TESTING THE ELEMENTS IN AN ORGANIZATIONAL KNOWLEDGE ACQUISITION, APPLICATION AND AUGMENTATION MODEL

Chengbo Wang[a]
John Johansen[b]
Niels G. Rytter[c]

[a,b,c]Center for Industrial Production,
Aalborg University, Denmark
[a] chengbo@iprod.auc.dk
[b] jj@iprod.auc.dk
[c] i9nr@iprod.auc.dk

Session L-4

Abstract

Following the published paper of "A Case-Based Reasoning (CBR) Model for Supporting Strategic Manufacturing Vision (MV) Development (CBRM)", this paper presents a role-play testing going through the two critical elements of "expert adaptation" approach and "expert evaluation" approach in CBRM. CBRM concerns the organizational knowledge acquisition, application and augmentation. The role-play is designed to simulate a virtual enterprise strategic meeting for formulating a MV – a combination of competitive manufacturing practices and activity patterns. In this role-play, the participants take the roles representing different areas within an enterprise. Their decisions are generated based on the given retrieved information from CBRM and their general domain knowledge, through the expert adaptation; and are reviewed and verified by going through the strategic process audit of expert evaluation. The direct outcome of the role-play has two aspects: one is a MV; another one is the deeper understanding and examination on expert adaptation and expert evaluation approaches. The usage of this role-play is also reviewed.

Keywords: manufacturing vision (MV), case-based reasoning (CBR), role-play, expert adaptation, expert evaluation.

Testing the Elements in an Organizational Knowledge Acquisition, Application and Augmentation Model

Chengbo Wang [a]
John Johansen [a]
Niels G. Rytter [a]

[a] Center for Industrial Production, Aalborg University, Denmark
{chengbo, jj, i9nr}@ iprod.auc.dk

Abstract

Following the published paper of "A Case-Based Reasoning (CBR) Model for Supporting Strategic Manufacturing Vision (MV) Development (CBRM)", this paper presents a role-play testing going through the two critical elements of "expert adaptation" approach and "expert evaluation" approach in CBRM. CBRM concerns the organizational knowledge acquisition, application and augmentation. The role-play is designed to simulate a virtual enterprise strategic meeting for formulating a MV – a combination of competitive manufacturing practices and activity patterns. In this role-play, the participants take the roles representing different areas within an enterprise. Their decisions are generated based on the given retrieved information from CBRM and their general domain knowledge, through the expert adaptation; and are reviewed and verified by going through the strategic process audit of expert evaluation. The direct outcome of the role-play has two aspects: one is a MV; another one is the deeper understanding and examination on expert adaptation and expert evaluation approaches. The usage of this role-play is also reviewed.

Key words: manufacturing vision (MV); case-based reasoning (CBR); role-play; expert adaptation, expert evaluation.

1. Introduction

Due to the tremendous pressure brought by the rapid changing industrial environment and global competition, an enterprise needs to establish a suitable and innovative strategy in manufacturing to help realize the general corporate targets. As noted by Skinner (1969: 136-145), competitive advantage will be created when manufacturing decisions are supportive of business strategy.

Manufacturing vision (MV) (adapted from Riis and Johansen, 2001: 313-324), as an important dynamic bridge between the corporate strategy and concrete production operations, plays a vital role in the course of an enterprise achieving its strategic targets and maintaining its competitive status. Nevertheless, MV is a quite new concept, and the problems MV is dealing with are quite complicated and open-ended, there is a lack of tools to tackle the development of an MV.

A relatively new artificial intelligence (AI) approach, case-based reasoning (CBR), as both a methodology to model human reasoning and thinking, and a methodology for supporting building intelligent computer systems (Bergmann, 1998), has its special effective property in dealing with the complex/open/real world problems such as MV development. The basic concepts in CBR field are case and case base, which will be used for knowledge application and augmentation in the CBR cycle (Aamodt and Plaza 1994: 39-59). A case is a practical and valuable source of knowledge. A case base is the storage of cases and normally embedded in a computer-supported platform. CBR cycle comprises four-step running procedure, which forms the general structure of a CBR system.

