Determining production management requirements in graphic arts companies

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Abstract: For some time, production management systems have been developed for and implemented at companies in the graphic arts industry. Earlier studies show, however, that many companies do not have enough resources in time or competence to determine the need for and the right level of a system.

This also depends on missing or poor business concepts and strategies. It must be clear what kind of production the production management system shall support.

This paper deals with production focus analysis in graphic arts companies, primarily of small size with up to 50 employees. The companies can themselves analyze their activities and focus with respect to a number of key figures and critical parameters (e.g. product structures, production equipment, collaboration and networking).

The results of this analysis will assist companies in making an appropriate specification of requirements for their production management system.

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Introduction

This paper is directed toward companies that have reached the insight that changes are necessary along with an implementation of a production management system. It is important that the companies themselves aquire the needed knowledge about their production to be able to define the requirements for a production management system.

A production management system has strong connections with the concept of CIM (computer integrated manufacturing) since computers today are used both in production and in administrative routines. An ideal CIM system applies computer technology to all of the operational functions and information processing functions in manufacturing from order receipt to product shipment (South 1994).

According to Vishwanadham (1992), a production management system regulates the manufacturing system at the operational level through its decisions regarding what to buy and make. Nordquist (1996) has extended the functionality regarding newspaper production to cover the entire production process and surrounding systems which indirectly or directly affect the manufacturing process.

It must be stressed that a production management system is not only a piece of equipment or a software package that is installed and used. It also involves persons and implies a permanent change of organization and routines. To succeed, everyone in the organization has to be involved and prepared for alternative scenarios.

Software demands on hardware and networks are not covered in this paper.

Analyzing production.

To be able to develop and implement a production management system you need to know your production, organization and routines. You also want your production management system to be consistent with your strategies and business concept.

There are no short cuts to do this. First you must find out the current situation. One way to do this is to answer a number of relevant questions. This paper describes one way of grouping and structuring such questions. The first group deals with a description of the production system. This part is quite general and is not unique for graphic arts

production. The second group deals with a description of routines and organization in an order handling process following the flow of an order through the company. The third and last group deals with some overall matters.

The benefit of answering the questions is not only in the answers themselves but also in the process of answering or trying to answer the questions.

By answering a number of key questions many things are achieved:

- You will get a lot of valuable answers.
- You will learn what information can be gathered with existing systems and routines.
- You will get to know what competence is lacking in the organization in order to make correct conclusions.

If a company recently have been working with a quality assurance system, e.g. according to ISO9000, some of this work might already be done and the results can be reused.

In the coming sections follows questions intended to establish the current situation to know what you are doing, how you are doing it and why you are doing it. The questions are compiled after studies at a number of commercial printers in Sweden. In a real case there should also be follow up questions to some of them depending on the answers. To some of the questions it can be difficult to give an exact answer but these are included to serve as thought-provokers and inspiration.

The answers to the questions will differ from company to company and will be of varying importance due to the type of production. However, for some of them it is obvious why they are important and for some short motivations are included. Some are also of a general nature and others are more detailed.

Strategic issues have to be adressed

Before analyzing the production it is advisable to do some reasoning about strategy in order not to make a production management system for an inadequate production system that is not consistent with the strategies and business concepts of the company.

Strategies are influenced by many things. Changes in the graphic arts industry has been dramatic in the last decade. Desktop publishing had it´s breakthrough in the second part of the 1980s, which together with the rapid development of digital printing has brought graphic arts companies up against new challenges.

If the development during the last decade could be described as driven by technological factors, such as the breakthrough of PostScript and other de facto standards, the future development appears to be driven, to a much larger extent, by the wishes and needs of the customers. The development has given the customers more alternatives than ever to choose among different suppliers, to choose what parts of the production process to buy from suppliers at all, etc.

All this means that graphic arts companies have to make strategic choices to meet new demands. Traditional graphic arts companies, at least in Sweden, are often characterized by a strategy resulting from deals made rather than from a conscious choice. The result is a diversified business, without direction (Aniander et al, 1996).

