

Teleworking – the potential scope of implementation in manufacturing company

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Abstract

In this paper the internal aspect of virtuality is stressed.

Telework can be considered as a way of turning the company towards internal virtuality, i.e. it creates the virtual organizational structure of company.

There are variety of functions performed in the organizational structure of manufacturing company. They can be systematically presented with the help of model of tree of functions. In this paper the model is used to appoint these functions which are susceptible to teleworking.

Working at off-site location (at home) requires IT to link the location to the central office of company. The technology is expected to ensure some functions like: secure access to the corporate network, high-speed connections to corporate network and flexible solutions including various ways of remote access to the corporate network. Depending on the IT configuration there can be different scope of the functions' fulfillment. In this paper a review of the configurations is presented.

Keywords

Virtual organizational, teleworking, firewall, VPN

1. Introduction

One of the most promising concepts of industrial organization is agile company. It was born in 1991 as a way of achieving competitive advantage against Japanese companies (Goldman S.L., Preiss K., 1991). One of the sources of the Japanese's companies success is implementation of methods fulfilling the concept of lean management. There are a set of tools exploited by lean management. Among others the concept uses methods like just in time, total quality management, concurrent engineering, empowerment, computer based integrated technologies and learning culture. They are also absorbed by agile enterprise as agility requires leanness. But agility is something more than leanness

(Kidd P., 1994). Comparing with lean management the concept of agile company is extended about the idea of virtual corporation (Davidow W.H., Malone M., 1992). The concept of virtual organization is not precisely defined yet but there is a common confidence that flexibility and cross functional co-operation is its defining characteristic (Norton, 1999). From the view point of practice, solutions like strategic alliances, consortium, outsourcing, teleworking and others are often given examples of virtual enterprise. The last organizational solution is discussed in this paper.

2. Virtual company – the core of the concept

2.1. Dimensions of integration of company

The organization as a system is characterized by its elements cohesion. The cohesion is an effect of the elements integration. In further text the elements are called partners or organizational unites. Examples of them can be separate companies staying in network relations or work station representing the smaller socio-technical system in an enterprise. The integration of the partners is a multidimensional phenomena and at least three aspect of it can be distinguished (Trzcielinski S., 2003): durability of the relations among the partners, the organizational distance and the required level of coordination of the partners' activities.

The durability of the relations depends on the stability of the tasks performed by the partners. In the turbulent and unpredictable environment the tasks have changeable nature. This implicate a situational selection of partners and temporary character of their relations. On the other hand, when the tasks are repetitive, the comparatively regular partners stay in comparatively permanent relations.

The organizational distance appears as a location, information and social distance. The location distance make difficult the cooperation of the partners. However the use of tele-computing technologies helps to overcome the negative effects of the long location distance. The information distance manifests itself in

time of reaction on potential disruptions. It is strongly influenced by the organizational structure. Moreover the distance can be shortened by selection of competent partner. The social distance concerns the possibility of having direct contact by the cooperating partners. The lack of such contact increases the feeling of loneliness and makes weaker the identification with the organization's goals.

The need of coordination of the partners' activities results from their participation in creating the chain of value of the product. If partners execute repetitive tasks then the coordination can be achieved by planning and formalization. Such partners remain comparatively autonomous. However if they execute changeable tasks, then the coordination is achieved by mutual adjustment. Such model of coordination takes place in team based working.

The above concept of organizational integration enables presentation of defining features of virtual organization.

2.2. Features of Virtual Organization

The virtual organization is a temporary configuration of partners working together for achieving bargain goals. The aspect of reconfigurability and the same temporality of partners is one of the most frequently feature of virtual organization appointed by authors writing on the organization of the future (Galbraith, 1997). Some authors however say that the virtual organization can last for years or only a few weeks. Although the statement "temporary configuration" allows subjective interpretation of the time of lasting of particular configuration, however if it lasts for years, then the relations become formalized and the virtual organization converts itself into the institutional one. Such cooperation network can be called "conventional virtual structure" and lasting for years consortia or strategic alliances are examples of it

The bargain and temporary character of the relations means that virtual organization reconfigures itself, so it has a dynamic structure. The changeable components (partners), which are taken from the environment, cause that the boundary between the virtual organization and the environment becomes fuzzy. Because of this it is invisible for its customers (Handy, 1997).