Inspired by the methodology of CBR and the pioneering researches on manufacturing vision development process (Riis and Johansen, 2001: 313-324; Maslen and Platts, 1997: 313-322), the model – CBRM for supporting the creation of MV was developed, which is briefly described in section 1.2, the details regarding the theoretical background and performance of the CBRM, are provided in Wang, Luxhøj and Johansen (2003).

In the CBRM, for each step, there are some certain methods and techniques used to support the complementation of its tasks. Among them, some are well tried out approaches, while some either need further refinement for the context of this research or are novel ones. Of the latter, the “expert adaptation” and the “expert evaluation” approaches are most critical ones to assure the outcome of the model; these two approaches possess the key components of the integrated gap-based knowledge

substitution and transformation and the strategic process audit (SPA). The gap-based substitution and transformation sits on the theoretical fundamentals of the well-known gap analysis (Slack, et al., 1998) and the substitution and transformation methods for case adaptation (Kolodner, 1993). The SPA is generalised based on the proposed concepts from some researchers (Slack, et al., 1998; Brown, 1996; Higgins and Vincze, 1993). Hence it is necessary to find some methods to test the two approaches for their applicability and effectiveness, and to refine them if needed.

By considering various techniques, the authors found the role-play could be one advisable choice, due to its characteristics stated in section 3. Thus herein, role-play technique is used to test the usage of the two approaches.

This paper is structured in the following way, the authors first simply introduce the CBRM, then present the brief introduction of the role-play technique, after that they describe the designed role-play for testing, and then summarize the results of applying the role-play testing; the paper is finalised by the conclusion and discussion regarding the usage of the tested approaches in CBRM as well as the goodness of the role-play session.

2. The CBR approach supported MV development model (CBRM)

This section is a brief introduction on some basic points of CBRM. The detailed information regarding the model is provided in Wang, Luxhøj and Johansen (2003).

2.1 The working procedure of CBRM

The construction of CBRM is composed by seven steps; except the basic step, the other six steps also consist the normal performing process of CBRM. The seven steps are:

Basic step: Preparation / Supplementation – basic “seeds cases” finding and formulating before the model running and supplementing cases from other sources beyond what gained from the model after its running; in the model, case refers to the recorded practical and valuable resources of knowledge;

Step 1: Starting – Initiation and new problem configuration through information pooling;

Step 2: Sorting – Information prioritising and features/values identifying for next step by information sorting and concept concretising;

Step 3: Previous case searching – previous similar MV case(s) finding (similar solutions finding for concretised MV concepts) through inputting the features and values into CBR supportive software;

Step 4: Analysis and modification – New case solution creation through direct applying or making adaptation on primary solution possibilities, by expert adaptation approach;

Step 5: Confirmation – Revising on the suggested new solutions from step 4; and repairing the denied results from revisal, by expert evaluation approach;

Step 6: Learning –New MV case put into use and meanwhile stored in case base.

The CBR concept penetrates all the steps of the working process of the model, in each step people could through retrieving the relevant previous case to provide information for the decision-making. In case of need, they can also use their experience and general knowledge to make contribution to the final solution part of a case. And the model is also flexible on account of intensive human interaction; any step could be iterated as many times as to achieve the final satisfying outcome.

While, in the role-play, the focus will be on step 4 and 5, which contain the processes and contents used in "expert adaptation" and "expert evaluation" approaches, the critical phases for knowledge acquisition and integration to formulate the solution possibilities of the demanded manufacturing competences. These two approaches are detailed at following.

Expert adaptation

In the "expert adaptation" process, using the aforementioned integrated gap-based substitution and transformation, first, the experts compare the new situations with those in the first ranked previous case retrieved through the CBR software (Intellix Designer 4.1)[1], to select the parts of the solution from the old case, which can be used to deal with the new problems directly or after adaptation, see Figure 1 for an illustration of the adaptation process. Then, for those portions of the new problems with no countermeasures in the previous case(s), the experts either try to use other retrieved case(s) for a certain issue or just use their general domain knowledge to create new solutions, or both.

