

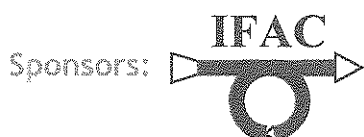


# IFAC Workshop on Manufacturing Modelling, Management and Control

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## PREPRINTS

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The Editor

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# PREFACE

Manufacturing systems of our days work in a fast changing environment full of uncertainties. Increasing complexity is another feature showing up in production processes and systems, furthermore, in enterprise structures as well. One of the recent areas of research is related to the globalization of production; production networks are formed from independent companies collaborating by shared information, skills, resources, driven by the common goal of exploiting market opportunities.

The scope of the IFAC Technical Committee (TC 5.2) on Manufacturing Modelling for Management and Control became of fundamental importance for production enterprises. One of the most vital features of the factories is their ability of cooperation, quick responses to changes and disturbances. These are matters of survival, independent of the size of the firms.

This year topic of the traditional IFAC Workshop on Manufacturing Modelling, Management and Control (MIM'07), i.e. Real-time Cooperative Enterprises is really timely. The importance of the field is manifested also in the fact that in the same area an Invited Session is being organised for the 17<sup>th</sup> IFAC World Congress, July 6-11, Seoul, Korea.

The Preprints contains 38 accepted papers grouped into the following 8 sessions:

- Modelling,
- Digital Factory,
- Control and Monitoring of Manufacturing Processes,
- Manufacturing Systems,
- Assembly Systems,
- Production Planning, Scheduling & Control,
- Real-time, Cooperative Enterprises,
- Supply Chains & Production Networks.



It is a special pleasure for the organizers that the representatives of two running European research projects took the opportunity of reporting on their main goals and achievements at the Workshop, namely the projects *Digital Factory for Human-Oriented Production System (DIFAC)* and *Automotive Chassis Development for 5-Days Cars (AC-DC)*. At the same time, the Workshop also serves as the closing, international event of the Hungarian National R&D project on *Real-time, Cooperative Enterprises (VITAL)*. The participants of the VITAL project are keen to present their results to the international audience.

We hope that all the participants of MIM'07 coming from diverse scientific and industrial communities will find this event intellectually stimulating offering an opportunity to address the above important challenge of contributing to a coherent framework of real-time, cooperative enterprises.

Special thanks are due to the members of the International Programme Committee of the workshop, particularly to *Professor Francois Vernadat*, Workshop Chair, and *Mr. István Salekovics*, Industrial Chair.

Last but not least, we would like to express our gratitude to *Mrs. Éva Thiry*, Workshop Secretary, for her enthusiastic and unflagging contribution.

Prof. László Monostori  
Host-Chairman of MIM'07  
Chairman of IFAC TC 5.2

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## COST- AND COMPLEXITY ISSUES FOR EXPANDING MEDIUM SIZED SUPPLIERS

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**Abstract:** The benefits associated with production factors are a common reason in the automotive industry for expansion and relocation to low-wage countries. However this can lead to a complexity within the organisational structure of the company, which can lead to redundancies and turbulences – not only in the new subsidiaries but also in the organisation and workflow in head office. These effects are barely noticeable in larger companies, but can lead to serious fundamental problems for medium-sized companies. Only organisations, which have been well-prepared in advance, can integrate new subsidiaries into their existing network and thus take advantage of their full potential. This paper describes a phase model for adapting the organisational structure during this expansion phase and discusses in detail the necessity of preparing the organisation for change well in advance. *Copyright © 2007 IFAC*

**Keywords:** Organisation; Expansion; Relocation, Automotive Industry; Production networks.

### 1. INTRODUCTION

One of the effects of rising cost pressure and internationalisation within the automotive industry is the growing trend by companies in Central and Western Europe to decentralise and relocate to low-wage countries. Increasingly medium-sized suppliers, which have hitherto focused on one or very few subsidiaries, are now following larger companies, who have far-reaching experience in international production networks.

Eastern Europe is set to play an increasingly important role over the next few years, particularly in the automotive industry. Important factors for the relocation boom of Western companies to the new EC countries are the low labour costs in these countries. On average these are not even 20% of the average labour costs in the 15 EC countries (see Fig. 1.). However it is to be expected that labour costs in Eastern Europe will rise sharply especially close to large industrial areas.

A further reason for relocation to and expansion in Eastern Europe is the fact that the benefit of lower labour costs is increasingly eaten away by the higher logistics costs. As a result adopting local procurement strategies is becoming more and more important.

Eastern Europe is no longer only known as a low-wage location but is more and more becoming an attractive new market for many suppliers as well.

While SMEs hesitate to transfer value adding to Eastern Europe due to capital restrictions or risk considerations, Original Equipment Manufacturer (OEM) already act: in surveys done by Fraunhofer PPL<sup>1</sup>, several small and medium sized enterprises report an increasing pressure from purchasing agents of the OEM to open subsidiaries in East European countries, see. (Palm, 2007).

