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CONDITIONS OF INTER-FIRM CO-OPERATION IN A VIRTUAL ENTERPRISE CONCEPT : THE CASE OF AUTOMOTIVE SECTOR IN PORTUGAL

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One can assist to significant changes in the organisation of manufacturing systems during the last years. Lean production, network enterprise or the virtual enterprises are reference concepts of the re-organisation of manufacturing systems. Some authors mention a new enterprise paradigm, of generalisation of intelligent manufacture, organised in networks and assisted by information and communication technologies.

The first part of the paper develops a critical approach to the illusion connected to these concepts, calling the attention to the diversity of the type of relationships among firms. If virtual enterprises (VE) are networks of firms with intensive usage of ICT, one can verify a predominance of a technicist perspective. This one considers that the development of VEs is a technological problem, of development and management of information systems, and of entrepreneurial share of different databases. Sociology can be useful, even fundamental in an anthropocentric approach.

The last part of the paper is on the Portuguese situation in the automobile sector, approaching the types of entrepreneurial organisation.

THE CHANGE OF MANUFACTURING AND ORGANISATION PATTERNS: THE EMERGENCE OF THE NETWORK ENTERPRISE AND THE VIRTUAL ENTERPRISE

In the explanation of the deep changes in the manufacturing organisation, the new market conditions and the ICT occupy a central role.

Organisational renewal is on the “ordre du jour”, on the management agenda, because is understood as an essential mean to improve competitiveness of firms, especially in the automotive

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sector. The European Commission launched a debate on this issue, i.e., on the renewal of the work organisation in 1997¹

The 80ies were demarked with the strong influence of the Japanese influence. An increasing number of experts disseminated the organisational principles and the Japanese management methods. For many appeared a new model, known as “lean production” since the publication and wide dissemination of the MIT reports on the future of the automotive industry². This diffusion and acceptance of the idea that the universal adoption of the lean production model/principles guarantee an improvement of competitiveness, explains a step back in the innovative experiences related to the European traditions of work humanisation and industrial democracy that characterised the 60’s and 70’s.

Thus, the European experiences related to anthropocentric production systems were forgotten and displaced by the lean production movement. The first mentioned production system is based on the use of skilled workers and flexible technologies adapted to de-centralised and participative organisational forms³. This model responds efficiently to the new market demands, but mainly, allows a substantial improvement of the quality of working life. The competitive advantages of the anthropocentric production systems and verified by several industrial experiences (cf. Lehner, 1992).

The first half of the 90’s was strongly influenced by re-engineering (BPR): “to manufacture more and better with less” was the main objective. The rationalisation of operational processes, through the maximum grouping of jobs and tasks, the vertical compression and de-centralisation of decision for an increased flexibilisation, the suppression of wastes, there are the American alternatives to the Japanese challenge. Although a substantial part of re-engineering experiences was not well succeeded, those ideas continued to be largely disseminated (cf. Hammer, Champy, 1996).

The new enterprise model is presented now as advancement in relation to the Taylorist-Fordist model. The importance of firm’s culture, mutual confidence, job autonomy and participation, is underlined. As well as the co-operation relation among individuals, groups, units, firms for the increase of productivity and quality improvement.

But there are some technical and organisational pre-conditions for a sustainable development of a Virtual Enterprise concept in a globalised framework.

Most of the times innovation involves the implementation of new tools leading to process changes, it is difficult to be understood and accepted by the workers. The right strategy points out to the involvement of workers since from the beginning of the process, participating with technology designers and developers in the definition of the best paths to innovation. However, these innovations are not disseminated at a significant level, especially in SMEs.

The technical approach of industrial sociology, on the work organisations and technology developments, has to overcome a set of new challenges in order to clarify the behavioural changes resulting from this new “virtual enterprise” concept. A virtual enterprise can be understood as a structure, organised around a multicultural and “multilingual”⁴ wide working groups (technicians,

¹ cf. CCE: *Green Book on a Partnership for a New Work Organisation*, Brussels, CCE, 1997, COM (97) 128 final.

² cf. WOMACK, JONES, ROOS, *The Machine That Changed the World*, 1990

³ Cf. KOVÁCS, I.; CASTILLO, J.J.: *Novos Modelos de Produção: Trabalho e pessoas*, Oeiras, Celta, 1998.

⁴ In the sense of different technical “languages”, concepts, sets of references.

operators, office workers, managers, engineers, etc.). This is valid for all organisational structures (virtual or not). But factors like, different contractual rules for new products, different rules inside enterprise nodes, different management structures and the resulting decision making shortening, are only a few examples of the complexities this new concept has to deal with.

Like in other changes that happened during the past industrial manufacturing technological evolution, the success of the introduction of virtual enterprise paradigm is also strongly dependent on the workers commitment.