Expert evaluation

In the "expert evaluation", after the new suggested solution was generated from "expert adaptation", for the aim of verifying the solutions' applicability, an expert group will start the process of revision on the new solutions. This work is performed by using the above stated strategic process audit (SPA), which goes step by step by asking the questions against the concerned aspects to confirm the new MV solutions. If some

[1] Intellix designer 4.1 is a product from Intellix A/S, H.C. Oersteds Vej 4, DK-1879 Frederiksberg, Denmark.

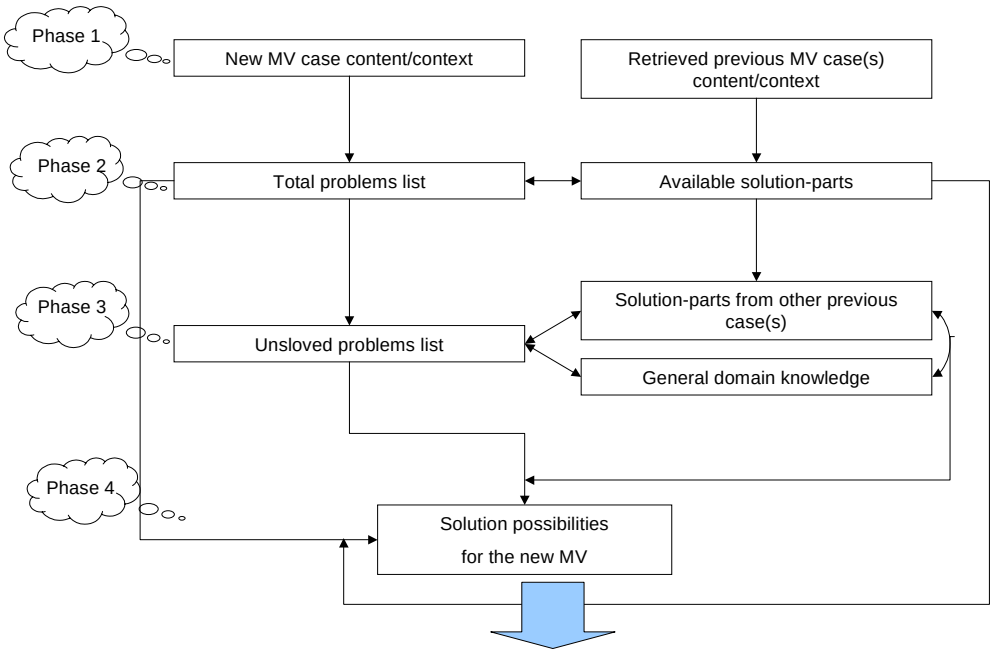

Fig. 1. Illustration of the expert adaptation process

Table 1. Examples of the strategic process audit (SPA) questions (Source: Wang, Luxhøj and Johansen, 2003)

Category	Focused decision areas	Strategic Audit on outcome
	General points for AUDIT	1. Have the contents of MV clearly illustrated the important and positive image of manufacturing in an enterprise, not just as a necessary evil? 2. Has MV clearly identified the measurements to solve the identified problems and gain future competence with a holistic view and future time horizon? 3. Are the strategies suggested by MV innovative?...
Hard factors	⋮	⋮
	Strategic issues on quality	1. Do the MV's measurements assure the company is fully aware of customer needs and able to satisfy them? 2. Has MV advised the ways to ensure the combination of product and process quality for a complete quality offering to take place? 3. Has the MV emphasized and provided any innovative ways to involve all personnel participation on continuous quality improvement?
	⋮	⋮
Soft factors	Strategic issues on workforce organization	1. Has the MV provided any means to improve the employee skills? 2. Has the MV supported the clear work organization, which assures the efficient performance?
	⋮	⋮

parts of the new MV are not satisfactory, the adaptation step will be repeated to repair the unsuitable solutions to reach better alternatives, until the real appropriate solutions are created. For contents of SPA, see Table 1 as an example.