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<sup>1</sup> Fraunhofer Project Group for Production and Logistics Management.

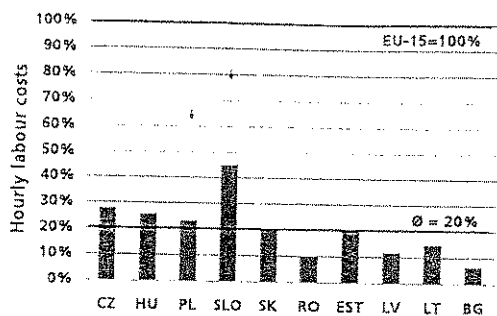


Fig. 1. Comparison of average hourly labour costs between EU-15 and Eastern European Countries. (Eurostat, 2005)

In the next few years the supply industry will be able to generate a huge procurement potential, which will itself generate further expansion. The following factors, among others, are responsible for this (Sihn, *et al.*, 2006):

- OEMs will be investing highly in Eastern Europe in the future.
- The OEMs own added value is low and is continuously being reduced further. This is particularly noticeable in the product segments which have been and will be relocated to Eastern Europe (volume models).
- There is currently an added-value shift from the OEM to suppliers and towards Eastern Europe.

However when suppliers are planning expansion, it is often not considered that the structure of the organisation can be seriously affected by the creation of additional subsidiaries. To take best possible advantage of the benefits of new subsidiaries requires a well-thought-out strategy as to how head office will interact with the new subsidiaries and how the subsidiaries will interact with each other. Questions such as "which functions should be managed centrally?" and "in which areas can responsibility be delegated to the subsidiaries?" need to be answered.

## 2. COST and COMPLEXITY ISSUES

All too often the relocation of parts of companies to low-wage countries, and especially the relocation of production facilities, happens rushed, without taking into account the effects that seriously increasing the complexity of the organisational structure will have on the company. This can result in unexpectedly high costs in the new subsidiary (see for example Deloitte, 2003). Companies often fail in the implementation phase of changes in the production network, because they underestimate the complexity of setting up a new production site abroad. (Abele *et al.*, 2006).

The decision-making process to set up a new subsidiary and the choice of its location has already been well-documented (e.g. in and will not be discussed in detail in this paper. This paper sets out to discuss the effects on the organisation of Medium

Sized Suppliers of setting up another subsidiary and the measures required to adapt the organisational structure of the parent company to this.

Regarding the quantitative definition of the European Commission the size range of Small and Medium-Sized Enterprises (SME) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million (European Commission, 2003). In this paper the differentiation between big and medium sized enterprises results not only from the absolute amount of annual turnover or staff headcount but is mainly determined by qualitative organisational criteria. Subsequently medium sized enterprises are related to enterprises, which organisation is characterised by a simple and flat organisational structure, which consists mainly of one person on top management and a small group of executives. Frequently there are no or only a few staff positions and the organisations gets by with few hierarchical levels. Communication happens informal to a large extent, directly between top management and organisational members (Nuber, 1997).

Concerning expansion of the production network, the organisational structure of larger companies is hardly changed at all by expansion, with a further branch simply being added to the existing organisational chart; the setting up of new subsidiaries within medium-sized businesses often means massive encroachment of the parent company's organisational structure. This often results in the total structure of the organisation becoming destabilised and existing processes can no longer be followed or have to be reformulated. The processes, which have to be reformulated, can cause great turbulence within the company and give rise to greater complexity and higher costs. This problem is often intensified by the expectation of senior management, that the core head office team can be slimmed down as redundant functions, such as production planning, manufacturing control or logistics can be set up in the new plants.

The effects of rushed relocations like this are the typical problems of a destabilisation phase, such as:

- Core head office team is over-stretched by the necessary transfer of knowledge and skills to the subsidiary
- Processes and responsibilities are not clearly defined between head office and the subsidiary.
- Customer communication is made more difficult because of the fact that contacts are spread further apart (e.g. planning at head office, production in the subsidiary plant)
- Lack of information flow resulting in a long delay in the transfer of information and resulting long planning and reaction times.

Medium-sized companies, which have hitherto mainly focused on their parent plant and are now expanding with new subsidiaries in Eastern Europe, are now facing a massive increase in co-ordination

and supervisory work, which they have simply not anticipated. The reasons for this include:

- Increased demands due to the complexity of the production network
- Communications and cultural issues: often language barriers and cultural differences are underestimated and communication between head office and the subsidiary is made even more difficult because of the geographical distances involved. Very often productivity and efficiency do not meet expectations, requiring greater supervision by head office.
- A limited supply of qualified technical staff often makes the transfer of knowledge, skills and expertise to the subsidiary more difficult. This makes delegation of responsibility to the subsidiary all the more difficult, with the result that planning and supervisory responsibilities remain with head office. This produces a drop in the quality of planning, as there is not the same level of feedback from the production plants.

