THE CONSTRUCTION- AND FACILITIES MANAGEMENT PROCESS FROM AN END USERS PERSPECTIVE - ProFacil

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ABSTRACT
There is an increasing need for all actors involved in the construction- and facility management process to have a common framework for describing their work and creating a more efficient business process. In this paper we present a theoretical framework model from an end user perspective using IDEF0 methodology. The presented model is intended to be used to support more detailed construction- and facility management process modeling work being carried out in the multinational MoPo (Models for the Construction Process) project. It can also be used by any of the actors involved in the described process to detail their own processes.

Keywords – Framework model, IDEF0, construction process, facility management process, end user, support activities, operational facilities, business process reengineering

1. INTRODUCTION

Although construction process modelling using computer-supported tools is a relatively new phenomenon, companies and trade associations have made definitions of the construction process or its parts for many decades using less formalised methods. These definitions have for instance served the internal needs of companies for rationalising their working methods, the needs of the construction industry for standardised principles for setting fees as well as the needs of society or the clients for quality control. Often such models have taken the form of checklists of activities published by trade associations.
An important conclusion from studying earlier efforts is that construction process modelling can be done on many different levels, ranging from the overall life-cycle of a building, thus spanning decades, down to the technical details of how to install different types of building components. The motives and views of the models differ considerably from one level to the other. On certain levels the central motive for modelling may be establishing the borders

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between the activities of the different companies that take part in the construction process, as well as defining the flows of products, materials, information and money that occur at the interfaces. On other, more detailed levels, the exact sequence of activities needed for some technical task may be modelled, in order to increase job safety, minimise the risk of defects or even to provide information support for the development of automation and robotisation equipment.

During the 90's the need for more formalised models as well as better (in practice computer-aided) modelling methods has steadily increased. The proliferation of integrated CAD, document management systems and the Internet make it difficult for the different participants in construction projects to co-operate efficiently unless the data creation and exchange process is well known and agreed to. At the same time there is increasing commercial pressure as well as legislation which force companies to define their processes as a part of defining quality systems. Many companies striving for competitive edge, for instance in utilising the possibilities offered by IT, have launched business process reengineering efforts where process modelling has a prominent role [1].

Important earlier attempts to define formalised construction process models include the IBPM from Pennsylvania State University [2], VTT's model of the Finnish Construction Process [3] and the UK Generic Process Protocol [4]. Each of these efforts have had a slightly different focus. Both the IBPM and the Process Protocol work have tried to define normative models which try to illustrate to industry how it should work in order to become more efficient. VTT's model is closer to current practice and tries to define it more precisely using formal modelling tools, in order to facilitate communication about the process.

In the multinational MoPo (Models for the construction process) project the aims are not so much to build a comprehensive normative model of how the researchers think the process should work, as to create new computer-aided tools and modelling methods that would allow companies to build models for themselves, both describing their current way of working and possible reengineered processes [5].The MoPo project partners include The Royal Institute of Technology from Sweden, VTT and EUROSTEP Sys from Finland, and the University of Ljubljana, Slovenia

In order to establish a modular set of partial re-usable sub-models a framework model on a high level of abstraction is nevertheless needed. In the following a first version of a generic model which has been developed within the project is presented. The focus of the model is to define the relationships between the building end user's business process and the activities needed to constantly supply this process with operational facilities. The latter include maintenance, new construction and refurbishing activities. The model is generic in the sense that it models activities which are always present, although they may be performed by different parties under different contractual arrangements, and although the degree of formalisation may vary. Large public FM and building organisation have often have quite formalised procedures for the processes depicted in this model, whereas one-off construction clients often lack such procedures.

2 METHOD

The model is defined using the IDEF0 modelling method [6]. IDEF0 is one out of a number of available process modelling languages for which efficient software is available. It has been quite popular in construction process modelling efforts during the 90's and is regularly used in product modelling for describing the processes in which product data is defined and exchanged. An IDEF0 model consists of a set of activities, depicted by rectangular boxes, which are interrelated and may be arranged in a hierarchical decomposition. An activity needs

some inputs and transforms these inputs into outputs by use of machines or people in the organisation. Controls constrain these activities by specifying which conditions that actually are regulating the performance of an activity. The purpose of using IDEF0 is to the reveal the meaning of a particular activity, and to show the kind of information, material or energy, which is conveyed through the interfaces (i.e. arrows) of activities in the building process. (Fig. 1) shows the basic concepts of the IDEF0 method.

