eTEAMWORK MODEL ON RED CERAMIC INDUSTRY PROCUCT CERTIFICATION

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Abstract. *The fast changes in the enterprise environment and the economical globalization phenomena inducted production process flexibilization which has made possible the emerging of Computer Supported Collaborative Work. The difusion of new information and communication technology also computing tools development are responsible for this paradygm changing. Regarding to this context, it has been studied the eTeamwork developed at the CEFET/RJ. The experiment was simulate the evaluation and certification of red ceramic blocks, using collaborative techniques by groups, involving a building constructor and a red ceramics company both of them located in Natal, Rio Grande do Norte State and an appraiser located in Rio de Janeiro. For the comunication at a distance between groups, the synchronous and asynchronous tools through the Internet had been used, and a computational tool developed in CEFET/RJ.*

Keywords*: collaborative work, eTeamwork, brick certification*

1. INTRODUCTION

We live on a time of dynamic changes on politics, economics, technologic, social and personal value fields. As the speed and complexity of the information grows, the phenomena interdependence and the development of an economy system that overcomes regional barriers, together with a high technological development that leads to very complex enterprise organizations to satisfy consumer demands can be considered as aspects of this new era. Indeed, the speed of information transmission overcomes the former obstacles (Trope, 1999).

The constant seek for flexibility is crucial on the organizations as they cannot stand anymore on a traditional and inflexible structure giving the reality of our days. The new organizational model consists of small workgroups that does not necessarily share the same physical space and can be modified very quickly according to the environmental needs. The agility to create or demobilize these groups allows the use of the best human resources, more capable to aggregate value on certain tasks no matter where they are located.

On this technology and globalization context a new team concept arises: the virtual team. These teams are becoming very popular - because of the increasing need for quick answers and information. They play an important role on corporations as it becomes easier to deal with the pressure for lower product prices and tight schedules along with organizational merges and acquisitions.

Virtual work dramatically changes teamwork habits. Virtual teams transmit and receive information between their members broadly using Information Technology (IT) as well as communication resources.

Those teams feel the experience of not being physically close to each other although their tasks need to be done. In this way it's possible that the group members never meet each other in person (Pithon, 2004). The group members are typically composed of people with different foundations that interact in cooperative manner exchanging information and sharing experiences to reach a certain goal (Moraes e Zorzo, 2000). Some prerequisites to work on such type of corporate environment, called Computer Supported Collaborative Work (CSCW), include the ability to collaborate, negotiate and to do proper communication and the respect of the individual differences.

This article introduces one experience supported by CSCW techniques involving a customer on the quality certification process of red ceramic industry blocks. The experiment consisted of simulating the evaluation of those blocks using CSCW and two groups apart from each other: a building company and a red ceramic industry (both located at Natal city on Rio Grande do Norte state) and an evaluator located at Rio de Janeiro city on the state of Rio de Janeiro. To enable the communication and data transfer between those groups, asynchronous and synchronous Internet tools have been used along with an application developed at CEFET-RJ. At the end of the inspection, the software issued a report that indicates which red ceramic batches are qualities accepted or rejected.

2. eTEAMWORK MODEL

This model is based on Concurrent Engineering (CE) team work. To reach the proposal of CE is fundamental that we have a multidisciplinary team with people of all areas and specialties involved in the project (Figure 1). This team should work synchronously and needs to take in account all the details, so that the work accomplished in each discipline area is compatible with the others and that each one feeds the other with correct information at the right time. This is the main dimension that obtained won in CE. As the CE teams work simultaneously, it is not possible to process more than a single product at the same time. On the other hand, the change for new products implicates reconfiguration of the team's structure and, possibly, it will also affect tools to support CE. However, the traditional enterprise organization functionality is affected and a new organizational project will be made necessary, based on the organizational team's project, guided for act in special tasks. It is common find thoroughly totally in the literature on CE favorable positioning. Nevertheless, inside that they are not positioned favorable, group points some fail or, at least, omission of certain relevant aspects for his implementation, such as, the organizational model for CE is not well adapted for development products returned for the small and medium enterprise. Therefore, if the CE teams are organized rigidly, haven't possibility of a team member to be quickly replaced by another human resource. That impossibility carts a loss of flexibility and efficiency in the CE teams' organization and as consequence his acting (Pithon, 2004)

