PROCESS-BASED MODELLING METHOD FOR COOPERATION OF GROUPS OF MICRO COMPANIES

Gergely BABOS

Department of Information and Knowledge Management
Budapest University of Technology and Economics
H–1521 Budapest, Hungary
Phone: (36 1) 463-1832, Fax: (36 1) 463-1225
e-mail: greg_babos@yahoo.co.uk

Abstract

The European Union is heading for an extension in the coming year. These countries can fulfil the requirements predefined by the EU, only via an entirely modernisation. Modernisation must be rapid. For this reason the whole set of informational instruments should be put in. The modernisation should come off in a co-ordinated manner, which cannot miss the methods of information technology. The content of the market in these countries – especially in Hungary – is special. According to statistics[1], 96.81 % of companies in Hungary are so called micro-companies (companies having lower yearly turnover, than 800 million Ft.). As corporate informational systems in the World were created for application at mammoth companies, their custom implementation is only possible if such quantity and quality demands are put up for them. If we want to apply them to support smaller companies, then their co-operation needs to be stepped up on a higher level through organising. This organising job means on the one hand the organisation of the participant companies into a network (into a virtual company), on the other hand the adjustment of these companies – as system-units – operating to the requirements defined by the specific network operation. This system-organising job can be carried out with considering, that the network will have a unit, a CSP (Commerce Service Provider), that on the one hand performs the requirements of e-commerce – as from content as from outlook – and acts on Internet, but at the other hand handles the network in an extranet system at the same time and organises its work fulfilling continuously the requirements of e-commerce.

Keywords: process modelling, micro companies (SME – Small and Medium Sized Companies), CSP (Commerce Service Provider), grouping, SIPOC model.

Existing e-business software – just like ERP, CRM, SCM, etc. software – is installed on the CSP side (see *Fig. 1*), but this should be completed by software, that assures its connection with network system units. This transformational software cannot be integrated to all network solutions, because the particular system units can be different.
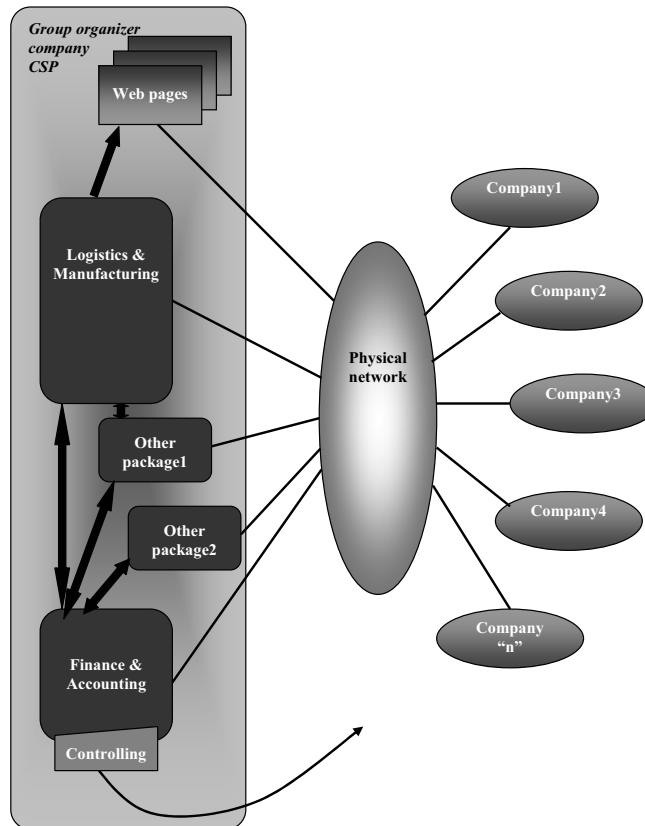
---

[1] Source: Világgazdaság

Fig. 1. Software solution for virtual company

1. Problem Analysis

Centuries ago handworkers concentrated in craft unions to utilize advantages resulting from joint-size. The main features of a craft union were the similar profile and the geographical similarity. At present co-operating groups the geographical similarity is not requirement anymore,[2] because of existing IT instruments to tide over distances. Furthermore IT gives new access to other aspects of forming co-operating groups, just like Internet technologies.

In the current situation micro companies do not have enough capital for the necessary IT development (e.g. implementing an ERP, or CRM system), moreover they have not realized the lack of such a system. Their relationships to business

---

[2]An exception is for instance the Tesco chain, that bands several small cultivators connected typically to one geographical region.

partners will be more and more weaker, because the higher the IT level of business partners, the weaker the connection-potential will be with the companies, that are not aligned with them. One solution is to enable micro companies to concentrate into groups in order to utilize the benefits of a group. The benefits are as follows:

- Necessary capital to make IT development;
- Synchronization, if the group contains a supply chain;
- Common usage of marketing channels, financial capacity, administrative tools, etc.;
- Optimal size of sales and finance departments;
- Optimal tax-payment possibility;
- Capacity for extended tenders;
- Decrease of investment costs;
- Equal partner to mammoth companies;
- Risk sink.

