

REMODELING AND VALIDATION BY SIMULATION OF MANUFACTURING SYSTEMS ARCHITECTURE FOR THE INTEGRATION IN VIRTUAL ENTERPRISE PLATFORMS

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Abstract In order to integrate the manufacturing systems in virtual environment some changes must be made in manufacturing systems architecture. To support this environment, the basic infrastructure for the enterprise must to consider two main modules: the Internal Module and the Cooperation Layer. The aims of this paper are to propose several techniques for manufacturing systems remodeling in order to integrate them in virtual enterprise environment, and to validate those techniques by manufacturing multi-processes simulation.

1 INTRODUCTION

The ability to transform a new product idea more and more rapidly and with less cost into a market-ready product has a new joined the quality and functionality of the product as a decisive competitiveness factor [3]. Companies can no longer remain competitive merely by optimizing their products. They must also be capable of:

- product data management (PDM) information
- push, pull, transaction
- partner registration
- conferencing
- export over time
- global workflow
- change management
- producing the product required by the customer flexibly, quickly and economically.

2 VIRTUAL ENTERPRISE PARADIGM

There are fundamental effects on the organization of business flows and processes, transaction costs, the creation of new business models, and changes in the boundaries of firms across sectors. All this effects are defining the new digital economy perspectives on business, products, individuals and technology. Digital economy encompasses e-business, e-commerce, and e-services as services or resources that can be accessed through people or businesses, using network technologies. We propose a presentation about the extended enterprise as core element of manufacturing globalization, under the impact of new network technologies, which are defining the perspectives of new digital economy. The Intranet/Extranet/Intranet based product development included methods database ensure high efficiency (doing the things right) by supporting management of selected product development projects [6].

For business, e-service is going to be a new way to save money, to revenue growth, and faster development model. For end-users, e-services increase productivity and simplify life, take advantage of more sophisticated and specialized services on as needed basis. At

the level of production dedicated enterprises, e-services are [5]: business-to-business (B2B), intra-business (IB), and business-to-customer (B2C) [3], [4].

In a real meaning, an e-business is any business that uses Internet or Internet technologies [5] to attract, retain and cultivate relationships with customers, streamline supply-chain, manufacturing, and procurement systems and automate corporate processes to deliver the right products and services to customers quickly and cost-effectively, also to capture, explore, analyze, and automate corporate processes information on customers and company operations in order to provide better business decisions [5]. For the future, e-services and e-business [6], as were defined, require the enterprise re-thinking and re-modeling, with the system and applications design for an efficient use of new network technologies.

The perspectives [4] of this kind of manufacturing and economy, named shortly new digital economy, we can see the product perspective (holistic product view, product life-cycle, value-network integration, etc.), business organizational perspective (new organizational form, customers and suppliers integration, collaborating organization etc.), the technology perspective (technological building blocks, infrastructures, interoperability etc.) and the individual perspective (skills, workspaces, collaborating individual, different rolls: worker, consumer, citizen). As a general requirement for an infrastructure to support virtual enterprise it can be underlined that the companies must be able to inter-operate and exchange information in real time so that they can work as a single integrated unit, although keeping their independence/autonomy. A complete redesign of an existing enterprise to converged enterprise would represent a big effort, not justifiable in market terms as companies are not replacing easily their running systems [3]. A better strategy is to try to separate the internal functionalities from the network-related ones and develop the necessary mappings to legacy systems, to correspond to the new aggregator model for modern electronic commerce.

3 SIMULATION IN VALIDATING MANUFACTURING SYSTEMS REMODELING

For the manufacturing industry, globalization means both tougher competition and tougher customer demands. As a result, manufacturing enterprises have to reduce time-to-market, deal with shorter product life cycles and large and unpredictable changes in volume on the one hand, and respond to increased demands on price, quality and delivery times on the other hand.

It is obvious that several aspects of these environmental changes put requirements on the manufacturing system to deal with this situation. As a result, firms have to restructure more frequently than ever before. This means that manufacturing systems will have to be designed and developed more frequently, in less time and with fewer resources available. The resulting manufacturing system then in turn needs to be agile or hyper-flexible.

Companies seem to lack clear guidelines for adopting simulation and increasing its level of integration with respect to the manufacturing system development process. At the same time, simulation research on integration aspects often deals with specific functional issues, such as developing various tools for integrating and connecting simulation to other systems, rather than general structural and hierarchical integration aspects as part of a methodological approach.

Conversely, research that takes a holistic view on integration of simulation into manufacturing system development is scarce, or researchers only implicitly report on how simulation in practice should be integrated.

