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Redesigning work organizations and technologies: experiences from European projects [1]

Report for D3
State-of-the-art on work design

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CodeWork@VO Project

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1 Abstract

Currently distributed business process (re) design (resulting in components of business networks) basically relies on technical criteria. And that are the main purposes of most research projects supported by EC. Through the process of building a European Research Area, this means a strong influence in the national research programmes. However it is generally accepted that it should also take into account social criteria and aspects such as the quality of working life, or participation in decision processes. Those were some of the objectives of projects in de 80s decade, and framed some of the main concepts and scientific approaches to work organisation.
The democratic participation of network and organisations members in the design process is a critical success factor. This is not accepted by everyone, but is based in sufficient case studies. Nevertheless, in order to achieve an optimization that can satisfying the requirements of agility of a network of enterprises, more complex design methods must be developed.
Thus, the support to the collaborative design of distributed work in a network of enterprises, through a concurrent approaching business processes, work organisation and task content is a key factor to achieve such purposes. Increasing needs in terms of amounts of information, agility, and support for collaboration without time and space constrains, imposes the use of a computer-based model.

2 Concept of collaborative and democratic work design in virtual organizations

One of the most important changes in work organisation in the last two decades is the increased flexibility in the assignment of task or deployment of personnel usually referred to as *functional flexibility*. A wide range of measures was implemented to achieve this, ranging from job enlargement and multi-tasking to team working. According to the European Foundation for the Improvement of Living and Working Conditions, 60% of all

employees in the EU work in some form of team [2]. There are, however, widely differing estimates of the extent of diffusion of new principles of division of labour such as "team-working", depending on the precise definition of the practices under investigation.
A rise in the demand for "soft skills", such as language, communication skills and *self-management* have encouraged a blurring of the boundaries between occupations and the emergence of new work roles. This process was accompanied by the flattening of decision-making structures, by a fusion of conceptual and operative roles [3], and by the broadening of roles and requisite skills of the individual worker (e.g. multi-tasking, team working).
Team working is a form of work organisation associated with the high-trust and commitment, and with the "high-performance" firm [4]. Its orientation toward quality competition and innovation, toward continuous upgrading and broadening of the skill endowment of its workforce, and its elective affinity toward collaborative, high-trust labour relations has earned it the special attention of the European Commission [5]. The results of the EPOC survey [6] are also supportive of the positive impact of employee participation in decision-making and job-enrichment on business performance [7]. It is often argued that high performance practices are complementary and their impact on performance is maximised when adopted as a group, rather than piecemeal [8], though there is not always a clear statement of which practices must be in the group or the nature of the bundles.
The distributed work forms demand that employees constantly reorient themselves to new situations, colleagues and problems. In fact, advances in technology potentially enable employees to work in distributed work environments, which greatly increases autonomy, and often means a change in company control measures.
Regardless of the theoretical and practical advances in business process design or re-

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[2] Paoli P. and Merllié D., *Third European survey on working conditions,* European Foundation for the Improvement of Working and Living Conditions, Dublin, 2001.
[3] For example, production and quality control, or assembly and maintenance at manufacturing sites.
[4] Cf. Milgrom P. and Roberts J.: "Complementarities and fit strategy, structure, and organizational change in manufacturing", *Journal of accounting and economics,* vol. 19, 1995, p. 179-208; and Appelbaum E., Bailey T., Berg P. and Kalleberg A.L. (eds.): *Manufacturing advantage: why high-performance work systems pay off,* Cornell University Press, Ithaca, 2000.
[5] Cf. Andreasen L.E., Coriat B., Den Hertog J.F. and Kaplinsky R. (eds.): *Europe's next step: organisational innovation, competition and employment,* Frank Cass & Co., New York, 1995; OECD, *The OECD jobs strategy: technology, productivity and job creation,* OECD, Paris, 1996; European Commission: *Partnership for a new organization of work. Bulletin of the European Union - Green Paper,* Supplement 4/97, Office for the Official Publications of the European Communities, Luxembourg, 1997; and European Commission: *Modernising the organisation of work - a positive approach to change,* EC, Brussels, 1998
[6] EPOC: *New forms of work organisation: can Europe realise its potential? Results of a survey of direct participation in Europe,* European Foundation for the Improvement of Living and Working Conditions, Dublin1997, and EPOC: *Employment trough flexibility: squaring the circle?,* European Foundation for the Improvement of Living and Working Conditions, Dublin, 1999.
[7] Sisson K.: *Direct Participation and the modernisation of work organisation,* European Foundation for the Living and Working Conditions, Dublin, 2000. See also Coriat B.: *Employee participation and organisational change in European firms: evidence from a comparative overview of ten EU countries,* CNRS Research Unit 7115, Paris, 2002
[8] cf. Lawler, E.E., Mohrman S.A. and Ledford G.E.: *Strategies for high performance organizations - the CEO Report,* Jossey-Bass, San Francisco, 1998.

structuring, re-engineering of processes [9], there are not relevant contributions that address the substantial changes in roles and responsibilities resulting from the new organizational context.

A Portuguese research project financed by the Ministry of Science and Technology (CODEwork@vo [10]) is trying to contribute to bridge this gap by developing a model that will act as mediator or integrator between the design approaches. The development of this model will result not only in substantial theoretical knowledge in this field, but also in practical knowledge resulting from the action-research approach. The main idea of this project is to develop a concept from the management of distributed tasks linked to overall goals, to the management of a web of relationships linked to overall goals (hyper-management).

The integrating model will be based on the work reported by Soares and Sousa (2002) where a social actors network approach was suggested to model the co-operation aspects of virtual enterprises. This work focused on the joint organizational and technical design of distributed management information systems supporting the VO business processes. The SAN model will be extended and refined to address the CodeWork project goals. SAN is a mathematical model of Stochastic Automata Networks, and as such, is a formalism to model complex systems as a collection of interacting subsystems. The model will have facilities for a qualitative evaluation of relationships at a structural, a relational or even at individual levels [11]. This will be achieved conceptually and by quantifying some attributes of the SAN model. This opens the way to consider multi-criteria decision methods in the SAN based business process and work design. In fact, as mentioned in a paper from Brenner et al. [12], this model of stochastic automata networks "is particularly useful to model parallel systems because its basic primitives are parallel actions and synchronism among them. Such a model could be used to help system administrators choose the right cluster configuration for their needs or to help programmers to optimize parallel applications".