The experts group here in this phase should include some other experts who have not participated in the solution generation process, to avoid biases. And, in order for the outside experts having a holistic view of the whole process, it is also a good idea to invite them to being present from the beginning of the sessions, but they just as the outside observers and not involved in the discussion in "expert adaptation" processing.

2.2 The cases that encapsulated in CBRM and that for testing

Referring to Wang, Luxhøj and Johansen (2003), based on the practical conditions of the obtained cases and the application of cases in the knowledge domain of MV, the cases in the case base could be divided into two categories: general supportive case and event case.

The major differences between general supportive cases and event cases are: a general supportive case is globally applicable in similar industrial enterprises; while an event case is only a "good experience" for a certain enterprise, and if another organization desires to use it, normally they must make an adaptation. Typically, a general supportive case has far less content than an event case.

During the real running of CBRM, the event cases are to be retrieved first, on account of their more abundant and extensive coverage. Then, under the condition that more information is required relevant to a certain area, the general supportive cases will be retrieved. And general knowledge will also apply, should a need exist.

Particularly, in this role-play, a hypothetical testing case generalized based on both the literature and the authors' experience will be used as original input problem to be dealt with utilizing the mentioned two approaches.

3. Role-play technology and its application

Role-play is a method of acting out particular ways of behaving or pretending to be other people in order to teach people or to learn how to deal with situations (Cambridge Dictionaries Online, 2003; Jones, et al. 1994). In a role-play, the participants are expected to act as they have prepared and formulated themselves appropriate to the given roles.

It is an approach normally used for education to enhance the participants' understanding and involvement regarding certain social or economical problems, and is

often used in the similar context as games and simulations, but role-play tends to give the participants less restrict regarding the contents and process, compared with game and simulation (adapted from Sutcliffe, 2002). Role-play will provide more flexibility for the “roles” to exercise their own interpretation based on their knowledge backgrounds. Under this condition, one can expect to receive a holistic viewed result regarding the certain focuses a role will hold.

A role-play can enhance the understanding and creative application of the knowledge of a subject. This is just the key points for knowledge analysis and new idea generation.

Role-play not only promotes the participants in arguing, but also provides the roles a supportive structure for analysing the problems, in the aspect of that the roles are playing in the simulated context structure of a real organization, and performing along the provided procedure. The type of role-play used in this testing is a kind of scripted role-play (Sutcliffe, 2003; Alden, 1999: 127-132), which will be detailed in section 4.

By using role-play, the participants can achieve a deeper understanding of their own views and those of others (adapted from Freeman and Capper, 1998), and to get inspiration from the interaction. Role-play will reinforce the participative dialogue dynamic during the running session, in helping eliminate the barriers and support for the knowledge sharing and communicating. This means that, when people want to try out some kinds of consensus or creative ideas over certain topics, which are just what the CBRM pursuing, role-play could be a suitable approach.

Of course, real world tryout would also be effective at the testing, may be even better; but, considering the cost and the stringent schedule of the real world people, the role-play is the most suitable alternative for the research at present stage, due to its robust property.

Regarding the above mentioned property of role-play, we would assume that role-play will help to complement the testing application and the assessment on the two approaches in CBRM - “expert adaptation” and “expert evaluation”, both of which involve analysing problems and arguing on different ideas and reaching the shared views. Thus in this paper, the authors are trying to extend the role-play’s application from educational context to more practice-oriented one – dealing with the problem for developing strategic activity patterns within MV development.

In role-plays, the capability of a participant to fully integrate into a situation where the roles will play depends on the relevance of their prior knowledge and experience. Role-plays are much more likely to be successful if they place participants in settings, with which they are familiar through their specific or general knowledge; if the role a person

plays differs much from his or her background, it is needed to give more detailed instructive information regarding the role of playing (adapted from Sutcliffe, 2002).
When considering the background knowledge of the people to be invited for the role-play simulation sessions testing the approaches in CBRM, it is reasonable to expect that the participants who have both theoretical knowledge and practical experience about enterprises' operations can assume the roles without difficulty, on account of their gained knowledge through immersing in both academic and empirical fields.