However the complexity of social dependencies beyond internal enterprise borders brings new challenges. It is necessary to define, in a new social framework modelling, including all the characteristics of an effective co-operation among persons belonging to different firms, different organisational structures and, maybe located in different countries. This new framework brings a new set of demands at societal level, e.g., at organisations, and even for each social actor, the necessity to incorporate a “network” culture, that is not exclusively technological but has strong social and cultural implications, is becoming more and more evident.

The sociological contribution aims to define a set of recommendations that will guide the implementation of the new emergent Virtual Enterprise concept. It is expected that those recommendations contribute to the development of the supporting technology according the socio-technical and anthropocentric theories and also guide those involved in its implementation, preventing productivity reduction and unemployment, consequences to an incorrect application of the technologies and re-structuring strategies.

Although most authors use in an almost undefined way these concepts of “network enterprise”, “Virtual Enterprise” or “flexible enterprise”, it is being used to classify a new emergent approach to the organisation of temporary networks of independent enterprise. Most of the products are not any more exclusively produced in one physical enterprise, and they are connected among each other through ICTs to reduce costs and share markets. Subcontracting is intensively used to get market opportunities, minimising the investments that are necessary to completely fulfil the development and production needs.

The word “virtual” was originally applied as a derivative of “virtual memory” that allows computers to use more memory than they effectively have. “Virtual” means also something that is real, but implemented by some strategy or system that provides a simulated reality. Based on this assumption it is possible to say that a product that has many contributions from many real enterprises was manufactured/produced in a Virtual Enterprise⁵. Therefore a Virtual Enterprise is an association of a distributed set of production/development resources. These resources are managed by real enterprises connected by a co-operation facilitator that can go from weak connections like route, surface mail, etc. to electronic connections building intra- and inter-enterprise electronic communication networks. In fact, enterprise networks exist since long ago, however co-operation has been bounded to restricted areas until the last developments of information and communication technologies.

Thus, this VE concept follows the theories developed around the concept of enterprise networking. Limited co-operation areas like the northern Italian “industrial districts”, the Basque Mondragón case, or the Ruhr valley networks, from many other examples, are even today positive examples of local co-operation among enterprises joining synergies. The main difference that emerges with this new VE concept is the availability of an infrastructure able to give firms in a network equal opportunities.

⁵ MONIZ, A. B.; URZE, P.: “Empresa Virtual significa Trabalho Virtual? Definições do conceito, limites, implicações”, *VIII Encontro Nacional de Sociologia Industrial, das Organizações e do Trabalho*, APSIOT, 1999.

Internet, as an infrastructure to support flexible co-operation, is an emergent technology that is receiving much attention and it is being transformed into a mass media mechanism for exchange and sharing information. It is possible to see Internet as an information and communication technology facilitator of a global co-operation, and that could play an important role to the development of an industrial democracy. Sub-contracting firms should be able to access other client firms (final enterprises or, in automotive industry, the assembly enterprises), to access innovative knowledge, to organise new relationships with other firms operating in the sector, and so forth.

As some authors mentions, the new ICT-enabled variables may be totally distinct from traditional design variables, as it is the case when virtual corporations are compared with traditional organisational subunits. The ICT-enabled variables may also be an extension of a traditional variable, as in the case of developing linking mechanisms. These functionalities reduce barriers towards distance and localisation, allowing firms in different regions (and countries) to get involved in the development of a same product, co-operating in a network.

Complex enterprise arrangements and/or agreements are being established to easily get market opportunities. This kind of arrangements is always fired by a business opportunity, and it usually has a co-ordinator at the enterprise that manages such goal. A domain until now reserved to large enterprises, the intensive utilisation of information of technologies, is being extended to SME's. As an example, the electronic information interchange, the commercial information in EDI is until now *quasi* exclusively implemented in large enterprises. This networking can rely on the production of a product by a group of enterprises, but it is transparent to the end-user how the production runs. Therefore, from this distributed production perspective, it is possible to say that a Virtual Enterprise has produced a product.

The enterprise co-operation arrangements can take many organisational forms. It is possible to find from completely dependent sub-contracting enterprises, most common in automotive industry, to more independent enterprises playing the role of sub-contractors, but always directing their productive resources to alternative markets. It is not possible to find, in most of the cases, a specific behavioural pattern neither at regional level nor dependant of the industrial sector. As a matter of fact it is possible to say that a virtual enterprise is grounded on a diversity of organisational models, those of each enterprise member.

A major financial integration and economical concentration is being a characteristic of the automotive industry. This is the case of large car-builders, as Nissan-Renault, Mercedes-Chrysler-Ford or BMW-Rover, but also the case of components producers (Delphi, Valeo), or among suppliers. Some authors refer then the existence of different types of automobile production networks⁶.