One first example in using the integrating model will the joint design through the UML business modelling approach [13] and the work redesign method of Hackman and Oldham [14].

The national projects WorTIs [15] and TeleRisK [16] were recent projects were one of the

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[9] Cf. Kettinger, W., Teng, J., and Guha, S.: "Business Process Change: a Study of Methodologies, Techniques and Tools", *MIS Quaterly*, 21, 1, 1997, pp. 55-80.

[10] Collaborative and DEmocratic work design and management in virtual organizations

[11] cf. Lazega, E., "Network Analysis and Qualitative Research: a method of contextualization" in Miller and Dingwall (eds.), *Context and Method in Qualitative Research*, London, Sage, 1997.

[12] Brenner, L.; Rose, C.; Fernandes, P.: "An analytical model to evaluate the performance of cluster architectures" (www.linuxclustersinstitute.org/Linux-HPC-Revolution/Archive/PDF02/29-Fernandes_P.pdf)

[13] Cf. Erikson and Penker, *Business Modelling with UML*, Wiley, 2000.

[14] Cf. Hackman and Oldam, *Work Redesign*, Sage, 1980

[15] Work Systems, Time and Space in the Automobile Industry, co-ordinated by António B. Moniz at IET (DCSA, FCT-UNL), funded by FCT-Foundation for Science and Technology (Ministry of Science and Technology).

team partners (UNINOVA/IET) consolidated important knowledge and experience on the relationships between work, technology and organization. These projects used cases from the automobile, textile, metal engineering and software industries. And another national project TOD-CME (1998-2000) [17] developed a set of concepts and tools about work organisation and information systems support in complex manufacturing environments. CODEwork@vo, that involves partners from these above-mentioned projects, is taking the sociological analysis of work organisation as an important input. The concepts concerning distributed business processes organization and co-operative planning in dynamic supply chains are central for this approach.
Some results of this project as well as the practical experience collected in semiconductor supply chain management will be used in CODEwork@vo. It is also important to mention two other international initiatives like COVE, a project on "COoperation infrastructure for Virtual Enterprises and electronic business" promoted by IFIP [18] that aims at contributing to the harmonization of the various worldwide initiatives on virtual enterprises. A network of excellence (THINKcreative) aimed at analyzing the future scenarios for collaborative networked organizations in order to advice the European Commission and national research funding agencies on strategic research directions in this domain. Both initiatives were considered to have relevant strategic importance, although the level of funding is quite low. The national project CODEwork@vo will have a close relationship with some EU IST projects. One of those is a European project aimed at developing a business model and a management methodology to dynamically configure and manage supply networks that are constituted in response to customer orders (MyFashion).
Is envisaged, through the CODEwork@vo project, to establish scenarios of cooperation enacted by the social actors work tasks in the client and supplier companies, and to fine tune the required logistic processes in terms of information access and exchange.
A model based on network of social actors should be adopted that could play the role of conceptual mediator in the application of specific design methods. This would support the collaborative design of distributed work in a network of enterprises, through a concurrent approaching business processes, work organisation and task content.
The central idea of this concept of collaborative work design is that the design of work would be focused on the relationships between the virtual organisation and social actors. At the same time, the above mentioned social actors network model would provide the means of structuring important information for the management of relationships in the virtual organisation.
This project will develop a web based distributed application, built upon “intelligent software agents” technology that will be specified and prototyped to address the requirements of information, agility, and support for collaboration without time and space

[16] Relações Laborais e Riscos Profissionais no(s) Contexto(s) do Teletrabalho em Portugal, co-ordinated by Paula Urze, at IET (DCSA, FCT-UNL), funded by IDICT-Institute for Working Conditions (Ministry of Labour)
[17] Also financed by FCT (Ministry of Science and Technology), and involving both partners (INESC Porto and FCT-UNL) of CodeWork.
[18] The International Federation for Information Processing

constrains. These software agents have the capability to generate and implement novel rules of behaviour and can engage in extensive logical planning and inference. One can say that the information overload can be successfully managed by the employ of "intelligent software agents", effectively converting raw data into "digestible" knowledge and appropriate action.
Thus, this can be a strategy to develop a concept of redesign of work organisations based on technological features that can help further criteria of flexible organisation using critical information systems in its business development.

3 European projects

As mentioned in the book of Ennals and Gustavsen on "Work Organization and Europe as a Development Coalition" [19], there is a special difficulty to build up a research project on work organisation. They underline that "anyone with some degree of familiarity with the history of work organization will know that there are potential difficulties in creating, not only a European project, but in fact any project that aims to deal with more than a single workplace or a small number of workplaces" (p. 3).
And many concepts used in the scientific literature are issued from (and are connected with) the work organisation analysis, such as motivation, alienation, satisfaction, productivity, innovation, flexibility and business processes, learning organisations, networks and virtual enterprises.
In fact, not so many projects were developed (or are being developed) in Europe about topics related to team working or collaborative work. As Ennals and Gustavsen acknowledge, "at one level of analysis, hindrances can be identifies as a lack of ability to incorporate the development of new forms or work organization into the agenda of the main social partners; a lack of willingness at the enterprise level to learn from each other and take 'good examples' to heart; a lack of supportive public policies, and the like. As the list grows longer, it grows, at the same time, more complex" (pp. 3-4).
Nevertheless, some efforts could be mentioned, as the classical programme on "Humanization of Work" in Germany, or ANACT in France, and even the position paper of the Commission on the "Partnership for a New Organization of Work" [20]. In fact, several national programmes were organised to support these experiences. But it seems that was not sufficiently extensive, or with enough resources and compromise that could enlarge the frame of involvement.
Here, in this paper, we will consider only those that were present since the 5th Framework Programme (5th FP), that is to say only from 1999 onwards. Some mentioned the concepts of "participatory technology assessment", "work process knowledge", learning organisations, collaborative knowledge modelling, or "virtual organisations", among others.
In the research area "Evaluation of Science and Technology policy option in Europe" one can find the following projects under contract with the EC:

[19] Ennals, Richard and Gustavsen, Björn: *Work Organization and Europe as a Development Coalition*, Amsterdam, John Benjamins Pub., 1999.
[20] Developped by the European Commission DG- V.