The virtual organization bases on team working. It exploits the mutual adjustment mechanism of coordination which depend on informal and direct contact between team members. The mechanism is efficient when the partners conform their actions to the achievement of common goal and express the willingness of cooperation. The mutual adjustment means that there is not only one coordination and decision centre and that such centre is emerged spontaneously according to the core competencies possessed by a partner. The decision centre moves from one to another partner who has the key competencies in

particular phase of the project. In results the hierarchy is replaced by heterarchy.

There is a long organizational distance between partners in virtual organization. In case of network of institutional enterprises the distance is determined mostly by the location and social distance. Quite often the dispersed location is assisted by time independency. Both features make not only weaker the social relations among partners but difficult to build the climate of their trust, which is one of the powers integrating partners within virtual organization (Handy, 1997).

The reduction of the negative influence of location, time and social distance is possible by selecting competent partners and implementation of information technology enabling effective communication and quick access to the common data basis. In this way the organizational distance and particular its information component becomes shorter. The information technology gives the organization a new quality and is an essential attribute of virtual organization. However it is worth to notice that the information distance can be shortened also by implementing organizational solutions like building short term cross functional teams, working in the same place and time. Example of such solutions are task or project structures which can functioning in frame of the structure of institutional enterprise. In such cases the tele-computing technology has not to be the dominant factor of integration of partners. Because of this, such solutions can be called conventional virtual structures. When the information technology becomes crucial for the team members communication, and this happens when the location, time and social distance increases, than the team is called the virtual one (Lipnack, 1997).

2.3. External and internal aspect of virtuality of company

Literature studies prove that virtual company is meant as a changing network of partner firms contributing to the overall enterprise based upon their core competencies (Hardwick, 1997.; Goldman, 1993). Such meaning stresses on external aspect of virtuality which includes such issues like (Trzcielinski, 2003): organizational forms activating virtuality of company, ability for creating the network of firms, forms of cooperation of firms in the network and telecomputing systems integrating the territorially dispersed firms (Figure 1).

Among others the forms activating virtuality of company include business centres, technology transfer unites and outsourcing. These forms not only create favourable conditions for the company leanness and concentration on its core competencies but encourage for developing a network of partners which is a source for obtaining the needed goods and services.

The selection of partners and configuration of their network is done by the network creator. It can also manage the project although the decision centre can

change in different stages of the project. The role of the creator of the network can be undertaken for example by that firm from the business centres which arranges the first contact with the client. The role can also be played by those institution which possess the knowledge about competencies required to execute the project and about the market for such competencies. They act as a broker of the market, and chamber of commerce, research institutes, training centre and internet portals can be examples of them.

The network is an effect of cooperation between companies. It often takes such organizational forms like strategic alliances, consortiums, and supply chain

partnering. These forms base on partnership. However there are also forms of cooperation which bases on the power concentration like it happens in operational holdings.

The territorially dispersed firms are integrated into the virtual company by use an advanced tele-computing technology. The technology is used for managing the project executed by the virtual company. The technology includes Internet, teleconferencing, mobile phones, supply chain management systems, customer relations management systems, workflow systems, and others.