There are several possibilities to connect, or organize companies into co-operating groups. One method is shown in chapter 2 of the present study. To reach the required final status of a group forming an effective co-operating group, also some other matters have to be taken into consideration. Namely, these are difficulties, which need a solution, or at least a preparation. These difficulties can be:

- Employees and managers of the member companies will not be dedicated to co-operation, moreover they will be against group forming. As usual, employees are afraid of any kind of modernization and change. Its solution is: change management.
- Companies inside of the group can be competitors. Solution must be given to handle conflicts arising from the potential at competitors to carry out the same job. This can be handled by well-structured, predefined agreements and contracts.
- How to share costs (investment cost, activity costs, etc.) within the group? An algorithm should be built also for this issue, just like in the previous case.
- Will the companies have enough autonomy to appreciate the membership of the group? Will they have their own external contacts, or the central unit of the group will handle every relationship (as it is supposed in the model of chapter 2)?
- Implementing IT solutions, systems, using services of a central unit (a group leader/organizer) is costly. What prize forming method can be adapted in case of a group?

The above-mentioned questions must be at least answered, but some cases also solved in order to avoid confrontations and disagreement inside of the group. Certainly there are several more issues to take into consideration, but the most important ones are included in the list above. I deal with their specific solution models in my Ph.D. thesis, or see my publication: '*Magyar mikrovállalatok lehetőségei az*

e-business felé vezető úton (Possibilities of Hungarian micro companies heading for e-business)'[3] . In the present study I would like to draw the attention to conflict handling of tendering inside of the group, in case if there are more than one company in the group, who are in possession of the potential and show willingness to carry out a job.

2. Group Organizing Method

The leader of the group-forming process mentioned in the abstract of the present study is a so-called '*group organizer company*'. *The duty of the group organizer company is to assort the member-companies of the group, to define the functional general conditions of the companies and to organize, co-ordinate their operation.* The group organizer company can be one of the member-companies of the group (typically the promoter company); or an external company (so-called consultant company), who recognizes the need of grouping at a certain company; or a company being asked by another enterprise to commence the grouping.

The grouping process is the following:

- External and internal analysis of the promoter company;
- Definition of the convenient grouping method according to the results of the analysis;
- Selecting the member-companies of grouping, conducting of general sessions;
- Preparation of organizational plan of corporate operation;
- Covenanted formation of the group;
- 'Informatization' (supporting companies with IT equipments, systems and methodology) of the group;
- Control and co-ordination of corporate operation;
- Searching for defects, process improvement.

Each step is worth a detailed discussion, but in the following study I will focus on the step 'preparation of organizational plan of corporate operation'. The steps taken before, form the base of this phase. Consultants related to the supplier of the future applicable ERP system could be dragged into the modelling of the group operation, depending on the complexity of the group and corporeal possibilities. The first step is: the modelling of companies' main-profile forms the backbone of the group. Before starting with this, it is important to clarify the meaning of the process. According to the definition of Davenport:

> '*The process is a complex of structured, measurable operations that aims to produce a certain output for specific client or market.*'

---

[3]Presented by series 'Alma Mater: Sokszínű e-világ (Colorful e-World)', Budapest, February 2002.

The main-profile is usually a technological process or in case of a service-company, it is a service process. Models built in this phase are general models, not detailed ones. After having the general models (main-processes), the use of a modelling-method is recommended. Such kind of modelling method can be the so-called SIPOC method. According to this method each process has an input, an output, a supplier and a customer. This process modelling method is well applicable especially at modelling of supply chains, where almost each process unit is carried out by a separate company, so one process unit can be dedicated to one company. Each company has a supplier and a customer, and they are also members of a supply chain. N.B.: the group can be different from a supply chain of course, but most typically it can easily be modelled as a supply chain.
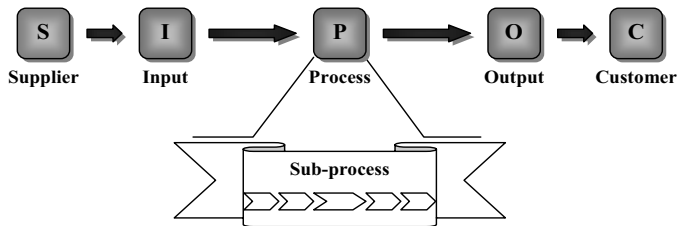

Fig. 2. SIPOC model

In the following chapter I will present a theoretical example for the usage of this modelling method, in the construction industry. The aim of modelling is on the one hand to understand the behavior and the acting of the group, on the other hand to find the conflicts – introduced in chapter 1 – inside of the group.

3. Modelling of a Corporate Operation

A *civil engineering company* initiated the formation of the group (named C1). They are usually main-contractors at channel constructions. They have problems with tendering sub-contractors, co-coordinating and organizing work-phases and finding the adequate sub-contractor. On the other hand they feel the lack of IT knowledge and instruments, they miss the methods, that bigger civil engineering companies use. Forming a group is a solution possibility for their problem. They look for a specialist, a management consulting company (group-organizer) to help them in the group forming.

