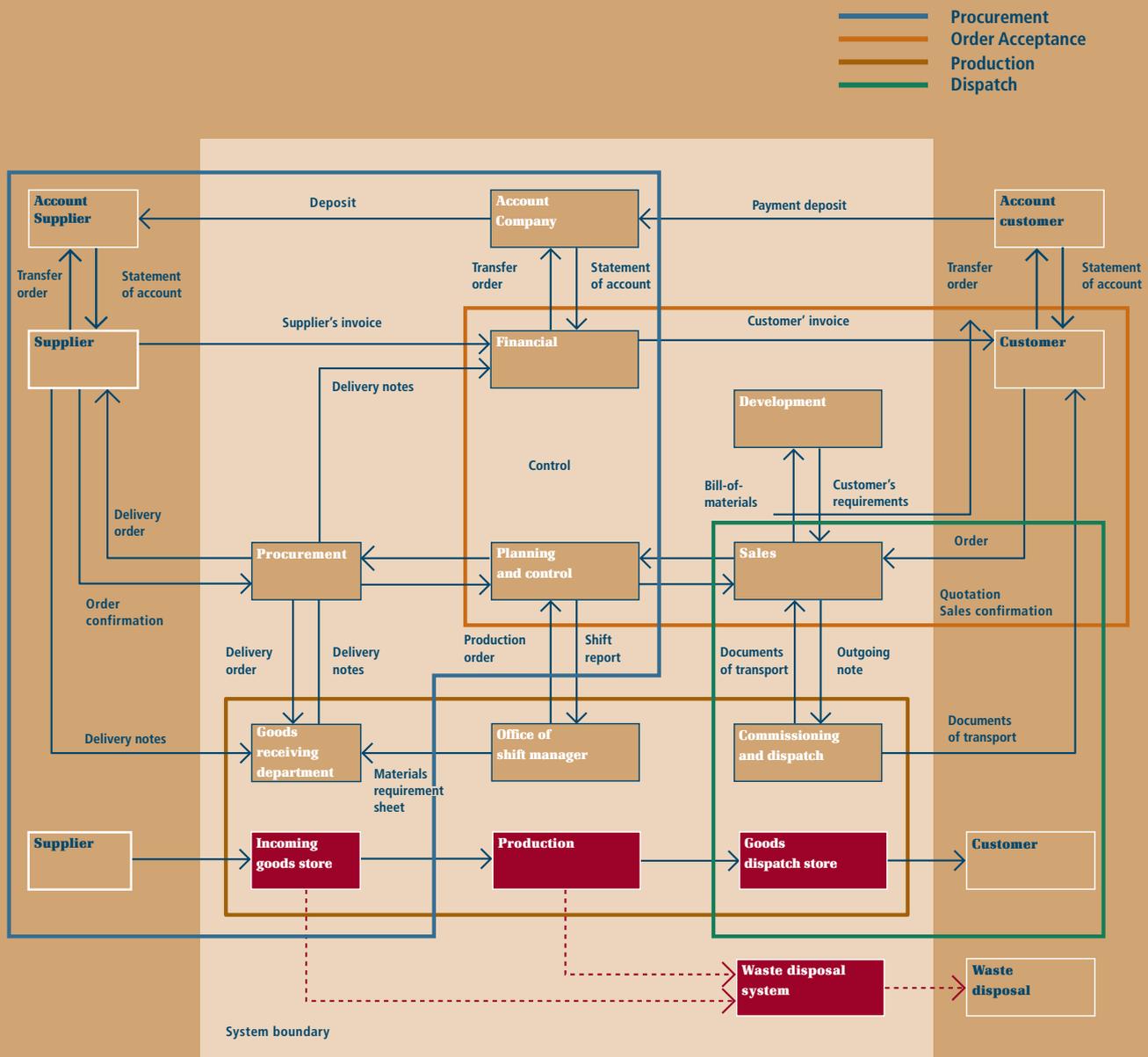


Figure 23: Material and information flow model with processes

Variant 2: Process specific process models

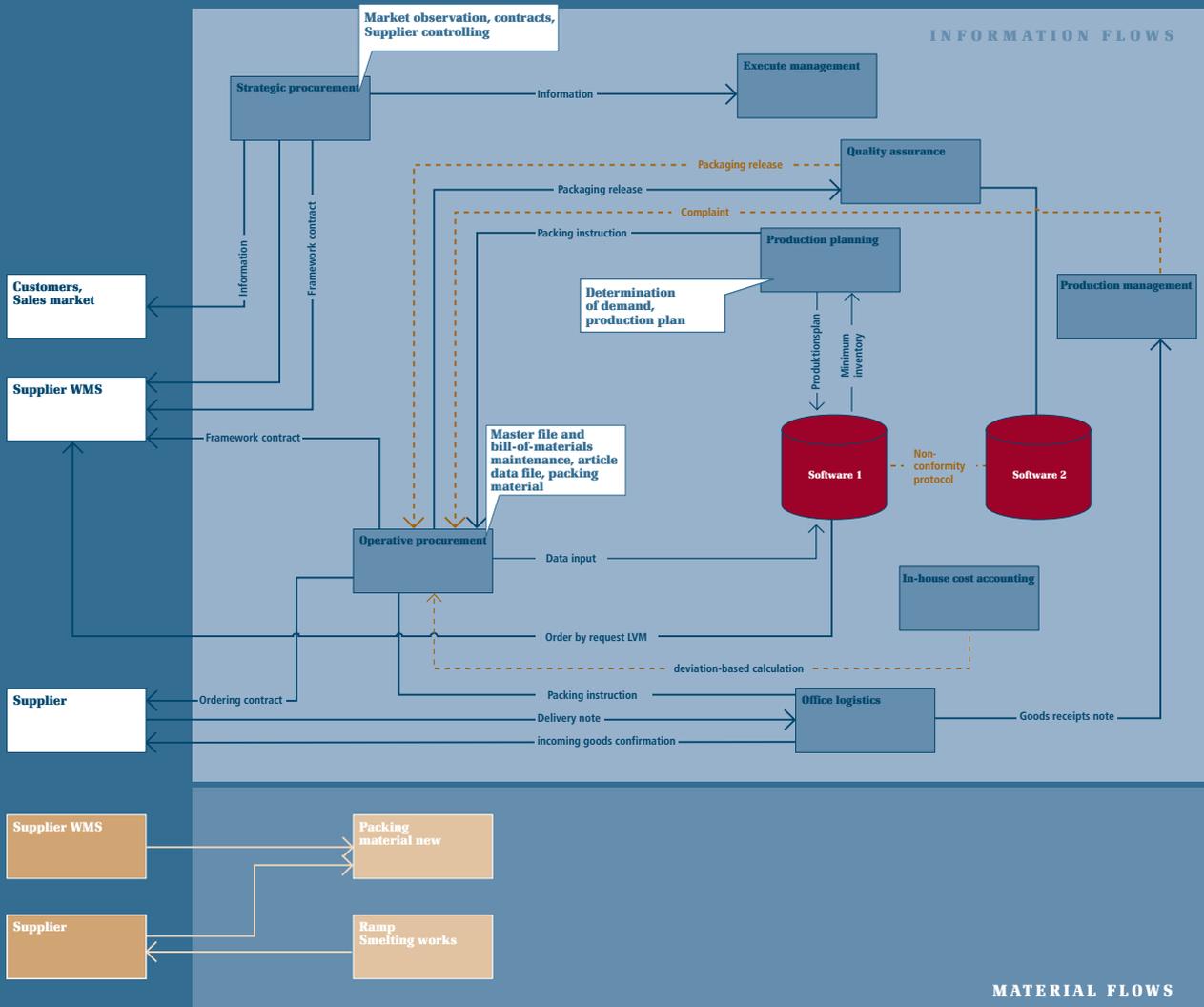
Detailed process diagrams are drawn up in the second variant. The most exact description is possible by so-called Event-controlled Process Chains (EPC). For the depiction of process chains, events (for instance: customer’s enquiries, production requirements, etc.) and processes/functions (quoting, production planning, etc.) are, alternatively, placed into a process logic. For the processes/function, the input and output of material and information is, each time, depicted in the diagram (see figure 25). This variant is very time-consuming in detail and should, therefore, only be used for very complex processes. The advantage:

This model is suitable for processes, for which the time sequence of activities needs clarifying.

QUOTE

“The evaluator was excited, when I showed and explained the flow models and the process depiction to him. In his opinion, nothing is now in the way of process orientation of the quality management!”

Manfred Rohleder, Head Quality Management, Schertler Verpackungen GmbH



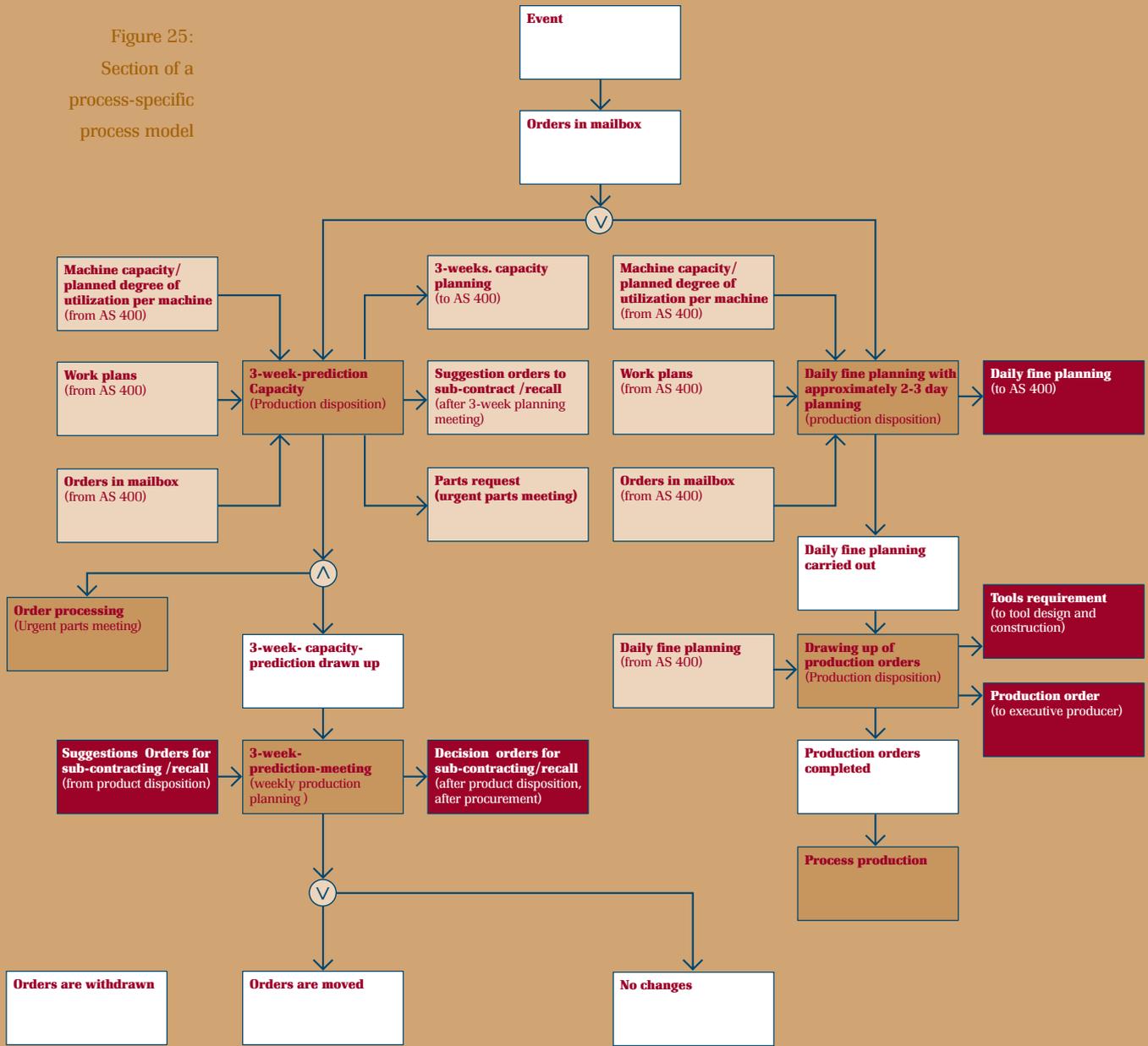
Information for carrying out modelling of business processes

In any case, the separation of business processes in the material and information flow model has to be carried out in a working group with representatives of all important business processes. Only in this way, the process boundaries, sequences and connections between the processes can be, systematically, determined. A current overview of the business processes can be given by completing the process

characteristics sheets. The description of the individual business processes takes place in small working groups which are made up of the persons involved in the processes. In this case, it is important that during the modelling only business processes are entered into the flow picture which have, already, officially been introduced and are practised. During the modelling phase, therefore, no business processes should be "invented" or "desirable" processes described.

Figure 24: Process specific flow model

Figure 25:
Section of a
process-specific
process model



QUOTE

“With this, we have an excellent basis for optimising our processes.”

Josef Huber, Head IT, Karwendel-Werke Huber GmbH & Co. KG

As in the modelling of the organisation units, in this modelling step, exactly at the boundaries of the business processes, interesting discussions were started with respect to the attribution of material and

information centres. It is, however, to be observed for business processes that it can, in fact, be sensible if individual quantity centres and information centres are attributed to several business processes.

In the interpretation, one has to be aware, that business processes are not real observable facts. Business processes are always the result of regulations and stipulations.