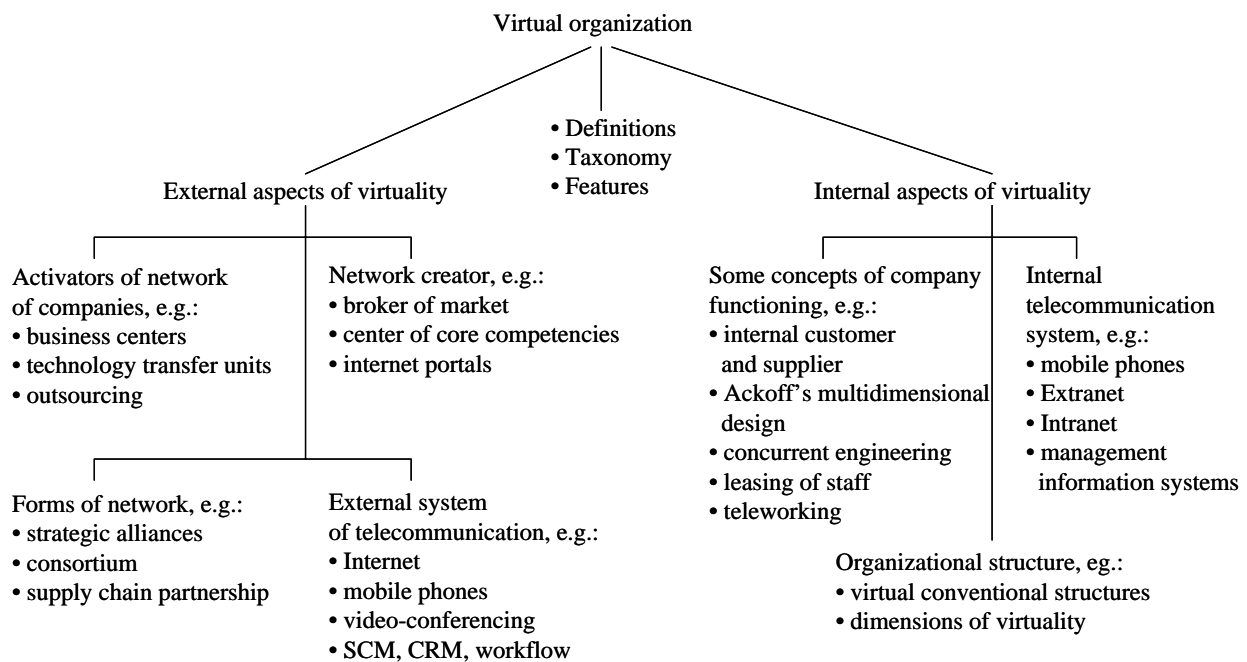


Figure 1. External and internal aspects of virtuality of company

The term of virtual organization may be also applied to the internal organization of institutional company. Particular it concerns such problems like (Trzcielinski, 2003): different concepts of functioning of the enterprise, internal tele-computing system, and virtual organizational structure (Figure 1).

There are different concepts concerning internal virtuality of company. All of them loosen the hierarchical relations among organizational unites and support development of internal network. One of them which is featured in TQM is the model of cooperation basing on the rules of internal supplier and customer. It has been developed by Ackoff as a model of multidimensional organization (Ackoff , 1981). Other solutions supporting internal virtualization of company include for example team based working, leasing of workers, and teleworking.

The implementation of internal virtuality of company requires effective communication among its organizational unites. It can be ensured by tele-computing technology like mobile phones, teleconferencing, Internet and intranet, workflow management systems and variety of management information systems enabling different users the access to the common data bases.

2.4. Teleworking as way of creating virtual organizational structure

Telework is defined as working at home or at other off-site locations that are linked electronically (via computer, fax, etc.) to a central office or principal place of employment (Sample Telecommuting Policy). It can be considered as a way of turning the company towards virtuality as it moves the resources like people, office space and equipment out of the company. In results the

company becomes leaner and increases both its agility and internal virtuality.

There are a few options concerning the relations in which the resources required for teleworking can stay with the company (Figure 2).