Nevertheless, a long way needs to be transposed before an effective virtual enterprise can be established. There are many constraints conditioning such tendency:

- Lack of an integrating infrastructure guaranteeing a global interoperability among SMEs.
- Reengineering of the internal enterprises business processes in order to deal naturally with the virtual enterprise.
- Reorganisation of the social and organisational structures again to fulfil the virtual enterprise requirements.

⁶ TULDER, R.; RUIGROK, W.: "The integration of Central and Eastern Europe in car production networks", in *Actes du GERPISA*, No. 25, Feb. 1999

As it happens with the networks emerged from direct contact deeply supported on mutual trust relation, the virtual enterprises crossing the physical accessible borders need also to get such confidence from entrepreneurs. It is not easy to overcome the absence of a physical presence.

When people are face to face, many informal and symbolic information items are exchanged or acquired by each interlocutor. It is not an easy task to model such ancestral confidence relations by using the new information and communication tools. The sociological intervention is essential to guide the changes referred to integrate organisations into a co-operative world.

As some authors point out, the new organisational design variables made possible through information technology are the following: structural, work process, communicational, and inter-organisational relations variables. "With co-production, the aim is to easy exchanges, individual and collective contributes to knowledge. This sonorisation is also the federator of cosmopolitan cultures of de-localised research, manufacturing, marketing and sales teams"⁷.

In fact the virtual organisation creates new management and co-ordination challenges. In most cases, traditional organisations are using technology to make partial changes in their structure without making major modifications to the entire organisation. For example, electronic or metal engineering manufacturers can set up just in time EDI links with parts suppliers, changing just one component of the organisation. At the same time, the supplier can then be viewed as part of the manufacturer's raw material inventory. Nevertheless, the organisational design variables should be the same as those mentioned above usually applied to more advance virtual enterprise concepts.

In what human resources are concerned there are two main drawbacks: on one hand the technology evolves on a small step by step basis; on the other hand the persons inside the organisations are only able to make changes also in a step by step basis. These two vectors - technologists on one hand and human resources (at different levels, from management, consulting, engineering, production, etc.), on the other hand -, all of them need to be involved in the movement of the changes. To get their adherence they must be informed about the changes and more than that, they must be considered as active contributors to the changes.

These constraints can be observed from another level - the technology design point of view. In fact, there are two main approaches: the technocentric, exclusively centred on technological aspects without considering sociological constraints and the anthropocentric that brings to the conception phase the sociological constraints. The technocentric strategy is focused on technical and technological issues. Instead, in the anthropocentric approach, the technological conceptions toward enterprise innovations shall involve organisational and social constraints, in order to allow a better integration between the technical and human aspects. "The anthropocentric option involves on the development of systems based on specific architectures conceived according to the human factor valorisation and new organisational principles such as: autonomy, creativity, participation, co-operation, decentralisation and professional skills" (KOVÁCS, 1993).

Therefore, the virtual enterprise is in some extent the conceptualisation of a production system based on a set of distributed enterprises following some co-ordination enterprise node to realise some business goal. Geographic distribution, different cultures (organisation, language, processes, etc.), flexible communication and co-operation mechanisms, privacy integrity and authentication, are some of the issues that need further research to achieve a reliable network of enterprises as the basis to create many virtual enterprises.

Another perspective of the problem is on the design of the technological solutions to support many of the enterprise functional needs. Information computational tools tend to be

⁷ ETTIGHOFFER, D.: *A empresa virtual ou os novos modelos de trabalho*, Lisbon, Piaget, 1999, p. 234.

general, to cover an increasing number of the enterprise needs. However this generality implies on some changes into the enterprises adopting the technology.

These changes sometimes don't follow the most advised path and as a consequence, they are classified as the main negative contributions to the innovation failure. This is a complex subject mainly for SME's those that cannot support internal developments, to customise the ICT tools to the reality of the enterprises. For large enterprises the situation don't apply because they usually have their own internal development departments or at least they have internal capacity and power to customise the new tools they are adopting.

DEVELOPMENT OF A VE IN THE PORTUGUESE AUTOMOTIVE INDUSTRY?

In the Portuguese automotive industry there are four types of entrepreneurial organisation:

- the CHD/vehicle assembler, where the design is located outside the country, and with an incipient network of SMEs;
- a local network of firms led by an important component company, strongly dependent from a car builder located outside the country;
- a car company with three-tier network, adopting a JIT regime for the first tier. The 2nd tier has only indirect participation (and mostly medium-sized firms). SMEs of the 3rd tier are suppliers of the 2nd tier firms, with indirect relations with the final assembler;
- component producers for outside markets.