During the formation, the *group-organizer* company (named C0) contacted all the suppliers and partners of company C1. Two *fabrics* (small companies, around 10 to 30 employees) *producing concrete pipes* (named C2, C3), three *fabrics* (also small companies, around 10 to 30 employees) *producing plastic pipes* (named C4, C5, C6), two *companies dealing with transportation* (with around 8 to 10 trucks

and other means of transportation, named C7, C8), one *company* (around 10 to 50 employees) *dealing with alignment* (named C9), two *civil-engineering companies* (who have similar profile to C1, named C10, C11) and one *accounting company* (this company is responsible for the book-keeping of C1 and supposed to do it further for the whole group; named C12) of them showed willingness to join the group. The group is illustrated by the following figure:
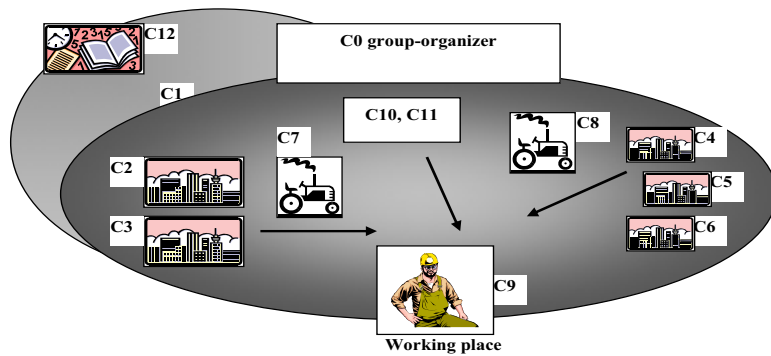

Fig. 3. Sample group

The following main-process can symbolize the operation of the group:
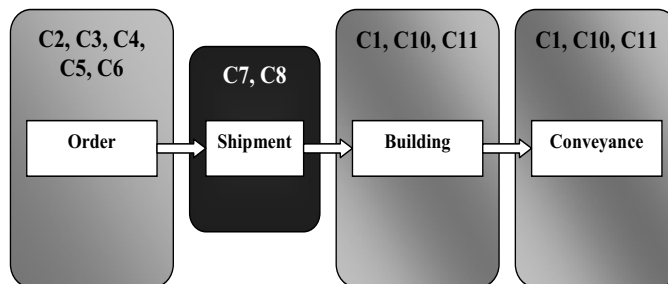
Fig. 4. The main-process of the group

From the point of view of physical activity of the group, the above shown main-process is convenient for the first analysis. Let us continue the inquisition of the process step-by-step according to the SIPOC modelling method!

The process shows that a new process called 'Production/Procurement' must be defined, being more precise it means the definition of two processes: 'Production' and 'Procurement'. Beside these a process called "Shipment" has to be introduced, but this process has already been mentioned among the main-processes. Supporting the usability, the processes should be administrated in a table to make easier the

<\\Order>

| Produc-tion/Pro-curement | Product (pipes) | Order | Ordered product (pipes) | Shipment |

S   I   P   O   C

Fig. 5. Order

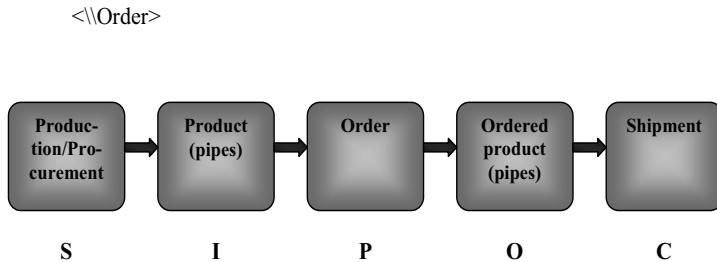handling of the processes occurring by the detailed analysis. The table contains the name of the sub-process, the library structure, where it takes place, a flag if it is completed and an indication for containing sub-processes.

Table 1. Bill of Processes

Name of process	Library structure of process	Status	Sub-process
Order	\\	ready	
Production	\\	open	
Procurement	\\	open	
Shipment	\\	open	

The 'Library structure of process' is important information to recognize the process – sub-process relation for the actual process. The status of the process refers to the completeness level of the process (if it has already been investigated). An elaborated process receives 'ready' status against 'open' status after completing the analysis of the given process. Let us continue with the process 'Production'!

