A Basic Business Loop as Starting Template for Customized Business-Process-Engineering Models

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Abstract

Conventional **Business-Process-Engineering (BPE)** consists of cautious small step improvements in succession to optimize target figures such as financial outcome, delivery time and leadtimes.

To support **BPE** for fast and focussed change, a simulation model on top and outside of MRP-systems in place is proposed. Useful business models for this task include the whole process from clients billing to suppliers paying. A continuous flow simulation allows to cover the long time horizons of several weeks to years to include the bottom-line-effects relevant for decisions.

Outside of existing MRP-systems means that alternatives of structuring the business-process can be assessed without the heavy reprogramming and database support needed, if you do this with the MRP-systems in place. We use process-chain-models with the appropriate flow calculations instead of the discrete-event type calculations of MRP-systems. This simplifications pays out in better focus on essentials such as dynamic control of the process-chains for the price of not going into the details of single piecewise operations.

A generic template as a starting model is used to cover the many-facetted problems of business-process-engineering in order to prepare the follow-up with a professional custom-model and simulation-tool for the real company's problems. Any final customized model is of course highly company specific.

A Basic Business Loop as Starting Template for Customized Business-Process-Engineering Models

Purpose of a template

The idea to use a suitable template as starting model exploits the existence of so called generic models described by Graham (1988).
In order to start the model-building and problem-identifying process in a focussed way, a template-model has to match two basic requirements:

- A minimum system represented should include the main business functions such as sales, production, production-control, supply, financial control, etc. in order to bring the subsystems interfaces into focus early.
- The minimum template starting model should allow for a relevant list of input parameters such as orders, deliveries, suppliers reactions and a connected output list of variables like orders lost, asset-turnover, costs and profits.

A suitable minimum system with selected groups of inputs and outputs will assure, that a loundry-list of generic problem-modes, see Graham (1988) is actively presented and allows a continuous enlargement to a multi-functional customized business-model. Inclusion of main business functions is a key success-factor to involve the people responsible. It helps to do the developpement of the submodels in parallel. With a focus on interfaces speed and simplicity results, getting from the template to the final customized company model.

Structure of the template

The reported template ist actually realised with the software MicroWorld® into which at present the Professional DYNAMO PD+®-models of different development-stages are imported. The description of the **Template Simulator** is organized into four segments:

-MicroWorld
-Infosystem
-Controls
-coupling of process-chain and accounting

MicroWorld®: Template-loops see fig. below. The system comprises the very much simplified structure of a business comprising the essential sub-systems that define its behaviour and profit:

-a supplier with his own planning
-a production process-chain
-a production and supply control system
-a sales operation trying to match backlog and market-driven delivery delay allowed

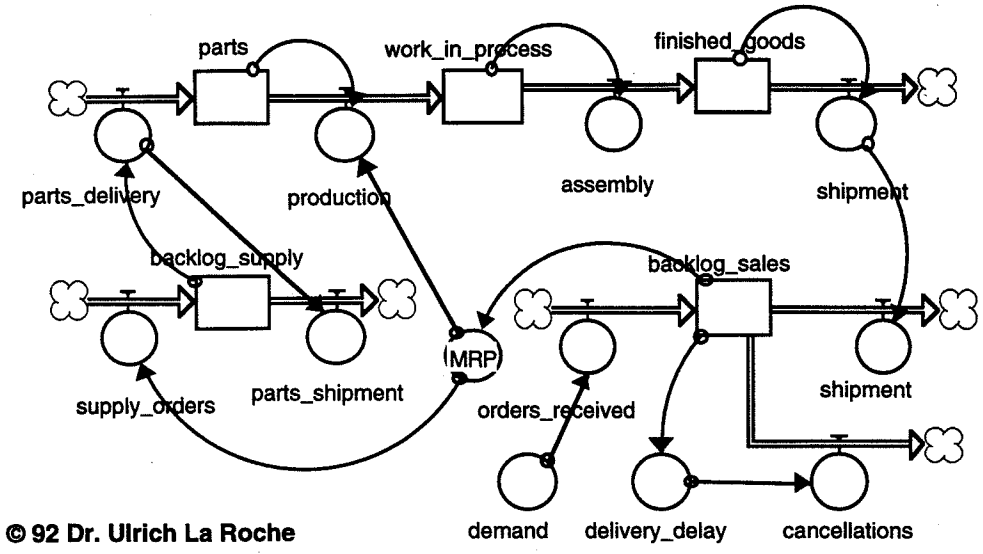
Infosystem. the simulator gives access to the accounting, operational and control situation at any moment in time such as:

-finances,
-selected elements of activity based costing
-operational behaviour with controls, costs, delivery, and other process parameters
-stocks and asset-turnover
-decisions taken on parameters (to be changed at any choosen moment during simulation)

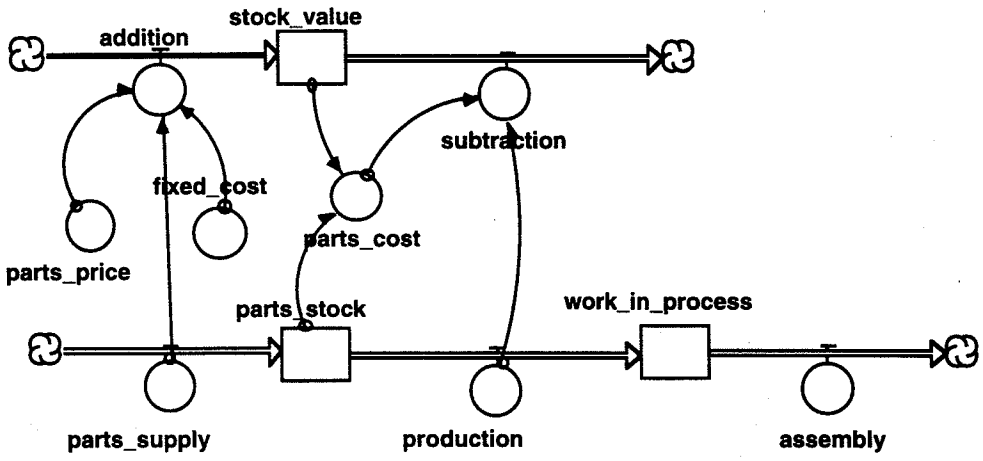
Controls. in order to adapt already the very simplified business structure to representative values and parameters of the clients company, a number of controls for the simulation runs are provided, such as:

-demand variations
-supplier behaviour
-business control parameters
-client behaviour
-cost structure
-operational parameters

Causal-Loop-Diagram of Template



Coupling of process-chain and accounting. The accounting is coupled to the process-chain by attribute-calculus. Consider for example the process-stage of parts_delivery to the parts_stock, fig. below:



The instantaneous value of the parts_stock is the integration of the input-stream added and the output-stream subtracted. Any material flow in the process-chain is in a similar way coupled to a flow of value (dynamic picture of the value added chain). For Activity-Based-Costing the process-chain-model with acounting attributes gives all the cause-effect information and insight to select the measures that really have impact.

Suppliers behaviour and integration

The coupling of the supplier to the company is a critical point in question. The model supplied provides the following alternative procedures:

- netdemand-driven supply. it operates after the rule that for any supply-order received, the actual supply will only fill the supply-pipeline to a prescribed level.

- control-modes. we can make a choice between the so called capacity-mode, which means, that all the activities will get in the same moment in time the same production-signal, or

the so called backterminated-mode, which means that any process-stage gets its signal backterminated from a planned shipment date.

Suppliers therefore can be integrated into the companies business by very different control structures with quite different impact on behaviour and consequently financial impact.

Business control parameters

For the control system, abreviated as MRP-system we have the choice of backterminated or capacity-control. Further leadtimes and capacity-startup-times can be adjusted to represent your case for any process station.