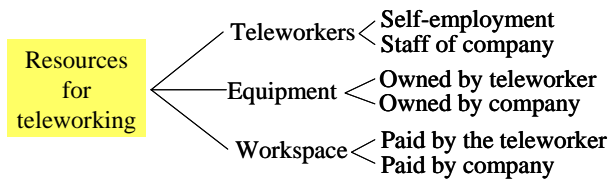


Figure 2. Relations between resources for teleworking and company

More the resources are independent on the company more teleworking is similar to outsourcing (Figure 3). Than the internal virtuality leads to external virtuality (networking company).

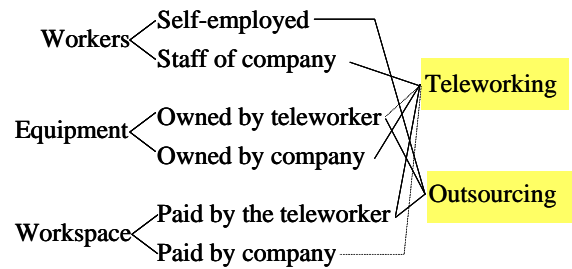


Figure 3. Teleworking and outsourcing

3. Susceptibility of manufacturing company's functions to teleworking

According to input, output and the processes transforming thy input into output, production and management subsystems can be distinguished inside the manufacturing company (Fig. 4).

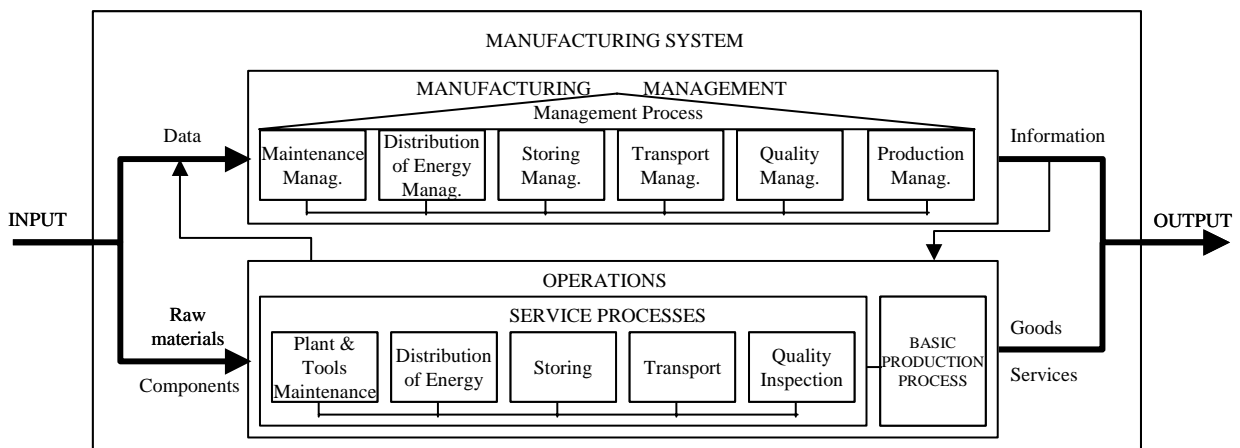


Figure 4. Subsystems of manufacturing company

The management subsystem transforms data into control information affecting the both an environment and production subsystem. Thus the nature of the transformation is information-decision process. In manufacturing company the production process requires technologies which exploit fixed assets and workstation owning physical space. Such processes or their phases can be outsourced but basically not teleworked. Contrary to them the information-decision process, if tooled in dedicated hardware and software, is susceptible to teleworking. Figure 6 shows tree of functions which are typical in medium and big manufacturing company. The functional areas cover information-decision processes. Teleworking lends itself to these processes (subfunctions) which consist of work that is characterized as follows:

- the jobs entail working alone or with equipment that can be kept in alternative work site,
- tasks and objectives are clearly defined,

- not at all or a little face-to-face communication is needed, particular with customers,
- work activities are measurable.

That characteristic concerns work which is repetitive, routine and does not require continuous learning by sharing knowledge with another co-workers.