The modelling helps to check in how far the existing boundaries of the business processes make sense. The business processes, on the one hand, limit the planning complexity, but on the other hand, they generate new interruptions and interfaces along the material and information flows. Especially small businesses should check, if they can omit fixing business processes.

In addition, the structure of business processes is critically analysed. If it becomes evident, that certain centres are involved in many business processes, then this points to the possibility of overtaxing and bottlenecks.

The connections and interaction between the business processes are analysed.

QUOTE

"If I have to run the whole day after 20% of the production orders, which have not been processed to a standard, and then in the evening I ask myself, what I have done during the day, it is very frustrating when I have to think to myself, it wasn't a very productive day."

Bernd Gohritz, Head Production/ Logistics, Hörauf & Kohler GmbH

> More detailed information is available on the website www.eco-effizienz.de. Under the heading "Flow Management" the report 'Methods of Material Flow Modelling' gives detailed information on this topic. Also Visio modelling templates are available for downloading.

B.2.1.2.3 Projects

To plan for the great need for adjustment and changes which, to-day, most companies are facing, the projects have become a solid and important part of the company organisation. In contrast to business processes, projects have a clear time limit. As soon as the goal of the project is reached, the project will be finished. In most of the companies regularly numerous projects run in parallel. These projects are not always co-ordinated with each other.

Modelling method

Most of the projects aim to change material and information flows in some way. These projects can be entered into the flow model in, exactly, the same way as organisation units and business projects. The box then describes the quantity centres and information centres which the project is supposed to change. As in business processes, at first, it is sensible to draw up the project characteristics sheets (see chapter B.2.1.2.2 for modelling of business processes).

Exemplary effects

- > **The modelling of the projects contributes to gaining a systematic project overview.**
- > **The interaction of projects is analysed, as in extreme cases the effect of projects can even be counter-productive. Possibly, the project goals must be adjusted accordingly.**
- > **Synergies between projects, running in parallel, will systematically be used.**

B.2.1.2.4 Material postings (ERP-System)

In the past years, so-called Enterprise Resource-Planning Systems (in short ERP-systems) have a large circulation also in medium-sized companies. The software systems are supplied by manufacturers such as SAP, People Soft or BAAN and support almost all in-house applications, from process control (Procurement, Work Planning, Sales) to financial and cost accounting and to personnel administration. Basis of these systems is an integrated, redundancy-free data base which is generated and used by various applications. From the viewpoint of flow management the material-oriented data base is, initially, of special interest, as here large data quantities are often available of material flows and inventory, which, so far, were hardly used. It is conspicuous, that just in medium-sized companies the knowledge is comparatively small for using the relatively complex ERP-systems. The systems were often implemented by external consultants. The employees of the company have, therefore, little knowledge of the internal correlations and are, often, not in the position to use the systems systematically and develop them further according to requirement. Drawing up a material posting model proved to be an important step for building up knowledge and gaining a higher action capability.

Modelling method

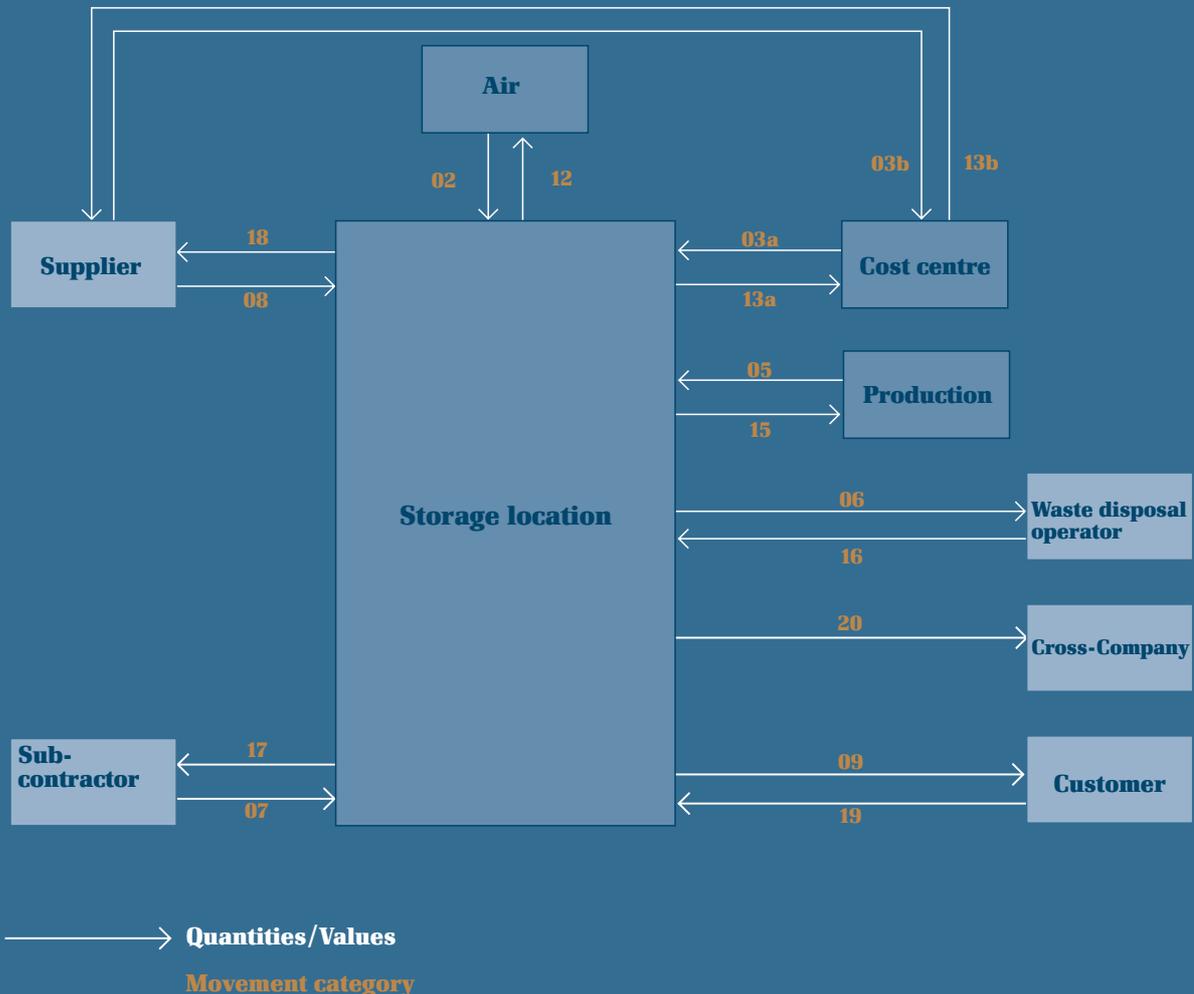
The material posting model describes the internal data structure by which the material data are filed in the system. It informs, therefore, which material flow data are available in the system. Material data can be generated in various connections in the system and stored in various files, so that a total overview, as a rule, is only achieved by the modelling. Essential elements of the material posting model are posting points, material postings and movement classifications. All those units (in the meaning of entities/data structure elements) are called posting points to which material postings have been attributed. Essential posting points are:

- > **Storage locations (meaning all storage locations which are controlled in the ERP-system which can, quite possibly, deviate from the physical storage locations; detailed structures from the Warehouse Management System (WMS), as a rule, are not needed)**

- > **Production order areas (all production orders are united into production order areas which are produced in a space-limited area; typical examples in chemical companies are setting-up, mixing, confection)**
- > **Cost centres (if material use is posted there)**
- > **Other account allocation objects (for instance: in-house orders)**

Material postings document in the ERP-system the material movements between the posting points. They are entered in the model as arrows according to their movement direction. It can be distinguished between retrograde postings (automatically generated by the system) and manual postings with actual data from the measuring stations (see chapter B.2.1.1.2. for information flow model). For a better overview it is, principally, recommended to collate the same kind of material postings according to their movement category. Typical categories of material movements

Figure 26:
Classification of
posting possibilities



are, for instance: in and out postings for storage locations, book transfer inside of a storage location, consumption postings for production orders or cost centre, return postings of production orders, out and in postings for sub-contractors, destruction of material. The basic posting possibilities are depicted in figure 26.

Attribution of postings to the movement categories is carried out, in this case, especially on the basis of already entered movement classification in the system (also: movement keys/types).

Example: Use of movement types

It often showed, during the modelling in the pilot companies that in posting practice the same movement types are used for different facts or that for identical facts different movement types are used. Here, the missing clarity, however, complicates a causes-related attribution and covers up the transparency in the company. Therefore, already in this project phase a multitude of sensible approaches were found to improve the internal posting logic.

The complete and unambiguous depiction of the material posting model (see figure 27) is, again, a guarantee for a high meaningfulness of the following material flow accounting. Potential data inaccuracies can, in this way, already be avoided in the run-up.

Example: Topicality of the ERP-system

As the ERP-systems were, often, installed many years ago, in some pilot companies a certain need for adjustment was evident. Some stores, for instance, were not at all, or only undifferentiated, combined with others, filed as storage location in the ERP-system. The visual comparison of the material posting model with the previously drawn up material flow model was for all involved persons especially exciting. It was shown, in this case, how good the existing ERP-system was in recording and processing the actual prevailing material flow structures of the company. The "placing one on top of the other" of the two models (compare figure 28) – for instance with a graphic application such as Visio – quickly revealed how congruent the physical quantity centres and posting stations are and how good the material flows and material postings are matched.

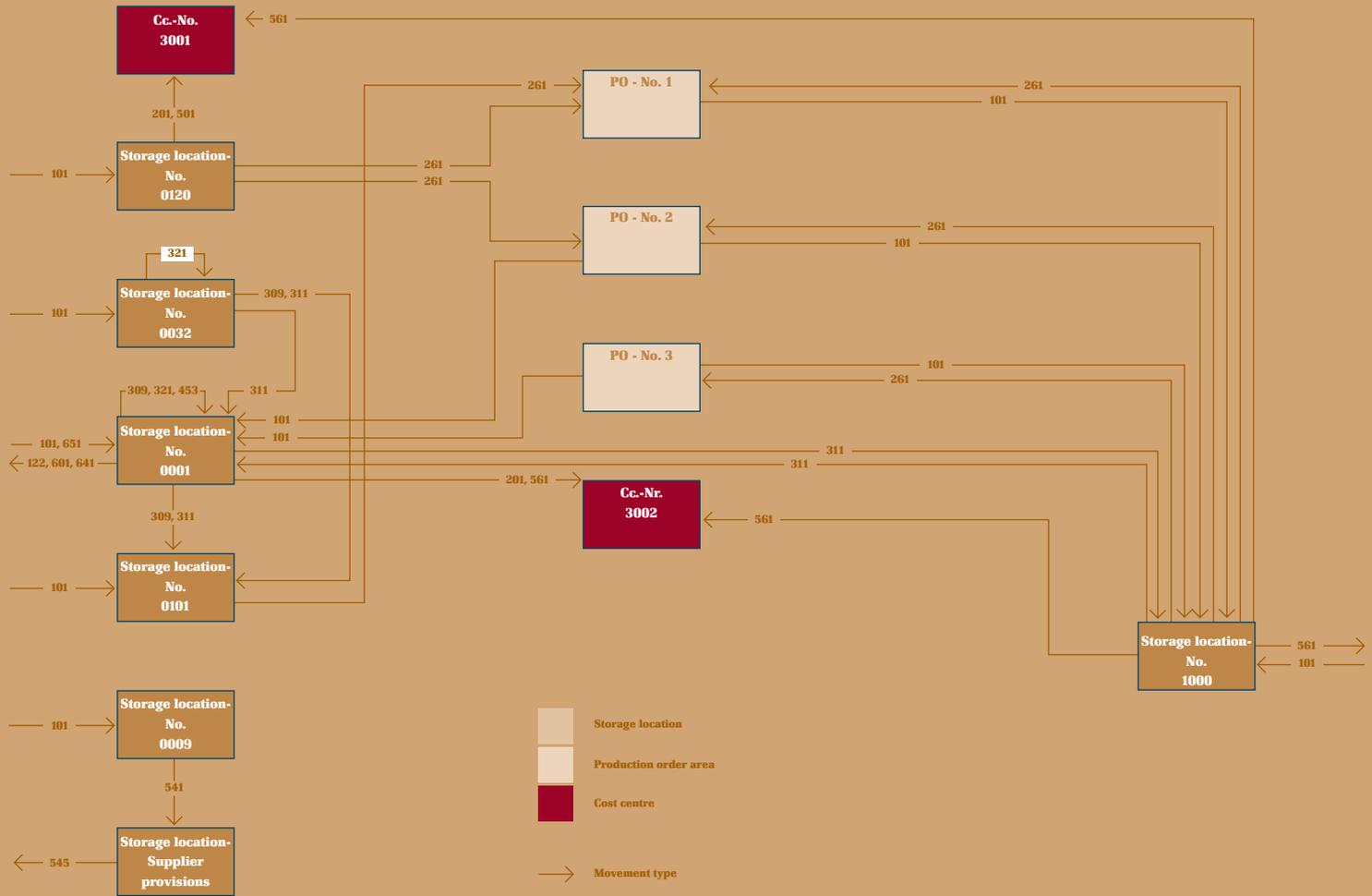
Example Freudenberg Haushaltsprodukte Augsburg KG: Material posting model shows wrong postings

The material posting model at FHP Augsburg revealed to the employees a surprising multitude of posting relations between storage locations, cost centres and production orders. Postings occurred by almost all posting points to the other posting points. Only an analysis of the individual posting relations with respect to frequency revealed that many posting relations between two posting points took place only once or twice per year. As a rule, this indicates wrong postings, which, afterwards, had to be cancelled again. The number of wrong postings, however, obliged the company to restrict the posting possibilities of the individual users according to their respective working area and reduce, in that way, the wrong postings significantly.