4. Design of the role-play

This section illustrates the aims, content and structure of the role-play testing run in the context dealing with a virtual realistic situation, by applying the two approaches – expert adaptation and expert evaluation for knowledge integration, creation and augmentation.

4.1 Aims and content of the role-play

This role-play has targeted to run the process of "expert adaptation" and "expert evaluation", through creating a MV to understand more about the two approaches. To achieve this aim, the participants in the role-play must have adequate theoretical knowledge and practical experience in manufacturing fields, and also know in advance the details of the two approaches and the role-play.
The roles will go through the components and processes of the expert adaptation and expert evaluation approaches of the CBRM during the applying of this role-play.

4.2 Type and structural organization of this role-play

Each role-play defines a setting and characters (or roles) through which a story will be developed (Sutcliffe, 2002). In order to deal with the uncertainty when the participants taking their role to express their ideas into the direction not desired for the aim of the role-play, one method might be to script the role-play in a more formal and ordered way, which is called scripted role-play by some researchers (Alden, 1999: 127-132; Sutcliffe, 2003). Under this thinking, we can define the information and concentration of each individual role mainly focusing on, by the structured procedure; and meanwhile remind them to consider about the relevance of their ideas to the context of the process. The participants should express their points of view consisting with the main topic and aim of discussion. Under such a framework the guide of the role-play can have a strong grip over the focus of the role-play; and in simultaneity, the participants could be prompted to explore the most highlighted result through the roles they are holding by using abundant information they could ever acquire through literature or

research as well as empirical knowledge. The benefit of this form of role-play is that it gives scale and scope for participants to reflect on their learning, while assuring that the activity will not “get out of hand” and out from the desired focus of the role play (adapted from Alden, 1999: 127-32).

Thus, the role-play used for testing the two methods here will be a kind of the scripted role-play, i.e., the individual participant of the game will assume a certain role in a manufacturing system, and equipped with the relevant information in that field he or she represents, following a structured form by referring to the structure/content in Figure 1 and Table 1, to carry out their debate and arguments, try their best to be representative of the knowledge and information in the related areas they were on behalf of, towards the formulation and confirmation of a MV with a holistic view of the manufacturing system.

However, when the roles go through the structured procedures, especially in “expert adaptation”, they could jump from one item, within the structure, forwards to another one, in case of no relevant information or ideas available at the time; or they can jump backwards when new ideas are inspired for the former items. This approach gives more mobility to the process, and will increase the effective knowledge generation. This is the characteristic point of the scripted role-play hereby used.

4.3 The roles (participants) in the role-play

The setting of the role-play will be a management meeting, consisting of participants (roles) from different fields of a manufacturing enterprise. And the meeting is conducted in a relaxed and non-title-focused environment, i.e. the top management will not be supposed to make final decision, the ultimate solution is gained through discussion to reach a shared agreement. The only difference would be, due to their different roles, their knowledge focuses within the manufacturing system are different.

These roles will focus their opinions chiefly on their designated areas based on the related available information and knowledge, but still they will backup their opinions on a broad view regarding their impact on the whole production system.

By considering the contents of MV, the criteria to choose the participant for a certain role will be: a person with academic or/and empirical knowledge regarding the fields of a manufacturing system, such as: quality, capacity management, process and layout design, etc.

The number of the participants will be dependent on the numbers of the areas chosen within manufacturing operations for running the role-play.

The roles in this role-play consequently have two types: one type is content-independent roles, appearing in each role-play session, includes the role of representative of the top management, who provides a holistic view regarding the whole fields within a business system; the role of managing secretary (guide of the role-play), who is responsible to provide the general relevant information before the session starts; to explain some already available information, such as the hypothetical problems used and the retrieved could-be solutions by running the software in CBRM; to make record of the agreed points during the course; and to monitor the role-play running process. Another type is content-dependent roles, with changing representative individual roles corresponding to the selected manufacturing areas upon the real time running of the session.

