MANAGEMENT OF SIMULATION TECHNOLOGY IN LARGE COMPANIES
A PANEL DISCUSSION

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ABSTRACT

In this panel discussion, five leading simulation practitioners discuss critical issues related to management of simulation projects in large companies. Defne Berkinn, Roger Klungle, Anil Menawat and Hwa Sung Na are internal consultants that manage simulation projects, while Mark Brazier is an external consultant. All participants in the panel have managed simulation projects in a manufacturing environment, except for Roger Klungle who has applied simulation mainly in the service industry.

The questions discussed in this article were chosen by Onur Ulgen with input from discussants. The role of central, divisional, and onsite simulation groups in management of the simulation activities in a company are addressed by the first two questions. The training issues are brought up in the third question. The last two questions address the need and management of company-wide simulation models and input databases. In many of the answers, the discussants emphasize the role that the current state of simulation technology (software and hardware) plays in managing the simulation activities in a large company.

QUESTIONS FOR DISCUSSION

How much should one centralize the simulation activities in a large company with multiple plants (multiple divisions, international business, etc.) based on the size of the company?

Defne Berkin:

The appropriate degree of centralization depends on the size and geographical location of different units in the company. If the units (plants) are not big enough to justify the existence of an on-site simulation group, different plants have to rely on either the central group or the regional group. Even if there are on-site simulation groups for most units, having a central group, supporting the on-site or regional groups, would promote better communication among different groups and leverage the use of simulation resources. In short, having a central group, even if there are on-site simulation groups, would be valuable in terms of supporting on-site groups, leveraging, and coordinating efforts throughout the company.

Mark Brazier:

Centralization provides at least four competitive advantages with respect to management of corporate simulation activities. First, it provides a mechanism for leveraging investments in personnel, equipment and the management of these resources. Second, it fosters

professionalism by concentrating upon fewer application domains than would more likely be the case in a distributed environment. Third, it facilitates more rapid problem solving by providing an environment conducive to teaming. Fourth, it helps ensure a more consistent approach to simulation activities within a corporation.

In exchange for these benefits, a cost is incurred. Problem solving obviously requires knowledge of the problem. Cultural issues and organizational lines of demarcation may effect the efficient or timely exchange of this information. Geographical separation may, in some cases, create practical limitations if faced with "short fused" delivery requirements. Billing methodologies between corporate organizational centers may present artificial financial constraints. Finally, centralization in itself may create an "ivory tower" effect losing the on-going support and advocacy of champions at the local level.

As a general rule, I support a policy of centralization if for no other reason, to ensure that at least some level of established expertise is applied to the modeling process. Even with the advent of simulators and general purpose templates, an expert should be available to assist and support the modeling methodology employed. If the frequency is such that full time staffing doesn't make sense, then consideration should be given to outsourcing work in order to achieve this level of expertise.

Roger Klungle :

For a large organization with multiple divisions, the centralization should be minimal and address mostly policy, standardization, coordination, and information sharing. A small centralized staff would also work on corporate simulation applications rather than specific problems within a division or plant. Centralized staffs are generally too far removed from divisional problems and applications to be effective. Centralized staffs generally increase projects costs due to travel, communications, and familiarization (learning curve). There is also the trust factor where it takes the users some time before they feel comfortable with corporate staff, whereas they work with divisional staff on a regular basis.

Anil Menawat:

Centralization germinates specialization and defeats the purpose of simulation. Simulation is a tool for fact-based decision making. We must understand the consequences of our actions when making decisions. Simulation is a "cheap" instrument to measure a decision's value. Centralization takes away the empowerment from the divisions or the plants for decision-making. All decisions such as capital investments or process reengineering, etc., require an assessment of the potential benefit. Simulation is most powerful for such decision making. Under centralized organization, the expert group would bless all the decisions. This creates power-play and slows the process; another step in the bureaucratic check-list. Ultimately, no clear owner of the decision emerges.

After arguing for de-centralization above, I want to add a word of caution. Simulation is of various sorts spanning from spread-sheet and discrete-event kinds to high-end transport phenomenon and control-systems. The entire range can not be decentralized-, some require high user-expertise and have large maintenance cost. The divisions and the individual plants, usually, cannot afford the cost of continual use to maintain expertise, nor do they have a recurring use of the specialty tools. Centralization of the high-end expertise, thus, becomes imperative. Often, it is the only means to have such expertise in- house. A team approach can often alleviate the territorial issues. In summary, simulation activities should be de-centralized starting from the low-end and moving up the ladder until it would no longer be cost-effective.