Procedure

A small working group of staff from EDP, Storage Management, Work Planning, Production and Controlling meets for modelling the material posting. After all, the complete drawing up of the material posting models requires the employees, who are best acquainted with the data structures in the ERP-system, to cooperate with colleagues, who carry out the daily postings. Controlling reaches a deeper understanding, how material costs are determined in the system. The group gets a first overview by an extensive compilation of storage locations, cost centres and material classifications in the ERP-system at the start of the modelling. The definition of the production order depends on the composition of the parts list, the disposition steps and the physical production technology. For determining the company-specific posting logic it is recommended to use already drawn up documentation (for instance: posting journal for quantity postings) and their extraction from the ERP-system by taking into account all material postings of the previous period. This contains in a condensed form all posting aspects of the evaluation period and, also, gives movement type, direction and frequency of posting. At the same time, with the help of such a clear depiction, drawing up the visualised material posting model is made easier. The group can easily explain in which context the individual movement type is used in posting practice. Often, the frequency with which movement types are posted allows conclusions about their relevance to be drawn.

Figure 27:
Material posting model

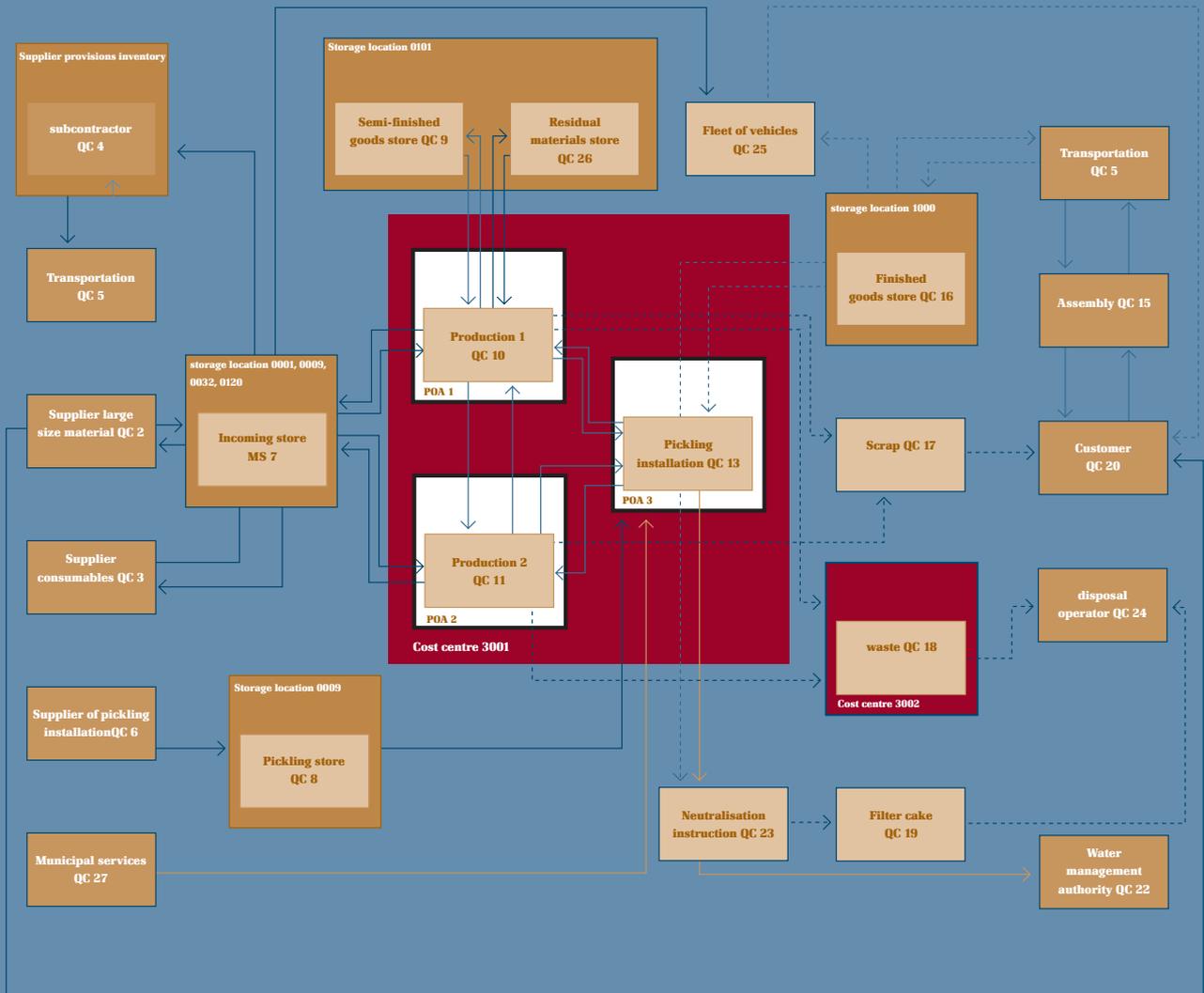


QUOTE

"The modelling of the posting structure was an excellent supplement of a procedure instruction for postings. In principle, one has here a visualised procedure instruction."

Peter Kammerer, PCI Augsburg GmbH,
Staff group Logistics

Figure 28:
Material flow model with
material postings



Example: Data consistency

In some pilot companies existing posting gaps and inconsistencies in the ERP-system became apparent even before performing the actual flow calculation. Already by investigating the data sets per movement type for structure and frequency of field entry, many starting points were found for further minimising wrong and correction postings.

Especially very rewarding is the comparison of the posting structure, as visualised by the working group - often describing an optimum status - with the posting structure (for instance: in table form), as extracted from the actual material movements of the evaluation period. The latter has the advantage, that it shows an unadulterated picture of the actual posting mentality in the company. How is posting to be carried out in the opinion of Controlling and how is it really carried out in situ?

Not less exciting, during the analysis of the posting structure, is the topic of finding accounts. Which stock, expenditure or costs accounts are used for which material movements? Here, also potentials were found for an optimised depiction and cost attribution in financial accounting.

QUOTE

"The postings for cost centres are too high in my belief. Detailed evaluations are very revealing for us."

Bernhard Pritschet, Commercial Director
Keimfarben GmbH & Co. KG

Example: Interface problem

Not least, an IDOC-interface problem with the separate warehouse management system (WMS) and SAP R/3 was, to the great surprise of the people involved, revealed in one of the companies. Connected with this were partially undesired or missing data field entries which could, then, be purposefully stopped.

Interpretation help

The material posting model contributes, apart from a better understanding of the company's ERP-system, to reveal structural and organisational deficits of material postings. Structural deficits appear, especially, when material postings and material flow deviate from one another and can, therefore, not be clearly correlated with each other. As a rule, the reason for this, were new sequences of material flows which did not lead to a respective adjustment of the ERP-system.

Example: Congruence of material flow and material posting

An example for this is the first-time sales of raw materials. While there is now a material flow from the raw material store to the customer, the consumption posting, for instance, is carried out from the raw material store to the production cost centres. The material transparency is lost and material efficiency of the production cannot really be determined. A further problem exists in that quantity centres and posting points cannot, unambiguously, be attributed. Pseudo-stores, for instance, are completely without spatial attribution. In another case, it was not clear to the Controlling Division, in how far, due to the introduction of a new material type, the account attribution in financial accounting had also, in fact, been adjusted accordingly.

Organisational deficits relate to posting procedures and use of movement classification. In most companies, especially, the movement classification is used rather non-uniform. One cannot, anymore, unambiguously, draw any conclusions from material posting to a physical material flow and its reason. Deficits in this area point to unclear posting procedures, a special need for training or extensive posting authorisation.

Example: Non-transparency of order posting

It showed in one of the pilot companies, for example, that costs were still continuously attributed, wrongly, to old in-house orders. The material quantities and values behind it had, so far, escaped Controlling.

Exemplary effects

- > Cancelling of pseudo-stores and clarifying posting procedures by which materials were, so far, attributed to these stores
- > New structuring of cost centres with simultaneous reduction of material postings to cost centres.
- > Widening and definition of movement classification
- > Adjustment of measuring stations and response points

Secondary question

- > Effects of a continuous drawing up of a posting structure on posting behaviour in the company

> More detailed information is available on the website www.eco-effizienz.de. Under the heading "Flow Management" the report 'Methods of ERP-Modelling' gives detailed information of this topic. Also Visio modelling templates are available for downloading.

B.2.1.3 Performing Material Flow Accounting

While basic and supplement models serve the visual depiction of structures and procedures, the material flow accounting contains a quantitative determination of the material flows. These can now, for the first time, be identified in detail by quantities and values. The goal is the improved controlling and due to this, an increase in efficiency of these material flows. Neither the currently used cost accounting, nor the existing reporting, are in the position, to-day, to depict the material flow sufficiently. The material flow accounting, by closing an essential information gap, supplements existing instruments. Because of the high relevance of the material costs (on average 57% of the total costs), the material flow accounting gives a valuable contribution to higher cost transparency and, often, opens significant cost reduction potentials. At best, by the results of the material flow accounting, simple solutions become already evident which enable to offer products in the market at more reasonable prices or at higher

profit margins. Under the circumstances, they also effect a change of point of view in the product policy with increased concentration on products and materials with rather small losses.

"The material flow accounting is a very interesting project for us. We started in 1998 to optimise our material flow, but whether or not we know exactly our material flow? I wonder."

*Werner Schmid, Plant Manager,
PCI Augsburg GmbH*

QUOTE

Data base of the material flow accounting are the material data of the ERP-systems, available in the company, such as material master file, inventory and movement data and bill-of-materials. It showed in practice that, often, not only the structure of the material data was inconsistent, but also the quality of the material data was insufficient.

Example: Completeness of bill-of-materials

In some of the pilot companies problems were revealed with regard to the completeness of, especially, the standard parts list. Repeated calculations showed that the total quantity of input production material did not correspond to the planned product quantity. This was, in part, due to the fact that conversion and rejects factors had not been updated. In part, planned quantities had, in this case, been increased afterwards and the used quantities not accordingly adjusted. There were even cases, in which individual product material numbers had, simply, been "forgotten". In individual cases, the bill-of-materials was even exclusively including packing material.

To avoid mis-interpretations within the scope of material flow accounting, initially, a thorough check of the material data is carried out. The data deficits or faults (like for instance: bill-of-materials errors, wrong and cancelled postings or inconsistent quantity units) are shown in detail and can, as a rule, then be removed without great effort. From the improvement of the data quality arise, also, numerous advantages such as higher process safety, lower safety inventories or greater decision safety. In the highest aggregated form, the material flow accounting for one period

(year, quarter, month) compares the total incoming material and the inventory changes with the outflowing material. The material outflow is differentiated in products and material losses/residual waste (solid waste, effluent, exhaust air). Deciding in this examination is that material movements and inventories can be valued with, only, the pure material costs (without activating production costs) and with uniform material prices. As a rule, companies can, so far, only depict the incoming material, in this way, in quantities and values. Contrary, the pure material value can, as a sum, neither for inventories nor products be exactly sufficiently determined by the current ERP-systems.

The results of the material flow accounting show, with one look, which input material went, value-adding, into the product and how high the value of the material losses were (also see figure 30).

The material flow accounting can show every material movement by quantity and value, if the data base has been arranged accordingly. Not only inflow and outflow can be depicted as a sum, but also the whole internal material flow. For these, the quantities and values can be given in detail per:

- > Material number and batch
- > Product
- > Production order
- > Production plant
- > In-house order/cost centre
- > Storage location

In this way, the material flow accounting forms the basis for efficient, integrated material reporting, which provides current material data in a tailor-made reporting for organisation units such as Production, Sales, Development, Quality, Environment, etc.

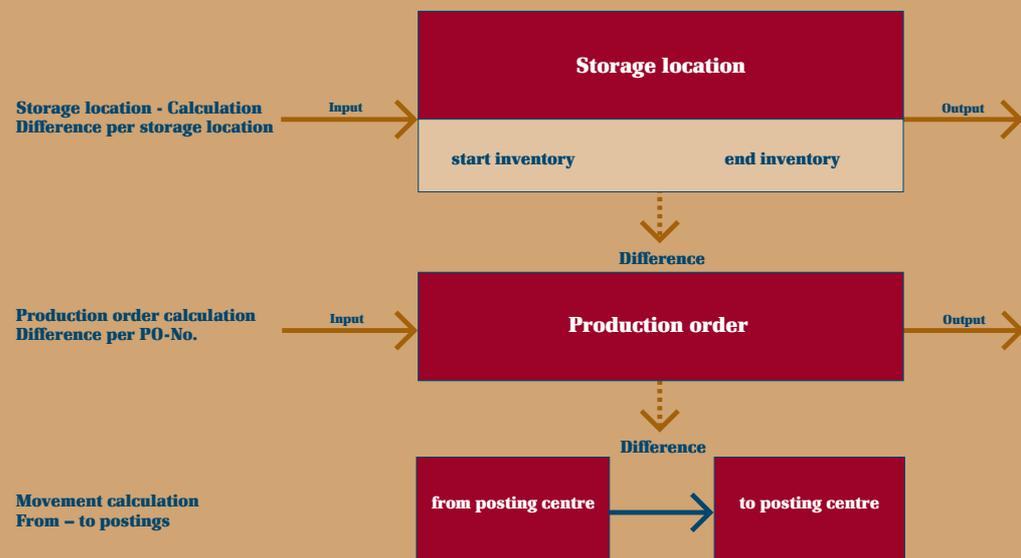
Methodology of material flow accounting

The three computer modules – production order calculation, movement calculation and storage location calculation (compare with figure 29) – examine the material flows of the company from different perspectives.