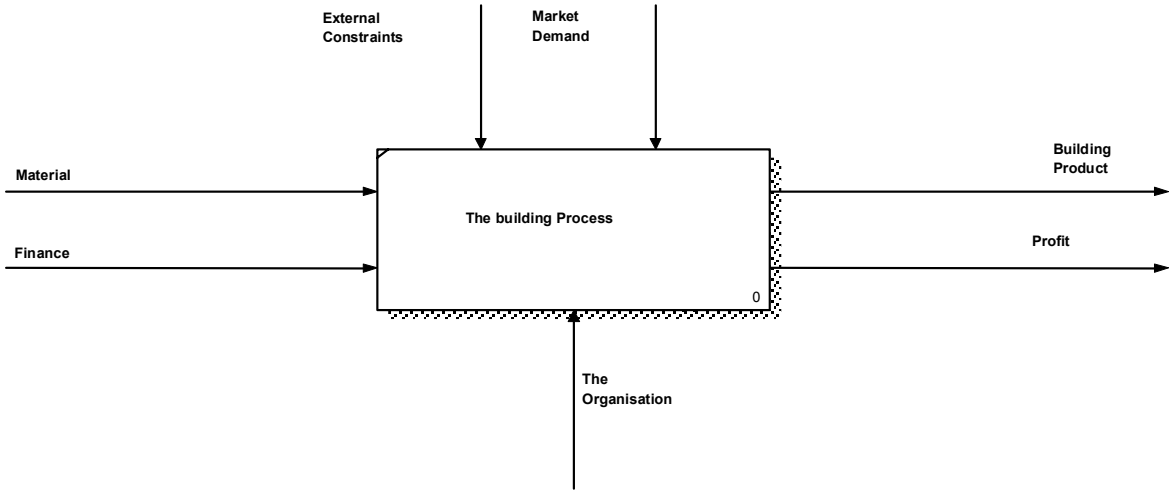

Figure 1. The basic concepts of the IDEF0 method.

Some examples which illustrates the use of IDEF0 syntax in our model:

- Inputs in our model; materials, land, facilities to be rebuild.
- Controls; demand, business plans, tactical facility plan.
- Mechanisms; the organisation, operational facilities.
- Output produced; profit, new, rebuilt or maintained facilities.

IDEF0 models are useful in focusing on the activities involved in a process. IDEF0 uses a top down approach which encourages a holistic approach. By using the IDEF0 methodology a process can be analysed as a hierarchical set of interrelated activities, where the diagrams at the top of the model are less detailed than those at the bottom. (Fig. 2) shows the decomposition structure of an IDEF0 model.

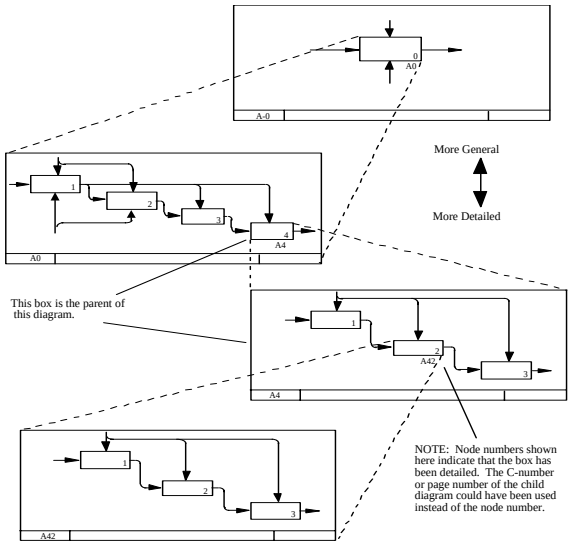

Figure 2. The IDEF0 decomposition structure.

3 THE PROVIDE FACILITY MODEL - ProFacil

The starting point of the model is the activity *Perform business activities of any organisation* (Fig. 3).