<\\Production>

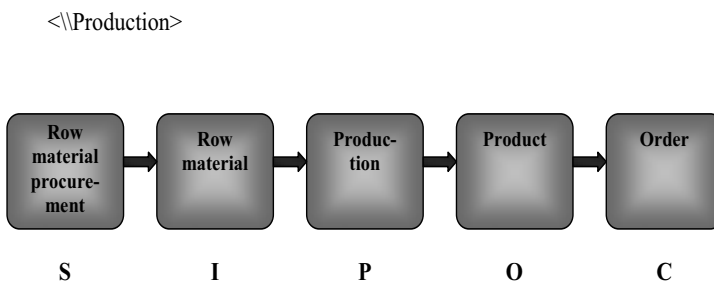| Row material procure-ment | Row material | Produc-tion | Product | Order |

S   I   P   O   C

Fig. 6. Production

Analyzing the process 'Production' a new process called 'Raw material procurement' has occurred. The new process has to be added to the Bill of Processes and the status of 'Production' is changed to ready. The following steps of this level are to be presented automatically, without any explanation. The events regarding to the processes are administrated in the Bill of Processes. The analysis is to be continued as long as a process is found running outside of the group, on the supplier or on the customer side.

<\\Row material procurement>

Row material supplier	Row material	Row material procure-ment	Shipped row material	Produc-tion
S	I	P	O	C

<\\Procurement>

Produc-tion	Manufac-ted product	Procure-ment	Product	Order
S	I	P	O	C

<\\Shipment>

Order	Ordered product	Shipment	Shipped product	Building
S	I	P	O	C

<\\Building>

Shipment	Shipped product	Building	Finished object	Convey-ance
S	I	P	O	C

<\\Conveyance>

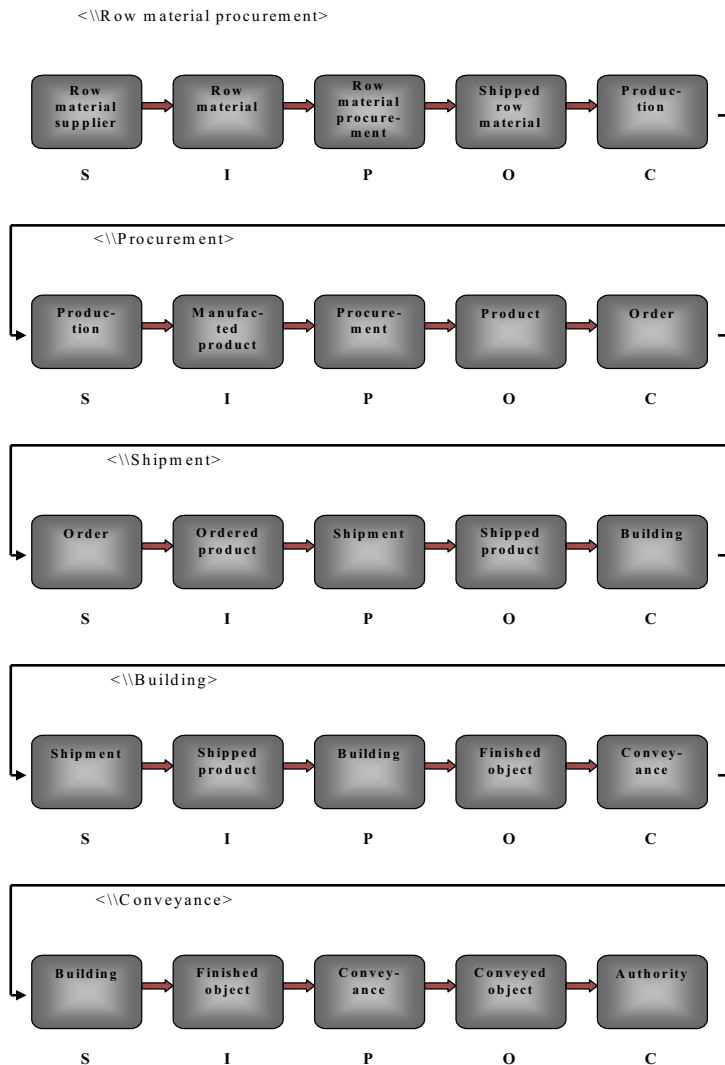| Building	Finished object	Convey-ance	Conveyed object	Authority
S	I	P	O	C

Fig. 7. Analysis of main processes

Table 2. Bill of Processes (1st update)

Name of process	Library structure of process	Status	Sub-process
Order	\\	ready	
Production	\\	ready	
Procurement	\\	ready	
Shipment	\\	ready	
Raw material procurement	\\	ready	
Building	\\	ready	
Conveyance	\\	ready	