4.4 The working procedure of the role-play

The following is the running sequence of the role-play simulation.

Preparation step: Days before the sessions, the involved people and their corresponding roles are determined. And all the necessary information and materials will be handed to them in advance for a thorough preparation towards good contribution during the actual operation.

The guide selects and arranges a meeting room, the roles are visualised by the name cards on a table, with the names and roles of the participants. And he or she should also arrange a computer and a projector for recording and projecting the relevant data/tables/figures/materials containing the elemental information. Figure 2 is the layout of the role-play meeting room arrangement.

Step1, introduction for the start of real time performing the role-play simulation: first, the role of managing secretary (the guide) introduces the background of MV and CBRM, and focuses mainly on the two approaches will be executed in the role-play. Then he/she explains the role-play and its instruction (detailed in section 4.5).

Step 2, going through the “expert adaptation”: first, the managing secretary (guide) and the participants put forwards the problems the company is facing – the problem part of a new case in CBRM. Then by running CBRM’s retrieval function to get (a) previous case(s) that contain some suggested possible answers to the related problems. And then, by going through the procedures described in expert adaptation approach, the participants start to analyse the new suggested solutions and make adaptation on them to make them more applicable and practically sound. For the problem items having no retrieved solution, the participants use their general domain knowledge to create

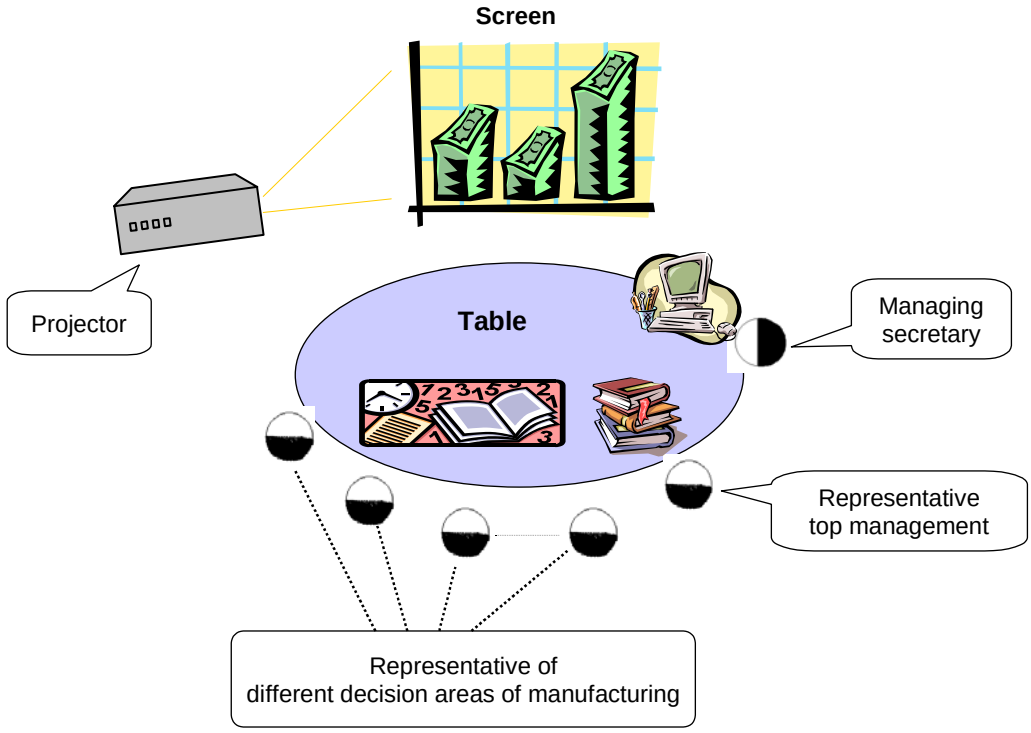

Fig. 2. Layout of the meeting room for the role-play

appropriate solutions.