In Portugal, the automotive sector is implementing a strong and standardised system of inter-firm co-operation applying the JIT techniques, and the specialised layers.

In the first case, the Fordist organisation model dominates (large batches, scale economies, standardisation of tasks, strong hierarchies, weak organisational flexibility). They can have problems with expected quality and productivity levels. This was the specific case of the former Renault factory at Setúbal was closed down and moved to a new factory at Slovenia. Other cases are exemplified with Ford (that is also closing down the Azambuja factory), and to a less extent with Opel and Mitsubishi. These cases are also not founded on local/regional sub-contracting networks.

The second type of organisation is illustrated also with Renault, but with a different factory. The one mentioned is located at Cacia-Aveiro, and produces gearboxes and motor components. It introduced concepts of JIT and quality control during the 80s. The analysis was developed by Moniz and Castillo research teams⁸, and a clear trend continued from that period: there exists an articulation of this firm with a local network of firms, acting as an extension of the components company.

⁸ CASTILLO, J.J.: "Renault-Valladolid: construire l'organisation du travail de demain" in DURAND, J.-P., STEWART, P.; CASTILLO, J.J.: *L'avenir tu travail à la chaîne*, Paris, La Découverte, 1998; and MONIZ, A.B.; OLIVEIRA, P.; RUIVO, M.S.: *Fábrica líder em Aveiro?* (research report), UNL, 1995.

The third type of enterprise is perhaps the one with a larger impact in the productive structure in Portugal. And is the one that could express better the VE model. The case is the AutoEuropa factory that assembles multi-purpose vehicles from Ford, VW and Seat. Its implantation as a Greenfield site originated substantial changes in the way as firms relate themselves in a network⁹, although it didn't produced a modern industrial district. In other words, it didn't create a true manufacturing "system" that stimulated externalities and synergies, influencing all the local entrepreneurial fabric¹⁰. Nevertheless, it was a case that assumed its functions on the qualification and training process, articulating also with the regional vocational training institutions.

The fourth case, reefer to the components companies (or supplier leaders), that have their market almost exclusively dependent from the larger car builders, or assemblers, located outside the country. Those are the Delphi case (subsidiary of GM), that in Portugal have several factories for cabling, seats, steering wheels, the Ford Electronics case (cabling, auto-radios), among others. They build-up components groups, that are increasingly complex, using their own suppliers layers. In some case they are even using joint ventures. These companies include logistic concepts, quality management, and price competitiveness.

CONCLUSIONS

A virtual enterprise (VE) can be considered as an temporary network, with some stability, of independent firms, connected through ICT, with the aim of reducing costs and market share. This concept follows the theories developed around the enterprise-networking concept. But here is underlined de development of a perspective of co-operation network, aggregating competencies and resources from different firms.

The division of company competencies is unbalanced between firms, founded on asymmetrical relation among them. Larger firms concentrate activities with more added values (as R&D, product design, planning, marketing, commerce). The less central tasks (as maintenance, distribution, security) are outsourced to specialised firms. Finally, are de-localised the routine tasks (manufacturing, transformation) towards regions with cheaper workforce, and to smaller firms at the 2nd tier, or even to leader suppliers.

But a common trend to the different regions (Europe, US, Latin America, Southeast Asia) is the cost control and the adhesion to dominant principles of competitiveness, that push firms to diminish their employment volume. The de-valuation of work and skills is even associated to the increase of qualitative investments of technology transfer. "Transplants" or de-localised firms are rarely followed by an employment increase.

But the VE concept implies the re-construction of entrepreneurial co-operation systems funded on confidence and information share related with a common product developed through a network. The social and cultural implications of this new organisation concept are very clear: definition of functions, co-operation principles, competence localisation, informal and symbolical inter-change of information.

⁹ cf. MONIZ, A. B.: *Estratégias de empresas trans-nacionais (TNE) em economias periféricas: O sector automóvel e o projecto da VW/Ford em Portugal*, relatório FAST/FINE, Anex 3, Brussels-Gelsenkirchen, IAT, 1993.

¹⁰ FERRÃO, J.; VALE, M.: "People carriers, a new opportunity for the European periphery? Lessons from the Ford/VW project (Portugal)" in HUDSON, R.; SCHAMP, E. (eds.): *Towards a New Map of Automobile Manufacturing in Europe? New Production Concepts and Regional Restructuring*, Springer Verlag, 1994.

The investment of computational networks does not create co-operation networks, but requires an increasing investment on human and organisational networks. For that reason, co-operation networks with symmetrical relations, as the VE would demand, are very rare in the automobile industry.

In production re-organisation processes, that have such variety of situations, the choices are multiple. But, the main conclusion is that choices are possible. There should be no *one best way* that limits our search of viable alternatives towards a better quality of working life.