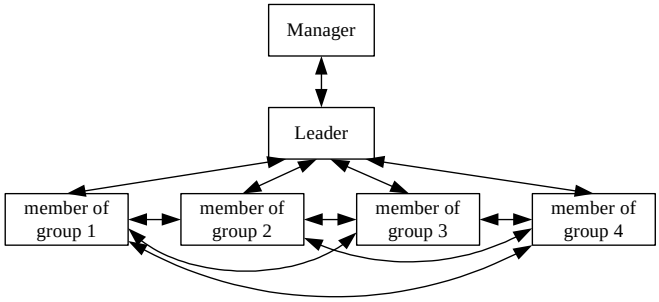

Figure 1. Model of Concurrent Engineering Teams

The main characteristic of the new model is the insertion of the broker between the manager and the members of the CE group (Figure 2). This model is composed by the manager, the broker, and the members of the group, with the following characteristics:

- Manager – responsible for all the macro level and for the strategy of action of the enterprise. The manager has a global supervision, delegating minor and detailed responsibilities to the broker;

- Broker – element chosen by the management to capture the necessary resources to the execution of the tasks, making the integration of the selected resources, reconfiguring dynamically the resources of the CE. It is the element between the management and the members of the group;

- Members of the group – components that form the work groups. They are the one who execute the tasks.

This proposal contemplates the temporarily or permanent reconfiguration of a group member by another one, making it possible to be a fast one and without loss of flexibility and efficiency in case of a break in the continuity of the tasks in off-line mode, e.g., if it is necessary to have an interruption between two distinct tasks. Despite the interruption of the task, the reconfiguration of one or more members of the team is given immediately, since there is a previous database of potential substitutes (resources market). In words of implementation, the resource is a physical support to the realization or execution of a task, ex.: machine tool, computer equipment, human operator and software.

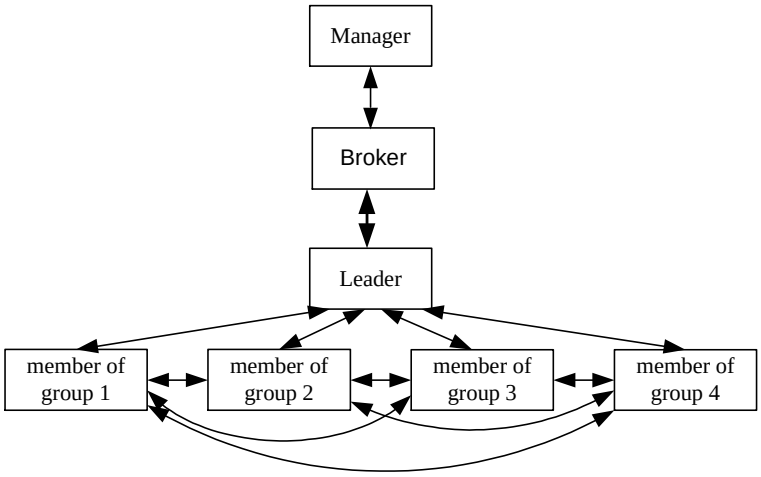

Figure 2: eTeamwork Model for Concurrent Engineering

This replacement will be conducted by the broker, which is a vital element to the functioning of the agile CE work groups. To make group management possible, the information of what's happening is necessary in the way the broker can take adequate decisions about the proceedings to be taken to favor the cooperation. This information is favored through the elements of perception that capture and condense the information collected about the participant's interaction.

In this context, the study of awareness and it's mechanisms of support are essential to support adequately the work group. The awareness inside an environment involves many cognitive aspects related to the human ability. On the interaction between people in an inside corporate environment, a face-to-face contact is natural as they are being able to view, to hear and to get in touch in person with each other. The situation get less easy when you try to give support to the awareness in the virtual environment as described in the context of this work. In these environments the information tends to be less visible and perceptible as if it were a face-to-face meeting. This way, awareness is an important factor to the broker, since it allows him to know the progress of the work of other members of the group, as for example, what was done, how it was done, what still have to be done, what are the preliminary results, etc. The awareness information is necessary, mainly, during the dynamic phase of coordination, to send change of plans and help to make a new shared agreement. They help to measure the quality of the work about the objectives and progresses of the group and to avoid the unnecessary duplication of efforts.

The main characteristic of the agile teams of CE comes from the fact that there is no need for the team members to be together in one physical place (face-to-face) neither needs them to work at the same time. This new way of team working allows a better flexibility to each member of the team, thus providing a better freedom in the execution of tasks, generating satisfaction and self well being, inducting a raise in the productivity.

The proposed model uses new information technologies that are developed aiming for a CSCW (Hawryszkiewycz, 1997), where physical distances do not represent an obstacle. This scene allows a dynamic and global actuation from different members of the group inside a simultaneous task.

The CSCW systems (Ellis et al., 1991) give support to people interact cooperatively and then make possible the raise of potential of the work groups involved in the common tasks. The cooperative work involves the change of information differed by the participants of the group and this change can happen between individuals, or between an individual and the group, and otherwise, being the communication between them the key point to the cooperation.