There are a number of strategic issues that a company must address. A traditionalist company is facing new competition based on two different strategies (see figure 1):

- Large companies, often specialized in one or few products, competing with low prices.
- Small companies, serving a geographically small market, competing with short delivery times and high service level.

It is almost impossible for a company to succesfully compete against low prices and a high level of services. Hence, the first strategic issue is whether the company should specialize in few products or base the business on a high level of services. The competitive positioning of companies is schematically described in figure 1.

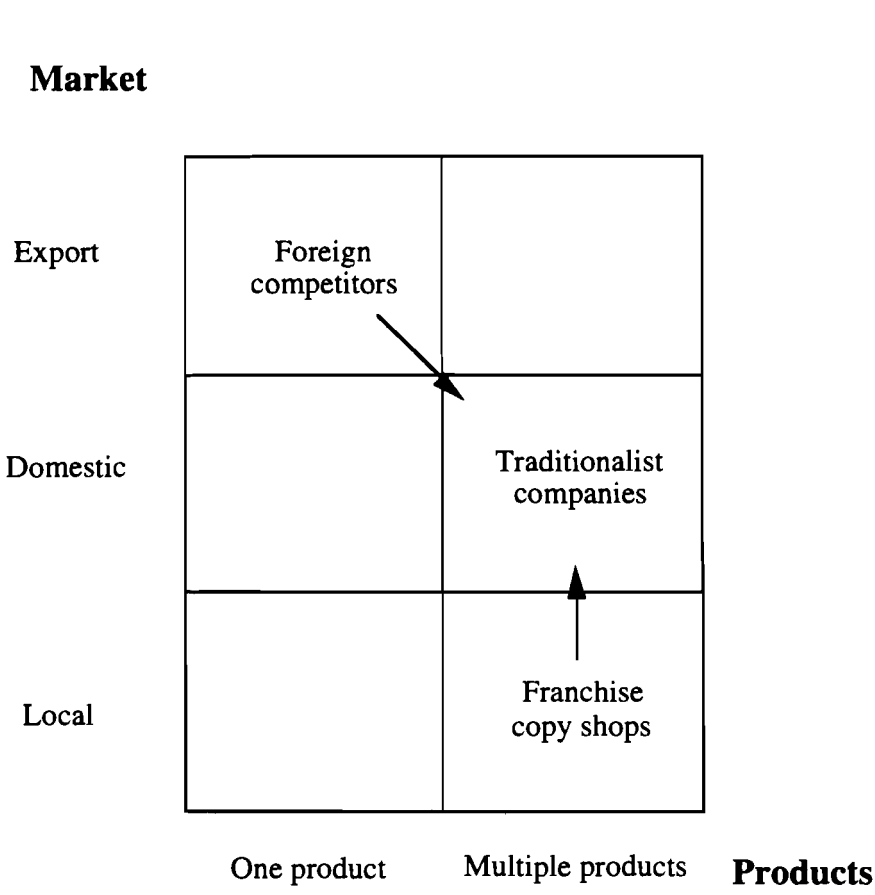


Figure 1. A schematic view over positioning of companies in the aspects of a global or local market and many or few products. (Aniander et al, 1996)

Relevant questions management in a company should ask in connection with figure 1 is:

- Is your company present in one or several areas?
- Is the company's position(s) obviously the right one(s)?
- Are future possibilities influenced by the fact that the company is present in different areas?
- Does the company experience different competition in different areas?

In order to answer these questions in a meaningful way, other questions could be stated as a means.

What do your customers prefer:
- Low prices?
- Short delivery times?
- Excellent printing quality?

What need do you consider to be most important to meet?

Which actions should be made in order to meet this:
- Is it possible to turn business proposals down?
- Should existing customers be more intensely cultivated?
- Should the business hours be changed? (When does the customer need to be served?)