Clients behaviour

A critical parameter is of course delivery time asked for by the client compared to your delivery time, which will control the cancellations of orders you succumb to.

Accounting and business process

The basis for the attribute coupling of accounting and process-chain-model is the standard accounting procedure to calculate costs by differentiation of time-dependent and volume-dependent costs, known generally as fixed and variable costs, allocated to the individual process-stages of the process-chain-model.

The template and later on developped model versions are presented to the management team using the **Cockpit-design of Microworld®** with three windows:

1. **Simulation parameters:**
   Gets access to change the parameters for:
   Demand
   Supply
   Planning permanent
   Planning cost
2. **Reports**
   Gets access to information-files and the overall-Process-chain of the template simulated for the last period.
3. **Graphs/Tables**
   Provides Graphs or Tables of the simulation reports provided.

The most important graphs/tables are:
-finances,
-elements of activity based costing
-operational behaviour with controls, leadtimes and delays
-stocks and asset-turnover

Scenario's for e.g. Business-Process-Engineering

The general task of maximising asset-turnover and net product contribution is dependent on the type of demand variation the business is subjected to

There are four demand scenario's provided, which can be added in any proportion:

test0: a step of heigth +20%
test1: a sinusoidal variation +/- 25% with time period persin
test2: a ramp increasing be slope per unit time
test3: a square wave +/- 25% with period per

An instructive gaming exploration tour would cover these four scenario's in a contest to arrive at maximum accumulated profit net product contribution at the end of e.g. a 100 weeks period. To illustrate the functionality of the approach reported, a few exemples are given of possible model interactions.

MRP

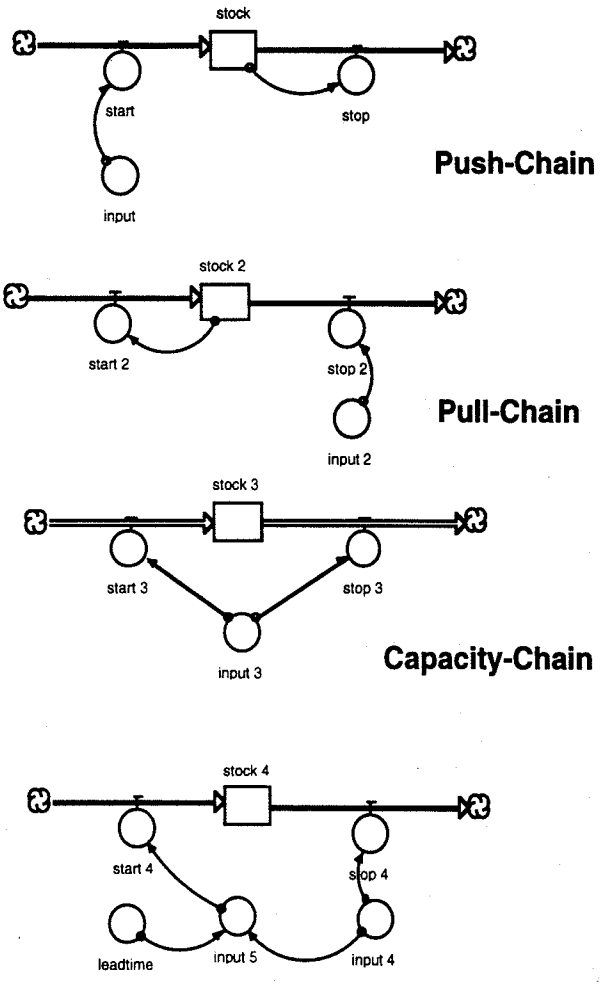
Capacity- or backtermination-Control
-reaction to different planning as given by variation of planning period and demand scenario
Planning parameters

-planning period in capacity mode or in backtermination mode. Use of different d emand-signals (test)
-use of feedback in capacity or backterminated operation.
Feedback means, that any difference in shipment to planned volumes is added as correction to the planning, closing the control loop.
effect with capacity control: adding to capacity signal
effect with backterminated control: delayed by total leadtime

Sales

Adjustement of Delivery Delay:
-For the planning case given by the parameters for planning period and control try different permissible delivery-delays to get minimum cancellations. Watch for the consequences of finished stock, when the leadtimes are kept unchanged.