This way, the possibility and the easy way of sharing and the change of information is fundamental for the success of a groupware application. In this environment, groupware is the system of software that supports or makes possible the collaborative work, using the computer. The groupware systems use the computer to support groups of pledged people in a shared environment. The communication between the members of the group can be organized and happen with the participants located in the same or at different places. As we mentioned on the previous paragraphs, when the group is in the same place the communication happens face-to-face or through support meeting systems (E.g.: the speak is an example of face-to-face communication). When the members of the group are not geographically close, the communication can be in two ways: the first, the members of the group will act collaboratively, change ideas, but not at the same time. This type of communication is called asynchronous and its main tool is the e-mail; in the second, the members of the group change information simultaneously through the network. This type of communication is called synchronous and its main tools are the video chats and the online chats.

3. RED CERAMICS BACKGROUND

The studies made by CEFET-RJ concerning the ceramic sector began on 1999 and they generate several institutional and pedagogic benefits (Souza, 2002). Besides other activities, we can highlight the CEFET-RJ engineering graduation and master's degree student's missions that produced consistent results on the research field at the fabric process and technology of the ceramic products along the master's degree thesis presented on this area.

A good example on how this kind of research can help the national industry was the development of software, named Ceramic, to control costs on the ceramic industry. This software is easy to operate and it is very helpful to enterprise management for the ceramic sector. Another software developed at CEFET/RJ was named PIB (block Inspection Program) that certifies the quality of ceramic blocks (bricks, tiles, etc.) used by building companies. This was the software used on the experiments between CEFET/RJ, CEFET/RN and the ceramic companies of Rio Grande do Norte. This software contributes to improve quality indexes and productivity on the ceramic sector.

The certification of ceramic blocks batches used by the building companies is crucial to achieve security and quality on the constructions. The PIB software is based on the need to standardize the dimensions as described on the NBR 15270:1,2 e 3 rules.

PIB consists of the following modules: Visual Inspection Module, Dimensional Inspection Module, External Walls and Diversion related to Straight Edge Inspection Module. To do our experiment, only the Dimensional Module was used to inspect ceramic sealed blocks sized 9cmx9cmx19cm. The report generated by PIB rejects an batch of pieces when the sample has an amount of non-compliant blocks on a rate greater than 5 on 12, otherwise, the batch is accepted.

A deep analysis is not needed to confirm that the red ceramic sector is not been properly updated about the recent industry and market changes. A possible explanation to the lack of investments on technology development would be the low prices of each produced piece – a direct result of the low market demand for quality products.

4. THE EXPERIMENT AT A GLANCE

The experiment was made from September to December 2006, as this was the period of time for the Masters degree class that makes this experiment come true. To do such task, two groups have been created: group "A" consisting of students of the Masters degree course on Technology for CEFET/RJ and group "B" formed with students from the Building Construction Technology course for CEFET/RN.

Group A had the main goal to use PIB software, briefly described previously, to validate the certification of a ceramic block batch used at civil construction. The sample for each batch was chosen by group B on four players of the ceramic sector of Rio Grande do Norte State.

Group B also did the input of the data collected on PIB software and then generated the certification report. Group A was responsible to validate this report, doing the same data input and report generation on PIB software, in the way to compare these results with the ones obtained by group B. Thus, both results need to match each other and so the experiment could be considered successful.

Transporting the model described above to the experiment (Figure 1), we can consider that both institutions CEFET/RJ and CEFET/RN took the role of Managers and the teachers of both classes assumed the role of *brokers* (so, the teacher for the CEFET/RJ class was the *broker* for group "A" and the teacher for the CEFET/RN took the same role for group B). The students for CEFET/RJ and CEFET/RN were, respectively, the members of groups A and B. The live visits to do the data collection activities were performed by group B.

During the experiment, several tools were used and all of those offered for free on the Internet. These tools were chosen according the infrastructure of the labs of both institutions and also because the operation of these tools was easy and well-known by the group members. The following tools were used:

- Discussion lists

Yahoogroups was the discussion list selected for this experiment due to easy access and operation and great reliability. The list named TCI_06_2 (http://br.groups.yahoo.com/group/TCI_06_2) was created and, between October and December several messages were generated by the list members, as shown on Table 1.

Table 1. Number of messages generated by the discussion list

Month	Number of messages
October/2006	5
November/2006	19
December/2006	18

The greatest number of messages was during November and December since the data collection on the field and the data validation using PIB software occurred at that time.

- Instant Messaging Tools

MSN Messenger and Skype were the tools used to allow exchange of online messages between group members anytime, anywhere.