The next strategic issue for the company is to determine which activity, or which activities, of the production value chain that the company should regard as it's responsiblity. Relevant questions concerning this issue are:

- Which activities of the production value chain is the company presently responsible for?
- Which activities are necessary for the production value chain?
- Are activities of today and tomorrow in concordance with each other?

Studies at a number of commercial printers in Sweden show that control of activities in the production value chain, especially the early activities, are regarded as very important by management (Aniander et al 1996). One could raise several questions in connection with that:

- Is it obvious that your company should control the activities it does at the present?
- Are there other ways of achieving this than through direct ownership?

An important strategic choice is how much of internal and external workflows that a production management system should cover:

- Shall the company implement a system of their own?
- Shall the company's system be part of the system of a dominant customer?

- Shall the company's system be part of the system of a dominant supplier?
- Shall the company's system be part of a joint system with other companies?
- Shall the company establish communication via EDI with other companies systems?

A digital workflow demands better management systems

In a traditional workflow for making printed matters a lot of the work was made by craftsmen. The flow of material was physical and visible, which made it possible to determine the status of a job by visual inspection.

In the digital workflow of today this has changed. The follow-up and control can no longer be based on craftsmanship alone. Hence, the production management systems must perform part of this control.

However, many studies have shown that it is quite difficult to computerize this kind of knowledge. Craftsmanship is made up of different parts. Tacit knowledge, i.e. knowledge that cannot be or has not been articulated is one part. In a study (Göranzon 1990) of how foresters assess the value of a forest, serious questions concerning the use of computerized decision systems are raised. It is almost impossible to computerize certain aspects of an experienced forester's skills. Moreover, the use of computerized decision systems tend to deteriorate the quality of the assessments, since young foresters lack of experience hinders them from evaluating whether the value assigned by the computer model is reasonable or not. This is not easy to resolve, since an important part of a forester's assessment consists of knowledge that cannot be articulated.

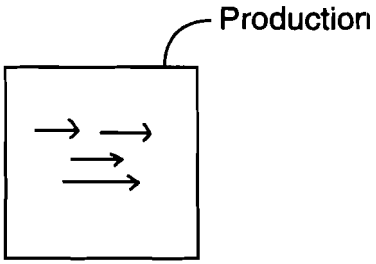
When determining the requirements for a production management system, tacit knowledge has to be addressed. Parts of the craftsmanship that has not been articulated have to be translated into requirements of the workflow model on which the system should be based. Other parts of the knowledge, parts that cannot be articulated, have to be provided by experienced craftsmen when the requirements on a production management system are formulated.

One part of the competence needed to determine the requirements of a system, thus should consist of important components of the craftsmanships involved in the production value chain.

Production system description

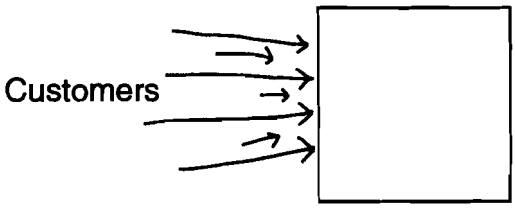
A simple way to describe a production system is to draw a box with arrows pointing in and out representing customers, products and flows (There are also arrows within the box representing internal workflows). Note that the arrows in the following sections not necessarily all represent the same thing. The box though, is the same.