Hwa Sung Na:

Because today's simulation software tools are much easier to use than their predecessors, total centralization of the simulation activities in a large, multi-plant/division, multi-national company is no longer a viable option. To fully realize the benefits of simulation, each decision-making component should have its own simulation capability. This does not necessarily mean that each location and every component will have its own model development capability, since model building is only a small portion of the total simulation effort. While external specialized resources can be used to build the model, the study as a whole remains the responsibility of the local "expert." In particular, the study goals must be specified and the results evaluated locally by internal personnel. In short, centralized corporate support should be the backbone of the total simulation effort, with local "experts" as its implementation arms.

What should be the role of the central simulation group(s)? What should be the role of the on-site simulation group/champion/contact-person? What should be the role of outside simulation consultants?

Defne Berkin:

The answer depends on whether there is an on-site simulation group or not. If there is, then the role of the on-site group would be, in addition to promoting simulation as a cost-effective decision support tool and looking for opportunities where it can add value to the company by improving the quality of decisions made, to develop models, run the initial scenarios, analyze and document results. The on-site group would probably have to run more scenarios during the implementation phase for demonstration, training and testing purposes. Finally, the group would train the actual user(s) of the model to enable them to run scenarios and interpret and use results, with the understanding that the simulation group members will give support to the users, when necessary. In this case, the role of the central simulation group would be give support to the on-site group as needed. The support can be either in the form of direct involvement due to tight timing restrictions; or occasional exchange of ideas for the on-site group to benefit from the experience of the central group, which might have developed a similar model for another plant/group.

If there is no on-site simulation group, then the tasks listed above, as tasks of on-site simulation group, would be performed by the central simulation group. In this case, the champion or the contact person from the site would have the responsibility of being in close contact with the simulation group throughout the project of getting the appropriate people involved at different stages, whether it be problem definition, data collection, model validation, etc.

The outside consultants would come into the picture to give support, at different stages of the project, when either the on-site and/or the central group needs additional capacity to meet project deadlines. Also, if the company simulation groups are new to simulation, outside consultants may have an important role as trainers.

Mark Brazier:

A central simulation staff provides the expert to the simulation process. The organization would act as an internal consultant to the local or on-site contact person(s), and could also be used in an

outsourcing role if sufficient capacity exists. As the expert, I would expect this staff to be responsible for corporate training, application selection and maintenance, simulation project management, and model development/delivery. In addition, I would assign the additional responsibility of maintaining corporate technology leadership, with respect to simulation, to this group.

Should outside consultants be utilized in the role of the simulation expert, many of the functions I have defined for a central staff would still be applicable, including corporate training. However, the role of interfacing and strategic direction would obviously need to remain indigenous within the organization. The local or on-site contact person(s) would ensure that the simulation expert/consultant is brought into the planning phase sufficiently early enough to ensure efficient impact upon the design process. This person would remain as the principal focus or contact during model development and should be sufficiently empowered to either make necessary decisions, or assign others to do so. Additional responsibilities would include obtaining/providing descriptions and data about process being modeled, providing feedback to the development team, and performing model management and analysis during post-model delivery.

The local contact person would be much better equipped to perform his/her functions if they were also trained (not necessarily at an expert level) in the simulation language, the simulation process and some form of statistical analysis. This training need would be even more pronounced in the advent that the local champion was also responsible for perforating experimentation following model delivery and/or consultants were being used solely for the model development process.

Roger Klungle:

The simulation group must work closely with user areas to define simulation applications that apply uniquely to their areas, develop simulation models, and assist in implementing solutions.

There are basically two roles for outside consultants, First, they ran participate on a project led by the divisional simulation group. Consultants often bring a special expertise that may not exist in the company. They bring a more varied experience and can be very useful for benchmarking purposes. They can also serve as mentors and educators.

The second role would be for the consultants to lead the simulation effort, with or without participation from the divisional group, At times the divisional group may not have sufficient resources because of the size of the project, or because of too many projects in progress.

Anil Menawat:

The central simulation group should serve as the champion of the technology for the whole corporation. They should define standards and policies for simulations. They also have the responsibility to manage the expectation level. Often successful projects can elevate the management's expectations beyond what the project team can deliver. In search for quick results, sometimes the project managers impel engineers to use lower-end tools to deliver higher-level performance. Engineers, as expected, flounder and ultimately fail; simulation technology gets the blame. Managing such unfortunate potentialities under check is another challenging task for the central group.