The main-process has been analyzed, no further processes have occurred during the analysis, all of the processes have the status 'ready'. Now follows the analysis of sub-processes belonging to different main-processes via similar method as shown above.
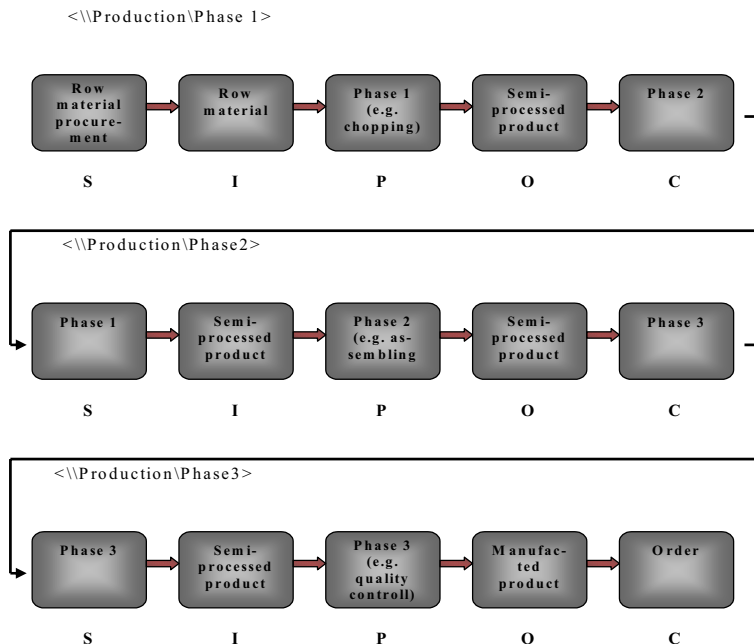
<\\Production\Phase 1>

Fig. 8. Sub-processes of process: Production

The sub-processes of the process 'Production' are the different phases of production. A process like this can contain several phases. It is useful to create each phase of all methods. Now I disregard this and show only 3 phases because it

is convenient to illustrate the modelling method as example. Different companies can carry out different phases. This is the necessary depth of the analysis, no more detailed levels are required. The following main-process containing sub-processes is "Building".
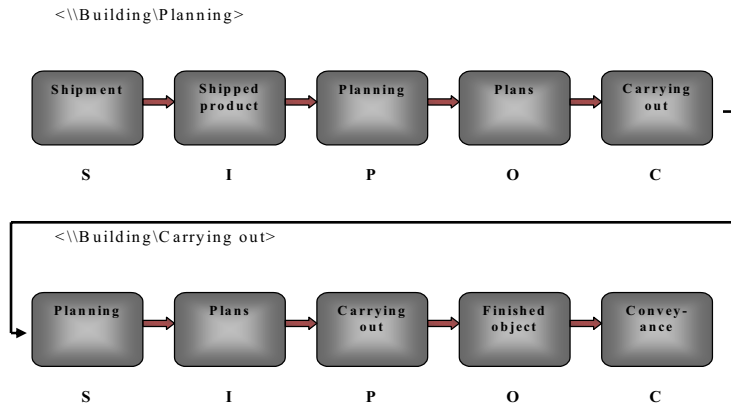
<\\Building\Planning>

Shipment		Shipped product		Planning		Plans		Carrying out
S		**I**		**P**		**O**		**C**

<\\Building\Carrying out>

Planning		Plans		Carrying out		Finished object		Convey-ance
S		**I**		**P**		**O**		**C**

Fig. 9. Sub-processes of process: Building

<\\Building\Planning\Preparation of plan of assignment>

Shipment		Shipped product		Prep. of plan of as-signment		Plan of assign-ment		Prep. of working drawing
S		**I**		**P**		**O**		**C**

<\\Building\Planning\Preparation of working drawings>

Prep. of plan of as-signment		Plan of assign-ment		Prep. of working drawings		Working drawings		Prep. of actualiza-tion plan
S		**I**		**P**		**O**		**C**

<\\Building\Planning\Preparation of actualization plan>

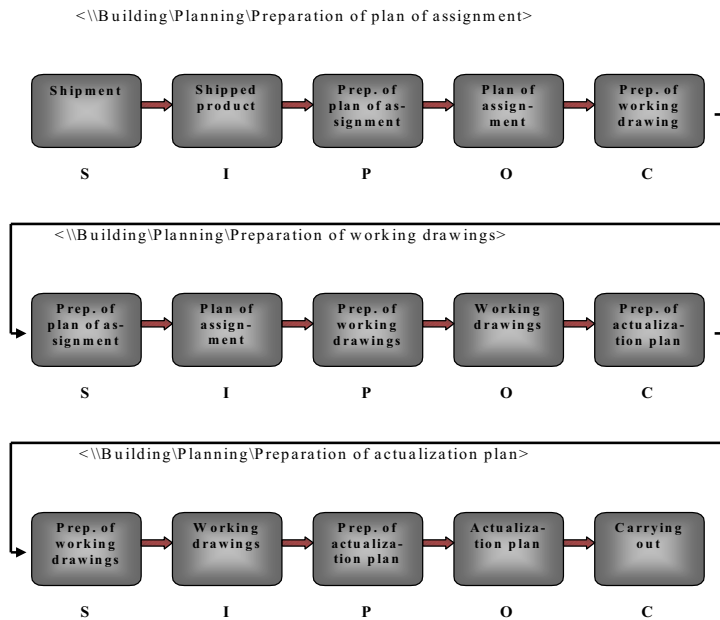| Prep. of working drawings		Working drawings		Prep. of actualiza-tion plan		Actualiza-tion plan		Carrying out
S		**I**		**P**		**O**		**C**