1. Production, what is inside the box?



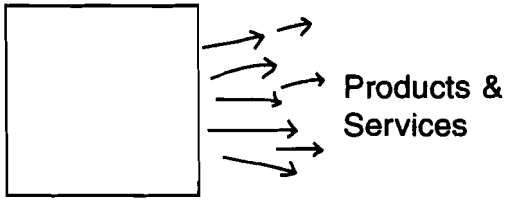
- What is the size of the company in number of employees and annual turnover?
- What is the number of and organization of operators, work managers and information administrators (planning and estimating functions)? What kind of education and experience do they have?
- Are responsibilities and authorities consistent?
- What part(s) of the total workflow for making printed matters is handled? Bellander et al (1997) has described the total workflow with six phases from product planning, creation and preparation of different components, page making and imposition, printing, postpress to distribution.
- What does the internal workflow for material and information look like? This question is essential and should be given extra effort. When you know how they are today it is easier to decide how they should be in the future. This can be done by using existing methods for activity studies, e.g. SDA – Systematic Description of Activities (Boström et al, 1986). These methods can be rather complex so an easier way to start is maybe to use the questions in the next section about routines and organization.
- What are the lead times for different product types?
- What kind of equipment is used? Does it have possibilities to gather and distribute production information to other systems?

2. Left side arrows. Customers.



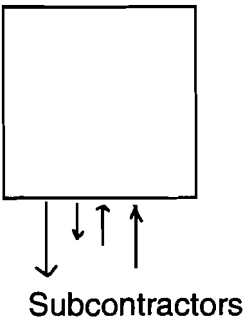
- How many customers are there? (Chosen period, e.g. year)
- Are there any dominant customers?
  How many of your largest customers do you have to accumulate in order to reach 80 % of the total volume, income and profit of the company?
- How does the external workflow for material and information look between the customers and the company?
- How many persons are involved with contacts to the customers and in what way?

3. Right side arrows. Products and services.



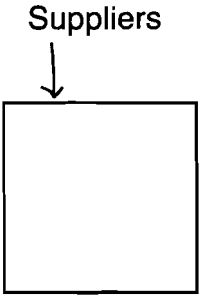
- Is production of make-to-order type or to inventory? If to inventory, how are the batch sizes decided?
- What are the medium and median value and the span for frequencies and sizes of orders? (Chosen period, e.g. year)
- Are the product structures shallow or deep? E.g. a one page leaflet with only text can be considered as shallow and a 200 page magazine with several signatures, inserts, ads and images as deep. The production complexity is bigger with a deeper product structure where different parts have to be ready before production can proceed in the next step.

4. Lower arrows. Own subcontractors.



- How does the workflow for this material and information look?
- How many subcontractors are connected?
- How much of the productions passes through subcontractors? Volumes and frequencies?
- For what reasons are subcontractors involved: technical capacity, volume capacity or other reasons?
- How are subcontractors chosen?
- How many persons are involved with contacts to the subcontractors and in what way?

5. Upper arrow. Suppliers.



- How tight is the cooperation with suppliers? How is information exchanged about the common workflow?
- How often are raw material purchases made and on what ground (make to order, to inventory etc)?
- How many different articles of raw material are there (e.g. different qualities of paper)? How much of the printing production is run on company standard papers?

- How much effort is put into prize negotiations compared with economic routines for inventory management? Where is most money saved?

The total picture of the company and its surroundings will look like figure 2. The ellipses represents possible coverages of a production management system. The system could be covering only the production and flows within the company but could also cover flows of material and information to and from customers and subcontractors of different extents.

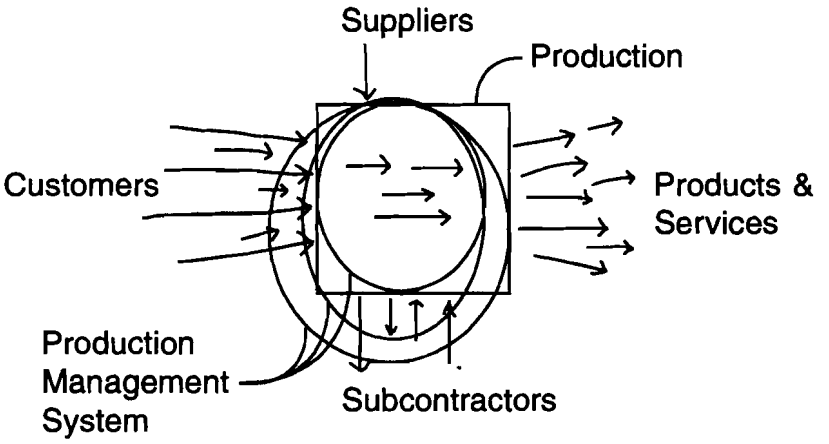


Fig 2. Schematic view of a company and its production management system scope.