3.1 Participatory Methods in Technology Assessment and Technology Decision-Making [21]

The overall objective of this project, which started at the beginning of 1998, was to advance the understanding of the function of participation in technology assessment. It is a multi-national comparative study of the theory, needs and practice of participatory technology assessment in Europe. The project critically assesses the experiences of different European national technology assessment organizations with participation, and develops a framework for new methods for use at both national and trans-national levels. The project aims at:

1. Developing a theoretical framework on the role and function of participatory technology assessment.
2. Characterizing and comparing current practice in, and experience with participatory technology assessment in different European countries.
3. Identifying new areas of application of participatory technology assessment.
4. Giving initial recommendations on the use of participatory technology assessment at trans-national level.

This project was co-ordinated by the Danish Board of Technology, Copenhagen, Denmark, and involved other partners as, ITAS-FZK (Germany) [22], University of Westminster (Great Britain), the Rathenau Institute (Netherlands) [23], the ÖAW-ITA (Austria) [24].

3.2 Work Process Knowledge in Technological and Organizational Development [25]

This thematic network (and not a research project), also started at the beginning of 1998, and was concerned with the impact on the knowledge required of the workforce due to the changes that occur when organizations acquire greater flexibility. These changes can occur also when the organization introduce new technologies in response to the pressures of competition. Thus, this Thematic Network intended to contribute:

1. To identify new working practices associated with these changes;
2. To integrate European traditions for conceptualising the ways of knowing needed in the workplace to adapt to these changes - 'work process knowledge';
3. To generate and analyze policy options for facilitating the development of this knowledge, including new approaches to learning in the workplace, the design of new technology and organizational development within enterprises.
4. By elucidating the knowledge required in the working environment, and by integrating European traditions for theorising this knowledge, the project will contribute to the development of a European social science infrastructure.

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[21] Project ERBSOE1CT971073. Information at http://www.techno.dk, and klüver@inet.uni-c.dk

22 Forschungszentrum Karlsruhe GmbH - Technik und Umwelt, ITAS-Institut für Technikfolgenabschätzung und Systemanalyse

[23] Nederlandse Organisatie voor Technologisch Onderzoek

[24] Österreichische Akademie der Wissenschaften ITA-Institut für Technikfolgenabschätzung

[25] Project ERBSOE1CT971074. Information at: http://www.man.ac.uk/education/euwhole/home.htm

Was coordinated at the Human Factors Research Group of the Victoria University of Manchester (Great Britain), and involved partners from FCT-UNL (Portugal) [26], the Danmarks Tekniske Universitet (its Department of Technology and Social Sciences), the Università degli Studi di Siena (Italy), the Institute für Technik und Bildung of the University of Bremen (Germany), the Centre National de la Recherche Scientifique [27] (France), the Technical Research Centre of Finland, the Linköping University [28] (Sweden), CIREM [29] (Spain) and HIVA [30] (Belgium).
In the 5th framework programme (FP5), under the IST (Information Society Technologies) programme one can find more projects that deal with concepts of work organisations and virtual enterprise.

3.3 CLOCKWORK - Creating Learning Organisations with Contextualised Knowledge-Rich Work Artefacts [31]

Is a Project developed under the programme IST (Information Society Technologies) that started in 2000 and finished 3 years later. As referred by Project outputs, in innovative companies, knowledge is intrinsically linked to the tools of work. Despite this, current approaches to knowledge sharing and re-use fail to integrate these tools into the learning organisation. These companies are also faced with the contradiction of needing to collaborate with other companies whilst protecting the private knowledge that gives them competitive advantage. The CLOCKWORK project focuses on the engineering domain. It will combine knowledge rich dynamical simulation tools, formal documentation and informal rationale to closely integrate working, learning, collaboration and negotiation, within and between organisations. This involves the extension and integration of previous work on agents, knowledge modelling, document discourse tools, simulation and machine learning. The CLOCKWORK business objectives are to support:
1) Open knowledge sharing within distributed teams for work practice improvement,
2) Knowledge reuse within an organisation for productivity enhancement and innovation stimulation, and
3) Cautious knowledge sharing for collaboration and trade between innovation companies.

The objective of the project was integrating working and learning as essential features within innovative commercial areas. Trading and collaborating while safeguarding sensitive commercial knowledge is crucial to survival and success. Neither of these commercial needs is successfully supported by current technologies. CLOCKWORK focuses on engineering knowledge created and contained in dynamical simulation

[26] Universidade Nova de Lisboa, Centro de Investigaçao de Ciencias Sociais Aplicadas - Faculdade de Ciencias e Tecnologia
[27] ER 0125 - Cognition et Activités Finalisées
[28] Centre for Studies on Humans, Technology and Organization
[29] Fundacio Centre d'Iniciatives i Recerques Europees a la Mediterrania, Department of Labour Market and Training
[30] Katholieke Universiteit Leuven, Hoger Instituut voor de Arbeid,
[31] IST-1999-12566. Aditional information at http://kmi.open.ac.uk/projects/clockwork/