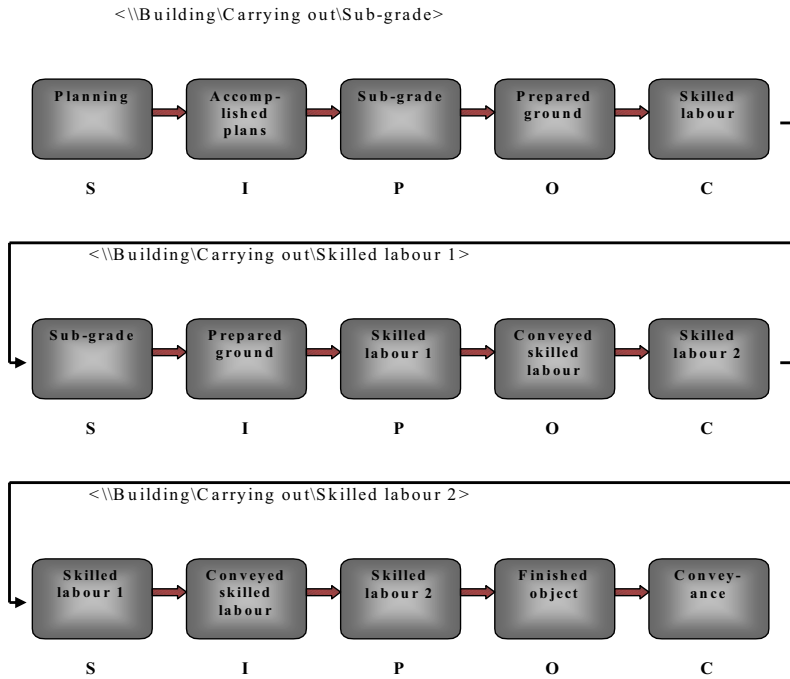*Fig. 10.* Sub-processes of process: Planning

Fig. 11. Sub-processes of process: Carrying out

The above shown processes can be detailed to sub-processes. In this case it is required, because the above said two processes can be accomplished by the co-operation of more than one company, so it does not cover the criteria of elaboration. The criteria of the elaboration say, that the process must be divided into sub-processes until a single company carries out the sub-process on the lowest level. The additional sub-processes are shown in *Fig. 10*.

Different companies can prepare each plan, but this is not adaptable in all occurrences. In case of working drawings further specification can be made of course, but this is not essential for demonstrating the example. The Bill of Processes in this phase looks like that:

The following process-analysis shows the sub-processes of the process 'Carrying out'.

Further sub-processes are also feasible by the analysis of the process 'Carrying out', but the narrowness of the above shown steps suffice the requirements of the example. The skilled labour can be for instance the building of a canal-spell, or preparation of a shaft, etc. The Bill of Processes was completed collaterally with the processes on *Table 4*.

The completed processes can form a flowchart. The flowchart should include companies or potential companies to execute the processes. The aim of constructing a flowchart is the definition of conflicts.

Table 3. Bill of Processes (2nd update)

Name of process	Library structure of process	Status	Sub-process
Order	\\	ready	
Production	\\	ready	3
Procurement	\\	ready	
Shipment	\\	ready	
Raw material procurement	\\	ready	
Building	\\	ready	2
Conveyance	\\	ready	
Phase 1	\\ *Production*	ready	
Phase 2	\\ *Production*	ready	
Phase 3	\\ *Production*	ready	3
Planning	\\ *Building*	ready	
Carrying out	\\ *Building*	ready	
Preparation of plan of assignment	\\ *Building \ Planning*	ready	
Preparation of working drawings	\\ *Building \ Planning*	ready	
Preparation of actualization plan	\\ *Building \ Planning*	ready	

Table 4. Bill of Processes (3rd update, complete bill)

Name of process	Library structure of process	Status	Sub-process
Order	\\	ready	
Production	\\	ready	3
Procurement	\\	ready	
Shipment	\\	ready	
Raw material procurement	\\	ready	
Building	\\	ready	2
Conveyance	\\	ready	
Phase 1	\\ *Production*	ready	
Phase 2	\\ *Production*	ready	
Phase 3	\\ *Production*	ready	
Planning	\\ *Building*	ready	3
Carrying out	\\ *Building*	ready	3
Preparation of plan of assignment	\\ *Building \ Planning*	ready	
Preparation of working drawings	\\ *Building \ Planning*	ready	
Preparation of actualization plan	\\ *Building \ Planning*	ready	
Sub-grade	\\ *Building \ Carrying out*	ready	
Skilled labour1	\\ *Building \ Carrying out*	ready	
Skilled labour2	\\ *Building \ Carrying out*	ready	