The consequence of this is that the subsidiaries do not operate independently as was hoped but have to be strictly supervised and supported by the parent company. Unlike with larger organisations, medium-sized companies often do not have sufficient resources to deal with this bottleneck. The consequence of this can often be the destabilisation of the whole company, as capacities needed by the parent company are tied to the subsidiaries.

### 3. POTENTIAL MEASURES FOR IMPROVEMENT – PHASE MODEL FOR ADAPTATION OF ORGANISATIONAL STRUCTURE

To avoid the difficulties outlined above, the company must define a clear strategy as to how the new site is to be structured and how it is to be linked to the new organisation on an organisational level. Jacob, Meyer, Leopoldseder (Jacob *et al.*, 2006) propose a three-phase development process for the organisational structure, including a start-up, a stabilisation and a maturity phase.

This model is based on the assumption that the existing corporate structure does not undergo any major changes as part of the expansion; rather, it is simply a case of one branch of the organisational structure being extended. Accordingly, one objective of the maturity phase is to return to the original organisational form. However, in order for this to happen the existing organisation must be in a position to integrate the new units. Although this condition is met in most large, international companies, in the case of midsize companies it would appear necessary to specifically prepare the organisational structure for the expansion.

Therefore an expanded four-stage model is proposed for the development of the organisational structure of midsize companies:

1. Preparation phase (of the existing organisational structure for change)

2. Ramp-up phase
  3. Stabilisation phase
  4. Maturity phase
- (See Fig. 2.)

#### 3.1 Preparation phase:

In this phase the existing organisational structure should be prepared for change. The preparation phase serves to ensure that the necessary framework is in place to enable implementation of the phase model as described above.

In less experienced midsize companies, it is necessary to define and implement standards which in larger companies, or companies that already operate within a production network, are already in place out of structural necessity. Particular effort must be invested in the following areas, which are described below:

- Process management and documentation
- Delineation of centralised and decentralised functions and tasks
- Timely definition of an organisational structure that provides optimum support to the process organisation

Process management and documentation. In many midsize companies, the documentation of business processes serves merely to fulfil standardisation or certification requirements. It is not considered necessary to define or map processes in the interests of a smooth process organisation, because all parties are familiar with the processes, are working physically close together, and can easily communicate with one another.

Relocation creates additional requirements that affect both the processes that take place at all sites, and the processes that take place only at head office. When different sites are geographically far apart, it is no longer possible to compensate for unclear definitions of tasks and responsibilities by means of personal contact between individual actors. Moreover, in the ramp-up phase in particular, more capacities must be transferred from the head office to the new plant. This results in a lack of process expertise at the head office, which can however be avoided by implementing thorough process documentation at an early stage.

In favour of that an effective process management is vital, that considers the entire operational action as a combination of processes or process chains. As basis thereto a methodical approach starting with the recording of processes in the process landscape and a clear delineation, the documentation of rules for process execution to the point of the defined reporting of processes is absolutely necessary.

A systematic management of processes with defined key figures and measurements is conducive to the clarification and improvement of value adding processes, responsibilities and expertise and is leading to an alignment of processes to strategic objectives (Jankulik, 2005; Wagner 2006).