models. The project integrates simulation tools with formal documentation, informal design rationale and formal knowledge models to support working while learning and provide a collaboration and trading framework for innovative competitive companies. The objectives were to support the knowledge sharing within distributed groups to promote reflection and improve work practices. But was also to acknowledge the re-use within organisations in order to enhance productivity and support innovation. And finally, was intended to develop cautious knowledge sharing between companies. This could create a favourable environment for cooperation and enterprise.
The project aimed to facilitate innovation and learning at the workplace. And aimed also the empowerment of innovative companies with new methods of trading and collaborating. This work was built upon the state-of-the-art and dealt with a number of remaining deficiencies and current challenges in supporting knowledge sharing and reuse, and proposes to test these innovations within industry. In particular, current systems fail to incorporate complex processes of work, in which vital commercial knowledge is held.
The project will be grounded in the dynamical systems engineering domain. The tools and methodology will provide support for context and reflection by integrating the products of work with their associated justification. Sophisticated knowledge level support will be provided for the reuse of integrated accounts of past work that encompass formal documentation, informal rationale and simulation models. Controlled sharing mechanisms will support effective trading and collaboration with knowledge about and contained in simulation tools.
The project partners encompass a range of expertise including organisational learning, dynamical systems engineering, machine learning and knowledge modelling. The project draws on a number of partners' existing tools including intelligent agents, collaborative knowledge modelling tools, digital document discourse environments, simulation tools and machine learning.
The project will take a case-study approach in which from the very beginning industrial user partners will adopt and integrate the tools of the project with their work practices. Their integration of the tools will be conducted in close participation with their respective facilitator partners, who will follow the participatory evolutionary development model to co-evolve effective tools and methodology. The project has strong exploitation potential within the web technologies market, and promotion, dissemination and exploitation will be a key part of the work. The project CLOCKWORK completed a toolkit to support knowledge sharing, re-use and cautious knowledge sharing. Was co-ordinated at the Open University of United Kingdom [32], and involved also participants from Slovenia, Czech Republic, Germany. Most of them were from the field of mechatronics and artificial intelligence.

3.4 VIRTUE - VIRtual Team User Environment

Also a project IST [33] started in 2000 and completed in 2003. For many types of meetings, the high-realism tele-presence conferencing system will replace the need to travel.

[32] Co-ordinator: Zdenek Zdrahal, z.zdrahal@open.ac.uk
[33] Project Reference: IST-1999-10044 and aditional information at http://www.virtue.eu.com

Technologies in computer vision and graphics have developed to a position where this vision is achievable. The Project VIRTUE was developed to make this happen in Europe. Achieving this vision will require practical and efficient solutions to technology issues, most importantly wide viewpoint synthesis from multiple cameras that deals with occlusion, and object segmentation from non-uniform backgrounds. A comprehensive set of user experiments will ensure the result is an empirically validated demonstrator.
The main project objectives were:

1. To develop the innovative technology necessary to produce a convincing impression of presence in a semi-immersive teleconferencing system;
2. To integrate and demonstrate a tele-presence system incorporating such innovative techniques;
3. To investigate the human factors involved in maximising the effectiveness and realism of tele-presence and to use them to drive the design of the system.

The project consisted of five logical phases listed in chronological order below although they overlap significantly in start and end dates:

- Requirements (based on human factors and technical issues);
- Algorithm development (image acquisition and rendering algorithms suitable to be ported to the real-time platform);
- Real-time platform implementation (developing a real-time image processing platform and implementing the algorithms upon it);
- System implementation (development of the system components including audio and video coding, virtual environment and construction of the complete end-to-end system incorporating the real-time platform);
- Assessment (technical and user assessment tests) In addition, Human Factors experiments will be performed in parallel with these technology developments.

The project therefore consisted of five work packages as follows:

- Algorithms - this work package will develop novel image processing algorithms for tele-presence videoconferencing that are suitable to be ported t the real-time platform;
- Real-time platform - development of a real-time platform for analysis and rendering and porting the code developed in the Algorithms work package to it;
- System - construction of an end-to-end system including physical system set-up, coding, transmission and display;
- Human factors - user requirements analysis, human factors experiments on each of the key features of the system and system evaluation;
- Management - management of the project including planning, proactive management, tracking progress and taking corrective actions when required, reporting, publicity and exploitation plans.

This VIRTUE Project had as co-ordinator the British Telecommunications (UK) [34], and the participants were the TNO Human Factors Research Institute (Delft, Netherlands),

[34] Contact as JEWELL, Michael and michael.jewell@bt.com

SONY UK, the Faculty ITS of Technische Universiteit Delft (Netherlands), the Heriot-Watt University of Edinburgh (UK) and the Fraunhofer Society (München, Germany).

3.5 SMART SME - Smart Forms of Collaboration among Inter-Networked Manufacturing SMEs

Another project from the FP5 Programme IST was the Smart SME [35] that finished in 2002. It involved 10 SMEs from 4 countries (Greece, Portugal, Germany, Norway) that have identified a common business problem: in order to improve their competitiveness on the market they need to establish new smart forms of strategic co-operation and networking. In the Project was detected that the SMEs have to considerably improve the coordinated planning and monitoring of their collaborative work. Therefore, they have to introduce proven IST solutions supporting, planning and monitoring across virtual enterprises based on information/knowledge sharing.
The main common business objectives of the consortium was:

(a) To maintain and further improve the competitiveness of the SMEs on the market based on innovative collaborative work within an inter-networked organisation;
(b) To identify and eliminate bottlenecks in the current, traditional forms of mutual cooperation and find ways to resolve problems related to resistance to a stronger, active partnership
(c) To identify the appropriate forms of collaborative work
(d) To improve their ability to exploit the opportunities by improvement of skills and to prepare these SMEs for further networking with other companies.