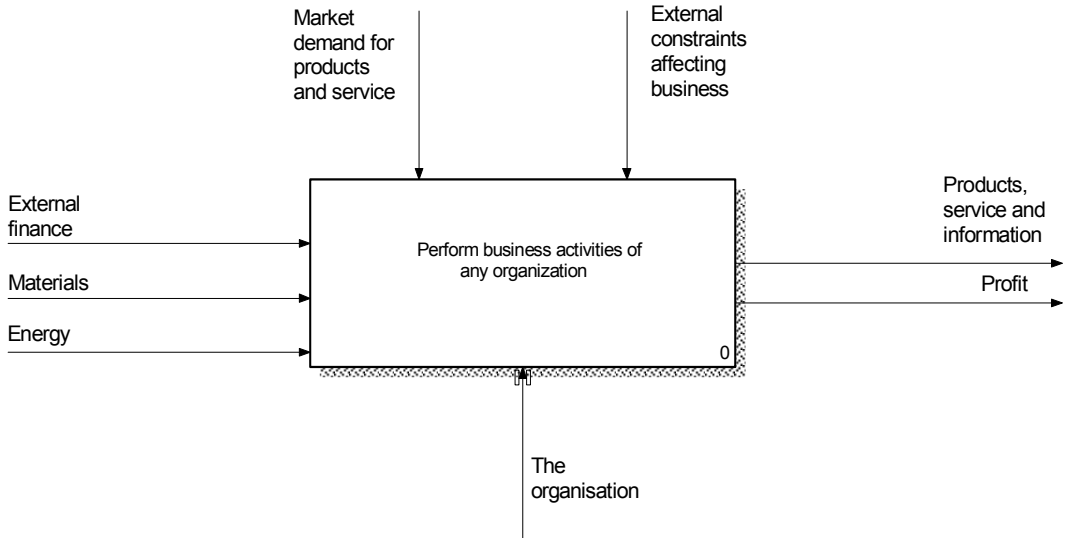

Figure 3. A-0 diagram. Perform business activities of any organisation.

It is assumed that the purpose of the organisation is to produce products, services or information, which has value to some external customer. In this early version we have modelled an organisation which sells its output, but it could equally well apply to a public non-profit organisation such as a hospital or a university, which is financed by tax money.

On the next level of the model we have included planning activities occurring on two different levels, as well as the actual day-to-day operations of the organisation (Fig 4).

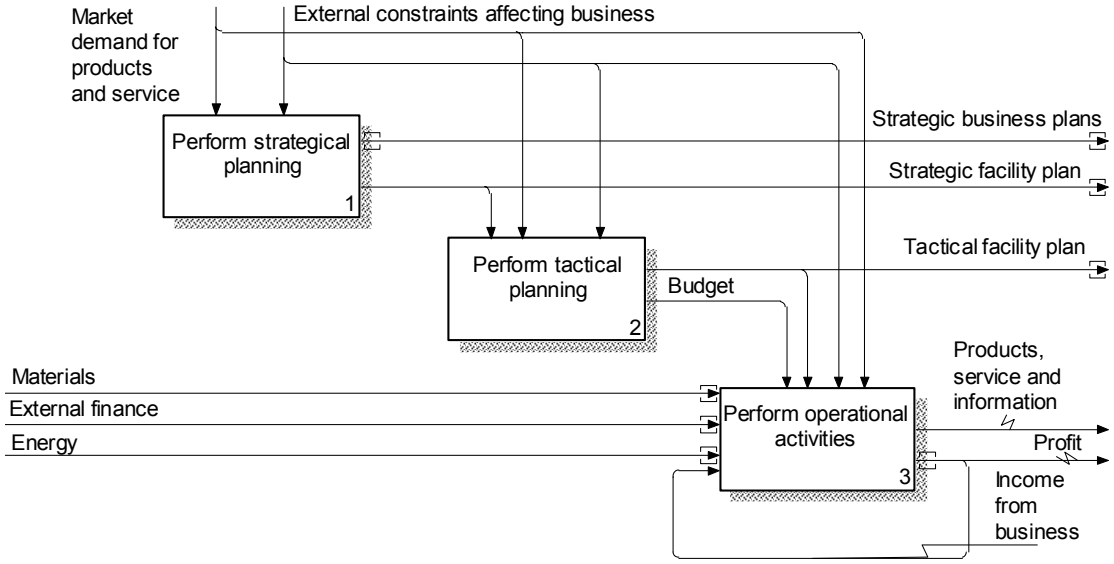

Figure 4. A0 diagram. Perform the business of any organisation.