The on-site simulation personnel are the end-users or the service-providers. They must understand the potentials of their technology. Despite the wide-spread use of simulation in decision-making, it still exalts aura. On-site users should deliver their ware and communicate the results effectively. They must understand the problem and ask the right questions to help generate the alternatives. Simulation is a decision-making tool to compare among the competing alternatives; it is, therefore, a management tool. Consequently, the on-site personnel should play the role of the point-person for the management. They must work with the managers to evaluate the scenarios without bias as their key contribution. The outside consultants should play a similar role as an extension of the on-site personnel. In situations where no on-site simulation people are present, the consultants may play the internal role as well.

Hwa Sung Na:

At a minimum, the corporate group should provide leadership and global support which include (but are not limited to) the following:

- establish a vision for applying simulation technology within the company
- lead the effort in implementing such vision
- monitor technology development
- evaluate various tools and methodologies available to the users
- bring in new technology
- develop corporate-wide training programs
- provide technical guidance and support to local users
- provide/maintain centralized simulation facilities
- "educate" management on the potential of simulation technology
- inform management of the resources and conditions necessary for successful simulation
- interface with the suppliers
- identify new application areas
- collect and maintain results of corporate-wide simulation efforts
- serve as information center for the internal/external community
- represent the company externally in the area of simulation activities

The local (or on-site) "experts" should promote and monitor simulation applications within their local organization:

- identify opportunities for profitable use of the technology
- lead/conduct/direct simulation studies
- make and support local policies regarding simulation efforts
- serve as the liaison between local users and the central group
- participate in setting corporate policy regarding simulation activities to support local needs
- support local, "infrequent", users of simulation
- assimilate technologic information within the local organization

The outside simulation consultants can provide the following support:

- assist in project identification, definition and scope
- assist in tool selection
- develop simulation models under the direction of local personnel

- assist local persons in simulation studies
- assist in promoting the simulation concept
- deliver training classes
- provide tool/technology information to the corporate group.

What type of training should be provided for the company simulation modelers and users? Who should deliver it? Who should prepare the material?

Defne Berkin:

Depending on the background of the company simulation modelers, training should be provided in

1. Simulation
2. Modeling
3. The specific software that they are going to use
4. Data analysis
5. Statistics

Items 1 & 3 can be delivered by the software vendor; whereas the rest can be delivered by an outside consulting company, if there is no central simulation group or if they are unable to give training due to their time restrictions. If there is a central simulation group, all items can be delivered by the group. However, in all circumstances, it is a good idea to take the software training offered by the software vendor.

Mark Brazier:

While there are several sources for this type of training, probably the most expedient and direct method would be to have the training conducted by the vendors supplying the simulation language. This training generally includes text books, language manuals, training software, etc. and is frequently bundled with the purchase of the simulation software. My experience with this training though is that it does not necessarily teach the "art" of simulation, rather it is primarily focused on the language syntax and its use. This training is typically offered in one to two week sessions that is accelerated in nature. I have conducted many of these classes myself and it has not been uncommon to see a general 'glazing' of the eyes by the end of the third or fourth day.

I strongly encourage considering the addition of consulting support or on-site classes to supplement the initial training process. This consulting can be obtained directly from the vendor or from several reputable third parties and provides many benefits. First, it is an ideal mechanism for supplementing the initial training process. Second, it allows the student to apprentice with an experienced modeler to learn application techniques or the "art" of simulation. Third, it tends to maximize the use of consulting support during the training process since clear deliverables are defined. Forth, it helps ensure a first time success in simulation during the rollout process. This is as much a political benefit as it is functional - corporate "buy in" is much easier following a quantifiable success on the first attempt.

Roger Klungle:

As a background, simulation modelers should have at least completed a one semester course in simulation which would include training in a simulation language (e.g. SLAM, SIMAN/Cinema, ProModel , etc.,). They should also have had two or more semesters of statistics. With this background, the organization should be responsible for keeping the individuals skills current through simulation conferences, language training from vendors, and specialized classes in simulation theory and methodology.

Users need a general seminar in process analysis and simulation modeling which could be developed in-house, but this is time consuming and generally not as effective as using consultants, Most simulation vendors specialize in training and educating users and bring a more varied experience. Thus it would be my recommendation to use them.

