Modeling and simulation of economic processes

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Abstract

In general, any activity requires a longer action often characterized by a degree of uncertainty, insecurity, in terms of size of the objective pursued. Because of the complexity of real economic systems, the stochastic dependencies between different variables and parameters considered, not all systems can be adequately represented by a model that can be solved by analytical methods and covering all issues for management decision analysis-economic horizon real. Often in such cases, it is considered that the simulation technique is the only alternative available. Using simulation techniques to study real-world systems often requires a laborious work. Making a simulation experiment is a process that takes place in several stages.

Keywords

integration of economic process, ontology, transition system, optimization methods.

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General issues concerning technologies of economic simulation

In this new millennium application integration concepts, techniques and technologies have become couples being able to sustain rapid economic change. To isolate the context of the complexity of integrating applications, such tactics and technology, this new phase will be referred to the integration of economic processes.
Responding to change has rapidly become the number one problem of economic processes. Pressures for change occurring in all directions, and how the response of economic processes is quickly discernible results. Once the organization acquires and develops new applications to keep in touch with change, Enterprise Application Integration (EAI) is a major tool to integrate existing applications (Rațiu-Suciu, 1999). Moreover, in many cases the approach is oriented tactical and technology, by making simple bridges between one application and another. Although the immediate problem was solved, the base than the new wave of change.
It appears as a constantly changing economic environment and support that the IT environment. Time restrictions, in particular, determines the reuse of existing systems and climate change is driven by the need for a strong architectural foundation to enable the prompt, try to define the field of applications in this context becomes more complicated. Implementation of specific components of economic processes distributed systems customers and partners throughout the value chain. Relations must be established and separated very quickly.
Economic integration is not a phenomenon purely technical substance, it needs a hierarchy of economic processes, applications and technical levels, with shared concepts and interfaces between them to be accepted by all participants. It recommends a service oriented approach to establish mutual agreement between the economic and IT.
Ultimately, success depends on the adequacy of the fundamental economic and IT goals. IT strategy needs to be aware of all the factors affecting the decisions of economic integration processes such as configuration of economic processes, their borders and place where change

is most likely to occur. Understanding economic goals, such as merger and acquisition strategies or cost and increase efficiency, appears as a fundamental key (Popescu-Bogdăneşti, 1999).

In general, the scientific study of a system or phenomenon can be done by doing real or artificial. Economic, real experimentation is rare because it involves high costs and risks, while artificial testing, although sometimes requires great intellectual and financial effort, will ensure that real situations with sometimes catastrophic implications. For such problems, disciplines such as: systems theory, decision theory, operational research, economic cybernetics, etc. use appropriate mathematical models.

Often in such cases, it is considered that the simulation technique is the only alternative available.

Using simulation techniques to study real-world systems often requires a laborious work. Making a simulation experiment is a process that takes place in stages.

The main stages of the simulation are:

- analysis and synthesis systems and processes;;
- conception and model design;
- scheduling model simulation;
- validation of the simulation model;
- simulation itself;
- analysis and results implementation.

Economic modeling provides managers vigorously its side ("science of driving"), multiple ways of reconciling the resources (material, human, financial) available to the objectives formulated for a certain period of time, giving him the opportunity to find and to decide "better" and "faster" without distorting reality (Stoica M., 1994).

The process of transition from the real system to model simulation

Obtaining information about the system "before" it can be done in concrete is possible with simulation technology. Simulation is a technique for making computer numerical experiments, involving construction of mathematical and logical models that describe the behavior of a real system (or of its components) over a period of time.

Simulation needs to generate inputs and taking into account the internal states of the system by appropriate algorithms to determine the outputs and to describe over time the internal state of the system.

While not providing exact solutions (but sub-optimal), simulation is an effective research technique for complex economic issues at company level, can not be studied analytically (economic-mathematical methods of optimization).

Using simulation to obtain several *versions of a decision* of the manager will choose the best corresponding current circumstances at some point.