By *Strategical planning* we understand the activities in the company, which study the long-term market conditions of the company as well as the opportunities offered by technological developments, funding etc. and which result in a strategic business plans for the company.

By *Tactical planning* we mean the yearly planning which typically results in yearly budgets for the different activities carried out in the company. The last of the *three levels* includes actually carrying out and monitoring the operations on a daily basis. Each of these three activities is then further subdivided into two different categories of activities; one dealing with what we call *the core business activities* of the company, the other dealing with the *supporting activities* (Fig 5*)*.

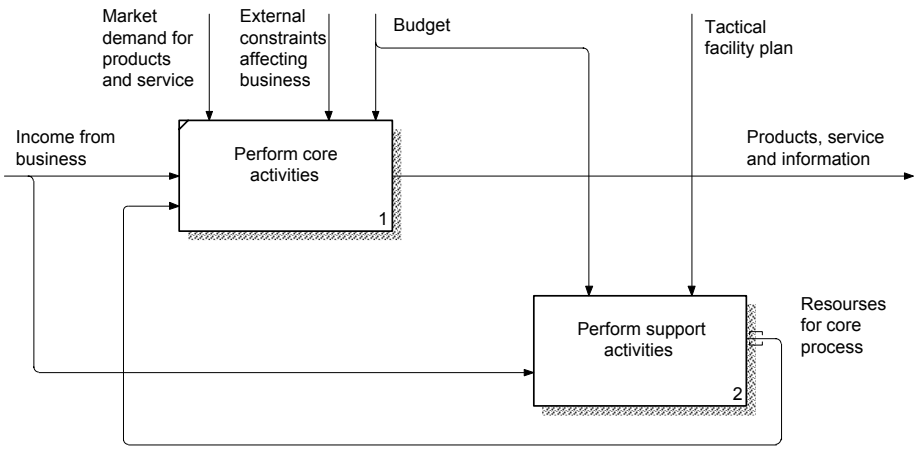

Figure 5. Diagram A3. Perform operational activities.

Examples of core business activities could be:

- In a university teaching undergraduates and carrying out research
- In a hospital examining and treating patients
- In a telecommunication company to develop and manufacture mobile phones.

Examples of support activities are:

- Paying the salaries of the employees
- Buying in stocks of materials needed in the core business
- Supplying the personnel with IT-equipment

Support activities can be further decomposed into five categories of activities (fig. 6).

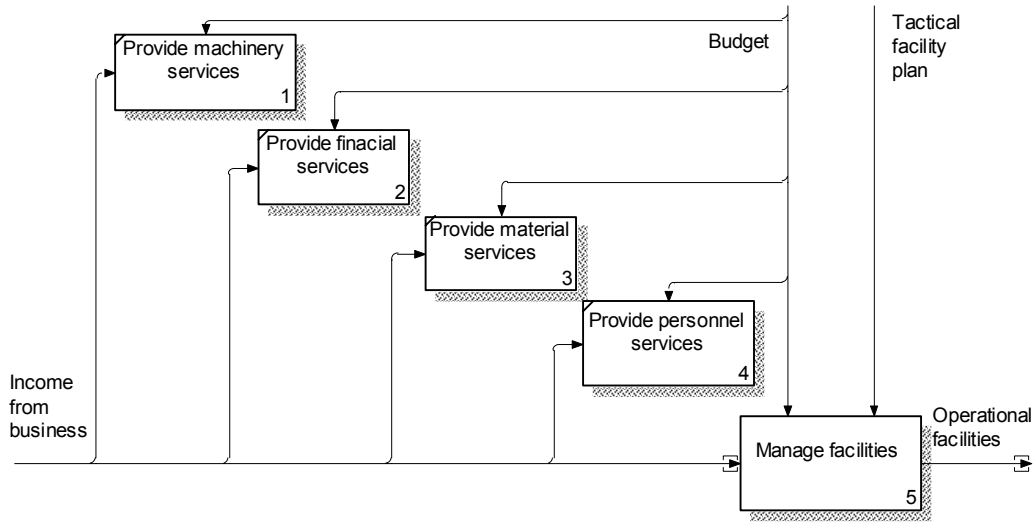

Figure 6. Diagram A32. Perform support activities.

