ABSTRACT PRODUCT DESIGN FOR ENGINEERING COLLABORATIONS ACROSS DIFFERENT FIRMS

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ABSTRACT

At the present time we are in a globalized world in which large companies continually change their location in a search for best costs for their products. The SMEs have not wished to be left out of this trend so they use Joint Ventures to search for companies in countries with very cheap labour, not highly qualified, to carry out their manufacturing activities so as to be able to compete with large companies at a global level.

One of the aspects to take into account is that the power of knowledge is within the reach of more people every day and at the same time there are more qualified people in the world who are able to assimilate it. For this reason, we see how these SMEs are also beginning to relocate, seeking qualified personnel at low cost in different parts of the world and thus being able to undertake collaborative engineering.

Today, according to the state of the art available to us, there are various tools and methodologies for the virtual development of a project.

Another point which must be mentioned is the communication necessary for the successful handling of project management. It is a very different matter dealing with people from your own environment and dealing with those from a diversity of cultures and working customs. For this reason the most leading edge methods for managing projects with the greatest possible success have been analysed.

Keywords: collaboration design, virtual education,

1   INTRODUCTION

At present, in an environment where companies are surviving in a globalized world and in a very agitated financial environment, they are obliged to relocate, always seeking a place where they can reduce the expenses of manufacture, logistics and trade.

The reduction of manufacturing expenses is logical, so they search for locations of low-cost labour in emerging countries and move all their manufacturing plants there, closing them down in those countries with high labour costs and high taxes. In the field of logistics they look for countries where the logistical service does not increase the port dues for goods and where customs taxes are minimal. Finally, the services of sales and customer service seek locations where the personnel, at low cost, have a minimal training and are multi-lingual, an example to mention is India, a country where training is high, at low cost.

On the other hand, the management of knowledge has always been concentrated at the location of the parent company and the added value of the knowledge has been maintained there. But this is changing. Every day virtual project processes can be seen

in which, for example, a phase of conceptual design is done in the head office, the detailed design is developed in another European location, the validation trials of the product are completed in the United States and finally the prototypes and first production series are made in an Asian country, which could be China.

This does not mean that all these processes can only be carried out by large companies. Small and medium companies are not left outside all this and they seek knowledge in the universities to develop part of the basic research and the applied research takes place in technological centres, where they also do the validation trials. At the same time they outsource parts of the project to other companies in other countries where parts of low added value can be made or those parts which are not their own speciality.

The companies, after analysing their weaknesses and strengths, define the most strategic factors to follow in the ensuing years and devote themselves with all possible resources to promoting their strengths and referring all their weaknesses to other companies.

The general objective of all the companies is to generate products of high added value, differentiated from the competition, with the purpose of maximum satisfaction of the customer's needs. These purposes and objectives will be a success if all this can be done in the shortest time possible and with the maximum effectiveness of all the resources available.

On the other hand, the more the product design and development personnel are trained in virtual group working, the more efficient will be the result.

2   CURRENT TECHNOLOGY OF THE MANAGEMENT OF KNOWLEDGE

Today we can use many 3D design programmes which permit the management of documents in a virtual manner through a PDM document manager or through modules incorporated into the 3D programme itself. There are also on-line communication systems available in which communication in virtual space is made easier, for example SKYPE, MESSENGER or, if we are looking for more developed programmes, there is WEBEX, among others.

In this way, two engineering departments may work virtually, with a computer with IP video telephone and a VPN connection with integrated PDM systems, called collaborative engineering tools, connected to the ERP system.

Among these tools, two of importance are usually distinguished:

a)   Tools of storage and launching, which have as a final result multimedia techniques by which one person can work on an active version of the project and the rest of the members of the project team can work on versions which are not updated, or on those which cannot be updated.

b)   Tools for working in real time, which make it possible for the members of the project team to work simultaneously on the screen of a monitor, being able to carry out modifications of its state, for example the VPN connections.

VPN connections can connect at whatever level as desired. The companies in which I have had certain experience are connected to various VPNs distributed geographically and all of these connected through Internet nodes. As can be seen, Figures 1 and 2 give examples of VPNs installed in the five continents. A very normal case today is that not
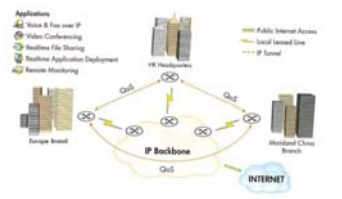

Figure 1

Figure 2

only the large companies install manufacturing companies in China, but also the SMEs are beginning to search out Chinese companies to be associated with in a Joint Venture in order to be able to manufacture at low cost.

In China the internal communications are not sufficiently good to be able to establish videoconference connections, they are normally unstable at various times of day, and to resolve this problem support companies have been set up which offer videoconference communications of high quality in many cities within the country. You can see this in figure 3.

On seeing the technological development which the emerging countries are achieving and at the same time the increase in highly qualified personnel, many companies install in these countries parts of their design development phase, such as sections of the project in which the company is not strong.