Some of the types of jobs that are appropriate for teleworking include: policy development, research and development, engineering and design, telephone customer service or marketing, contract preparation, legal work, financial planning and budgeting, management and planning, project management, computer systems analysis, computer planning, data entry, technical writing, correspondence writing, word processing, administrative work. No matter on the functional areas (Figure 5), teleworking arrangements are available for staff to work from an alternative office location either occasionally or on a regular basis or

under special circumstances provided the following conditions are met:
 - work can be completed efficiently and productively,

- customer service delivery has to be maintained.

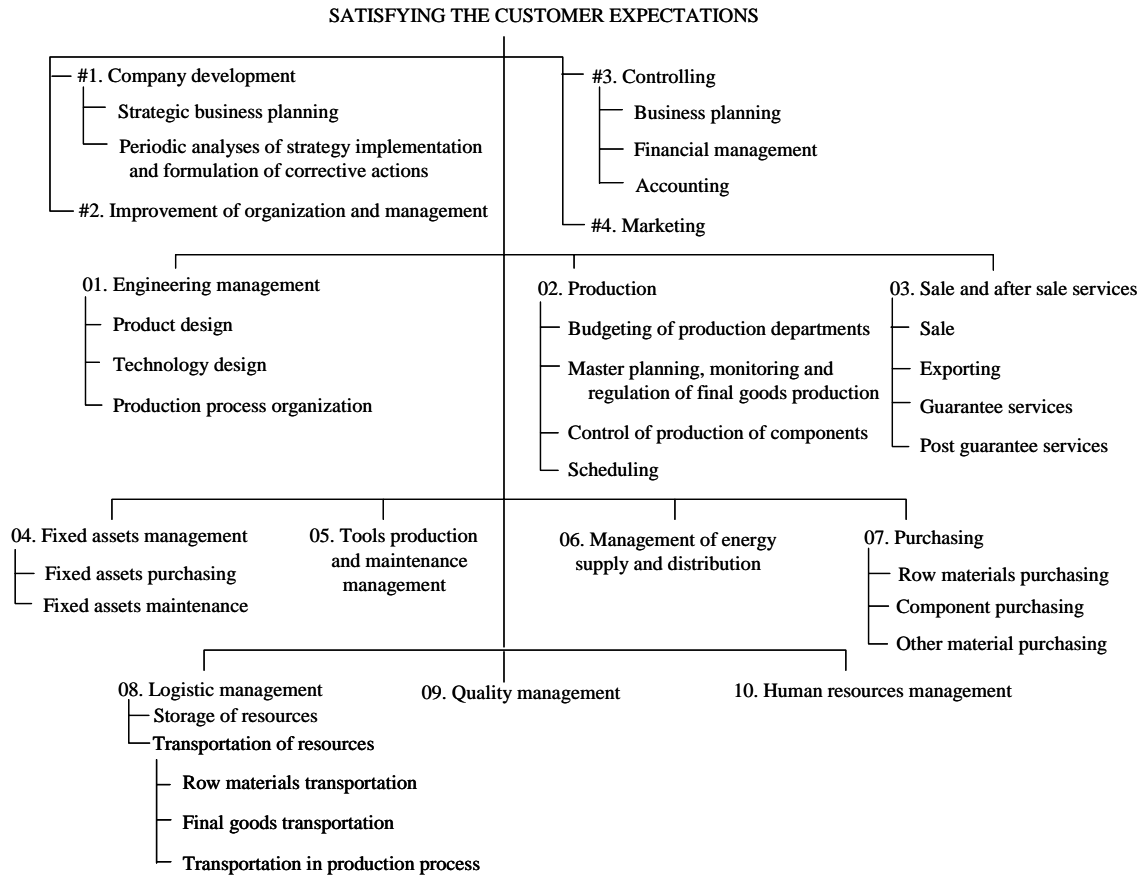


Figure 5. Tree of functions of manufacturing company

4. IT configuration for teleworking

There are full-time and part-time teleworkers, as well as day extenders – employees, who for any reasons work flexible hours at home. To meet their expectation the IT must fulfil three basic functions:

- secure access to the corporate network, which includes: internal and external intrusion prevention (steal of data, damage of information resources, taking the control over the network), internal users secure access to external resources and external users access to internal resources, quick identification, containing and eradication the attacks to ensure that corporate network resources are unaffected and uncorrupted;
- high-speed connections to corporate network;
- flexible solutions including various ways of remote access to the corporate network, and standardization on one platform the support for teleworkers using various WAN technologies (Redovian J., 2003.).

Thera different configuration available for connecting the off-site (teleworker) office to the corporate network.

According to the solution, they fulfil the functions (expectations) in different level.

1. Flexibility of remote-access service

Basically the teleworker can choose either a user-managed (VPN: virtual private network), vendor-managed (DSL: digital subscriber line), or other remote-access services like ISDN (integrated services digital network), Frame Relay, or dial-up.

The teleworkers can have remote access to the central office or principal place of employment either with the use of physical connection (copper cable or fibre optics) or can be connected by radio (wireless connection). The applications available for them includes: multi-party teleconferencing, distributed work sessions, personal digital assistants, the transmission of voice, video, images, and data.

2. High-speed connections to corporate network

There are several solutions influencing the speed of communications in the network. If the access to the Internet is via Public Switched Telephone Network

(PSTN) than the signal coming out of the phone set is analogue. It is usually transmitted over a twisted pair cable still as an analogue signal. At the telephone services provider's office this analogue signal is usually digitised, using 8000 samples per second and 8 bits per sample, yielding a 64 kb/s data stream. If the wires are replaced with Synchronous Optical Network (SONET) which is broadband networking standard based on point-to-point optical fibre networks, than high-bandwidth "pipe" to support ATM-based (Asynchronous Transfer Mode) services is provided. SONET has been designed to take advantage of fibre, in contrast to the plain old telephone system which was designed for copper wires. SONET carries connection oriented data in frames at speeds in multiples of 51.84 megabits per second (Mbps) up to $48 * 51.84$ Mbps that is 2.488 Gbps.

If modem is used for transmission signal over the telephone line than it can be a crucial factor for the transfer speed limitation. A common telephone line modem can transfer data at 28.8 kbps compared with 500 kbps or higher for cable modem, which allows to access the Internet via cable television service. A modem may either be internal or external (connected to one of the computer's serial ports). The actual speed of transmission in characters per second depends not just the modem-to-modem data rate, but also on the speed with which the processor can transfer data to and from the modem, the kind of compression used and whether the data is compressed by the processor or the modem, the amount of noise on the telephone line (which causes retransmissions), etc.

The data can be moved over regular phone lines with the use of Integrated Services Digital Network (ISDN), i.e. a set of communications standards allowing a single wire or optical fibre to carry voice, digital network services and video. It can provide speeds of roughly 128 kbps over regular phone lines. In practice, most users is limited to 56 kbps or 64 kbps.

Another method for moving data over regular phone lines much faster than a regular phone connection is Digital Subscriber Line (DSL). It is a family of digital telecommunications protocols designed to allow high speed data communication over the existing copper telephone lines between end-users and telephone companies. When two conventional modems are connected through the telephone system (PSTN), it treats the communication the same as voice conversations. The bandwidth available for the communication is the same as that available for voice conversations, usually 64 kb/s at most. The twisted-pair copper cables into individual homes or offices can usually carry significantly more than 64 kb/s but the telecommunication company needs to handle the signal as digital rather than analog (FOLDOC – Computing Dictionary).

