Simulation for Industry and Services

By studying in detail the stakes and parameters before each decision, simulation gives the manager good visibility of his process and therefore a major competitive bonus.

Factories submitted to many constraints

Consider a manufacturing unit, after recent decades of changes. Its behaviour is shaped by many constraints: it must produce, in a flexible way, limited series of highly customizable products, without stock, without too many operators, without defects, within no time - and sometimes even without plants!

There are other kinds of constraints: those linked to people, environment, logistics, and so on. Add some worldwide competition in the background…

The industrial workshop has become the center of a great complexity. How can we deal with it?

No matter what are the fundamentals of his industrial organization, the manager of a factory must face concrete questions: which level of intermediate buffer is tolerable, which batch size is preferable, which delay for delivery, which schedules, how much investment, which profitability for the workshop?

The advantages of simulation

To simulate means to create a virtual prototype on the computer (the model) representing the system to study, and to apply to this model the rules of the real-world system, in order to be able to conduct some experiments, rapidly and at small costs.

On this model, the system is examined globally, taking time into account, and focusing on flows that constitute the system. The end-user may develop designs of experiments to cover a set of possible options in the factory.

One can measure the impact of an investment, observe intermediate stocks, simulate the manufacturing cycle of a new product, or test new scheduling rules. To sum it up, one can get reasonable answers to concrete questions.

Only simulation can take into account the dynamic aspect of a production system: one part waiting for another, downtimes, shared resources, random phenomena, etc.

Each question gets a numerical answer that has been computed using the constraints of the industrial system.

This technique requires a minute analysis of the real-world system, experience in creating models and in exploiting the results. It is meant for operational units in a company: production, planning engineering, scheduling, projects, logistics, etc.

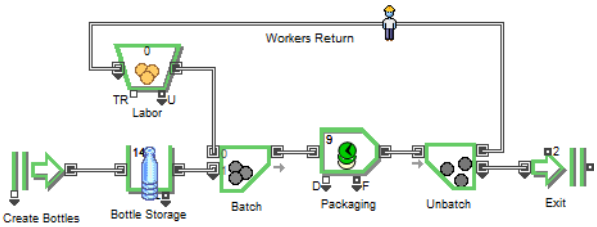
1Point2

1Point2 had already joined the family of simulationists by the 80's. Trained in the United States and in France to industrial engineering techniques, the staff took an important part in spreading simulation concepts and techniques in France.

1Point2 offers several types of services, such as:

- building models with all levels of interface,
- training in simulation techniques (introduction short courses, professional training in software tools and methodology, teaching in schools and universities),
- developing vertical libraries,
- distributing simulation software (also providing technical support and assistance).

1Point2 has experience in simulation in many different fields, for the major corporate industries.



All models illustrating this document are built with ExtendSim™.

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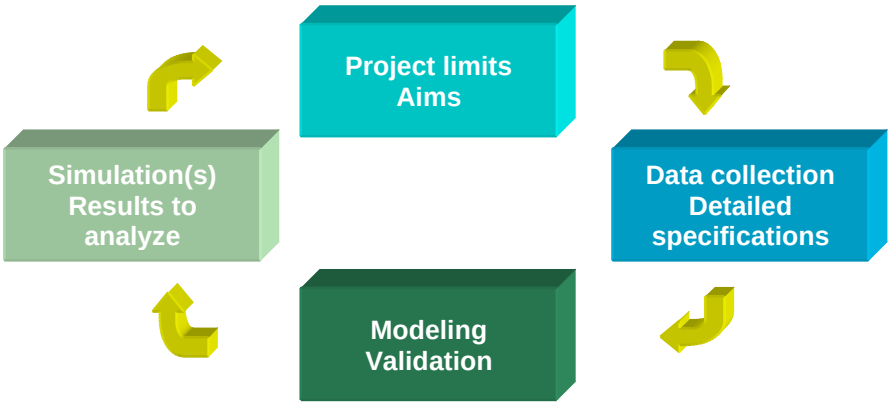
The success of a simulation project

Whether you want to achieve internally a simulation project, or prefer to have it developed by a third party, its success depends primarily on a good anticipation of the various steps it is made of. Which software is used often reveals secondary, and a lesser potential cause of failure than other points.