Consequences of real experience, without experience "simulated", can sometimes be harmful to business management. If an existing system (company, enterprise), its behavior can be provided by a simulation model that highlights the effect of the change of parameters describing the system. The simulation work involved three major elements, namely the real system, model, computer and two relations: relations modeling and simulation relations.

"Real system" is human perception system. The "real model" means the replacement of *real system* and corresponds, in principle, with the original system. The "abstract model" made the transition from "real system" to "real model". It replicates the real system by decomposing basic system parts and establishes links between them. The validation is done by determining the consistency of data from the real and model provided. Because in real systems trends are influenced by random causes whose effect must be demonstrated in the simulation model, one of the important mathematical problems of numerical simulation is generated using computer statistical selection of the various random variables and statistical processes (Văduva I., 1983).

Another important issue related to building simulation models is the evolution of states cronometrării simulated system. Simulation algorithm must contain a variable called "simulation time" which is subject to a finite number increases during the simulation. Today attention is given to simulation of economic activity. Known methods for generating random variables of different types of mathematical models for simulation of economic processes and to build practical simulation models are now software packages and specialized computer languages.
Simulation is the technique of making computer experiments, involving the use of mathematical and logical models that describe the behavior of a real system (or some of its components) over a period of time. Known variants of simulation: simulation type game and Monte Carlo analysis. Simulation type game refers to those situations that are characterized by a "conflict" between partners or between humans (which must take certain decisions) and nature (which offers more human variants that he will choose the one convenient). Simulation type game has broad applications in problems of organization and management of economic activity. Analysis of Monte Carlo simulation is a technique related to problems with more than random. Monte Carlo analysis was shaped as a field of mathematics itself, in connection with the settlement of purely deterministic problem that can not be solved by deterministic methods (Văduva I., 1983).

Simulation models are classified into: deterministic, stochastic, static and dynamic.

Deterministic models are those for which all variables are nealeatoare, operational characteristics of such models will be assumed by some form equations instead of probability density. There are plenty of ways to solve for them and because of this simulation technique is not always required to solve them.
Stochastic models are those in which at least one variable input is random and therefore one of the operational characteristics is given by a density distribution. These models are more complicated than the deterministic, analytical techniques appropriate for their resolution is too low, and thus they will occupy an important place among the simulation models.
Static models are those which do not explicitly take into account the variable time. Most of them are deterministic and their solutions can be obtained analytically.
Dynamic models are those which take account of variation and interaction while the variables considered and are therefore appropriate simulation of economic systems. Simulation models are usually stochastic and dynamic models.

Decision support systems

Decision support system (DSS) is essentially a coherent set of tools used in making decisions. The idea of multidimensionality, ie taking into account multiple criteria simultaneously leading inevitably to issues studied in class classification problems. To solve such a class of problems (identified in the literature by the so-called problem type) is called becoming more methods, techniques and tools (so-called procedures) Mathematics, Statistics and Informatics. The following are some methods of calculation useful in solving problems most common type in the economic activity that incorporates: statistical analysis of experimental data, optimization in modeling complex decision-making, planning and control complex network projects, cost analysis -benefit analysis, simulation of complex decision (business / management games) etc.. Experience shows that industrialized countries using economic and mathematical models and software performance coefficients results in significant increases in load capacity, significant reduction in stocks of materials, cuts transportation costs, saving material resources, financial, human and simplification collection operations and data processing.
The objectives pursued by the use of SSD's in the disciplines of the curriculum are:

- economic integration Mathematical Models and computer facilities provided by the economic processes in research and research processes;
- training of users and implementers of SSD and reusable software applicable economic and technical management of production processes;
- training mathematical thinking (in essence triad Model - Algorithm - Product Program) that will allow the study of real problems and realistic solutions in terms of efficiency;

Usually models are classified into: verbal models, graphical models, mathematical models (Rațiu-Suciu C., 2002). In the literature are distinguished different classes of models: physical models, analogical, symbolic, mathematical, economic and mathematical, etc. An economic-mathematical model provides essential information to substantiate the decision cycle: FORECAST-SIMULATION-OPTIMIZATION.