Example: Pure material value cannot be determined

This problem concerned, especially, the companies with several production steps, different production variants or otherwise heterogeneous production structure. By step-wise activation of proportional depreciation and personnel costs they could not easily determine, retrospectively, the pure material value of the produced intermediate or finished goods. Here, the material flow accounting offered help by consequently breaking down the parts list to the level of input material.

Figure 29: Modules of material flow accounting



In addition, there is the possibility to show inflow postings, outflow postings and, if so, determined material differences end-to-end for the level of production steps (with respect to produced intermediate products), as well as, also for the level of the initial input material (with respect to procured raw materials).
 The **production order calculation** informs about the incurred material losses during the actual processing. These can be attributed, cause-related, to the respective production orders, products or input production materials.

Example: Detail-exact material data

For the employees of Production especially exciting was, the question, which of the standard-produced products contributed most to material losses in production. The answer was given by monthly evaluated Top-Ten-Lists. For the first time the "front-runners" with significant material losses could be shown without problem by quantities and values. As a matter of interest, often, the employees found themselves supported by the results of the material flow accounting. Of course, they had never before been in the position to confirm their guesses or coarse estimates by concrete data. Showing differences for individual target products, also, opens the view on production variants. Hereby, the central question is how "good" or how "bad" a product was produced in the various production orders. The evaluation of exploitation variants supports the in-house learning process, when causes are determined, discussed and the insights are implemented in future production procedures.

QUOTE

"The implementation of the flows cost accounting at Sortimo led to a clear improvement of material transparency and data quality. This enables us now to, systematically, reduce material costs and relieve the environment. Furthermore, we are now counting on an optimised storage management and improved production planning."

Andreas Mannitz, Commercial Director
 Sortimo International GmbH

The **storage location calculation** puts a figure to the quantity and value of material differences for the storage locations which are registered in SAP R/3 or a separate warehouse administration system.

Figure 30: Material flow and inventory values in thousand EUR



Example: Inventory rectification

This evaluation was of special interest to two pilot companies, as for individual storage locations (for instance: silos), in the past, always unexplainable storage differences occurred. These had, regularly, to be balanced by so-called "Inventory or inventory differences postings". These "clearing-ups", provided for by the ERP-system and wide spread in practice, are problematic, especially on the background that they are covering up the real reasons for the losses. The causes for these significant differences can now, finally, be systematically and purposefully traced with the help of the material flow accounting.

In contrast to the other two modules, no differences are calculated within the scope of the **movement calculation**. The material postings of the evaluation period under investigation, as documented in the information system, are solely in the foreground.

By revealing the material quantities and values of selected material flows such as:

- > **Destructions**
- > **Devaluations**
- > **Renaming**
- > **Postings from/to sub-contractor**
- > **Wrong and cancelled postings.**

the company-specific relevance of these in practice, often typical, problem areas become evident for the first time.

Example: Renaming

Renaming of material is a problem for every controller with respect to tracing the value flow. In principle, renaming is characterised, in that a material number A (value X) is changed to a material number B (value Y). As a rule, renaming takes place because of insufficient material availability. The material, as planned by work planning is not available or in insufficient quantity and has to be replaced, short term, by an alternative material. This means, often, a loss of value or increased costs for the company, as low-value material is replaced by a higher value material. Renaming can also be an indicator of a line

of additional typical problems such as manipulation of cost centre costs, presenting a distorted picture of transfer prices or lower process safety. In one of the pilot companies a need arose for a detailed evaluation and analysis of renaming. The data, needed for this, could be generated within the scope of the material flow accounting without great extra effort.

Significant data are a precondition for identification of concrete material flow problems and, therefore, the basis for a continuous material cost management. The added up quantities and values of the movement calculation provide a differentiated, but still clear, overall view of the in-house material flows. Also, correctly posted material losses can now, easier, be narrowed down. In connection with the revealed material differences in the storage location and the production order calculation, a transparent picture arises with respect to the efficiency of the material usage in the company.

Example PCI Augsburg GmbH: Unexplainable material gains

As a rule, the material differences as revealed by the flow calculation are, in fact, physical material losses. To the great surprise of the participants in the project, at PCI also – at least in the calculation – significant "material gains" were detected in the production order calculation. The posted quantity of input material was, in this case, less than the quantity of the posted target product. In the following detail analysis, the reason was identified as mainly posting and parts list errors. Certain material movements (for instance: saleable coupled products, filling residues or raw material without inventory posting) had, in part, not been posted at all or in too little quantity (for instance: typing errors). The company was pleased to take up these starting points and implemented, immediately, improved posting instructions and bill-of-materials corrections during the project.

Procedure

The material posting model is the basis for the material flow accounting, as it gives information about kind and size of the material data of a company to be analysed. The material data, existing already in the information system, are exclusively needed for the material flow accounting. An additional data recording is not necessary. As the ERP-systems in circulation have not, as a rule, comfortable evaluation possibilities, it is recommended to carry out the material flow accounting on an external data base (for instance: Access or SQL). Programming knowledge in a data base language is necessary for material flow accounting. In detail, the following procedure steps have proved to be successful:

- ❶ Determine data requirements
- ❷ Carry out data extraction/spooling
- ❸ Carry out data quality checks
- ❹ Carry out material flow accounting
- ❺ Generate material flow statistics/characteristic index

Determination of data requirements

Initially, the requirements for the data, to be supplied by the company, will be determined on the basis of the material posting model. The material inventories, material movements, material master data and bill-of-materials are essential to carry out the material flow accounting. The respective relevant core fields are to be set for these source tables, by exactly naming the fieldnames, contents and formats (field type/field length). The respectively used ERP-system and the existing data base decide, in this case, about the kind and number of the needed core fields. Also data from further source tables (for instance: production order header data) might be required.

Performing data extraction/spooling

According to the data requirements, the required core fields of the source tables can be extracted from the ERP-system and transferred into a respective output format. As this requires sound knowledge of the data structures and the retrieve logic of the ERP-system (key word: ABAP), it is recommended to ask for support from the in-house EDP division.

Typical output formats are tables (for instance: Access or Excel) or text files. Especially well proved in practice are txt.-files by using uniform hyphens (for instance: semicolon). Finally, the exported material data are spooled into a respective data base for analysis.

“The data were all there in SAP, but if somebody wanted to know anything, it was so complicated, that, sooner or later, they just gave up. Analysing and working is again a pleasure due to the material flow calculation.”

Werner Schmid, Factory Manager,
PCI Augsburg GmbH

QUOTE

Performing data quality checks

An extensive check of the consistency and completeness of the exported material data is the first evaluation step in the data base. Important checking steps consist of, for instance, completeness of the data files in the source tables (see also material master files and bill-of-materials) or the end-to-end use of the basic quantity unit throughout the data sources. Already a comparison of the production order data with the parts list gives early indications of posting problems in the production.

Example Freudenberg Haushaltsprodukte Augsburg KG: Results of the consistency check (Quality check)

The consistency check at FHP Augsburg showed that the given depth of movement types in SAP and their proper use were not suitable for meaningful evaluations. A detailed evaluation for returned goods, material costs, procurement volumes, customers' deliveries, deliveries to sub-contractors and deliveries of sub-contractors was not possible because of the coarse use of movement types. For instance: cancelled postings, physical material returns, virtual solid waste reposting and credits, were posted with the same movement type. A later differentiation of the individual postings was very difficult. Another problem was the non-uniform carried out posting cancellations. In part, the whole initial posting was erased by posting cancellations to repost the correct quantity; in other cases, only the wrong difference amount was cancelled. Due to this, a uniform evaluation is, therefore, not possible. In addition, cancelled postings were posted to stores, different from the store of the original posting. Due to this, the data inconsistencies and inventory differences increase and, therefore, also the effort for data correction. By a uniform posting concept for the movement types and additional training of the respective employees for the correct use, this problem could be reduced and, due to this, the data evaluation improved.

Carrying out material flow accounting

The material flow accounting is carried out in three parts: storage location calculation, movement calculation and production order calculation. As these kinds of calculations can be carried out independently from each other, the material flow accounting can be restricted to individual company-relevant aspects. However, comprehensive and end-to-end statements of in-house material flow efficiency, always, require the combined use of all three modules. Only in combination they facilitate comprehensive evaluations and analyses (for instance: determination of total material losses at the company site).

Material flow statistics/performance indexes

The statistics and performance indexes, connected to the material flow accounting, facilitate the presentation of often detailed results in a clear form. Numerous performance indexes are available, to compact the material data which can, in part, be entered into the Balanced Scorecard. For instance: evaluations of storage duration and frequency of movements can be carried out by using the material data. When a batch number is stored in the ERP-system, flow or processing-time can be traced across several material flows and quantity centres.

Example PCI Augsburg GmbH: Material reporting

The material report at PCI, in contrast to the SAP-system, supplies all data in an overview and with direct analysis possibilities. In this way, the "quick overview" and the "sound individual analysis" can be combined in a powerful parcel, which can be used by all employees with very little additional effort. Every employee can directly access the SQL-data base and process the current monthly evaluations. Time-consuming ABAP-programming and care, distributing and waiting for paper circulation, individual investigation in the SAP-system etc. become obsolete. This time saving and flexibility leads to an immediate and high acceptance of the material reports.

Interpretation help

The material flow accounting supplies a well structured data base for a number of analyses. Conspicuous items in the flow data can be found, very quickly, by respective evaluations and selections.

Examples for such conspicuous items are:

- > **Material numbers with the highest material losses (material destructions, production losses, inventory differences)**
- > **Products with the highest material losses in production**
- > **Target products with the highest variance (If for two different production orders of a product the loss quota varies strongly, this points to improvement potential.)**
- > **Production orders with the highest material losses**
- > **Production areas with the highest material losses.**

Exemplary effects

- > **Improvement of data quality**
- > **Reduction of material losses**
- > **Reduction of input material in product and packing (for instance: thinner container walls)**

Secondary question

- > **In how far do material losses, provable by the material flow accounting, increase due to a continuous improvement of the data quality (reduction of wrong postings and bill-of-material errors)?**

> **More detailed information is available on the website www.eco-effizienz.de. Under the heading "Flow Management" the report 'Methods of Material Flow Accounting' gives detailed information of this topic.**

B.2.2 Assessment: Systematic derivation of main activity foci

Modelling must not be understood as pure review of the situation. By the extensive involvement of the employees in various working groups and the changed perception due to the various modelling methods, already during the modelling phase numerous improvements arose. A multitude of smaller problems and deficits were removed by the employees almost unnoticed. Furthermore, often an improved cooperation and communication climate started which became noticeable in more efficient material and information flows. Already in the modelling phase one can count on perceptible improvements. Of course, there is also the danger to, already, start individual measures during the modelling, before the full picture has been drawn up. This can then quickly lead to ineffective actionism. It is, therefore, important to look at the results after the modelling in one's own time and recognise the central development need, instead of getting lost in many side scenes. This approach requires openness, courage and creativity from the company management and employees. Also here, central structures, procedures and behaviour patterns are, as a matter of principle, to be questioned. In so far as the assessment is a sensible phase, as it uncovers problem areas in the company to which, as a rule, responsibilities will be quickly attributed. By participating in the assessment process, the employees are supposed to get a neutral point of view of the causes of potential requirements for changes. The assessment is, essentially, based on a systematic effect analysis and the following depiction of possible action foci in an assessment matrix. Within the scope of the effect analysis, initially, the connections between the goals of a company and the various modelling areas are described which are in direct connection. Afterwards, the performance level of the various modelling areas is assessed. From a comparison of goal relevance and performance level possible action fields will, then, be deducted. These action fields are then, again, compared with each other, assessed and adopted. Because of the complexity of the assessment also the following three-step procedure is recommended:

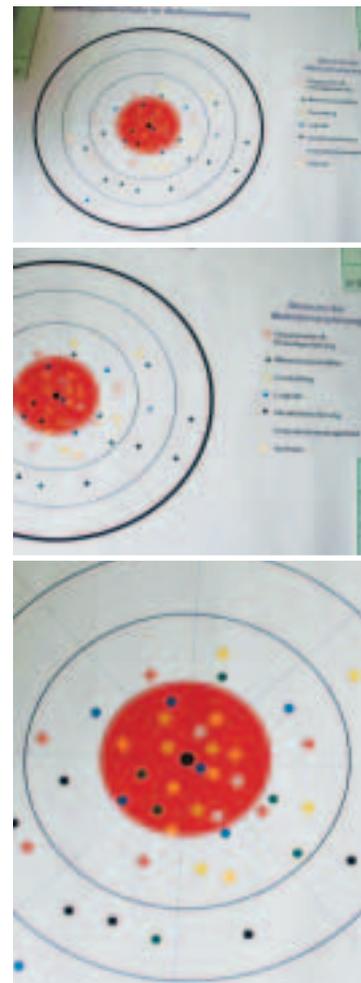
- ❶ Evaluating modelling results from company goals and classifying according to performance
- ❷ Deducing activity areas and compacting
- ❸ Defining and adopting activity areas

Example Rohrleitungsbau Süd GmbH & Co. KG: Process contribution calculation

For better control and improvement of efficiency of the re-organised processes, the so-called Process Contribution Calculation (PCC) was developed at Rohrleitungsbau Süd GmbH on the basis of the target costing approach. Initially, the budget process contributions (in %) of the sub-processes for "order processing" were determined. Following the company goals, the targets for the main process "order processing" were defined. As the sub-processes contribute to the processing they are subject to the same targets. In this way, the actual contribution to the process "order processing" of the sub-processes could be determined via the contribution of the sub-processes to the individual targets. By an analysis and interpretation of the budget/actual deviations several problem areas could be uncovered and potential solution approaches suggested. In this case, there were, especially, recognisable lack of separation of competence and task areas and the resulting interface problem. The process "production" attracted special attention by the PCC and could, after exact analysis, be optimal adapted to the worked out requirements.