Steps in a study

Each step has its own traps, and must be dealt with care and method.

The first step is to **identify the study**, and formulate which questions it will answer … and will not! For it is not efficient to try and include everything into a project: the model will be very intricate, which means that it will be long to build and difficult to use. It is better to conduct two well aimed smaller studies, one after the other, rather than start with something big and very global.

The second step will be used for gathering data until writing **detailed specifications** that will explicitly list everything that is part of the study. It is a serious and concrete analysis task, requiring a real know-how about modeling implications, formalization of heterogeneous information, extracting and implementing control rules. Already at this stage, without even getting close to a computer, the simulation approach will have changed your vision of the system, and will turn out to be a precious catalyst for ideas among the involved team.

The third step for **modeling and validation** will reflect the quality of the specs. The model will be straight and easy to build if the description of the system was done with adapted methodology. The quality of the resulting model (being robust, evolutionary, legible) will also depend on the expertise with the modeling tool.

Lastly comes the simulation step, that is, **exploiting the model** by testing options, and analysing the corresponding results.

This stage can last longer than expected, especially if the « designs of experiments » were not correctly prepared, or if the results (statistics, graphs, animation, figures) are scattered everywhere.

Already with step 2, it is common to observe some changes in the project and its goals: one question is abandoned; an alternative and new options are added on another section. And this is quite normal: simulation is an iterative approach, that gets fed by what it reveals, and adjustments will be all the more important as the experience is low. On the other hand, beware of unstable projects with no characteristic aims.

Choosing the software

In addition to the price, the potential power of the simulation tool seems to us to be of major importance, because whatever the system is, there will be the need to reproduce cases specific to the company (production constraints, scheduling rules, custom organization). The risk of being limited by reduced or standard representations must be avoided.

This flexibility applies as well to the types of flow taken into account by the software: continuous, discrete, mixed? Better choose a tool allowing for all these families.

Lastly, it is essential that the simulation software has been used on many cases and projects, and that experienced staff is able to offer technical support, training, assistance, today as well as in several years from now.

Do not built the first model alone

The current available simulation tools, accessible both technically and financially, make it possible to consider developing some internal simulation competency. It implies having one lasting person that has been trained and that will be able to devote many hours to simulation projects, from time to time. A simulation study cannot be made from extra hours or week-ends!

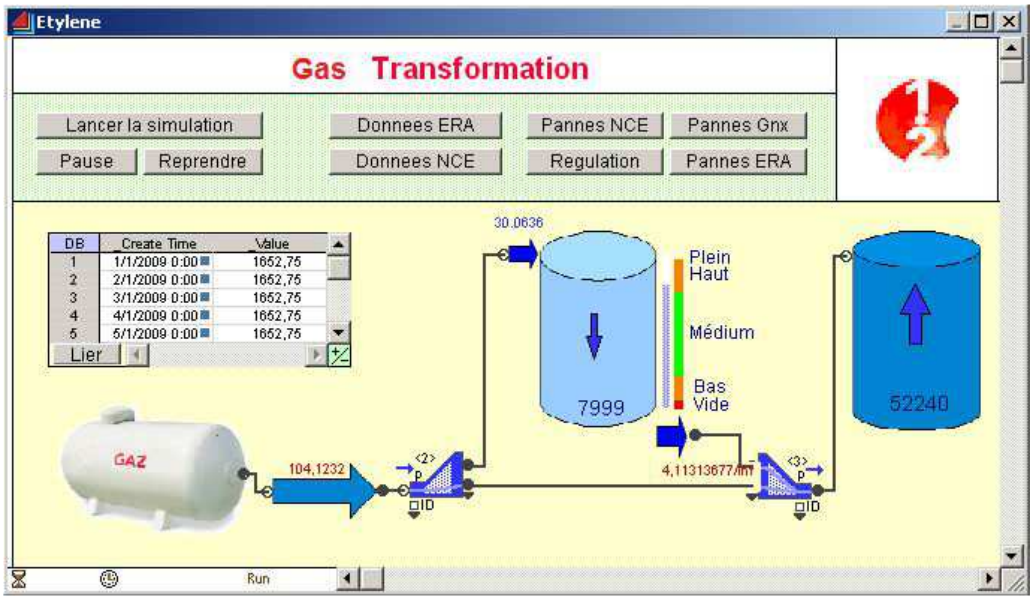
Whatever the context, the first simulation project puts up with all teething problems: first use of new software, initial confrontation to the stages of a study, modelling situations that were never met.