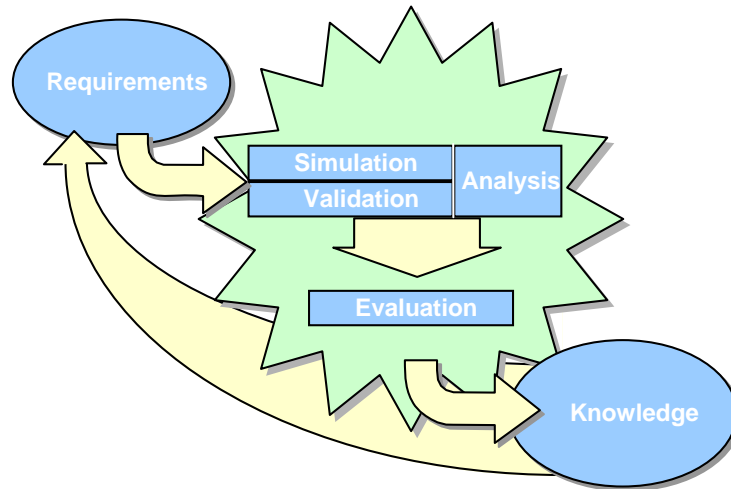


Figure 1. Model evaluation – a step in process simulation [2]

Simulation not only is well suited to cope with the general trends in industry, but also it needs to become an important part of an integrated methodology or concept for manufacturing system development.

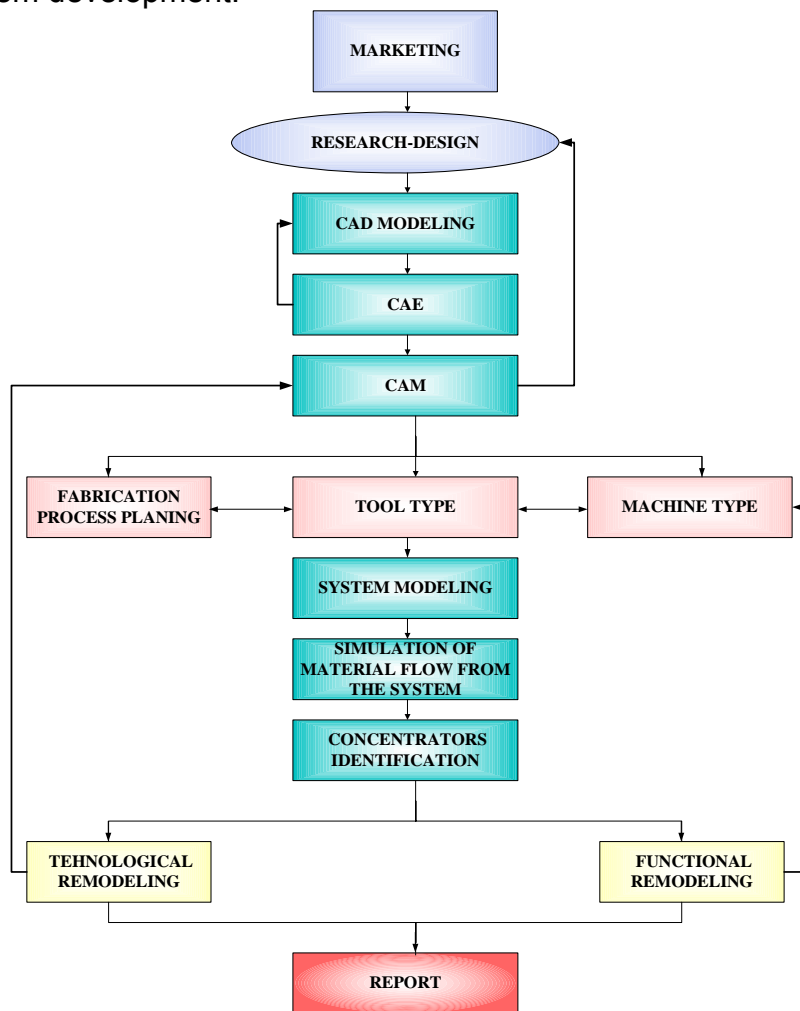


Figure 2. Modeling and simulation methodology for validating manufacturing systems remodeling [2]

This methodology should not provide a complete set of tools and models. Rather, it should be applied in concordance with existing tools and models, for process mapping, organizational charts, validating manufacturing systems remodeling etc. The overall objectives of the research apply to the manufacturing industry as a whole and include reduced time-to-market, support for agility or hyper-flexibility, lower production costs, and increased customer satisfaction.

4 CONCLUSIONS

1. As opposed to the classical enterprise model (mono-localized), inside a Virtual Enterprise first we perceive the customers requirements and then the product design and manufacturing is started, keeping a continuous relation with the customer.
2. The technologies, techniques and methods used in Virtual Enterprises bring to cost, design and manufacturing time reduction, distribution time reduction and higher customers satisfaction.
3. In order to integrate the manufacturing systems in virtual environment some changes must be made in those systems architecture.
4. After material flow analysis and simulation for one part manufacturing result if it is necessary or not to design and manufacture the part in Virtual Enterprises.
5. For simple parts or assemblies it is sufficient a classical architecture enterprise for part design and manufacturing but for complex parts or assemblies it result the necessity of a virtual enterprise and concurrent engineering (distributed architecture).
6. The techniques for remodeling the manufacturing systems in order to integrate them in the virtual environment can be validated by simulating the manufacturing processes involved in such a project.

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