Three typical partnerships were been identified as being of the highest relevance for the SMEs: (a) companies in the supply chain; (b) companies dynamically sharing the manufacturing of common products (distributed manufacturing chain) and (c) companies producing complementary products, all with the common business objective to improve services to their customers by offering a wider spectrum of products and better costs/quality/time conditions.
Thus the project analysed the current practices in SMEs and the models for dynamic networked organisations that best suited the specific needs. Also identified the optimal organisation of co-ordinated planning and monitoring of work in progress, and selected easy-to use IST solutions supporting co-operation and flexible co-ordinated planning and monitoring across virtual enterprises based on information/knowledge sharing, taking into account language/cultural diversity. Finally, organised pilot implementations of the open and interoperable IST solutions and platforms for flexible working between organisations and tested the selected co-operation models. This included the measurements of the success of selected solutions, which could serve (from the point of view of the authors of this project) as a basis for further elaboration of the co-operation strategy.
The co-ordination of the Project was held at the University of Patras (Greece) [36] and involved other participants as the Companhia Portuguesa de Têxteis (Matosinhos,

[35] IST-1999-20744. See more at: http://www.lms.mech.upatras.gr/Projects/SMARTSME/index.html
[36] MOURTZIS, Dimitris. The contact is at: mourtzis@lms.mech.upatras.gr

Portugal), Technika Plastika S.A., (Thiva, Greece), Peruma Têxteis (Vila do Conde, Portugal), IPF – Indústria Produtora de Fios (Felgueiras, Portugal), VIORAL S.A. (Aspropyrgos Attiki, Greece), Laskaris (Attikis, Greece), the INESC Porto (Portugal), the Empresa Industrial Sampedro (Caldas de Vizela, Portugal), the Institut für Angewande Systemtechnik Bremen (Germany), R. Seldis (Hamburg, Germany), A/S Timms Rerbane (Oslo, Norway) and Drahtseilwerk GMBH (Bremerhafen, Germany).

3.6 UNITE Ubiquitous and Integrated Teamwork Environment

The UNITE Project, finished in 2002, was also an IST one (FP5) [37]. It pretended to develop a fully distributed architecture of the platform, using open standards, widely used technologies, and emerging components. The main approach of the project addressed usability and effects on team members, teams and organisations, and cost/benefit ratios associated with the introduction of the specific technology developed there. The prototype has been deployed for use by a team of geographically dispersed consultants conducting their project, and evaluated. The evaluation results were fed back to the next version of the requirements, architecture and specifications, and prototype development. The project UNITE aimed to offer project teams and virtual organisations user-friendly, highly efficient co-operative workplaces that pervasively, dynamically, securely, and transparently binds project context information with team members, their physical workplace and own information tools. It was dealing with the requirements and paradigm of co-operative workplaces. Should define a suitable platform architecture, and validate the concept and the architecture with prototypes operated with real project teams. The Project approach implemented the vision of ambient intelligence. Its life cycle comprised four phases: the solution concept, the establishment of the basic platform, the development of an enhanced platform and, finally, the consolidation.
Was a Project co-ordinator by Compagnie IBM France (Courbevoie, France) [38], and involved other partners, as STERIA (Velizy, France), Penta Scope Groep B.V. (Gouda, Netherlands), the IAO- Fraunhofer Institut für Arbeitswirtschaft und Organisation (München, Germany), the Coventry University (UK), the IBM Research Laboratory in Haifa (Israel) and ADETTI (Lisbon, Portugal).

3.7 VIEW OF THE FUTURE - Virtual and Interactive Environments for Workplaces of the Future

This IST project lasted until the end of 2003 [39]. In the technical framework was defined that scientific and market research indicate that virtual environments (VE) would play a significant role in the workplace of the future. In this respect, the VIEW project aimed to help establish the role of VEs in supporting high quality work within industrial workplaces of the future. At the same time it aimed to understand the impact of VE

[37] IST-2000-25436 and more information at http://www.unite-project.org
[38] cf. LACOSTE, Gerard at lacoste@fr.ibm.com
[39] IST-2000-26089. More information at http://www.view.iao.fhg.de/

technologies on their users. Some pilot cases of VEs reflected the activities across the product life cycle in design, prototyping and training. The virtual environment design and circumstances of use were assessed in terms of their utility, effectiveness and acceptability, their health and safety implications, user satisfaction and development of technical and social skills. There were also some analyses on potential barriers of VEs. The co-ordinating team was at the University of Nottingham (UK) [40], and the participants in the consortium were IAWTM (Germany) [41], the department of Human System Integration of AB Volvo (Sweden), the IAO (Germany) [42], the VTT (Finland) [43], the Institute of Computer Science [44] (Greece), the firm Peugeot Citroën Automobiles (France), ICCS/NTUA (Greece) [45], Sensetrix Oy, at Espoo (Finland), John Deere Werke Mannheim (Germany), Alenia Spazio, at Rome (Italy), and the University of Basel (Switzerland) [46].
And under Human Potential Projects of FP5 ("Improving human research potential and the socio-economic knowledge base" programme), fewer projects were mentioning aspects related with work organisation. We focus in one of those:

3.8 NUEWO - New understanding of European work organization

Is a Project that was finished in 2003 [47] and co-ordinated by Göteborg University (Sweden) [48]. During the 1990s there has been a gradual movement away from on-going employment arrangements toward an increased use of 'contingent' employment arrangement. This development seems to be similar in most advanced industrial economies. This development may be one of the most important changes of work, with lasting effects on the quality of life for European citizens in the future, both in terms conditions for life-long learning and changing attitudes to work. The NUEWO study aimed at understanding the differences in the development of contingent employment in various European countries and the consequences of that development on individuals, work organisation and unions in various industries. The project was designed to be a cross-national, comparative study and conducted by means of case studies in users of contingent labour in different industrial sectors in the five participating countries (Sweden, Spain, UK, USA and Netherlands) [49].
More recently, in the 6th framework programme few other projects relates with work organisation and working groups. The most are at the IST programme. The concepts are

[40] cf. WILSON, John at john.wilson@nottingham.ac.uk
[41] Institut für Arbeitswissenschaft und Technologiemanagement (IAWTM) of University of Stuttgart.
[42] Fraunhofer Institut für Aarbeitswirtschaft und Organisation (München)
[43] VTT Information Technology, Valtion Teknillinen Tutkimuskeskus (VTT), ESPOO
[44] Foundation for Research and Technology, Iraklion, Crete.
[45] Laboratory of Microwaves and Optics of the Institute of Communication and Computer Systems, Athens.
[46] COAT-Basel (Center of Applied Technologies in Mental Health)
[47] HPSE-CT-1999-00009
[48] Department of Business Administration School of Economicsa and Commercial Law, contact at bo.sanuelsson@adm.gu.se
[49] The entities involved were: University of Sevilla (Spain), the Bristol Business School at the University of the West of England (UK), the California Polytechnic State University at San Luis Obispo (USA) and the Rotterdam School of Economics of Erasmus Universiteit Rotterdam (Netherlands).

the level of virtual multimodal processes, simulation tools, collaborative work environments, or standard settings.