Step 3, going through the “expert evaluation” on specific aspects of the solutions: using the questions in aspect-focused part of SPA in expert evaluation to verify and confirm all the created respective new MV solution possibilities. If there are some unsuitable points identified, repair them using “expert adaptation” and go through the SPA again.

Step 4, going through the “expert evaluation” on general view: using the general-focused part of SPA, the participants make evaluation of the MV as a whole, to make sure the MV really applicable and meaningful to practical circumstance.

In step3 and step 4, outside experts should join the assessment for a justified evaluation.

When all the points are well done, a break now is necessary to make the participants cool down and then they can focus on the work in next step.

Step 5, information collection and feedback: a simple questionnaire will be collectively handed to the participants (including the outside experts during the “expert evaluation”) to acquire the comments regarding the methods tested and the role-play session itself.

The contents of the questionnaire could be as shown in table 2:

Table 2. Questionnaire contents for reviewing after running of the session

Score item / Reviewing focus	Methods tested-expert adaptation	Methods tested- expert evaluation	Role-play itself
Easy for understanding			
Easy for practical usage			
Effective for supporting decision making			
Improvement suggestions			

Note: Likert score: 1 to 5. 5-Strongly Agree, 4-Agree. 3-Uncertain. 2-Disagree. 1-Strongly disagree.

4.5 The instruction given to the participants regarding the role-play session

To make the participants well prepared and easily involved in the process, this instruction could be printed on a big paper and put at an easy reading position during the sessions for participants' reference.

General instruction

After the introduction of CBRM as well as the role-play, you have grasped the ideas about the background of the session. Now, let's assume our role as a representative in different area of an enterprise's operations, and dealing with some new problems. You are encouraged using the information and materials, which are available to you, as well as the knowledge you have in your brain. Please be persisting to your role during the discussion, and based on your representative area with a holistic view of the whole enterprise.

The targets for the session

Main target: Generating a new MV by using expert adaptation and expert evaluation approaches; and deepening the understanding of the application characteristic of the two approaches, modifying them in case of necessity.

Additional target: Reviewing the effectiveness of this role-play design.

The form of the role-play in the session

The role-play here takes the form and follows the process of a real management meeting. It has the following phases:

First, the background information introduction;

Second, the testing case problems description and reviewing to all the participants;

Third, the managing secretary (guide of the session) of the meeting announces the start of the discussion regarding the problems provided;
Fourth, by following the structured two approaches, you bring forward your opinions to deal with the problems, you can disagree with each other, but the participants must assure to avoid sticky to one particular specific point for too long time thus forgetting the main topics; and after getting reminding from the guide, you should follow the guide's suggestion to ensure the complementation of the session.
Fifth, after all the topics are finished, the guide gives a simple summary. And you are kindly asked to fill in the feedback questionnaires.

The roles within the session

Managing secretary (played by the guide): responsible for general information introduction and explanation of the procedure of the role-play, and final information collection and summary.
Representative from the top management: responsible for providing the view regarding the manufacturing system as synthetic and holistic as possible, and he or she is supposed to be prepared with all the relevant information regarding the problems.
Representatives from the certain aspects of manufacturing: such as quality management, inventory management, HRM, etc., each responsible for expressing the view with deeper focus on a certain filed. This requires the representatives be prepared with the focused information and they are expected to have more detailed understanding on their representing areas.

The arrangement for the articulation of the participants:

To avoid the situation that some people dominate the talking during the session, the ideas expression of the participants will be conducted in turn. And each person would be limited to maximum ten minutes for speaking each time in his or her turn.

5. Results after running the role-play

This role-play was conducted in both Denmark and USA. We invited two groups of master students respectively, who have both practical experience in the enterprises and deep understanding in theoretical background.
The role-play tests took around 3 hours each, and the participants went through all the steps within "expert adaptation" and "expert evaluation" approaches. The session in Denmark focused more on the expert adaptation, while the session in the USA more on the expert evaluation. The American group agreed with almost all the solution possibilities created by the Danish group, despite the participants' different background and empirical experience from dissimilar industries as well as enterprises.