B.2.2.1 Evaluation and grading of modelling results

The influence, which certain areas of the company exercise, is not always of the same magnitude. For instance: Customer's satisfaction can in one company be easier improved by innovative product development and in another company by short-term, reliable dispatch. Therefore, in the assessment phase it will initially be asked, which of the modelled company areas can contribute and what size of contribution will be made to achieve the company goals. The desired or planned contribution can be entered into a table with values from 0 to 3 (see table 6).



The results of the modelling should be attributed, directly, to the individual company targets. The connection of the company goals to the four fields of the Balanced Scorecard creates additional orientation and clarity. The contribution to the company goals refers, in the first place, to the results of the supplement models. The material and information flows of the basic models excel especially by the feature that the flows can only, purposefully, be

re-organised as a whole. Then, of course, the “weakest link of a chain” determines, in this case, the efficiency. For material and information flows care must be taken for an end-to-end efficiency. Still, also, material and information flows can be analysed with regard to their contribution to the company goals.

Table 6:
Classifying
modelling results
by company goals

Balanced Scorecard	Financial	Customer	Processes	Development
COMPANY GOALS	Profit margin of 5% Turnover of 200 Million Eur Market share over 30%	25% more new customers Customer ties < 90% Complaints < 1	Quotation within 1 day Delivery on the following day Product development in less than 6 months	Integral team orientation High flexibility and Innovation rate Setting up a cooperation culture
BASIS MODELS				
Material flows				
- Material flow structure				
- Quality problems				
- Processing time				
- Material inventory				
- Input material				
- Material losses				
...				
Information flows				
- Information flow structure				
- Processing time				
- Reliability/errors				
...				
SUPPLEMENT MODELS				
Organisation units				
- Procurement				
- Technical development				
- Production				
- Sales in-house service				
- External sales				
- Personnel and Organisation				
- Controlling				
...				
Business processes				
- Procurement				
- Product development				
- Contract execution				
- Sales				
- Work planning				
- Dispatch				
...				
Projects				
- Implementation ERP-system				
- Modification goods distribution centre				
- Increase international sales				
...				
IT-system				
- Material posting structure				
- Posting procedures				
- Material data quality				
...				

It has to be checked, after the first classification, that all company goals find sufficient support. If this is not the case, the contribution of the modelling results must either be critically analysed or the goal must be revised. Also modelling results which have only a small contribution to the company goals should be critically reflected. In the next step, irrespective of the contribution to the company goals, it will be analysed, how big the satisfaction is with the performance level

in any case, participate in the classification. The classification can be carried out by majority or by consensus. Only in the second round, the classification is carried out in agreement with the company management.

B.2.2.2 Deriving and compacting of activity areas

The determination of activity areas takes place, essentially, by the comparison of contribution to the company goal and performance level. The highest need for activity exists, where a high contribution to achieving the company goals is expected, but where also the current performance level has to be classified as low.

Exemplary activity areas

- > Simplifying information flows
- > Simplifying material flows in the dispatch area
- > Acceleration of order acceptance
- > Better coordination between production and development in the development process
- > Acceleration of product development
- > Re-organisation of company organisation structure
- > Merging of raw material store and procurement
- > Improvement of material data quality
- > Introduction of material reports
- > Reduction of material losses

	0	1	2	3
BASIS MODELS				
Material flows				
- Material flow structure				
- Reliability/errors				
- Processing time				
- Inventories				
- Material losses				
- ...				
Information flows				
- Information flow structure				
- Processing time				
- Reliability/errors				
- ...				
SUPPLEMENT MODELS				
Organisation units				
- Procurement				
- Technical development				
- Production				
- Sales in-house service				
- External sales				
- Personnel and organisation				
- Controlling				
- ...				
Business processes				
- Procurement				
- Product development				
- Contract execution				
- Sales				
- Work planning				
- Dispatch				
- ...				
Projects				
- Implementation ERP-system				
- Modification				
- Goods distribution centre				
- Increase international sales				
- ...				
IT-system				
- Material posting structure				
- Posting procedures				
- Material data quality				

Tabelle 7: Classification of modelling results

of the single modelling results. As known from experience, a first impression, already, results during the modelling on which performance level the respective area is. The performance level is to be entered into a table on a scale from 0 to 3. Initially, the members of the modelling working groups should,

Before the activity areas can now be specified more exactly and adopted, it has to be analysed which effect-cause-connections exist between the activity areas. The activity areas are, often, not isolated from each other, but closely connected. It can, for instance, be the case that inefficient setting-up procedures and time bottlenecks at dispatch can be identified as problems. At a closer look, it can turn

QUOTE

"In the determination of causes-effects relations, the entrepreneurial assessment must dominate abstract arithmetic."

Prof. Dr. Jürgen Weber, WHU,
Otto-Beisheim-College

out that the problems are already caused by preceding procedures (for instance: in order acceptance). Instead of "setting-up optimisation in production" or an "acceleration of dispatch" the re-organisation of order acceptance should become the activity focus. In this way, the number of activity areas can, possibly, be reduced. By this, the ratio of effort and benefit can significantly improve in the following planning and implementation phase.

QUOTE

"It is the goal, to achieve a rather big effect with rather little intervention."

Dr. Markus Strobel, Executive Partner, imu augsburg

When tracing the activity areas back to the central causes, it should be considered that deficits along the flows, in the structures or processes, often, arise from social and cultural problems. Personal conflicts between directors or division heads, competing divisions or lack of acceptance and esteem of certain areas or persons often lead to the deficits, which are then recognised as activity area. In such cases, a solution on a structural level will only then be possible, if also subliminal social and cultural problems can be resolved at the same time. The respective activity areas should, therefore, be supplemented by measures such as, team development, supervision, group-dynamic sessions, experience-pedagogical elements or other methods of organisation development. Occasionally, a revision of the activity area can become superfluous due to developments on the social and cultural level.

When assessing the company and the compacting of activity areas, the following principles are to be taken into account:

- > **Understanding and accepting the existing organisation is of great importance for the assessment.**
- > **Quick (pre-)condemnation, naming of the "guilty party" and an attempt of finding scapegoats must be avoided.**
- > **Activity areas (measures or projects) are not used for fighting "symptoms".**

- > **In the foreground is recognition of essential connections and to reach the "core of the problem".**
- > **Causes of numerous deficits are social and cultural problems.**
- > **Social and cultural problems cannot be removed by structural measures or even by software.**

B.2.2.3 Defining and adopting of activity areas

When the company-relevant activity areas have, finally, been fixed, they still have to be defined accordingly. For the definition of an activity area, at least, the following information is necessary:

- > **Objects**
- > **Estimated expenditure**
- > **Planned benefit**
- > **Responsible person for the planning**
- > **Other persons involved in the planning**
- > **Date for finishing the planning**

Passing the defined activity areas is carried out by the company management.

Example Karwendel-Werke Huber GmbH: Two-step assessment

The success of the flow management depends largely on an intensive participation of the employees in the re-organisation of the material and information flows. For this reason, at Karwendel, the assessment of the modelling results was carried out in two steps. In step 1 the modelling results were presented to the involved members of the work group in clear activity tables, which concerned areas such as procurement, production planning, production controlling, logistics, innovation management and sales.

These tables contained

- > a brief description of the current situation,
- > objects and requirements of the activity focus,
- > improvement potentials,
- > procedures for further processing
- > an estimation of effort/benefit

As it was not possible, to process all activity foci, the employees were asked, to, critically, reflect on the suggested procedure per activity focus. Furthermore, every employee could set the urgency from his point of view by using an assessment target per activity focus. In step 2, the activity foci, as assessed by the employees, were presented to the management. Then, management had the possibility to take account of the preferred activity areas as stated by the employees. This procedure was extremely important for the further project development, as the acceptance by the employees of the selected topics was very high.

B.2.3 Planning: Preparation of creative alteration processes

The planning, by which concepts and measures, in fact, an improved achieving of the goal of the organisation is supposed to be reached, is purposely de-coupled from the assessment procedure. The development and planning of measures and how these can be implemented, is a creative process, which can bring out all potentials of all employees. But of course, only when the employees, by involving them in the modelling and assessment are acknowledged as actively acting persons. The involvement of employees into the planning of measures secures, in addition, that the activities to be carried out can, in fact, be carried out by them as they will perform on their own to the tune of their performance capability. It is of special importance, that the individual measures are adjusted by the tools of the modelling exactly to the overall company connection and, due to these measures the base is laid for a coordinated implementation of the measures. In the first place, a careful planning requires a very high creativity and a procedure, coordinated with the respective situation. Drawing up a program can be supported by simple methods of the project management. Scenario technics facilitate a more exact overview of the actual effects of the activities. For utilising the creativity of the employees, the setting up of largely independent measurement development teams is a classical method. These teams can, possibly, operate without a moderator and are brought together from across all hierarchies and areas. The involved persons have, therefore, differing points of view of the activity area, in which they are supposed to process.

In detail, the following procedure is recommended:

- ① Distinguish between models
- ② Drawing up concepts
- ③ Drawing up and formulate management programme

B.2.3.1 Model delimitation

During the development and implementation of measures, it should be taken into account that each measure can trigger numerous effects along the material and information flows. If, for instance, sales and order acceptance are re-structured this can, to a high degree, influence procurement, work planning and production. In this way it often happens that one "solution" removes one problem and three new ones arise instead at another location. To avoid such "apparent solutions" the solution development should be carried out on the basis of the modelling results. At the beginning of the planning it should, therefore, be found out, which of the models will be influenced by the concept development for processing an activity area. The activity area "new structuring of the sales in-house service", for instance, will influence the information flow model, the process of order acceptance and the forming of organisational units.



B.2.3.2 Drawing up concepts

Basis for drawing up concepts are the selected models. For instance: the information flow model, the description of business processes and the boundaries of organisation units will be changed. It can be ensured, in this way that the developed concept is not only coherent, but that it fits into the company as a whole. On the one hand, by this action an integrated planning is carried out, and on the other hand, the concepts are systematically documented and the whole modelling result is continuously updated.

B.2.3.3 Drawing up and adopting management programmes

Still to be named are the concrete measures which must be carried out, to get from the present status into the new one. The measures can extend from training employees, via adjustments of the IT-system to technical modifications. The result of the planning is a classical management programme, which comprises, per activity area, at least the following:

- > Measures
- > Responsibilities
- > Resources / Instruments
- > Deadlines

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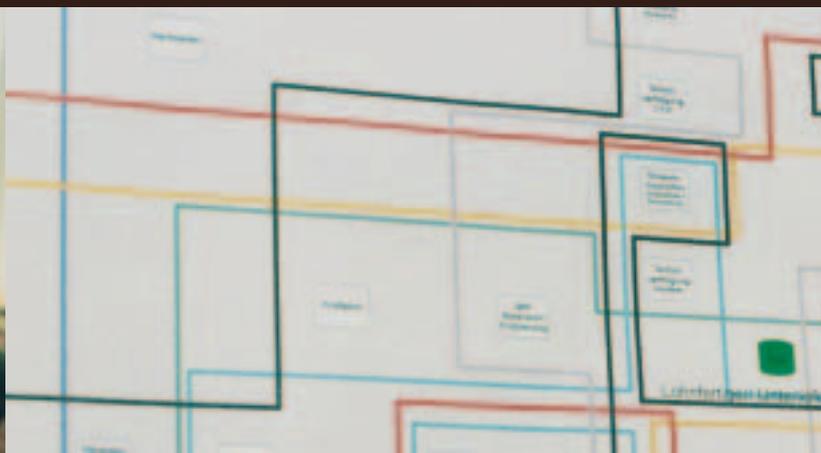
"We can marvellously combine the systematically developed measures catalogue of the eco-effizienz project with our intended re-structuring."

Manfred Lantermann, Director,
Schertler Verpackungen GmbH

Example Keimfarben GmbH: Improvement of data recording

Because of the retrograde production order posting (posting with planning data) at Keimfarben, over the year, material differences (deficiencies) at the storage locations accumulate. These material differences were, so far, accepted because of this posting variant. It was determined by the material flow accounting that, already, the in-posting for viscose materials into the raw materials store was too high and, therefore, the information system showed a too high material inventory. The posting was carried out on the basis of a delivery note, but the actually filled quantity of viscose material was, significantly, lower because of material adhering inside the tanker lorries. Weighing the delivery vehicles, as well as, installation of load cells in the silos facilitate quantity-correct posting of material in future. The material differences which had to be cleared in the annual stocktaking could be, by this measure, significantly reduced.