3.9 VERITAS - Virtual Enterprises for Integrated Industrial Solutions

The co-ordinator of this project, to be finished in 2005, is Archemidea (Athens, Greece) [50], and its overall objective is to increase the dynamics of European Industrial Enterprises by transforming them, where appropriate and possible, to more agile and re-active companies that use the Virtual Enterprise concept in a manageable and effective way. The project goal is to help manufacturing companies with high production-related costs to understand and implement the concept of virtual enterprise, enabled through smart organisation and process restructuring and supported by the use of Information Technology, cross-organisation work management solutions in particular. The combination of these elements is the main project concept.
The machine tool industry in particular is the target sector, but they will try to keep the findings and output abstract, to an extent that will make a similar usage of the results possible in other industries.
VERITAS' primary activity will be the permanent creation of three stable virtual industry clusters. It will not force a VE initiative within its time horizon, but will provide all the necessary prerequisites and knowledge to form a VE in the future. This includes comprehensive training of the target companies in configuration, co-operation and competence management for VE as well as the development of tools to monitor and manage Virtual Environments. In addition, VERITAS will provide step-by-step instructions for forming a virtual enterprise with the set-up of a multilingual portal solution, once is envisaged to reach the target industrial organisations on a large scale. Although are connections with work organisation, the emphasis is not clearly in the team working concept. The participant organizations are the University of Wien (Austria), Makina Imalatcilari Birligi (Turkey), Sylvie Feindt Consulting (Germany), Agoria [51] (Belgium), and FMSIÖ [52] (Austria).

3.10 ELOGMAR-M - Web-based and Mobile Solutions for Collaborative Work Environment with Logistics and Maritime Applications

Under the 6th FP there is an action line on “applications and services for the mobile user and worker”. There was approved the Elogmar-M project [53]. The major aim of this activity is to gather and co-ordinate activities in the field of Information Technology and Communication solutions (Web-services, GPRS and WAP/WML mobile services, simulation, technologies for information systems design, virtual reality) with maritime

[50] Project Reference: 511013
[51] The Multisector Federation for the Technology Industry.
[52] Fachverband der Maschinen- und Stahlbauindustrie Österreichs.
[53] Project Reference: 511285, co-ordinated by Fraunhofer Gesellschaft zur Forderung der angewandten Forschung e.V., Munchen, Germany. More information from grote@hhi.fhg.de (GROTE, Norbert)

and logistics applications. The maritime freight route "Baltic Sea feeder ports - Western Europe hub port (Hamburg) - Mediterranean ports - Chinese ports" is selected as the subject of investigation and demonstration. One of the main objectives is devoted to the problems of setting up a collaborative partner pool, which unites 17 organisations from different countries (Germany, U.K., Finland, Greece, Poland, Lithuania, Latvia, Estonia and China) operating within the selected transport route by means of integrating their electronic information resources (databases, information systems, Web-sites and portals) in collaborative work environment.
Another important objective is focused on new work methods for the mobile actors in logistics and maritime areas (traders, resellers, railway carriers, shippers, consignees, insurers, agents, forwarders etc.) providing them with advanced mobile services, such as WAP over GPRS, PC-connected Web surfing and mobile e-mail and chatting. A set of collaborative activities will support the main objectives of the project that will be finished in 2006:

a. Definition, organisation and management of joint initiatives;
b. Organisation of conferences and workshops;
c. Setting up of expert groups;
d. Exchange and dissemination of good practice.

The participant organizations are: Politechnika Warszawa (Poland), Tredit S.A. and Thessaloniki Port Authority S.A. (both from Greece), Maritime & Supply Chain Solutions (Europe) LTD. (UK), Sabiedriba ar ierobezotu atbildibu IDC Informacijas Tehnologijas, SIA Sistemu Servisa Centrs "Latvian Intelligent Systems Ltd" and Rigas Tehniska Universitate (these from Latvia), Hafen Hamburg Marketing E.V. and RTSB GmbH. Rail Transportation Service Broker (both from Germany), Beijing Zhongke Hope Software and China Harvest Development (both from China), Uzdaroji Akcine Bendrove "Sonex Kompiuteriai" and Klaipedos Valstybinis Juru Uostas (from Lithuania), Kokkolan Kaupunki (Finland), Interbalt Maritime Agency Oshauehing and Logitrans Consult Ou (from Estonia).

3.11 AMI - Augmented Multi-party Interaction

Within the action line on “Multimodal interfaces” comes the project AMI [54] co-ordinated by the University of Edinburgh (UK). The AMI project is concerned with new multimodal technologies to support human interaction, in the context of smart meeting rooms and remote meeting assistants. The project aims to enhance the value of multimodal meeting recordings and to make human interaction more effective in real time. These goals will be achieved by developing new tools for computer-supported cooperative work and by designing new ways to search and browse meetings as part of an integrated multimodal group communication, captured from a wide range of devices.
The applications and activities addressed by AMI include:

1. Multimodal input interface: including multilingual speech signal processing and visual input;

[54] Project Reference: 506811. Co-ordinator: srenals@inf.ed.ac.uk (RENALS, Stephen)

2. Integration of modalities and coordination among modalities, including multi-channel processing (e.g. audio-visual tracking) and multimodal dialogue modelling;
3. Meeting dynamics and human-human interaction modelling, including the definition of meeting scenarios, analysing human interaction and multimodal dialogue modelling;
4. Content abstraction, including multimodal information structuring, indexing, retrieval and summarisation;
5. Collection, management, annotation and sharing of large multimodal meeting recordings via networked media file servers;
6. Technology transfer through exploration and evaluation of advanced end-user applications and prototype systems;
7. Training activities, including an international exchange programme.