Figure 3

3   PROJECT MANAGEMENT

It is taken as a premise that there is not a need of a specific location for each department, nor do the projects necessarily have to be located in a physical environment. Integrated communications can be set up automatically in all the departments to undertake any task in any project in progress. This project may be a product, service, improvement, etc. Every department carries out a specific task in a specific project designed by a project manager, where the resources, the time and the cost of each task are all integrated. In this way it is much more convenient to work with concurrent engineering since the tasks can be organised in such a way that several of them can be done in parallel and the final time reduced. Again, each department can

have sections located in any part of the world, for example, the mechanical part can be in Barcelona and the electrical section in Frankfurt.

Not having a physical space to relate to a specific department motivates and creates a virtual environment for working in matrix format.

The matrix format is formed by the number of projects accepted by a management team which has agreed a specific time and financial resources. All this will be carried out by human resources assigned by the different departments, sections or virtual environments, which at the same time can be external or internal to the company. Each project will be managed and controlled by a project head appointed by the management.

The project management need not necessarily by run by the technical manager. It could be run by a financial manager, a process under-manager or even the manager of time and motion costs, among others.

What does this create? It creates a series of conditions which require teamwork and at the same time continuous collaboration between departments. For example, if project manager A is the technical manager and he needs a budget increase of 2% because he believes that in the long term it could bring a substantial improvement in the product, and he asks the financial manager to collaborate so that he can adjust his budget, or if necessary, request an increase in credit, that person will try to collaborate to the maximum in achieving it. The same thing could happen to the financial manager in the case that the project he is managing leads him to ask for help from someone in the technical department to solve some technical point in his project.

With this we avoid the problem of many companies which have the departments totally isolated from each other and the phases of the project are passed from door to door, delivering at that point the responsibility, the follow-up and the job of carrying it out, with each department disassociating itself totally on delivery of the phase.

All this can bring success for the project if the participants in it are trained for teamwork and to work in a virtual way and also know at any moment their inputs for each task and which outputs they have to deliver. At the same time the whole team is open to giving support to the colleagues who ask for it and also to receiving support when they need it.

The only danger which arises is that there has to be control over the time for the task assigned for each resource and if for any reason there is an interruption through a request for support, to warn of the delay which may be caused to the project.

There are various tools for managing the resources, time and costs of each project. An example could be the Project Server. The next figure 4 shows the environment explained.
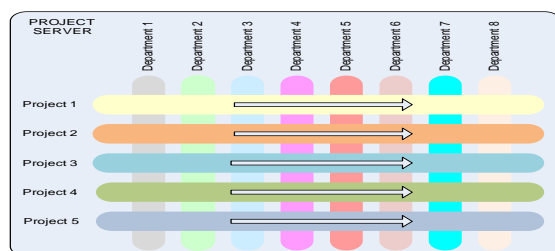

Figure 4

Finally we have to take into account that the way of managing a project varies according to the culture of the country where it is intended to be installed. For example, and according to my experience, Chinese engineers act in a more visual way than we do, they find it easier to copy a graphic sketch than to develop a product from written

specifications. Therefore it is important which documents must be prepared for the technical transactions to guarantee that your agent for that phase of the project understands it to perfection.

4   ADEQUATE TRAINING OF THE HUMAN RESOURCES

After analysing the virtual environment existing in companies which work with these environments and their project management system, we may glimpse that this can be linked to very similar training in the phase of advanced and postgraduate studies.

For example, we know that the Bologna Treaty tends to reduce master classes and create training seminars. In this way a task of research and teamwork is left to the students in order to finalise the knowledge obtained in the seminars. Therefore, we have the same virtual environment as the companies, but now from the particular environment of each student, which may be his home or a classroom.

On the other hand, we find that each student will have some group work which must be delivered at an agreed time and at the same time it can be the case that the student has to contribute some of the cost of the material used in the project.

Let us take a feasible example. A working group of 5 people is created in which a job is assigned to each of them, making that person responsible for the evaluation of the work. Here, then, it is understood that each of them can take on the management of a job as though it were a project. In this way each student has to manage the work and share out the tasks in an equitable way with all his colleagues and, at the same time, he has to answer for the work which was entrusted to him by each work manager, to be able to do it correctly and within the time set. As can be seen, this is pushing a kind of teamwork in which everyone is responsible as the manager of a task and at the same time takes part in other tasks where he feels part of a team managed by someone else. In other words, he knows at each time what he feels, both as a "master" and also as a "slave".

Let us make this still more real. There are virtual environments in the ERASMUS programmes, without leaving home. Each student has an environment of his own at home, an ADSL connection with a Web-CAM and communication with a training centre such as, for example http://www.webex.com/. In this way each student can show the work done to each of his colleagues although they may be in different physical locations. See Figure 5.
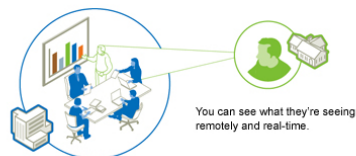

Figure 5

In this format any student, without regard to his financial resources, can exchange classes with any country of the world without leaving home. On the other hand we are training the students to work virtually and with teamwork environments.

5   CONCLUSIONS

Finally, it can be concluded that there is a need at training level to globalize the training at a virtual level where the student learns in an accentuated way to work in a team and, at the same time, promote virtual training with other foreign universities.

In environmental terms, we could save a lot of carbon dioxide if telework were encouraged with financial incentives for achieving targets. We would strengthen the balance of the work-family relationship. We would eliminate a number of travelling hours, both for the student and for the workers, who would gain in their family relationship.

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