This type of subdivision can obviously be questioned but we find it meaningful, because this provides the means to place FM activities into a larger context as only one out of half a dozen support activities which typically are needed to run an organisation. From the organisations viewpoint, well-functioning spaces and buildings are only one out of a number of resources needed as inputs to the core process. In larger organisations there are often specialised departments set up to manage these different categories of support activities.
It is important to note the links between the strategic planning of the core business and strategic FM planning. Signals to start planning for changes in the stock of buildings and spaces in use mostly originate from business plans which include quantitative and qualitative changes in core business activities.
On all the above three levels (strategic, tactical and operational) the FM support activities can be grouped into four different categories, depending of type of activities (Fig 7):

- Provision of a new or existing facility in response to a change of needs
- Rebuilding of existing facilities
- Maintenance of existing facilities
- Operation of existing facilities

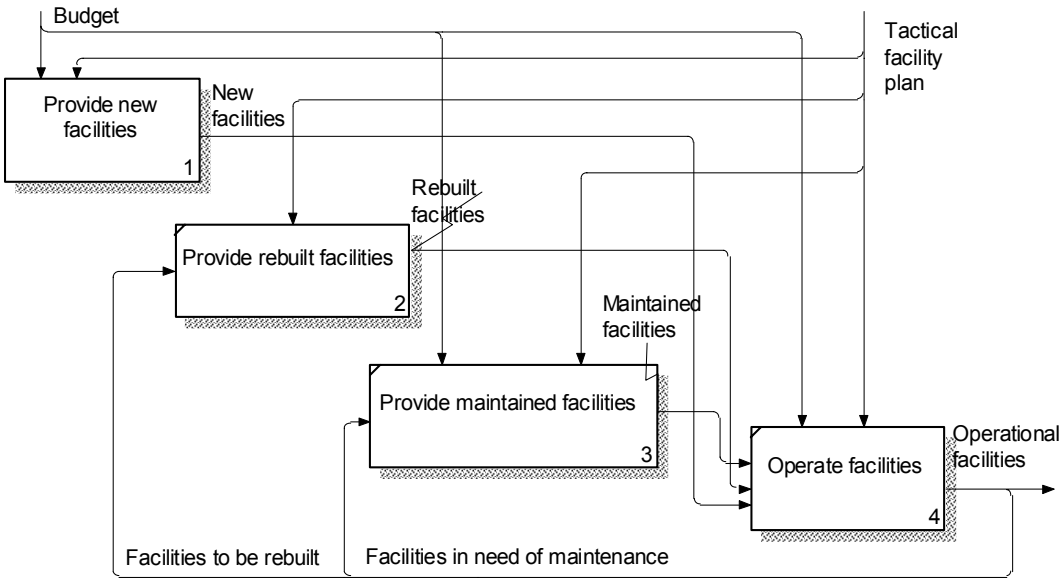

Figure 7. Diagram A325. Manage facility.

In a further detailing of the model the provision of a new facility can be provided in two separate ways (Fig 8).
Firstly through buying a built facility on the real estate market or renting facilities on the property market. Secondly by acquiring land and constructing a building. Or thirdly by rebuilding a building already owned.

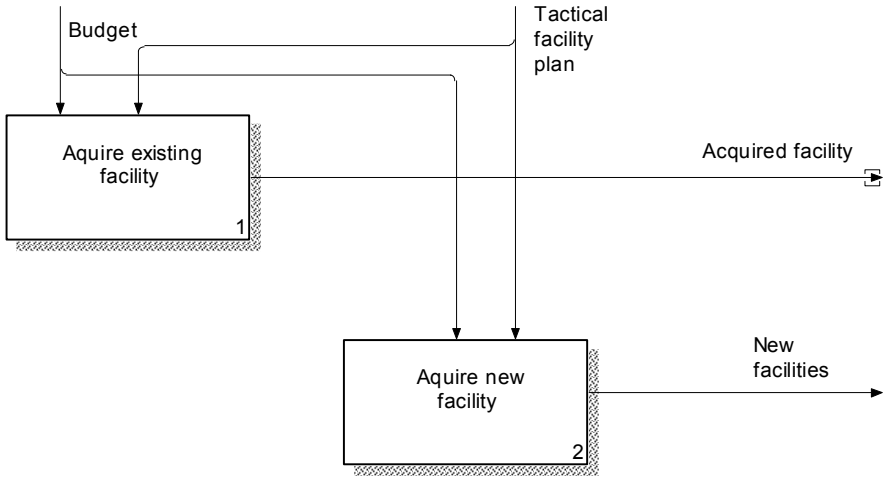

Figure 8. Diagram A3251. Provide new facility.