Modeling complex process of decision

The complexity of economic processes requires detailed study of the issue decisions that take into account multiple criteria simultaneously. Decision theory emerges as a subject of study around the years 1950 and from the outset and aims to become an effective logical decisions. Depth studies in this area and complexity that require calculations made in a timely manner had a great impact on what we call today's decision support systems.
Decision Theory considers that a decision process is characterized by the following elements:

- decision criteria (points of view from which examines the issue);
- the objective to be aimed;
- decision-maker, that person or group of persons who seek to make the decision to achieve the best conditions of the objective or objectives;
- set containing all possible alternatives for action to achieve the objectives considered;
- crowd possible states, each state representing the complex of conditions that cause a certain impact for a particular alternative and a clear objective;
- alternatives including possible consequences set exactly how many alternatives there are consequences (single state - a condition of certainty), or several possible consequences of each alternative (more possible states - conditions of risk or uncertainty);
- utility they expect to achieve a decision-maker from certain consequences.

Current trends in the enterprise computerization

The term "Information Society" is used to describe current changes (mutations) in all fields (economy, politics, culture, education, health, legal, trade, etc.). Following widespread use of IT & C. Information society is to support computer networks providing access to digital data stored in text, sound and images (multimedia). Intemetul, originally designed as a global information network, has become the global communications platform that provides storage of huge volumes of data and information and quick access to prices ever lower.
The transition to information society divides traditional organizations and businesses in modern organizations using IT & C and systems for businesses. Great software producers (Microsoft, IBM, etc..). Develops technologies that allow building applications that operate in rural Internet / Intranet. For this purpose a company's computer system includes the following modules:

- ✓ Entreprise Relationship Planning - ERP, which is a system that integrates key business processes that occur in business, namely: Finance, Resources Management, Purchasing, planning and monitoring production, sales.

- ✓ Customer Relationship Management - CRM - (the entire complex of interactions between the enterprise and its customers). CRM facilitates the provision of services via Internet, telephone, ATM / Kiosk etc..
- ✓ E-commerce (e-Business) - Business Online in Internet-access website of ERP. E-business can take one of the forms: Business-to-Business (B2B), Business-to-Consumer (B2C), Supply Chain Management (SCM).
- ✓ Business Intelligence (BI) - applications for collecting, storing and processing data for decision making. BI applications include activities such as:
    - Decision Suport Systems - SSD
    - Online Analytical Processing - OLAP
    - Data Warehouse
    - Data Mining.

CRM systems and e-Business ERP components interact to perform desired functions. in this respect, e-Business (B2C or B2B) calling ERP components for processing or processed by the ERP data are regularly archived and processed data warehouse using OLAP tools, etc.. The test results are used by components BI to make decisions and to develop business plans.
The enterprise is a system (a living organism) to evolve after its development law, in any business identified the following subsystems: Research - Development, Commercial, Production, Personnel and Finance - Accounting. Cropping system into subsystems (areas of study) is made as functions of the enterprise (Popescu-Bogdăneşti, 1999). The main task undertaken by the management company is to coordinate transformations in the sub set to achieve performance targets proposed in the system, provided it is known that any transformation entails changes. Within each subsystem, within any enterprise, activity base has a specific frequency. For operational management activities necessary to ensure that the basic cycle activity can be collect and process data for the preparation of the decision together with the development, communication and tracking to implementing decisions relating to business cycles analyzed. In any company who has mastered the information flows ensured success.