"Learning for the future.
Creative and efficient with flow management"

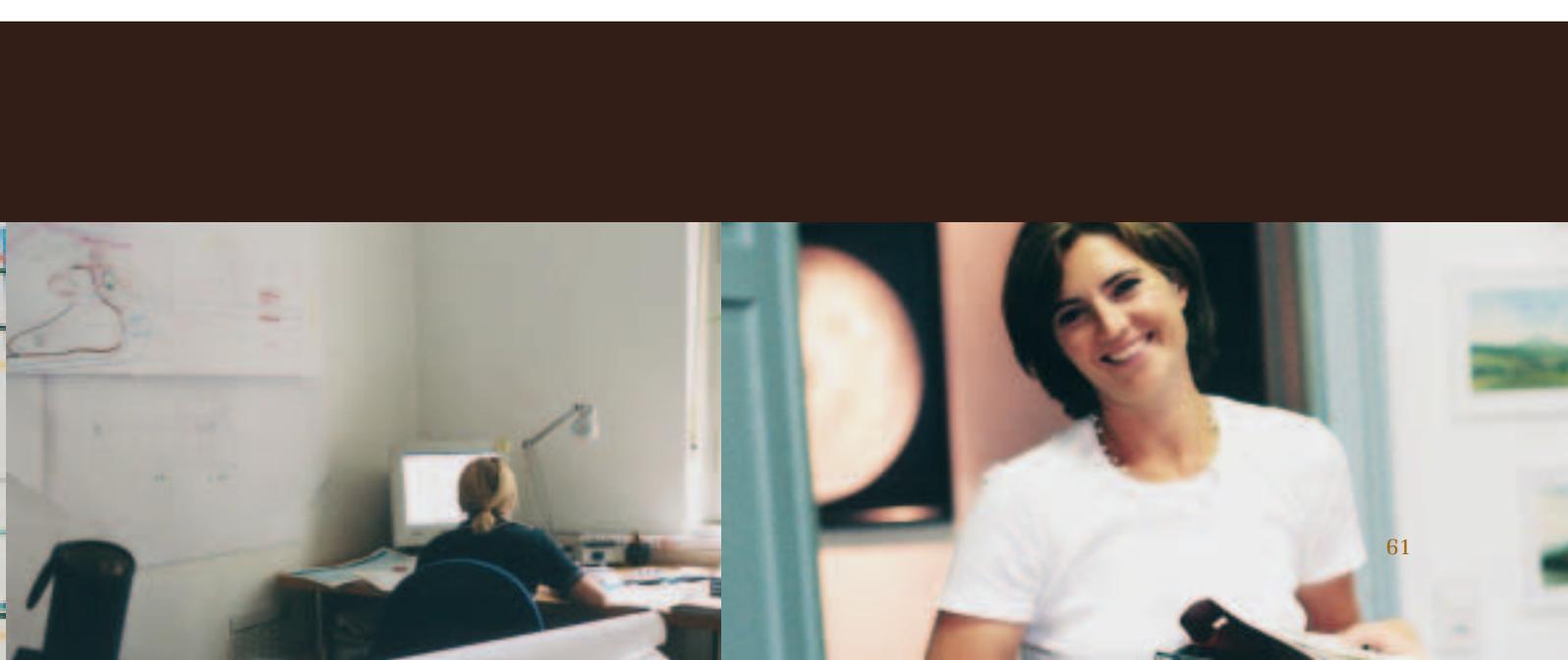


Example Karwendel-Werke Huber GmbH: Improvement of the procurement process

Because of the very high material cost proportion of over 65%, the focus for the procurement process was, not only to reduce procurement costs, but also to search for improvements in material handling and coordination processes. On the background of the entrepreneurial growth goals and the requirements of processes both in front and behind, the strategic and operative arrangement of material procurement was stated more precisely. In this context, an optimal dealing with the procurement markets and transition to on-call ordering of materials and, by this achieving a flexible own inventory played a significant role. With respect to an efficient Supply Chain, clear successes could already be achieved. Installation of a complaints list for incoming faulty material, an improved coordination of material storage between in-house logistics and production, as well as, direct posting of inventory data into the ERP-system are measures, which could be implemented due to the flow-oriented process planning. Unclear responsibilities between disposition, sales and production planning for procurement and handling of packing material could be clarified by the project.

Example Hörauf & Kohler GmbH: Improvement of internal capacity utilisation

The company goal of an internal capacity utilisation of over 80% was not achieved at Hörauf & Kohler at the time of the company modelling. With respect to this goal, order processing and production planning play an important role. Apart from specific process internal problems, especially the coordination and information exchange between the information centres of sales in-house service, production disposition and sales were not optimal. Both processes, with active cooperation of the employees concerned were re-organised and coordinated with each other with the instruments of information flow modelling and drawing up of Event-Process- Chains (Flow diagrams), expanded by information units. To maintain friction-free processes, in the future, a detailed measurement programme was, in addition, drawn up with responsibilities and deadlines. The motivation of the employees was very high, despite the expected short-term additional efforts. They expected from the measures, carried out on their own, an improvement for the company, but also for their own work circumstances. For instance: A coordinated, longer-term capacity planning was introduced, as well as, several assessments of diverse suppliers and sub-contractors were carried out. By this, the basis was created to achieve better placing or recalling of external orders, which means that sub-contracting was, also, included in the long-term capacity planning.



B.2.4 Implementation: Achieving the project goal together

The concrete implementation of measures, as they result from a systematic assessment and planning is a central problem for all management approaches and every fundamental change of companies. Many problems result from the circumstances that the assessment, planning and implementation of measures are carried out, as a rule, by different persons. From the point of view of the flow management, the implementation of measures becomes a success, if "becoming active" arises out of the motivation of the involved persons. Especially suitable for working in working groups are spokespersons who are capable and competent to transmit the achieved results to employees and colleagues. For the implementation it is necessary to supply the executive level with the respective means or infrastructure. Initially, the demand may sound trivial to give the necessary freedom of activity for the implementation of the measures. However, it can be observed rather often that exactly in this point – despite careful measure planning – "stones are put in the way". Typical are executives who occupy their employees with measures other than planned, change measures without agreement or simply let them drop "under the table". With respect to the measure implementation, if needed, training of employees is to be carried out. It is, easily, possible by using the instruments, that employees recognise requirements and possibilities for activities and are unsure, of their performance ability, but not of their basic performance willingness. If measures for personnel development start at this point, a maximum success can be expected, because the employees will be encouraged by their own motivation.

Example Rohrleitungsbau Süd GmbH & Co. KG: New organisation of residual materials store

Bad clarity in the residual materials store of Rohrleitungsbau Süd GmbH and the wrong attitude of the employees towards residual materials (they were often called waste) led, over the years, to not utilising significant saving potentials. Sheet metal residues were not or only insufficiently marked. High value materials of stainless steel (V4A) could only be used as lower class material (V2A) or had to be completely disposed of. To process these cut-offs adequately exact markings, such as sheet thickness or material number, must be carried out. Also, the storage of the material was untidy and not material-conform. Furthermore, large area cut-offs were often damaged by incorrect handling. Kinks, dints or scratches over large-areas made cut-offs, in fact, unusable. The new organisation of the residual materials store by correct storing, marking and handling of the materials has promoted "sheet metal residues and waste" to "second choice input material".



B.3 Continuous development process

By implementing the flow management, a lasting process of changes is to be started. This means, that the implementation of the annual management cycle as described in chapter B.2, has to be supplemented by a continuous development process during the year. Not a one-time check and the following implementation of improved, but again solid structures, are the goal, but the creation of an unlimited flexibility, to be able to react permanently, quickly and efficiently to changing basic conditions, as well as, internal weak spots and problems of all kinds or on all company levels. The company must be in a steady flow in the direction of a total optimum (realisation of company vision). This steady company development comes from inside by putting the employees into the position, to identify activity needs and remove faults within their area of responsibility independently and coordinated. It is, however, decisive that the activities take place coordinated and the employees, affected from the intended change, will be involved and/or informed. In this way, it will be avoided that the removal of local problems can, again, lead to negative effects in the locations both in front or behind. Creation of free activity space for the employees is of central importance for a rapid and efficient implementation. Not only are employees encouraged to bring forward ideas and suggestions for improvement (like it is the case in most in-house suggestion schemes) but they are also (co-) responsible for assessment, planning and implementation. When creating these free spaces in the organisation for activities, the decision authority, also has to be regulated. It must be clearly defined, who has decision authority for what in-house levels and areas. With this, it must be determined, how much time can be invested for initiating and implementing changes by the employees according to their own decision and from when on, a coordination with and approval by other decision makers in the organisation is necessary. By these regulations, known to all, the decision paths and improvement cycles will be kept short by involving only the relevant and competent employees of the respective activity areas. By strengthening own responsibility and distribution of decision authorisations, the creative potential of the employees is fully used, weak spots are effectively and efficiently removed by the respective employees and, by this, the motivation and identification with the company are greatly improved.

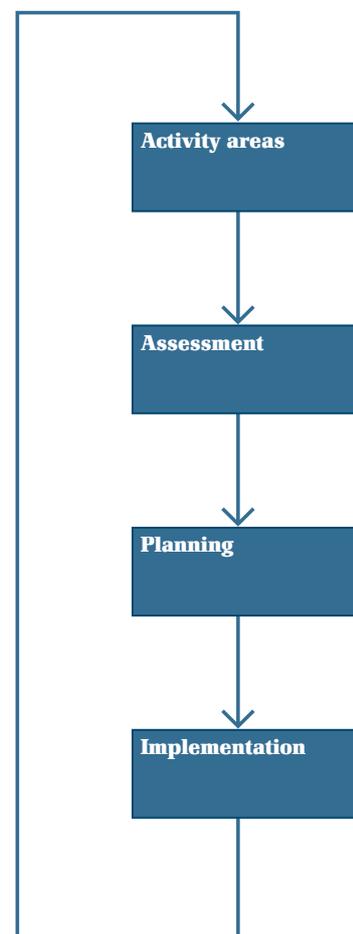
B.3.1 Areas of activities

A company is as good as the quality of their employees. All employees are asked in flow management, for the benefit of the whole company, to suggest improvement potentials and handle the improvement process independently. The areas of activities can cover all company levels and areas, from small immediate measures, such as changing the storage space for incoming goods to larger topics like re-organisation of the procurement process. Activity areas can, for instance, arise from the transparency, created by the flow models, changing basic conditions, user-specific material reports, which are drawn up on the basis of material flow accounting or from goal control by the Balanced Scorecard (see chapter B.1.3). To avoid fighting pure symptoms, it is of extreme importance to put the planned measures into an overall in-house connection. This overall connection is taken account of by limiting the activity areas in the respective current updated flow models. By limiting the activity area, on the one hand, the involved or, affected information centres by possible changes, quantity centres, processes, departments, as well as, employees will be identified and on the other hand, the potential effects on their neighbouring areas, both in front and behind, will be clarified by the model. If these effects are not in contrast to the general company goals, the problem can be removed, independently, by the relevant decision makers.

B.3.2 Assessment

The principles of the annual organisation assessment of chapter B.2.2 are also valid for the assessment of the continuous development potentials. However, this is not a matter to establish cross-company main activity foci, but to establish by the effect analysis in how far removing a currently found problem contributes to reaching the company goal. Precondition of the purposeful assessment is the ability of the involved employees, to recognise the essential correlations. These connections are visualised by the current flow models. The assessment of a planned change is carried out jointly by the involved employees. If the improvement potential is classified as advantageous by all involved employees, planning can start.