Anil Menawat:

Proper training is important for successful use of simulation technology. There should be multiple levels of training available-simulation awareness, product specific, mentoring, and interpretive analysis. Participants in the awareness training should include the team members and managers responsible for analysis and decisions. This should be done internally to clearly articulate the standards and policies. This also is the place to manage the expectation levels. The product specific training should be done by either the manufacturer of the product or their authorized representatives. We believe the mentoring and the interpretive analyses are at the crux of modeler training. Every user needs some degree of hand holding and guidance. Successful mentoring makes for successful modelers.

Hwa Sung Na:

Four levels of training should be available from the company:

- awareness training for the general public, including management
- modeling methodology training for simulation
- users tool applications training for model developers
- expert training for the corporate group and local champions

Qualified experts in simulation technology (expert in more than model building) should deliver the training classes and tool specific experts can deliver the tool training classes after the participants have received training in modeling concepts.

The training material should be jointly developed by the simulation expert, the tool expert (e.g. tool suppliers), and the training center experts.

Is there a need for company-wide generic simulation models? Who should write it? Who should maintain it?

Defne Berkin:

Having company-wide generic simulation models would be very valuable, in terms of saving time to develop models. The value will be more significant for companies which have similar processes in several different plants. Ile central simulation group, if there is one, should be writing the company-wide generic models, closely collaborating with the relevant plants and the on-site simulation groups of these plants. The same group should also maintain them.

If there is no central simulation group, then one of the two following options can be selected: 1. A team consisting of members of the on-site simulation groups of the relevant plants ran be formed in order to develop each model depending on Lime availability. 2. An outside simulation consulting company can be called in, to develop models.

Mark Brazier:

The advent of company-specific application templates is here. These tools are designed to simplify the modeling process and remove some of the "guru" requirements associated in the past with the simulation effort. It's a natural extension of the simulator vs. general purpose language justification process.

The simulator was first developed to ease the modeling process associated with general purpose languages. However, it too was somewhat general purpose in design. As a result, we have seen recent product releases in more domain-specific simulator application areas such as medical systems and business process reengineering that can significantly ease the modeling process.

Concurrent to the simulator approach, but somewhat slower to the market has been the release of what I would characterize as a fourth generation language in simulation modeling. This environment attempts to couple the advantages of the simulator with the power and flexibility of a general purpose language. To do this, an expert in the general purpose language crafts a "template" that is domain specific to a particular environment - say automotive stamping. At a higher level, third party organizations are also producing more generic templates that, while not as specific as the customized template for a specific application, can compete very effectively against a simulator designed for the same purpose. Perhaps the greatest advantage though is that third party template manufacturing can potentially occur.

Another interesting feature of the template approach is that it can be used alone or in conjunction with other templates, including the general purpose language it is crafted in (essentially another template) if supplemental features are desired. Thus, both the ease of use of a simulator and the power of a general purpose environment ran be theoretically obtained. This has its obvious advantages in leveraging a corporation's assets when simulation modeling needs to be performed - assuming adequate training in use of the environment can be obtained.

My experience with the template environment strongly suggest that an expert be used in the development/manufacturing process. This can be achieved in a variety of ways including contractors, internal simulation staff, or a combination of the two. Regardless, person(s) performing this function should be very familiar with the template design process, the modeling language being employed, and the application domain being modeled.

Maintenance of the template is another key aspect to its continued success within a corporation. This is a two-part process, to accomplish these changes, the user community must be responsible for ensuring that timely change requests are submitted to the staff responsible for performing these changes.

Roger Klungle:

To some degree there is a need, depending on how similar or varied the applications. For the type of applications we deal with, there are 3-4 types of general models that can be developed and modified for each particular application (e.g. queuing processes, scheduling, work flows and process re-engineering). When developing a new application we first look at our library of simulation studies for similar applications. If one exists, we simply modify it saving considerable time. This is basically the responsibility of the divisional simulation group, However, the corporate group can play a significant role here.

Anil Menawat:

I do not believe that there is a need for company-wide generic simulation model, because sufficient differences exist among each implementation to make them unique. However, maintaining parity in level of detail is important. Equipment or process templates lend good mechanism. Simulation provides an ability to model different facilities and compare them. This would not be meaningful if the information contents of the models differ. Development and maintenance of the standards should be the responsibility of the central group in consultations with the manufacturing divisions.

Hwa Sung Na:

This is a time-dependent question. Given today's technology and the ability of the engineering work force, the answer should generally be yes. However, the progress in software and hardware may change the answer in a few years as "off the shelf' offerings improve.