A common configuration of DSL allows downloads at speeds between 1.5 and 9 megabits per second and uploads at speeds between 16 and 640 kilobits per

second. Because of that it is called Asymmetric Digital Subscriber Line (ADSL). DSL is a popular alternative to Leased Lines and ISDN, being faster than ISDN and less costly than traditional Leased Lines. The high-speed lines, greater than 200 Kbps in at least one direction, which includes either DSL or cable modem, is called broadband. Broadband does not cover ISDN or dial-up access.

3. Secure access to the corporate network

Basically there are two groups of solutions to protect the company's network and the teleworker's resources. The first is firewall and the second is Virtual Private Network (VPN). Each of them can structure the network's protection in several ways.

Firewall is a system designed to prevent unauthorized access to or from a private network. Firewalls can be implemented in both hardware and software, or a combination of both. Firewalls are frequently used to prevent unauthorized Internet users from accessing private networks connected to the Internet, especially intranets. All messages entering or leaving the intranet pass through the firewall, which examines each message and blocks those that do not meet the specified security criteria.

There are several types of firewall techniques: packet filter, application gateway, circuit-level gateway and proxy server.

Packet filter looks at each packet entering or leaving the network and accepts or rejects it based on user-defined rules. Application gateway applies security mechanisms to specific applications, such as File Transfer Protocol (FTP). Circuit-level gateway applies security mechanisms when a Transmission Control Protocol (TCP) or User Data Protocol (UDP) connection is established. Once the connection has been made, packets can flow between the hosts without further checking. Proxy server intercepts all messages entering and leaving the network. The proxy server effectively hides the true network addresses. In practice, many firewalls use two or more of these techniques in concert (Webopedia.com).

Generally, firewalls are configured to protect against unauthenticated interactive logins from the outside world. Firewalls can't protect against attacks that don't go through the firewall. That means that the data is not secure when moving through the internet.

A firewall is considered a first line of defence in protecting private information. For greater security, data can be encrypted.

Encryption is a translation of data into a secret code. Encryption is the most effective way to achieve data security. To read an encrypted file, you must have access to a secret key or password that enables you to decrypt it. There are two main types of encryption: asymmetric encryption (also called public-key encryption) and symmetric encryption. Public-key encryption uses two keys – a public key known to

everyone and a private or secret key known only to the recipient of the message. The public and private keys are related in such a way that only the public key can be used to encrypt messages and only the corresponding private key can be used to decrypt them. Moreover, it is virtually impossible to deduce the private key if you know the public key. Symmetric encryption is a type of encryption where the same key is used to encrypt and decrypt the message (Webopedia.com).

Virtual Private Network (VPN) is a secure, private tunnel between two or more devices across a public network such as the internet. A VPN device can be anything from a standard PC with VPN software installed on it to a dedicated hardware device called a VPN router.

VPN is secure because it employs very strong encryption to protect data as it travels across the internet. Because of that it can not be understood by the intruder. Another important security aspect of VPN technology is that VPN devices continuously monitor their data traffic in very sophisticated ways that ensure information is never altered while travelling across the public network (Ebitsolutions.net).

4. Conclusions

Virtual organization is supported by different organizational solutions. One of them is teleworking. Teleworking becomes extremely popular. Example given there were over 2 million teleworkers in the UK in spring 2001, about one in fourteen of all those in employment (Labour Market Trends, 2002); 85% of Cisco employees in the US are part-time teleworkers and 300 employees in the US are full-time teleworkers (Redovian J., 2001).

According to Labour Market Trends, teleworkers were concentrated in certain occupational groups, with the largest numbers being in the professional; managerial and senior officials; and associate professional and technical groups. Numbers were much smaller in groups such as personal service; sales and customer service; and process, plant and machine operatives. Potentially, most of work which relate to information-decision processes included into different manufacturing company's functions can be done by teleworkers. However to be effective, teleworking must be supported by IT ensuring flexible, high speed and secure access to the corporate network (LAN) resources. Configuration of IT for teleworking is one of factors influencing the effectiveness.

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