Routines and organization
(From the company's point of view)

A certain process is taking place when an order is moving through the production. The following group of questions follows this process. In connection with these questions we will also find out if we have routines and information to easily answer them.

1. Shall we bid on this order?
- Do we have capacity?
  Technical capacity, do we have the equipment to produce this order? Volume capacity, do we have free capacity at our resources? If not, shall we buy capacity from subcontractors?
- When can we deliver?

2. Pricing and offering.

- What is the ground for prizing? Prime cost plus margin or estimated value for the customer? Pricing for graphic arts products is changing from a more product based model to a service model where the value for the customer is regarded. The same printed matter with the same prime cost can have different value for a customer under different circumstances, e.g. if it should be delivered in two days or two months.
- Do we know our prime costs?
- Do we want to take the order? Will it give enough profit? Will we take it anyway if it is to an important customer?

3. If we get the order?

- What does the order routines look like? What function does the registration of new orders? How are new orders registrered? How many persons are involved? How are orders confirmed to the customer?
- What is the organization and relation between the functions for estimating, scheduling, purchase and production? How do these communicate about future purchase needs and scheduled production?

4. Planning and scheduling.

- Which different planning horizons are there (e.g. year, month, week, day)? How often is the planning information updated in the different levels and why (e.g. change of load, changed priorities, differences in production data compared with plans)?
- Where is the border between scheduling and operation management?

5. Ordering.

- How are the operators in the production told what to do? Order sheet on paper, on screen etc.
- What are they told about what to do? Are they told the right things?

6. Production (including delivery).

- How is the coordination between different departments organized? How is information exchanged about the common workflow?
- What kind of reports are made from the production (e.g. time used on orders, produced volumes, used raw materials)? How are the reports made (written reports, on-line tracking etc)? When are the reports made in relation to production? Who makes the reports?

Reports are crucial to get to know the production. Common order information for all participants within the workflow and simple routines for production tracking would be helpful. This could be accomplished by using a standard format for description of products (Bellander et al, 1997).

7. Follow up.
- How are reports from the production used and by whom? (Actual costs, production statistics, base for invoicing etc)
- How is feedback given to employees?
- How high is the utilization in the different steps of production compared with manned time and calendar time?
- How long are the lead times compared with worked time?

Especially in smaller organizations it is important that reporting, combination and follow up is easy to make in order not to use too much time and resources. This is also important when you have a high frequency of orders with low order values.

Overall matters

1. Computer support.
- Which routines have computer based (supported) systems today?
- What are the levels of computer experience within the organization?

2. Economy.
- What kind of forecasts are made and for what reasons?
- How are forecasts followed up?
- Does the functions for estimating and scheduling use the same values for production speeds? How often are these values updated based on feedback from production reports?

3. Strategy and business concept plan
- What is the existing business concept?
- What are the strategies? E.g.
  - Delivery service.
  - Delivery precision.
  - Shorter lead times.
- After answering all the questions and attendant questions that might be raised, does the production support the strategies and business concept?

Conclusions

When all the questions are answered there are several possibilities:

1. If the strategies and business concepts not are the required these have to be reconsidered and reformed. To take the next step you must know where you are heading, which is something that not can be told from the outside but has to come from a strategic choice within the company.

2. If the strategies and business concept are the required and the answers are sufficient the latter can be translated into requirements for a production management system. The already existing routines should be incorporated.

3. If the answers are not sufficient the questions must be answered again with knowledge of what the answers **should** be, and demand must be put on the organization and routines to get the needed. The defined targets and the demands on the organization and routines can then be translated into requirements for a production management system.

In forthcoming research this questioning method will be tried at a number of companies along with studies of their actions.

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