As defined in the proposal, this research will be undertaken in the framework of well-defined and complementary application scenarios: meeting browser, remote meeting assistant, and integration with wireless presentations.
In this integrated project participates the TNO, University of Twente and the Philips Electronics Nederland B.V. (from Netherlands) [55], the University of Sheffield, RealVNC and Novauris Laboratories (all from UK), Fastcom Technology, IDIAP and Spiderphone (from Switzerland), the DFZKI and Technische Universität München (both from Germany) [56], International Computer Science Institute (USA), Geie Ercim (France), and Vysoke Uceni Technicke v Brne (Czech Republic).

3.12 NO-REST Networked Organisations - Research into Standards

At the action line on "Networked business and governments", the IPK (from Fraunhofer Society) co-ordinates a Specific Targeted Research Project on networked organisations [57]. The NO-REST project aims to investigate the applicability and dynamics of standards in the e-business and e-government sectors, and to develop toolkits for the assessment of their performance, and of the impact they have on networked organisations. To this end, NO-REST will evaluate the various standards development platforms, examine how implementations affect standards and interoperability, and do a re-active performance analysis of standards as well as a pro-active integrated impact assessment.
This project will look at the application of standards, and will analyse how standards, and their implementations, are subject to change incurred by the environment within which they are implemented. They will then devise an analytical framework for a causal model of such changes. This, in turn, will help understand the nature of these changes and will allow for the formulation of adequate counter-measures or for the derivation of conclusions for developing standards in the future, and possible mechanisms to feed back these changes continuously into dynamic standards building.
The project will also analyse the various standards setting organisations, with a focus on how they react to - and influence - the dynamics of the environment within which they

[55] Netherlands Oorganisation for Applied Scientific Research
[56] Deutsches Forschungszentrum für Künstliche Intelligenz GMBH
[57] Project Reference: 507626. RABE, Markus at markus.rabe@ipk.fraunhofer.de

work. This will also include an analysis of the relation between the "credibility" of a standards setting organisation, in other words, to which extent does the origin of a standard influence its viability in the market place. The project will then establish if, and how, a standard's origin affects its performance, and will set up guidelines helping those who wish to create a standard decide which standards setting organisation to select. Finally, based on the above, the NO-REST project will develop, and apply, a methodology to help assess, *a posteriori*, the performance of a standard. This will ultimately contribute to a tool-kit to evaluate – *a priori* - the impact a standard will have on the market. Thus this methodology can have an indirect influence in the conditions of development of working team. But is not clear, if this would be envisaged by the project. The other organisations involved are: the Technical University of Delft and the above-mentioned TNO (Holland), the University of Edinburgh (UK), the SINTEF (Norway) [58], and the Rheinisch-Westfälische Techniche Hochschule Aachen (Germany).

The only project under the priority 7 of the 6th framework programme on "Citizens and Governance in a Knowledge-Based Society" that is dealing with aspects related to work organisations is WORKS, that briefly is an integrated project that will carry out research on how employment, learning and labour practices adapt to change and with what effect.

3.13 WORKS- Work organisation and restructuring in the Knowledge Society

The main objective of the WORKS project [59] is to improve the understanding of changes in work in the knowledge-based society, their driving forces and their implications for the use of knowledge and skills and for the quality of life. In particular, new forms of work organisations will be analysed taking account of global value chains and regional institutional contexts. It is intended to develop analysis around fluid concepts such as occupations in change and business functions. One innovative approach relates to the assumption that changes in work are related to global developments. Another one relates to a roadmap for European convergence of existing organisational surveys.
The main concepts and topics to be approaches deals with:

1. Future perspective
2. Use, change and development of knowledge and skills and the development of occupational identities
3. Different ways of achieving flexibility
4. New forms of work organisation
5. Quality of life (outside and within work)
6. Use of time
7. Social dialogue aspects
8. Implications of the knowledge society for work and related policies
9. Gender issues

[58] Stiftelsen for Industriell og Teknisk Forskkning ved Norged Tekniske Hoegskole
[59] Project reference: CIT3-CT-2005-006193

This project is co-ordinated by HIVA (Belgium) [60] and involves teams as FORBA (Austria), the London Metropolitan University and the University of Essex (both from UK), the University of Twente (Netherlands), the IET-UNL (Portugal), the Panteion University of Political and Social Sciences (Greece), the Institute of Sociology of the Hungarian Academy of Sciences, ITAS-FZK and ISF (both from Germany) [61], the National Institute for Working Life and the Arbetstagarkonsultation (from Sweden), the Centre d'études et de l'emploi (France), SINTEF (Norway), Fondation Travail-Université (Belgium), Istituto di Ricerche Economiche e Sociali (Italy) and the Institute of Sociology of Bulgarian Academy of Sciences.

[60] Hoger Instituut voor de Arbeid (Higher Institute for Labour Studies) from Catholic University of Leuven.
[61] ITAS from the Forschungszentrum Karlsruhe is mentioned above, and ISF is the Institut für Sozialwissenschaftliche Forschung (München).

4 Preliminary conclusions

Starting from the main reference of COdeWork@VO project, we "visited" some European projects supported by the EC under the last two Framework Programmes. One can conclude that the main topics related with work organisation and team working is changing since the decade of 80s. At that time the main concepts were developed from the anthropocentric approach, the ideas centred on the workplace environment that implied task enrichment, job enlargement, task rotation, decision support systems, direct participation, and so forth. Two decades later, the main concepts are developed around the engineering tradition of logistics, standards, communication procedures in organisational co-operation, user interfaces, web services, virtual reality, simulation of working environments, distant training and learning.