Figure 31:
Continuous development process



B.3.3 Planning

Smaller measures will be carried out directly after the assessment by the involved employees without the need for a separate planning meeting. However, it is important that all affected employees are informed of these changes and these changes are documented in the current flow models. The adaptation of the flow models is to be carried out according to the installed procedure for its continuous updating. More extensive activity areas will be handled as described in chapter B.2.3. In this case, planning is carried out with the instruments of modelling and on the basis of the existing models. Changes are coordinated by the involved persons and updated in the respective models. Due to the coordinated updating of the flow models a rigid documentation is avoided. Instead, the necessary management documentation is updated, flowing, to the current status and, therefore, always reflecting the real structures and processes of the company. Due to the fact, that the planning and changes are carried out and determined jointly by the affected employees, the probability for implementation and efficiency of the measures increase enormously. The consequences are, not handed down measures from external authorities or the upper hierarchy levels, but coordinated concepts, optimally, adapted to the abilities of the employees. The continuous company development is achieved by the permanent further development of the employees. In this, not only the personal development, but also the development of the social behaviour in a team, plays an important role. Apart from the most differing team development strategies also simple behaviour rules proved themselves to limit the time needed for coordination in the planning work groups. These rules are, for instance

- > **Cooperative, open behaviour**
- > **Complying with deadlines**
- > **Determination of concrete targets at the beginning of the meetings**
- > **To be prepared**
- > **Naming of a moderator**
- > **Hierarchy differences of the participants play no role**
- > **Avoiding disturbances**
(for instance: switching off mobile phone)
- > **Result and task-orientated discussion**
- > **Taking on responsibility and making decisions**

- > **Documenting results (result protocol)**
- > **Distribution of results (Who is affected?)**

B.3.4 Implementation

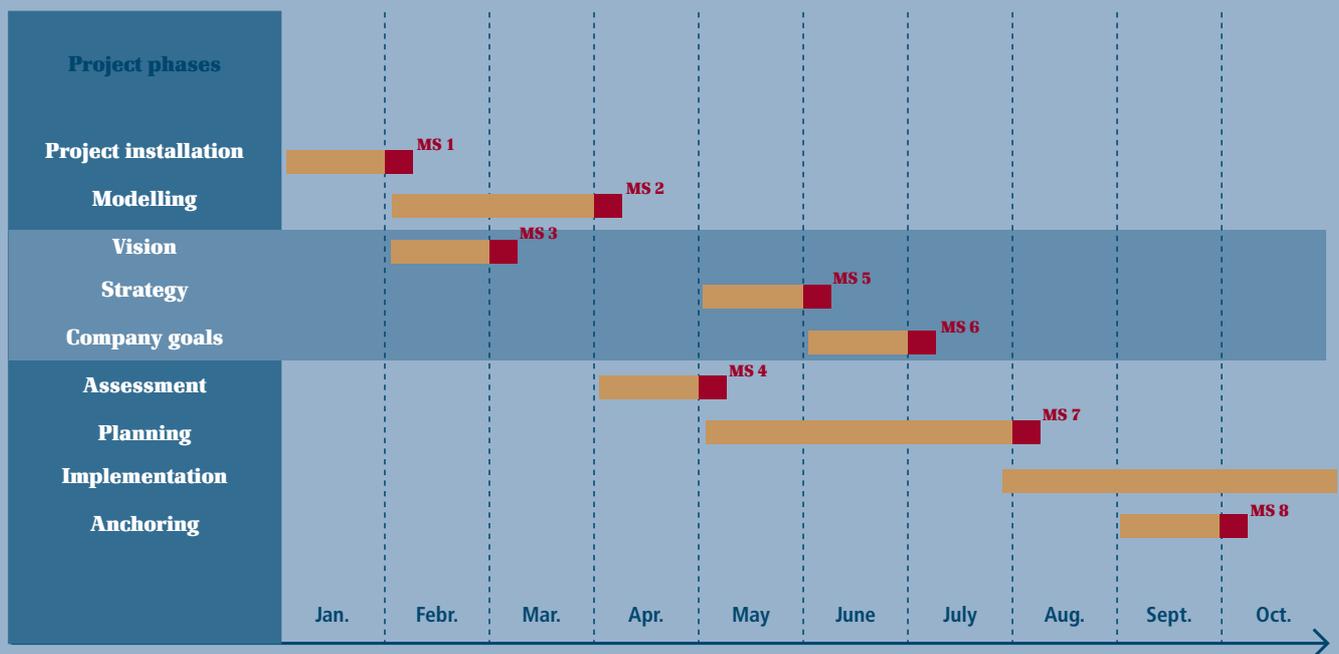
The implementation phase is carried out analogous to chapter B.2.4. In this phase, the discipline of the employees is the deciding factor. If individual activities are not carried out according to plan, the whole improvement flow could stop. To prevent this and the resulting de-motivation of the other employees, it makes sense, to name one responsible person from management, who controls the achievement of the target and measurement implementation. Furthermore, he (she) should also be available as contact person and mediator in case of conflicting interests and also act as the information flow ensuring linkage between the levels of hierarchy. The overall control of all optimisation measures, carried out during the financial year, and their interaction will be ensured by the overall modelling, to be carried out annually, and the following assessment within the scope of the annual management cycle.

B.4 Worth to know about project management

An exact and agreed goal determination, in consensus, is the basis for a successful project. Therefore, before the start of the project, it is to be determined, which goals are to be achieved by the implementation of flow management, so that the relevant persons and areas can be tied in accordingly. A further precondition is the active involvement of the company management. Apart from the official project order and public support of the project, the management is to be involved by regular short presentations about the project status. This has the advantage of quick intervention possibilities in case of occurring problems and keeps the management informed of the current status. Central for the implementation of the project is the project coordinator. Also in the case of external support it is necessary to install an internal coordination function. On the one hand, the project coordinator takes over the organisational tasks

(invitation of employees, organisation of space and office material, distribution of information, etc.) and on the other hand, this position collects the knowledge of methodology of the flow management and the achieved results. The contents are drawn up by cross-departmental working groups. Depending on the size of the company and availability of employees, the various topics should be dealt with by the working group with the same members, so that the individual topics can be jointly elaborated and, in that way, increase the acceptance and implementation of the results. Furthermore, this procedure generates a better understanding for the overall connections and lays the foundation for a cooperative company culture. The implementation of the flow management must be planned for a comprehensible period of time. It is helpful to draw up a schedule, into which the single project steps are entered (see figure 32). Fixing milestones for the single project steps ensures an effective control of project and project success.

Figure 32: Schedule with milestones



Possible milestones could be:

- > **Project plan with selection of employees**
- > **Material flow model**
- > **Information flow model**
- > **Material posting model**
- > **Report on inconsistencies**
- > **Vision of the company**
- > **Company strategies**
- > **Company goals**
- > **Activity foci**
- > **Implementation programmes**
- > **Procedure rules for lasting anchoring of the flow management**

The actual project should start with an official "Kick-off". All persons, involved in the project should be invited to this meeting and be informed about the methodology of the flow management, the project procedure and their tasks. In the introduction, the company management should underline the importance of the project and clarify the role of the project coordinator. Insecurities of the employees and possible resistance will be avoided right from the beginning by early involvement of all participating persons.



C Case studies of the eco-effizienz project

In total, twelve pilot projects were carried out during the past three years at companies in the region Augsburg-Swabia. The variety of the project contents was astonishing. There was rarely a uniform starting situation. In the individual companies there were rather very different starting points and, still, all companies had one goal in common: The improvement of material and information flows. In the case studies presented, the contents are a selection which allows an insight into the spectrum of the pilot projects.

All case studies are available as .pdf-data files on the web site www.eco-effizienz.de under the heading "Download".

A printed version can also be ordered from:

imu augsburg GmbH & Co. KG,
Gratzmüllerstr. 3, 86150 Augsburg,
info@imu-augsburg.de

C.1 Rohrleitungsbau Süd: Organisation planning for single-piece-production

Reduction of input material by flow-oriented organisation planning

Rohrleitungsbau Süd achieves by flow management:

- > **Efficient material and information flows, overall process planning and material-orientated product innovation**
- > **Reduction of material losses by 25% and lowering of annual input material by 12,000 kg**
- > **Creation of two new jobs**

Rohrleitungsbau Süd GmbH & Co. KG

Rohrleitungsbau Süd GmbH & Co. KG is a medium-sized company with approximately 70 employees. The company operates in plant construction and environment technology. As project producer it supplies the chemical and paper industry, communal sewage plants and environment technology suppliers. Rohrleitungsbau Süd also manufactures

components for well-known engineering companies. The manufacturing spectrum covers apparatus, containers and pipelines as well as flotation plants, mixing and agitator containers to clarification tanks, helical conveyors and separators for solid matters to liquids separation. At Rohrleitungsbau Süd, the material cost proportion amounts to approximately 60%.

Before the flow management – The competition pressure increases continuously

During the last few years Rohrleitungsbau Süd registered a strong growth. An adequate adjustment of the organisation, however, did not take place despite the increased number of employees and project sizes. The advantages, which the lean management structure of Rohrleitungsbau Süd offers, therefore, was often lost due to interface problems and information losses. The Technical Management had to compact, practically, all information from customers, suppliers and employees, process and pass them on accordingly. This meant that only three people were responsible for all the planning, design, procurement, work planning, coordination and customer care. Therefore, information was lost during processing and transfer or clear delays occurred, which affected, especially, the following areas of the value adding chain. In consequence, especially, the employees from production complained about belated and partially incomplete work planning.

As at Rohrleitungsbau Süd, almost exclusively, stainless steel is processed and the price for stainless steel rose by almost 50% in one year, the proportion of material cost rose from 46% to 63%. Because all products were made from stainless steel, the calculated prices of the company rose, in consequence, by 20 – 30%. The key to an improvement of the competitive situation was, therefore, a reduction of the material cost proportion and the reduction of consumption of the gross material quantity (= purchased material quantity).

Flow modelling – A company recognises itself

At the beginning of the project a material flow model was drawn up. The consultants of imu augsburg discussed the company material flows, together with the employees, until it was possible to depict the flows which were then clearly understood by everyone.

To be able to illustrate the communication paths and contents, the information flow model was drawn up. In this way, the company was conclusively depicted and an exact detailed idea, of how the different processes were interconnected, was presented to the employees. The common point of view of the company made it clear to every employee what their own contribution to the overall success was. Significant progress was achieved at Rohrleitungsbau Süd just by jointly drawing up the flow models. Furthermore, already after the modelling, very concrete measures were initiated for the material flow. An excerpt:

- > **Implementation of improved material marking of material cut-offs, to increase the reused proportion and to create a new material consciousness in employees**
- > **Uniform, systematic marking of raw materials at goods receipts to avoid mix ups and delays**
- > **Clear organisation of material ordering and preparation in the small parts store to avoid doubled orders, delays or even production standstills.**

Flow organisation – A company re-organises

"We could save ourselves a lot of time, if we could have more exact drawings and bills-of-materials for every order. Technical Office would be hampered less by enquiries and we could, in addition, even save material due to fewer errors! Proper Work Planning is just missing."

Dieter Schönwälder, Workshop Manager

QUOTE

The processes are the key for efficient organisation re-structuring. The differentiation by contents and its closeness to the actual daily processes plays a significant role. By the combined material and information flow models, initially, the actual status of the work procedures was depicted at Rohrleitungsbau Süd. Overlaps became visible and interface problems could be communicated. The working groups for process planning, repeatedly, brought to light that the responsibilities and duties of the individual departments were not clearly defined.

With the help of Event Process Chains (EPC) a target state of the process landscape was modelled with the assistance of the employees. In addition to a more detailed regulation of authorisation also process-orientated job descriptions were drawn up. The involvement of the employees in the re-structuring process was followed by a high degree of acceptance of the new system. Still to-day, one year after the end of the project an increased contentedness and the will for further development are clearly recognisable. The following examples of problem solutions give an insight into the project successes:

Rohrleitungsbau Süd recognised that material orders were processed by up to five employees from three different areas. This deficit could be removed by an overall planning of the procurement process.

The material and time-intensive in-house manufacture of cut out materials did not prove to be efficient. They were subcontracted, in part, to local laser cutting companies because of better utilisation and the resulting, more cost-effective production.

Before the start of the project, the Technical Office was responsible for inquiries, processing, customer care and design, as well as, work planning (bills-of-materials, manufacturing drawings, processing, etc.) and technical supervision of the production team leaders and, therefore, often overloaded. The result was superficial, incomplete work planning.

Unavoidably, there were enquiries by the production team leaders. Answering those led to time bottlenecks and increased processing times. A large portion of these tasks were taken over by the newly created division "Work Planning" with the procedures regulated by the EPC. For manning the new division, two new jobs were created. Trainees are now consequently involved in the solution of specific problems of make-to-order-production. The trainees document the results and report to Technical Management. In this way, handling of problem situations is trained. Furthermore, errors in production and, material losses are avoided, in future, by the documentation.

In the product development "Container" the following result was established: By reduction of the wall thickness and strengthening with rings and reinforcements 50% of the material can be saved without loosing out on time and quality. At the same time, the cut-off on containers could be

reduced due to a higher reuse proportion. Since the restructuring the stores personnel is used to capacity, and the production team is relieved.

Flow management – the will to continue

By re-structuring, improved communication and a more precise determination of responsibilities and competences interface problems and capacity bottlenecks can largely be avoided. The active participation of the employees in the change process of the company also changed the conscience of the individual persons in the way they handled valuable materials and production times. The common point of view of the companies allows the employees to recognise their contribution to the overall success and increase their own contentedness. This is supported by the newly created Work Planning, as the work could be significantly facilitated due to better guidelines and additional quality controls.

Flow management helped Rohrleitungsbau Süd to realize considerable cost savings in various areas:

- > **Reduction of doubled and repeat orders**
- > **Material savings by avoiding errors and reuse**
- > **Time savings by avoiding errors and optimisation of processing times**

The cost savings can only, in part, be quantified as Rohrleitungsbau Süd, so far, is without the support of EDP for production planning and control. To back-up the estimates with real data, a simplified material flow accounting was carried out. It can also serve as a decision basis for the future system implementation.

The restructuring created in total two new jobs which can be financed by the savings from the flow management.

To bring the flow management with all its merits to fully prosperity, it needs the following preconditions:

- > Maintaining transparency of material and information flows and organisation structures
- > Maintaining the communication about planned changes and activities with effects on material flows
- > Further development of ability to purposefully and coordinated change of material flows

The chances are very good at Rohrleitungsbau Süd for a lively flow management integrated into the daily procedures.

QUOTE

"Our company culture changed, the employees have developed a different point of view of the important issues of our company. Exactly this will make the company successful. Problems at Rohrleitungsbau Süd are now quickly recognised. The knowledge, that detecting inconsistencies in the material and communication flow has a big improvement potential, will ensure quicker learning and, by this gives the company competitive advantages."

Edwin Ferhadbegovic,
Commercial Manager

C.2 Karwendel Werke Huber: Flow-orientated process re-organisation for continuous production

Process innovation by focussing on material and information flows

- > Implementing and re-structuring a material and information flow orientated organisation
- > Building up a data base for controlling the flow management
- > Clarification of responsibilities at the interfaces

Efficient company control and development on the basis of extended material and information models and use of standard data bases

Karwendel is one of the important dairy companies of Germany with a turnover of 196 million Euro in 2001. The product range includes cream cheese, natural and fruit quark, hard and processed cheese and snacks. Karwendel products are known by the brand names Exquisa, miree and Karwendel and are found in 88% of all shops of the German food retail shops. The export proportion, mainly in Europe, is 28%. The owner-managed company is located in Buchloe and employs in total 380 people.