6. Conclusions and discussions

According to the summary of the feedback information in the questionnaires, the authors have the conviction to say that for application in knowledge intensive environment, the two approaches within the CBRM (namely “expert adaptation” and “expert evaluation”) are effective and efficient to support the knowledge integration, creation and perfection. As two of the critical parts in CBRM, they facilitate the model to machine the immense and sometime isolated information, data and knowledge into meaningful, applicable knowledge portfolio.

With the support from these two approaches as well as the other integrated methods within it, CBRM will function as a vehicle to link and propel an enterprise from the current position to its future higher level of performance for sustained competitive advantage.

Role-play’s important supportive characteristic in the area of knowledge acquisition, application and creation is well illustrated through the sessions. It will reduce the cost by avoiding distracting many people from their routine work, provided that the roles own enough knowledge and information as the people in practice do. And it also has the possibility to reduce the time consuming for generating new knowledge when based on an extensive knowledge source - case base. It is also reasonable to assume that role-play could also be used in dealing with real world situational problems, besides as an educational approach and as a tool testing some approaches as done in this paper. Role-play would be an option for support decision-making using the knowledge from different sources.

7. Acknowledgement

The authors would like to extend their thanks to the participants for the sessions in Denmark and the USA, for their beneficial informal discussion and formal participation in the role-play sessions and all the relevant support.

Reference

Aamodt, A. and Plaza E. (1994), “Case-Based Reasoning: Foundational Issues, Methodologies Variations, and System Approaches”, *AI communication, IOS Press*, Vol. 7: 1, 39-59.

Alden, D. (1999) “Experience with scripted role-play in environmental economics”, *Journal of Economic Education*, vol. 30, no. 2, 127–32.

Bergmann, R. (1998), *Introduction to Case-Based Reasoning*, University of Kaiserlautern, http://www.cbr-Web.org/CBR-Web/cbrintro/, July 20.

Brown, S., (1996), *Strategic Manufacturing for Competitive Advantage Transforming operations from shop floor to strategy*, Prentice Hall.

Freeman, M. and Capper, J. (1998), *An anonymous asynchronous Web-based role-play*, at: http://www.ascilite.org.au/conferences/wollongong98/asc98-pdf/freemancapper.pdf.

Higgins, J., M., Vincze, J. W. (1993), *Strategic Management, Text and Cases*, 5th edition, The Dryden Press, Harcourt Brace Jovanovich.

Jones, et al., (1994) *ROLE-PLAYING Based on excerpts from The Expert Educator* , at: http://www.neiu.edu/~sdundis/hrd362/roleplying.doc.pdf.

Maslen R. and Platts K. W. (1997), "Manufacturing Vision and competitiveness", *Integrated Manufacturing Systems*, Vol. 8, No. 5, 313-322.

Riis, J. O. and Johansen J. (2001), "Developing a Manufacturing Vision", *International Working Conference on Strategic Manufacturing*, Aalborg, Denmark, August, 313-324.

Skinner, W. (1969), "Manufacturing: Mission Link in Manufacturing Strategy", *Harvard Business Review*, May-June, 136-145.

Slack, N., Chambers, H., Harland, C. Harrison, A., Johnston, R. (1998), *Operations Management*, 2nd edition, Financial Times Pitmann Publishing.

Sutcliffe, M. (2002), *Simulations, games and role-play*, at: http://econltsn.ilrt.bris.ac.uk/handbook/games/, September.

Sutcliffe, M, (2003), *Using role-play to teach undergraduate business students: challenging the teacher, supporting the learner,* at: http://www.business.ltsn.ac.uk/events/BEST%202002/Papers/Sutcliffe.PDF.

Wang, C., Luxhøj J. and Johansen, J. (2003), "A Case-Based Reasoning Model (CBRM) for Supporting Strategic Manufacturing Vision Development", *Proceedings of Hawaii International Conference on Business*, Honolulu, Hawaii, USA, June.