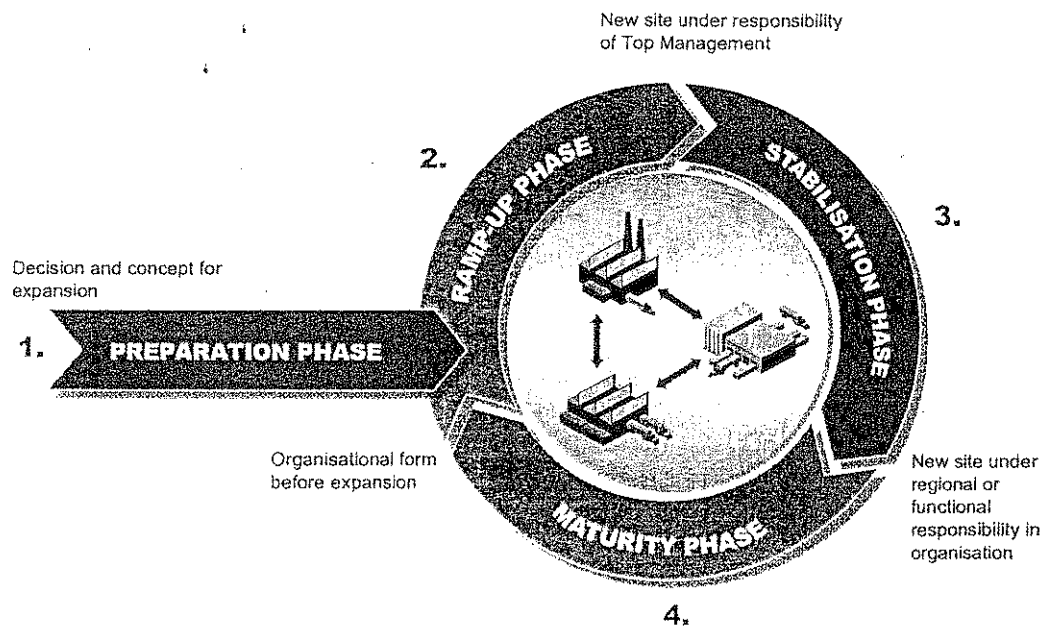


Fig. 2. Expanded phase model for adaptation of organisational structures in midsize companies

Prior to a relocation, it is indispensable, to define and document tasks and responsibilities exactly. It is particularly important to set out which activities are to be performed at head office and which at the other sites.

Delineation of centralised and decentralised functions and tasks. In order to avoid redundancies and a responsibility vacuum, it should be decided which tasks are to remain at head office and which are to be transferred to the other sites before the relocation. To gain an optimum balance between centralised control and decentralised autonomy, the core in-house performance indicator (in German Kerneigenleistungstiefe, KET) is particularly appropriate.

The method for determining the core in-house performance indicator was developed by the Fraunhofer Institute for Manufacturing Engineering and Automation (IPA). It takes the form of a scoring process which uses a combination of two evaluation factors to produce a value (the core in-house performance indicator) on which to base a sourcing or relocation decision. The advantage of this method is that it allows a company to reach a decision based not only on costs but also makes other criteria - such as the retention of production stability - measurable, such that they can be incorporated into the decision-making process. The main objective of the process, in this context, is to enable the company to make a well-informed decision as to the allocation of centralised and decentralised responsibilities.

Timely definition of an organisational structure that provides optimum support to the process organisation. In order to implement the phase model it is necessary to anticipate the final form the organisational structure will take before the site is established. As well as responding to the requirements associated with the relocation, this will help to avoid other turbulence and changes in the organisation as a whole.

The company must therefore examine whether the existing organisational structure is adequate for integrating an additional unit, and if not, how the existing organisation must be adapted.

In medium sized enterprises the organisational structure is based significantly on personal relations of involved persons in the organisation. Thus a new definition of company organisation structure as well as the determination of duties, competencies and responsibilities of the organisational staff is necessary before expansions and start-ups of new sites are implemented. Moreover most medium sized enterprises show a functional organisation, where a divisional organisation turned out to be a better solution for production networks (Jacob *et al.*, 2006), which is another reason for timely preparation and definition of the structural organisation.

### 3.2 Ramp-up phase

After the preparation phase is successfully conducted, the ramp-up phase can start. The objective of this phase is to open up new markets with agility and to quickly exploit factor cost benefits. Overall responsibility for all areas lies with

senior and top management, who are responsible for planning and implementing the structure of the new site. In this structuring phase, focused project management and good communication help to simplify and accelerate decision-making processes.

### 3.3 Stabilisation phase:

The objective of this phase is to achieve stabilisation and to utilise global synergies, as well as reducing scrap rates and raising quality levels. The focus during this organisational phase is to integrate the new site into the existing network. After this phase the new site is under regional or functional responsibility in the organisational structure and not any longer under top management.

### 3.4 Maturity phase:

At this stage, sustained, profitable growth is the long-term focus of the company's strategic orientation. The company should be looking to address new potential customers by diversifying the product range. On the management side, a return to the original organisational form, which was defined in the preparation phase, is expected.

## 4. CONCLUSION

When it comes to expansion or site relocation, a purely cost-based analysis focusing on the new site alone is insufficient if the changes resulting from the creation of the new site are not taken into account. This approach massively underestimates the destabilisation of the company as a whole. New sites can only be integrated into the network – and therefore fulfil their potential – if well-prepared organisational structures are in place. A clear strategy for the composition and structure of the network of head office and other sites should be defined before new sites are set up. The allocation of tasks to site and head office must be clearly defined. It is not only a question of incorporating the site into the network on an organisational level, but also taking into consideration what changes might be necessary in the existing structure. As a methodical approach for the expansion or change of the organisational structure of midsize companies a four stage model has been presented. In particular the importance of a preparation phase has been pointed out to ensure that the organisational framework is in place to enable the integration of the new sites or is adopted accordingly before the change. Suitable tools for establishing a balance between centralised control and decentralised autonomy include the core in-house performance indicator method, which identifies which activities should be undertaken by the head office and which by the sites, and also the clear definition and description of business processes.

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