Row material supplier		Potential companies
Row material procurement		C2, C3, C4, C5, C6
Phase 1		C2, C3
Phase 2		C4, C5, C6
Phase 3		C2, C3, C4, C5
Procurement		C1, C3, C6, C7, C8
Order		C1
Shipment		C7, C8
Prep. of plan of assignment		C1
Prep. of working drawings		C1
Prep. of actualization plan		C1
Sub-grade		C9
Skilled labour 1		C1, C10, C11
Skilled labour 2		C1, C10, C11
Conveyance		C1
Authority		
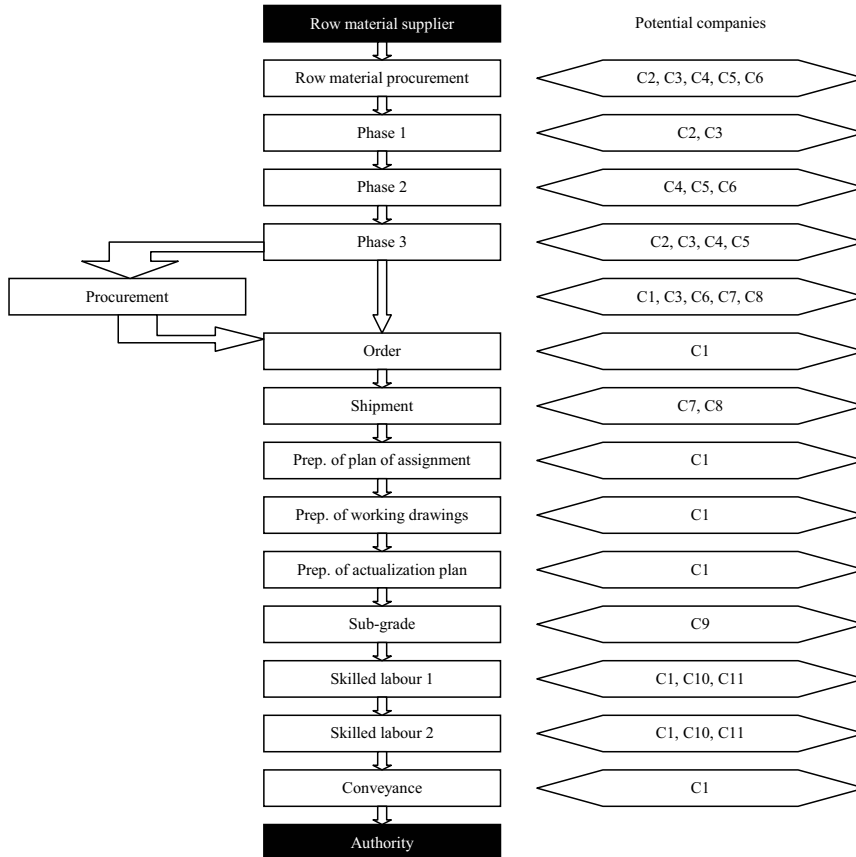
Fig. 12. Flowchart

According to *Fig. 12* there are several processes to be potentially executed by more than one company. A conflict[4] is situated before each of such processes; their managing is required! *Fig. 13* shows these conflicts.

The conflicts are marked in *Fig. 13*. A solution must be drawn up to avoid them. The simplest regulation is according to the optimum tender. In this case each of the potential companies sends in a tender to complete the job and the venture sending the optimum tender will carry out the job. Another possible solution is according to the identical average volume of the potential companies. In this case a mechanism calculates the former proportion and profit coming from the received orders and shows favour toward the one being in disadvantageous position. The

---

[4]Conflict = conflict at tendering, if more than one company is in possession of the potential and the willingness to carry out a task or job.
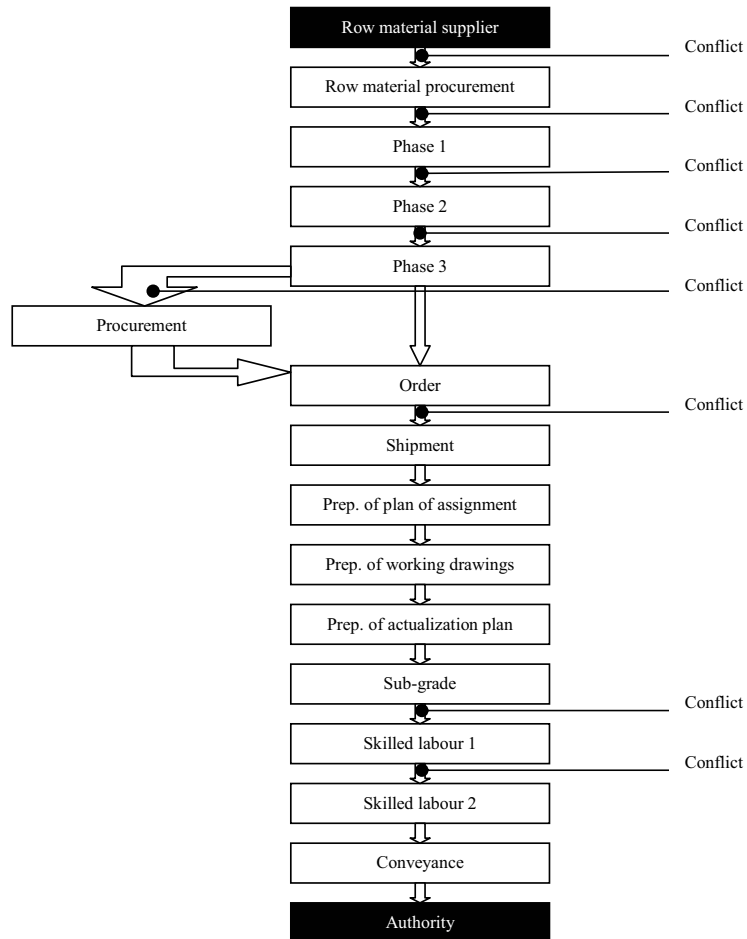
Fig. 13. Conflicts