- MSN Messenger

MSN Messenger is an instant messaging application where the participants can see who is connected and then interact with their peer or peers simultaneously by typing or doing audio and video conversations. It also permits to send files between users. During the experiment, the interactions between the groups A and B took about 160 minutes.

- Skype

It is a P2P (peer-to-peer) application that allows a superior voice conversation compared to MSN. The interactions between the participants of both groups reached 135 minutes.

During the whole experiment, some difficulties were observed, most of them related to IT infrastructure. The issues on the IT infrastructure can be related to software update problems, hardware limitations on some machines, limited bandwidth of the networks used and connection failures. In general, these small difficulties lead to some delays on the experiment schedule.

Another issue was related to communication problems and to the behavior of some group members. These problems are mainly due to some language misuses – spoken and written – that happened sometimes. Also, the time zone was different between Rio de Janeiro and Natal by one hour, which was not a big challenge but it's a point of attention in order to avoid delayed meetings and other misunderstandings.

5. OBTAINED RESULTS AND CONCLUSIONS

Unlike all the difficulties reported during the data transmission and reception task between the two groups, we can consider that the ***e***Teamwork model implementation succeeded since the experiment result was satisfied and the scheduled tasks were fully performed. All the data was validated and final reports (Figure 3) have been generated by the PIB software.

Result of Blocking Block Inspection - 9x19x19

Quantity of Concordant Item

Product Name	*Lot*	*Sample*	*Qtde Lot*	*WidthPiece*	*HeightPiece*	*Block*	*1/2 Block*	*1ª Sample*	*2ª Sample*	*Total Item*
Inspection Data										
4/12/2006										
Blocking Block 9x19x19	**2**	**9**	**10**	**9**	**19,1**	**19**	**0**			1
Blocking Block 9x19x19	**2**	**8**	**10**	**9**	**19**	**19**	**0**			1
Blocking Block 9x19x19	**2**	**7**	**10**	**8,9**	**18,9**	**19**	**0**			1
Blocking Block 9x19x19	**2**	**6**	**10**	**9**	**19**	**19,1**	**0**			1
Blocking Block 9x19x19	**2**	**5**	**10**	**9**	**19**	**19,1**	**0**			1
Blocking Block 9x19x19	**2**	**4**	**10**	**9**	**19,1**	**18,9**	**0**			1
Blocking Block 9x19x19	**2**	**3**	**10**	**8,9**	**19**	**18,9**	**0**			1
Blocking Block 9x19x19	**2**	**2**	**10**	**9**	**19**	**19**	**0**			1
Blockink Block 9x19x19	**2**	**1**	**10**	**9,1**	**19**	**19**	**0**			1
Average				**8,9**	**19**	**19**	**0**			

Result

Concordant Item	**9**
Not Concordant Item	**4**

Accepted Lot

Figure 3. Final report of sealed blocks certification sized 19x19x9

About the collaborative work process used to certify the ceramic blocks, Table 2 shows all the actions performed during the experiment that used the eTeamwork model.

Table 2. Actions performed on ceramic block certification

Actions	Number of Minutes
Live visits on the companies to acquire data	225
Interactions by MSN	160
Interactions by Skype	135
Interactions by Yahoogroups	420
PIB software learning time	120
Total	1060

The time spent on the experiment was about 17,6 hours (1060 minutes). This time could even be optimized if the communication and infrastructure problems related above did not happen. At the end a cost inventory was not performed since the IT infrastructure used belongs to both institutions and also the costs needed to perform the live visits were not took into account. Anyway it is easy to notice the costs savings brought by the collaborative work in the way that it avoided the need for several other costs like transportation, food and lodging of the group members.

In effect, collaborative work brings the possibility of a great agile, costs savings and increased productivity when compared to traditional working process, since it minimizes the needs for transportation and allows to contact and to work with human resources of different areas of knowledge located on several different geographic regions.

6. REFERENCES

Ellis, C. A., Gibbs, S.J., Rein, G. L., 1991. Groupware: Some Issues and Experiences. Communication of the ACM, 34(1), pp.38-58.

Hawryszkiewycz, I., 1997. Designing the Networked Enterprise. Artech House.

Pithon, A.J.C., 2004. Projeto Organizacional para a Engenharia Concorrente no Âmbito das Empresas Virtuais. PhD Thesis, University of Minho, Portugal.

Souza, C. G.; et al., 2002. Resultados do Intercâmbio entre o CEFET/RJ e a FH Kön envolvendo Projeto de Inovação Tecnoláogica. In: Congresso Brasileiro de Ensino de Engenharia, Rio de Janeiro. Anais. Piracicaba, Unimep.

Troppe, A. 1999. Organização Virtual: Impactos do Teletrabalho nas Organizações. Rio de Janeiro, Qualitymark Editora.

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