This does not mean a technological orientation of the scientific debate, but certainly a closer identification with companies needs and processes. During the 70s and 80s, the controversies were connected with the problems of work organisation and working conditions in order to improve the productivity level through the working live components. In other words, the competitivity of firms could be achieved through the improvement of working conditions and better labour relations. Actually, the emphasis lay on the management and business processes. And lay on the technological platforms to support the competitive strategies. The focus on the shop floor individuals and on working team building is much less clear.

Under this context, some research institutions are involved more intensively in these projects and topics. The only relevance of this aspect is the possibility to make a competence mapping at the European level. One can call the attention to IAO from Fraunhofer Society [62] and ITAS-FZK [63] (Germany), SINTEF (Norway) [64], TNO [65] and Universities of Twente [66] and Delft [67] (all from Netherlands), and UNL (Portugal) [68]. But in terms of country involvement, one can acknowledge the meaningful importance of Germany in terms of research (21 participations in the projects mentioned here). Next are United Kingdom (13) and the Netherlands (11). Portugal and Greece occupy the next position with 8 participations each, which reveals a large interest in these countries for such topic for research and development.

In the 5th framework programme were developed concepts as of "participatory technology assessment", "work process knowledge", learning organisations, collaborative knowledge modelling, or "virtual organisations", among others. In the 6th framework programme the mainstream concepts are the level of virtual multimodal processes, simulation tools, collaborative work environments, or standard settings. Thus, when compared with the

[62] With projects UNITE and View of the Future.
[63] Projects "Participatory methods" and WORKS.
[64] With the projects No-Rest and WORKS.
[65] Projects VIRTUE, AMI, No-Rest.
[66] projects AMI and WORKS.
[67] with the projects VIRTUE and No-Rest.
[68] projects "Work process knowledge" and WORKS.

previous programmes in earlier decades, the concepts are clearly changing and moving. There are still some projects that maintain their research objectives in the deepening of the debate on work organisation alternatives and working life improvement.
In spite the fact some projects are more sociologically oriented and others more engineering, it should be assumed therefore that overall effectiveness of networked organisations would only be achieved through designing together the distributed business processes and the individual and group work tasks.

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6 ANNEX

Project	Acronym	Nationality of co-ordinator	Partners
3.1	Participatory methods	DK (DBT)	DE (ITAS-FZK) UK (Univ. Westminster) NL (Rathenau Institute) AT (OAW-ITA)
3.2	Work Process Knowledge	UK (Univ. Manchester)	PT (UNL) DK (DTU) IT (Univ. Studi Siena) DE (Univ. Bremen, ITB) FR (CNRS) SF (TRCF) SE (Linköping Univ.) ES (CIREM) BE (HIVA)
3.3	CLOCKWORK	UK (Open Univ.)	SL (Univ. Ljubljana) UK (Loughborough Univ.) CZ (CTUP) DE (Elotherm) DE (DFZfNT)
3.4	VIRTUE	UK (BT)	NL (TNO) UK (Sony UK) NL (TUDelft) UK (Heriot-Watt Univ.) DE (FhG)
3.5	SMART SME	EL (Univ. Patras)	PT (CPTêxteis) EL (Technika Plastika) PT (Peruma Têxteis) PT (IPF) EL (Vioral) EL (Laskaris) PT (INESC Porto) PT (EISampedro) DE (IFAS Bremen) DE (Rudolf Seldis) NO (Timms Rerbane) DE (Drahtseilwerk)
3.6	UNITE	FR (IBM France)	FR (Steria) NL (Penta Scope) DE (IAO-FhG) UK (Coventry Univ.) IL (IBM Israel) PT (Adetti) DE (FhG)
3.7	VIEW OF THE FUTURE	UK (Univ. Nottingham)	DE (Univ. Stuttgart) SE (AB Volvo) DE (IAO-FhG) SF (VTT) EL (FR&T) FR (Peugeot-Citroën

			Automobiles) EL (ICCS) SF (Sensetrix) DE (John Deere Werke) IT (Alenia Spazio) CH (Univ. Basel)
3.8	NUEWO	SE (Göteborg Univ.)	ES (Univ. Sevilla) UK (Univ. West England) USA (Cal. Polytechnic State Univ.) NL (Erasmus Univ. Rotterdam)
3.9	VERITAS	EL (Archimedia)	AT (Univ. Wien) TR (Makina Imalatcilari Birgili) DE (Sylvie Feindt Consulting) BE (Agoria) AT (FMSIÖ)
3.10	ELOGMAR-M	DE (FhG)	PL (Politechnika Warszawska) EL (Tredit) EL (Thessaloniki Port Authority) UK (Maritime & Supply Chain Solutions) LV (IDC) LV (SIA-LIS) DE (Hafen Hamburg Marketing) CN (Beijing Zhongke Hope Software) LV (Rigas Tech. Univ.) CN (China Harvest Development) DE (RTBS) LT (Sonex Kompiuteriai) LT (Klaipedos Uostas) SF (Kokkolan Kaupunki) ET (Interbalt Maritime Agency) ET (Logitrans Consult Ou)
3.11	AMI	UK (Univ. Edinburgh)	NL (TNO) UK (Univ. Sheffield) CH (Fastcom Technology) DE (DFZKI) NL (Philips) UK (Novauris Labs) CH (Spiderphone) CH (IDIAP) UK (RealVNC) USA (ICSI) FR (Geie Ercim) CZ (VUTBrne) NL (Univ. Twente) DE (TUniv. München)
3.12	NO-REST	DE (FhG)	NL (TUniv. Delft)

			NL (TNO) UK (Univ. Edinburgh) NO (SINTEF) DE (R-WTHAachen)
3.13	WORKS	BE (HIVA)	AT (FORBA) BE (FTU) DE (ISF and ITAS-FZK) UK (London Metropolitan and Essex Universities) FR (CEE) NL (Univ. Twente) PT (IET, FCT-UNL) IT (IRES) EL (UPSPS) SE (NIWL and ATK) NO (SINTEF) HU (ISB) BG (IS)