There definitely is a place for company "generic" models today. Internal experts and hired consultants have been working on them for at least 25 years. Such efforts have not only given the company a timing advantage in realizing the benefits of simulation, but have also given them a definite edge in guiding the future directions of the simulation industry.

Ownership is a minor issue when compared with the maintenance problems. As Dr. Merchant pointed out in 1990, software tools are entering the "mass production" era just as hardware tools were at the turn of the century. Widespread usage of such "generic" models requires customer support -- duplication, technical support, enhancement, updates - all to high quality standards. Even the simplest software tool requires maintenance, updates and hot fine answers.

Ideally, the corporate group should be able to spread the usage and to shoulder the responsibility of maintaining such models. In reality, the main business of the large companies under discussion is not developing nor maintaining simulation models or software. They need use the technology to enhance their core business. It is not cost effective for the individual company to use large resources to maintain some special purpose software with limited usage. The simulation software vendor, on the other hand. can potentially spread support costs over a larger user base than that of any single company. A user company benefits when it can encourage simulation software vendors to develop and support tools that enable the development of specific models costing the users no more than using an internal "generic" model.

Given that today's simulation software vendors are relatively small companies with limited resources, it pays for the large companies under discussion to spearhead generic model development as R&D efforts. Such efforts can result in well established requirements definitions for the "generic" models. Such models can also act as feasibility demonstrations. Software vendors can then use such definitions to modify or develop new tools for the mass market, taking responsibility for tool maintenance. The "generic" version can be viewed as the "prototype" of a new product, and software suppliers can address the mass-production and support aspects of the business. In the meantime, the originator of the "generic" model can use the "prototype" to reap more benefits from simulation. An active development effort also ensures that the company's experts are abreast of or leading the "state of the art" and are thus fully qualified to support their companies applications and evaluation efforts. It is a win/win situation.

Should there be a policy to create a company-wide simulation model database? Input database?

Defne Berkin:

It would be very useful to have a policy to create company-wide simulation model database. The value of having a policy to create a company-wide input database is questionable. Since we are considering big companies, this may an undertaking requiring more effort than it is worth. Also, the issue of who will have access to the databases, with what kind of privileges, should be considered carefully.

Mark Brazier:

A common database of models completed as well as their supporting animation's could be very useful to leveraging their investment. While it is frequently easier to begin a model from scratch, I have found that certain techniques and constructs can be pulled into a new model from one previously completed. More frequently though, I have used previously completed models as a basis for demonstrating possible approaches to a new modeling process being considered.

With the advent of templates, a common database of company-specific constructs could be maintained for inclusion into future modeling efforts when that process, person or device is called upon in a future application. This database could be something as simple as a corporate file server that is accessible throughout the company. Certainly, an input database in the form of request for new constructs should be considered. This concept is probably already in place with many companies connected via wide area network and supported by a core application support team.

Rover Klungle:

A library of all simulation models created in the company can be an extremely useful tool for divisional modelers to avoid duplication of efforts and reinventing the wheel. If it were possible to define what inputs would be used regularly, then an input database would make sense. However, depending on the type of study, data often has to be estimated or specifically collected since no prior need has existed for that particular data.

Anil Menawat:

A company-wide simulation model database is not necessary but it is highly advantageous. It provides a forum for all users to know what others in the company did and what approaches they adopted. Along with the model database, channels to exchange information are also imperative.

Hwa Sung Na:

This would be ideal. The undertaking is ambitious and time consuming, yet the benefits will be overwhelming. The design of the database should be addressed jointly by practitioners and academics, and some research may have to be conducted to ensure that the database developed will be meaningful and manageable. Within a large company, the initial responsibility should be with the corporate group.

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Mark K. Brazier is an Associate with Perot Systems Corporation in Detroit, Michigan, currently assigned to the Kelsey-Hayes Account as manager of the simulation. His responsibilities include, among other, the performance of simulation modeling and analysis. He has developed simulation applications in a variety of manufacturing, transportation, and service industries including steel, automotive assembly, rubber, electronic assembly, textile, shipbuilding, pharmaceutical, food processing, warehousing and distribution, aerospace transportation, and railroad transportation. His area of interest includes production-distribution systems analysis, simulation modeling, applied scheduling, and inventory control. He received his BS degree in Computer Science in 1977 and his MS degree in Industrial Engineering in 1987 from Texas A&M University. He is a member of AIIE, SCS, ASQC, and APICS.

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