It is only at this level in the model, by breaking up further the *acquire new facility* that we find the familiar categories of *design* and *construction*, which are the central activities in many construction process models (Fig 9). This is after all not so surprising, due to the chosen focus of the model. If construction companies strive for more customer orientation, they could take a model such as ProFacil as a starting point and then integrate their detailed breakdown of the design and construction activities with it.

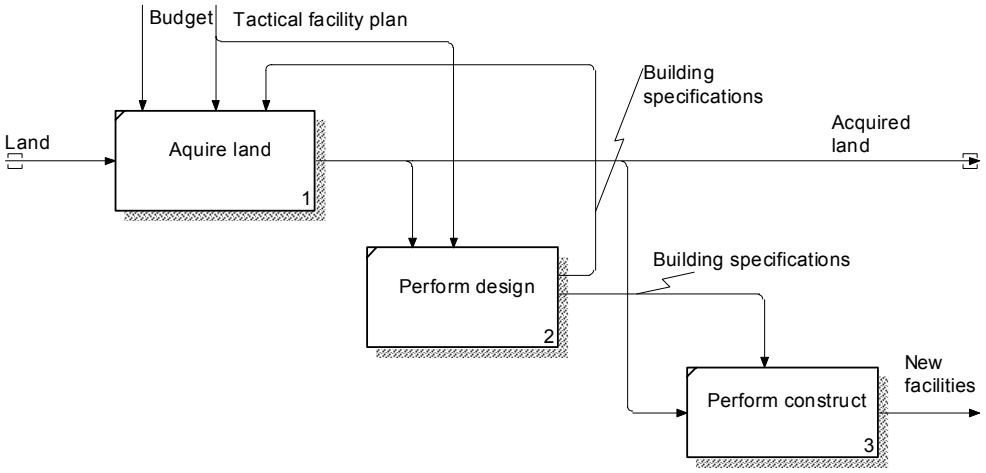

Figure 9. Diagram A32512. Acquire new facility.

4 DISCUSSION

The purpose of ProFacil is to give all actors involved in the construction- and facility management process a common framework from which they can clarify and develop their own business processes in an effective way.
What we have tried to show in this paper is the need to look at the process from the end users perspective. The reason for doing so is that the value of the building is mainly determined by the value it has in supporting the core business process of the user.
Having this perspective could help managers of companies involved, researchers, and other interested organisations to create a more efficient facilities process
In ProFacil, we do not in detail model strategical, tactical, financial, personnel, machinery or material processes in the organisation, but indicate the place for such activities in a more comprehensive framework, with the aim to position FM activities and their relationships to other such activities. This is a feature which has been lacking in many of the construction process models reported in the literature. One model which does contain some elements similar to ProFacil is the FM process model proposed by Svensson [7].
ProFacil does currently not contain more than six levels of decomposition, because lower levels of decomposition will be sub-models and are subject to further work within the MoPo project. It is important to note that the version of ProFacil discussed in this paper is a very early version of work in progress. Also some diagrams have been left out due to the restrictions on the length of this paper. Readers are encouraged to visit the MoPo project web site [5] to get the latest updated version of the model.
The model will be further refined and tested in close co-operation with the companies participating in the MoPo project. This will be done both through workshops with industry representatives and through interviews with domain experts and studying company documentation of their processes (internal guidelines, quality systems etc.). This testing has two interrelated aims. Firstly to test whether the model is an accurate description of reality (model validity) and secondly whether the model, and the way it is presented using the IDEF0 methodology, is perceived as useful by the company representatives.

5 AKNOWLEDGEMENTS

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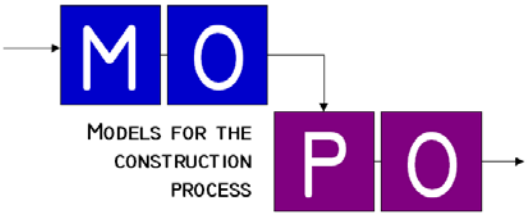

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