QUOTE

"By the visualisation of the material and information flows, the transparency of processes and knowledge was enormously increased as to which effects individual working steps have for the other areas. At the same time, this procedure was an excellent basis for the process description. Our employees recognise their position much better in the planned processes, than in rigid, hierarchic organisation structures."

Klaus-Dieter Reiter,
Manager Production

Re-organising material and information flows for and with the company

On the occasion of a generation change in the owner family, Karwendel-Werke Huber GmbH & Co. KG was subjected to a new orientation. To achieve the ambitious growth goals, the new organisational orientation of the company was to be carried out with respect to the processes. Within the scope of the outstanding changes, also the implementation of a new ERP-system was planned. However, to be able to implement a process organisation and an ERP-system, which would take account of the specialities and requirements of the company, it was necessary to gain exact knowledge of the in-house material and information flows. For these reasons the following project tasks were agreed:

- > **Creating a common starting and communication basis for all affected employees as a precondition for re-structuring the organisation**
- > **Cross-departmental focus on material and information flows and, going hand in hand, reduction, as well as, clear regulation of interface and communication problems**
- > **Consequent orientation of material and information flows on the strategies and goals of Karwendel**

It was, however, clear to all participants in the project, that the crucial issue for a lasting project success would lie in the tailored material and information flow re-organisation for the company with little maintenance and adjustment efforts.

Modelling of material and information flows - a detailed depiction of the company

A detailed actual analysis of material movements could be carried out by a systematic investigation and preparation of a total of almost 100 quantity centres and 400 material flows in working groups with participants from Purchasing, Production, Logistics and Sales.

A detailed description was given by determination of the material centres and flows with respect to the following parameters (examples):

- > **Which quantity centres (for instance: stores, machines) are involved in which material flows?**
- > **Which kind of material is moved (milk, packing material, fruit and ingredients)?**
- > **Is the material movement a pull-or-push principle (responsibilities)?**
- > **Are there interfaces with information centres, for instance: in the form of measuring stations?**

In a second step 150 information centres, in total, and over 500 information flows were determined. In this case, additional employees from the areas Marketing, IT, Finances and Controlling cooperated, so that the information flows could be stated more precisely by an exact description of the information unit (for instance: bills-of-materials, production order, delivery note), the transfer medium and the responsibilities and weak points could be identified.

IT-support

To be able to describe the existing operational situation in the company and to plan the following changes, an Access data base was used within the eco-effizienz-project for the support, visualising and description of the company structures and processes and adjusted to the individual requirements of Karwendel.

For a detailed description of sub-processes, data sets can be automatically converted into extended material and information flow pictures. Furthermore, the possibility exists, by calling up from the data base, to generate flexible reports for differing requirements (quality management, Balanced Score Card). These contain process-specific information such as functions of material or information centres, process targets, characteristics, responsible persons or also current documents (for instance: hygiene regulations, working instructions). A management manual of the conventional kind became, therefore, unnecessary.



Employees learn to re-organise their own processes

The modelling of the material and information flows in the cross-departmental and hierarchy working groups brought into the open improvement potentials in the most differing areas. A clear process landscape was generated, which classified all material and information flows into main and management processes, as well as, supporting processes. However, it was necessary due to the time limit of eco-effizienz to set foci, which would put the employees of Karwendel in the position to complete the process-orientated new planning independently after the end of the project. Sufficient reason, to select processes from the various project categories for the planning and implementation phase.

On all levels: Communication – innovation – material efficiency

Management process: Developing products Innovation drive by strengthening the employees

During the evaluation of the classic management process "Developing products" it was important, to recognise and promote success-promising suggestions for development projects at an early stage. A speciality of the process "Developing products" is here, that the know-how of very different organisation units (Marketing, Controlling, Technical Department, Production, Disposition, Company Management, etc.) should be utilised, to have the concentrated knowledge of the employees available, especially in uncertain decision situations. But this, also, places the process into special organisational challenges. To classify the multitude of development processes correctly and increase the efficiency, the management decided on an extensive structural change, which chiefly manifests itself in strengthening the position of the employees. At the same time, the management drew up a criteria catalogue which facilitates the decision about initiating projects of the persons responsible for processes. In future, only in individual cases the decision will be made by the management. Also the requirement catalogue for project managers has contributed to the extensive changes. In future, the project managers of Karwendel will be judged by their innovation and communication ability to coordinate projects with the company strategy. Furthermore, the transparency of project progress is

now comprehensible for all employees and generally controllable by new project management tools.

Service process 'Production controlling': Well-founded indexes increase transparency of material input

A substantial potential with respect to improvement of company control could be implemented by an intensive coordination process between Controlling and Production. After a joint inspection of the production facilities, use of the material flow model and, on the basis of existing data, an index system (material and energy indexes, machine indexes) could be developed. In parallel, it was possible to draw up the requirements for a new ERP-system with respect to data collection and availability, as well as, data quality. The depiction of the connections between data origin, data collection, index calculation, assessment and reporting was carried out in an Extended Information Flow Model.

Main process 'Procurement of material': Optimum handling of the procurement markets

Because of the very high proportion of the material cost of over 65%, the focus in this process was placed, not only, on reduction on procurement costs but also on search for improvements in material handling and in cooperation processes. On the background of the entrepreneurial growth goals and the requirements of other processes, the strategic and operative orientation of material procurement was stated more precisely. Especially in this connection, an optimal handling of the procurement markets (price/performance/reliability) and flexible material call-up and, by this, own inventory, played an important role. With respect to an efficient Supply Chain, clear successes could already be achieved. Installation of a complaints list of incoming faulty material, an improved coordination of material storing between in-house logistics and production, as well as, direct posting of inventory data into the ERP-system are measures which could be implemented because of the flow-orientated process planning. By the project, so far unclear responsibilities between Disposition, Purchasing and Production Planning for all processes of material procurement could be clarified.

Also in the future everything will continue to flow

Also after the end of the project Karwendel uses the flow management. The involved employees have learned, even more, to value the advantages of a cross-departmental communication. A mutual appreciation of the working methods of colleagues from other organisation units has developed and the chances of an open information policy are increasingly used. The management intends to continue promoting these effects as success factors for the future company development. First steps in this direction have already been taken:

To explain the chances of flow management to all employees and, at the same time, lay the foundation for handling the new system, a flow management training seminar for the management and department heads was held. For processes, which were not processed within the scope of the eco-effizienz project, responsible persons could be named, who have in part, already in parallel to eco-effizienz coordinated and further developed their processes. The readiness is immense to plan the further development of the processes in cross- departmental working groups. Especially, the installed flow management data base at Karwendel will clearly facilitate to the employees the adjustment and maintenance of processes and the connected material and information flows.

Q U O T E

"By the data base, we have created a flexible system for description of our material and information flows. The great advantage is that with this, we have created a lively system which is also used by all."

**Peter Schlumprecht,
Head Production Planning**

C.3 PCI Augsburg: Monthly material reporting for series production

Material flow efficiency by monthly material reporting

- > **Check of quality of material postings in SAP R/3**
- > **Material flow accounting enables consequent tracing of batches through the company**
- > **Monthly material reporting supports well-directed identification of material losses and posting inaccuracies**

Company description PCI Augsburg

PCI Augsburg GmbH is one of the leading manufacturers of chemical products for the building industry with over 300 high-value and innovative building materials. The most numerous product assortments are sealing materials for buildings, concrete repair systems, repair mortar, filler materials, screed material and sealing materials.

PCI Augsburg GmbH is part of the company area 'building chemicals' of Degussa AG. Across Europe almost 800 employees belong to the "PCI-family", with 450 employees working at the company headquarters. Further production locations are in the Luther-town Wittenberg and in Hamm. The total turnover across Europe amounted in 2002 to approximately 200 million Euro.

Starting situation: Successfully meeting the cost pressure

Thanks to the excellent quality of the product assortment, PCI was able to establish itself in many areas of the branch of industry as market and cost leader, a position, which the company was able to hold also in the years of economic slackening. To meet the cost pressure from competing cheap suppliers efficiency increases and in-house cost reductions have, increasingly, become the compelling key factors. However, not exhausted potentials are suspected, especially, in the area of material costs. With a proportion of about 65% of the total manufacturing costs they are, by far, the largest block of costs.

Still, at the beginning of the project, the size of the in-house material losses due to manufacturing and storing could, only roughly, be estimated.

What proportion of the procured material is actually used to add value to the target products?

From unexplainable storage differences, there were already indications of material losses. To close this information gap, material flow accounting was introduced as an additional tool at Augsburg. By its end-to-end transparency of material flow quantities and values down to the level of single materials or product batches, the material flow accounting is excellently suitable for this purpose.

Current and handling-orientated information supply with detailed material data simplifies the development of technical and organisational measures for the decision-makers in the areas of production, logistics and controlling.

Project description/successes

In December 2002, after a half-yearly development and trial phase, the material flow accounting was implemented at the PCI headquarters in Augsburg. Now, all material flow relevant data are transferred from SAP R/3 via an interface into an SQL-data base, tailored especially for the needs of PCI. Material postings, inventory and production order data are now, sensibly, combined with each other by algorithms, checked for consistency and evaluated. The results are automatically edited in table form, in a structure required by the decision-makers.

QUOTE

“Modelling the posting structure was an excellent supplement for drawing up a procedure instruction for postings. In principle, you have got, by this, a visualised procedure instruction.”

Peter Kammerer, Staff Group Logistics

Check of quality of material postings in SAP R/3

Before programming the SQL-data base, especially the knowledge transfer with the employees from Production, Materials Management, Logistics and Controlling was in the foreground. On the basis of a jointly set up material flow model for the factory in Augsburg, the involved persons, initially worked out a common communication basis. Based on this, the imu-consultants checked the material movements,

documented in SAP R/3, for the period of one year. How should these, according to the opinion of Controlling, be posted and how are they actually posted at the location? By checking the data sets per type of movement by structure and frequency of their field entries, already a multitude of starting points to further minimise false and correcting postings arose. Not less exciting, in this analysis of the posting structure, was the topic of account finding. Which material movements are addressed in the inventory, expenses or cost accounts? Also here, potentials for an optimised depiction and cost allocation were found. Also the IDOC-interface between the warehouse management system (WMS) and the SAP R/3-system held surprises. Undesired and missing data field entries and transfers could be stopped after detection. Basically, the posting model, also here, showed: Considering the multitude of postings, at PCI Augsburg everything, with regard to posting, is perfectly alright!

QUOTE

“For us, the material flow accounting is a very interesting project. We started in 1998 to optimise, but do we know our material flow exactly? I wonder...”

Werner Schmid, Head Production

Consequent batch follow-up across the whole company

During the project, PCI realised the big demand for a consequent follow-up of batches – starting from goods receipts of the company via the individual production steps to the finished goods dispatch. For every purchased or produced batch number detailed information must, ad hoc, be available. So that an end-to-end full picture can be formed, answers will be given to the following questions:

- > **Where to do the quantities and values of the purchased or produced batches go?**
- > **What is the period of time, until a batch is used in production?**
- > **At which store location is a batch stored and at what inventory quantity?**
- > **Were there any inventory losses or are there any posting inaccuracies recognisable?**
- > **Have they already been corrected by stock or inventory differences postings?**
- > **Did a batch have to be destroyed and how long did this take?**

Of the greatest interest, however, was the knowledge of batch-specific material losses over several production steps. The persons involved in the project know only too well: Material losses occur during mixed contracts (for instance: vessel adhering or exhaust losses), as well as, during the following filling contracts (for instance: pump adhering).

The successful implementation enables the location Augsburg, for the first time, a consequent follow-up of batches. An SQL-data base continuously shows suspicious material movements, as well as, store and production order differences. At PCI, a simplified quantity and value analysis leads, in this way, to a well-founded insight into the decisive causes and generating factors of material losses.

Conclusions and outlook

On the basis of the material flow accounting, PCI can to-day make detailed statements about quantities and values of their in-house material flows. Due to this, it is easier for the areas Production and Logistics to determine, in a well-directed way, systematic activity foci. By the regular monthly report cycles, the current trends can be followed-up (for instance: deviation analyses for the sales hits) and the effects of initiated measures assessed more precisely. The new implemented SQL-data base provides, in addition, a multitude of detailed evaluation possibilities and helps the company in the well-directed search for material losses and posting inaccuracies.

Setting up the monthly material reporting on the basis of the new material flow data was in the foreground during the first half year of 2003. As a main activity, it was necessary to determine personal responsibilities, as well as, to define the required result tables and report formats. Furthermore, it will have to be clarified in, how far, an improved data base can be sensibly used for sales, quality or environment reports. After this, the roll-out to the production sites in Hamm and Wittenberg is planned.

A further focus is, surely, the measures development. Starting with the insights of the detail analysis, employees are trained in posting and bill-of-materials maintenance. Eventually, direct adjustments in SAP R/3 will be carried out. Task of these measures is, finally, to make lasting use of the improved material transparency for efficiency increases.

“The stone has started to roll. It is now necessary that the material flow data are followed up by material flow actions.”

**Frank Rösiger, Head EHSQ
PCI Augsburg GmbH**

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D Finally

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