An expert at your side will help avoid many problems:

- he will help circumscribe the questions and will choose the most adapted precision level (beginners will have a tendency to build a heavy model with too many details),
- he has a « flow vision », and will specify how to formulate the questions about the system, and how to transcribe the answers,
- he will have a neutral point of view on modeling (will take nothing for granted), as much as on possible solutions.

A simulation study done by service providers does not imply excessive costs: an expert works fast, with tools he has a perfect knowledge of, and he is committed to respect specifications and delays.

For a first experiment, this will limit drifts (costs, delays, consistency) common in a study entirely realized internally. The reason is that it could turn out to be costly: software licence, training, assignment of a person.



How does it happen with 1Point2?

We follow the above-mentioned steps. We commit ourselves for a contract job, after interviewing our customer to determine the target and scope of the study, with the detail of the processes. For a complex and big case, we ask for a preliminary analysis of 2 or 3 days, in order to write solid specifications on which both parties agree and that will be the basis of our work.

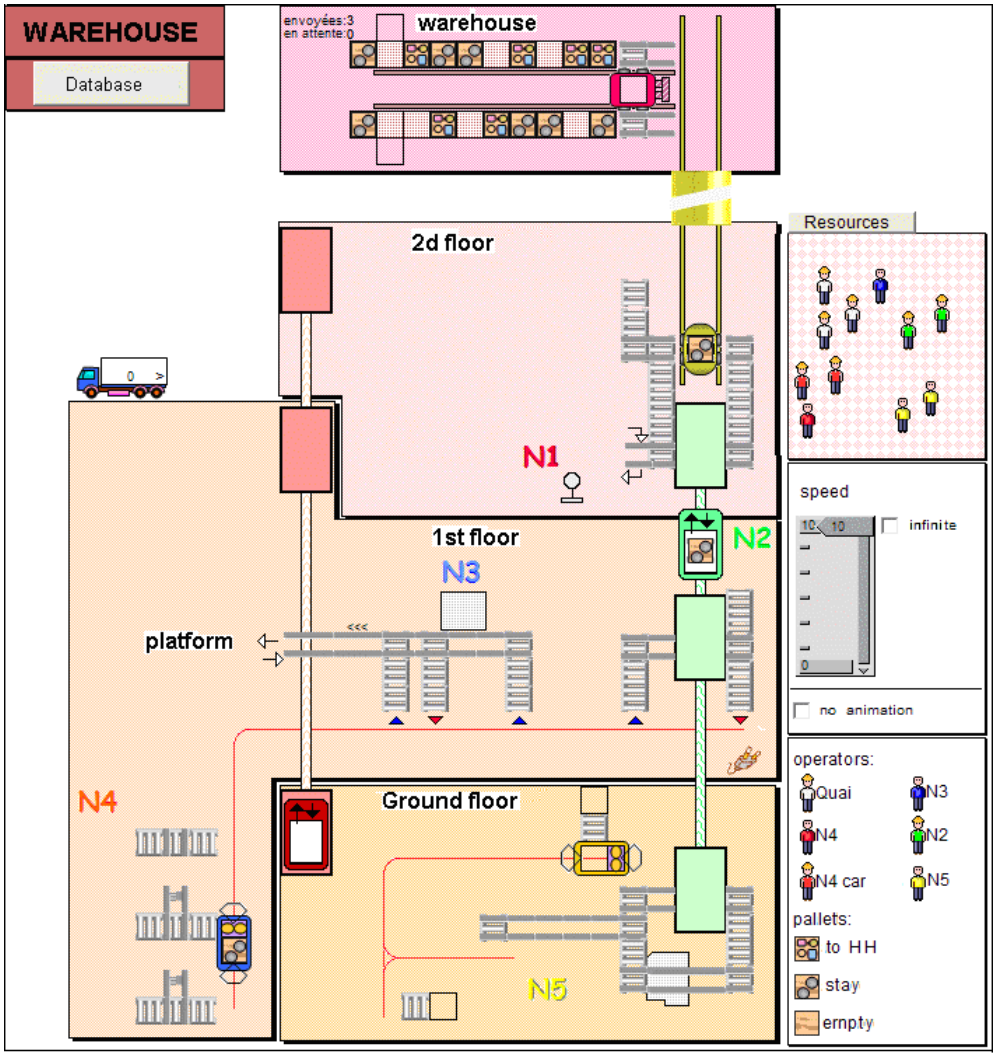
We believe it useful to have the people directly involved trained to some basics of simulation, so that everybody shares a common view of requirements and expectations associated with such techniques. Only one or two persons, though, will be our contacts during further steps of the project, and will be entitled to judge the quality of some information, get further data or appreciate the consequences of recommended changes.