following mechanism executes this regulation by the process 'Skilled labour 1' for example:

```
Extern long variable C1_overall_profit
Extern long variable C10_overall_profit
Extern long variable C11_overall_profit

C1_overall_profit = 0
C10_overall_profit = 0
C11_overall_profit = 0
```

```
SELECT C1_profit, C10_profit, C11_profit
FROM   C1_returns, C10_returns, C11_returns
WHERE  C1_phase, C10_phase, C11_phase =
       'Skilled_labour_1'

SELECTDO
    C1_overall_profit = C1_overall_profit
        + C1_profit
    C10_overall_profit=C10_overall_profit
        + C10_profit
    C11_overall_profit=C11_overall_profit
        + C11_profit
ENDSELECT

IF C1_overall_profit < C10_overall_profit
    and C1_overall_profit < C11_overall_profit
THEN DISPLAY(C1)
ENDIF

IF C10_overall_profit < C1_overall_profit
    and C10_overall_profit < C11_overall_profit

THEN DISPLAY(C10)
ENDIF

IF C11_overall_profit < C1_overall_profit
    and C11_overall_profit < C10_overall_profit
THEN DISPLAY(C11)
ENDIF
```

The short program above takes out the profit values relevant to the potential companies and the process from the database (from the accounting tables) and totalizes them into one variable. After this the program analyzes the relations between the above defined value of the variable and the other, similarly defined values of variables concerning to other companies and sorts out the variable having the least value in order to print out the incidental company. Beside printing out the program can execute a lot of jobs of course (e.g. it can send an order automatically to the sorted company to fulfill the process); the functionality above serves only for illustration. Logical traps can be built into the program of course, just like so-called 'Inconsistent triads', viz. if

```
C1_overall_profit < C10_overall_profit,
C10_overall_profit < C11_overall_profit,
C11_overall_profit < C1_overall_profit
```

– that is unimagined in case of a well constructed system – then it can be used to indicate the defect. Further difficulty can be the same value of overall profits. Its

probability is very small, but still positive, so preparations must be taken! In this case the agreement of the companies is authoritative.

The example above shows only one process. Further main-processes can also be defined, just like making a tender. Each phase has a financial aspect, but it is not discussed here.

4. Overview

Describing complex systems on an easy way... This is the point in modelling. From the several available methods I chose one to analyze a possible operation of a co-operating group. The aim of the analysis was to define conflicts inside of the group to show a possible automatic working out. Globally, forming of co-operating groups – containing either supply chains or partners – can be a solution for alignment of micro-companies and larger enterprises.

Several companies deal with market problems, some companies spend significant amounts to collect and organize suppliers and transporters and most of them have not realized, that in the coming years acting without IT background and equipments will not be possible, will lead to market shortage. Beside these none of the companies is in possession of enough capital to execute development or modernization alone. They are micro-companies. According to the method shown above companies will form co-operating groups. Their costs (especially trading and transformational costs) will be lower, and their co-operation and production will be faster. From the several advantages I would like to draw the attention on the possibility of market extension and trading via Internet, that will grow in the coming few years. Company groups will be matching partners of enterprises.

References

[1] SAMUELSON, P. A. – NORDHAUS, W. D., *Közgazdaságtan I-II-III* (Economics I-II-III), Economical and Loyal Publisher, Budapest, 1992.
[2] ULLMAN, J. D. – WIDOM, J., *Database Systems*, Panem-Prentice-Hall, Budapest, 1998.
[3] HETYEI, J., *Vállalatirányítási Információs Rendszerek Magyarországon I-II* (Corporate Informational Systems in Hungary I-II), Computer Books, Budapest, 1999.
[4] BRYANT, N., *Szakértői Rendszerek* (Managing Expert Systems), Novotrade Rt., 1989.
[5] BABOS, G., Magyar mikrovállalatok lehetőségei az e-business felé vezető úton (Possibilities of Hungarian Micro Companies Heading for e-Business) – Sokszinű e-világ (Colorful e-world), BME, Budapest, 2002.