The different types of process-chain control and its application in the basic model



Production & Supplier

Adjustement of leadtimes.
-smaller leadtimes will get a quicker response, but more problems with stocks. Start by experimenting with only one process-stage
Supplier-Integration.

-simple ordering, netdemand policy or integration into MRP are ways to influence thesuppliers behavior and its repercussions on your business. e.g. check best method to absorb sudden variation in suppliers leadtime.

The model developpement process

Using a template model at the start is the essence of broad model building experience in the field. The approach lends itself to an interactive and repetitive model building process, described below.

Step 1
Model building is started by a provisional problem exposure of the people concerned with BPE using the template model and adjusting its parameters to fit the case. A first assessment of the key problems to focus on is established. The tool is a gaming version e.g. in Microworld® format.

Step 2
Here the system expert starts to expand the template model structure towards the actual business process-chains. This is a phase of very down to earth identifying the real process tohether with the people involved.
Interview results are iteratively played back and verifyied by simulation. As a tool e.g. Professional Dynamo® has its strong points, beeing sufficently fast for complex models and at the same time very portable to a ubiquitous PC-platform base with very modest system requirements.

Step 3
Putting the pretested subsystems together gets an updated version of the customized business-model. Replaying historical business records and other tests serve to validate this model e.g. playing back accounting, sales and delivery behaviour for short (Weeks) and long (Years) time intervals.
When after some modifications the validation is satisfactory in view of the problem fcussed, the model is imported into e.g. Microworld® to present selected situations and problems in the form of ganes, which leads us back to step 1 for the next round.

The repetition of focussing and problem solving is used to assure a concurrent build-up of the customers model and the understanding and commitment of the people involved. In practical cases there will be needed something between three to ten repetitions to arrive at the final model from scratch.
How to integrate with discrete-event subsystems was proposed by La Roche (1992). The continous models discussed here are of top-down nature and meant as an integrative background for subsystems not amenable to continous modelling.

Practical applications

Positioning of approach is found to cover the following representative applications:

-**Audit** for financial and operational parameters such as return on assets, leadtimes, delivery-delay and delivery-flexibility, asset-turnover

-**Tool** for activity based costing

-**Diagnose** of MRP-systems

-**Piloting and Checking** restructuring projects to reach operational and finacial key figures, see auditing

-**Quantitative** evaluation of strategic investment decisions

Conclusions

As borne out by La Roche (1992), use of a continuous top-down model of the business-process-chains is a useful and versatile tool to get the grand picture of the really worthwhile improvement directly reflected on the process. Because restructuring usually means change of processes on a continuing basis, the focus on control-loops, stocks and rates of a continous model is a simple and effectiv minimum simulation implementation.
The approach is one of the very few solutions to close the actual gap between prediction and evaluation time horizon of classic MRP-Systems with piecewise operation and midterm strategic planning of some weeks to years at reasonable cost and with due flexibility while changing structures of process-chains.
It is also one of the very few effective tools to treat so the called "soft process-chains" in departments of administrative nature like developpement, sales, supply, etc. in order to really optimize the company as a whole.
Focus of the application of top-down continuous process-chain models is a behavior prognosis, and an ongoing quantitative evaluation of the bottom-line impact of general business-control.
The dual use of software for gaming and supporting the validation of field-work in complex process-chains was the procedure distilled from practical cases.

References

Alan K. Graham, Generic Models as a Basis for Computer-Based Case Studies, Proc. of the ICSD La Jolla 1988

Ulrich La Roche, System Dynamics Analysis, a Prototyping Tool for Production System Design, Proc. of the ICSD Utrecht 1992

Trade names

Professional DYNAMO PD+®, MicroWorld® are trade-names of software for simulation cited in the text