The results of the study will be provided in several ways, according to your needs:

- we can launch all simulations, analyze the results and present them with our recommendations: the model is exploited by us, not directly by you.
- we can also deliver one or several models to be used with a runtime version of the software. You will be able to test existing models with new data, but you won't build new models or change existing ones. With little training, you learn how to run simulations and get results from them.
- you may use the models with a development version of the software. You will choose this option if you wish to continue with simulation, hoping to built alternative versions and see the model evolve with new ideas in the following months. Training and expertise transfer is of course longer, about one week as a minimum.

Industrial applications

Operators and equipments assignment, efficiency of investments, cost analysis, impact of new product, kanban loops dimensioning, production capacity validation, process reengineering, schedule optimisation, automated system estimation, reducing stocks or manufacturing cycles, machine utilization…



Standard and specific questions

Beside some "standards" in simulation studies, you will soon discover that simulation can answer very varied questions, and produce results in shelf-space meters, K-euros, utilization rate, list of skills...

When you have appreciated the flexibility and accuracy of the simulation approach, you will not make strategic decisions the same way!

Read more about it (in French)

Gestion de flux en entreprise : modélisation et simulation, Hermès 1997.

Gestion de flux en entreprise shows the gaps in classical decision-making processes, versus the advantages of the global approach of modeling and simulation, and its ability to lighten the orientations of companies in all fields.

Web Site: https://editions.lavoisier.fr/economie

1Point2's References

Airbus, Air France, Andra, Alcan, Arkema, AstraZeneca, Bouygues, CERN, Dade Behring, Danone, Dekra, Ecole des Mines, Eli Lilly, EPFL, Frontex, Firmenich, GlaxoSmithKline, Gambro industrie, Iberia, Ifremer, INSEAD, Lisi Automotive, MDBA France, Millenium, Monsanto, Nuvia, Procter & Gamble, Quick, RATP, Rhodia Solvay, Rohm & Haas, Sagem, Saipem, SBB Cargo, Sew Usocome, SNCF, Technip, ThyssenKrupp Total, Toyota, UCB Chemicals, Unilever, Vico, Yoplait…,