Software development – concepts

The development of computers, have built software for them, software that are increasingly complex. Therefore, development cost, maintenance and use of a software system for solving problems has become quite expensive. Current methodology for dealing with the computer is encoded in a program in computer memory. Implementation of this program is described by repetitive structure:

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while((PC). opCode≠ Halt) Execute (PC); PC:=Next(PC)
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Here, PC is an index which is the current instruction address value of the program, Execute () performs the operation encoded in instruction and function Next () determines the address of next instruction program. Computer programs are based on the repetitive structure when used for troubleshooting.
The current trend is that a soft approach to human logic to solve problems. This approach must be accompanied by a learning methodology that uses previous experience to develop intuitive software system that solves a class of problems facing the areas. This can be achieved by a methodology of solving the problem where users manipulate computer processes instead of data representation and machine operations, following the logic of the problem instead to follow the logic machine running the program. Handling processes computer users will have a higher level of abstraction, which are solutions to sub-problems of the problem data. It follows as a consequence that computer users must be provided maintenance populated specification mechanisms, tools and independent software components.

Specification mechanisms allow the user to adapt the issue without a formal framework, the tools are used to generate the correct software components correct specifications, independent software components are universal algorithms outside the scope of the class of problems specified and they operate on structures data generated by the tools and functions in the specification.

Programming languages be used to express the software system architecture that solves a class of problems in terms of independent components compatible with PSE (Problem Solving Environment). Rațiu-Suciu (1999) proposed a new application development methodology based on separation of the functionality of the software system architecture developed by this system. The system architecture is described by the language of description of architectures (Architecture Description Language-ADL), while the functionality of the system still is described by any high level programming language or low. ADL's used by the computer user is problem-oriented field and is built to the highest level of vocabulary, which preprezintă problem domain ontology. Each ontological term used by the ADL is associated with one or more independent software components and these components implement functionality.

Current research led to the development of architecture description languages, a language such as that presented by Garlan which was based on the following ontology:

- One area of application is characterized by a lot of software architecture called styles. A style specifies a family of related systems and defines a vocabulary of designs and types of elements which constitute the theme of values.
  - Types of elements determined to define a style are:
  - Components are computational units of the system. The components are equipped with interfaces called ports.
  - Connectors represent interactions between components. Connectors are provided with interfaces called roles.
- Systems, wich are graphs whose nodes are components and edges are connectors. System topology is defined by attaching explicit roles of ports and connectors to attach ports roles components connectors.
- An element can have one or more descriptions in terms of other elements, descriptions called representations. It contains a hierarchical description of architectures in terms of other architectures.
- An element can have one or more properties that represent semantic information.
- An element can have one or more constraints as system architecture can be developed while maintaining baseline.

A problem solver uses a domain to express problem-oriented ADL system architecture that solves the problem. An interpreter examines the architectural expression, localized functions that implement various components of the architecture, creating processes developed by these components and compose these processes in a process represented by architectural expression that solves the problem (Văduva I., 1983).

An environmental problem solving (problem solving environment - PSE) refers to a range of problem identified by:

(1) a collection of specification mechanisms;

(2) instruments operating mechanisms for specifying data and transforming them into corresponding operations parts;

(3) components to solve classes of problems through universal algorithms in terms of data and transactions generated by the instruments.

There is a dynamic relationship between the specifications, tools and components, where the tools can be used as components and parts can be used as instruments. The effect of this approach is a hierarchical methodology where problem-solving algorithms are decomposed in terms of more primitive algorithms above are implemented (Rațiu-Suciu C., 2002).

The first step in the development of a language is to establish the ontology language and the second step in the development of language is the combination of ontology nodes with computational significance. But these are matters which are subject of another study of mine.

Conclusions

In general, the scientific study of a system or phenomenon can be done by doing real or artificial. In the economic field, real experimentation is rare because it involves high costs and risks, while the artificial testing, although sometimes requires great intellectual and financial effort, will ensure that real situations with sometimes catastrophic implications. As long as the key instrument for achieving economic integration is the implementation representation of flows, classical design principles remain valid. Sequencing activities to identify which services should be listed first (not necessarily the same) and should be used consistently (Rațiu-Suciu, 2002). For all these the programmers have created models and architectures, which in the early new millennium have resulted in managers dedicated software. It is about the formal languages, based on which they were created economic modeling and simulation.

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