8 APPLYING TELECOMMUNICATIONS SERVICES IN REALIZATION OF PROJECTS BY MICRO AND SMALL ENTERPRISES

Remigiusz Kozłowski
Logistics Division, University of Łódź

8.1. Introduction

Contemporary market requires more and more flexible organizational solutions, within the framework of which work is performed. It is partly due to this reason that projects are more and more often realized. Securing a relevant communications system is necessary for these ventures to be successful. Telecommunications is one of key elements of this system. A proper adaptation of telecommunications services to requirements of a given project is one of the factors influencing the achievement of assigned aims by ventures of this type.

Projects' realization is not a domain of large and medium enterprises exclusively. It seems that this organizational form is also applied by small and even micro enterprises.

The aim of the article is to present the structure of telecommunications services used by micro and small enterprises in the course of realization of their projects.

Apart from literature on mentioned subject matters, the results of research conducted by the author were also used to prepare the article.

8.2. The characteristics of projects and project management

Projects have always been realized and their effects have influenced strongly people's lives and development of civilization [33, p.14]. Grand ventures (e.g. the Inca and Egyptian pyramids) were realized already in ancient times. Managing large projects, on the other hand, as it is understood nowadays, dates back to building an atomic bomb program in 1941 in the USA. In the course of this experiment, methods of planning and controlling performance of large

ventures were worked out. In non-military ventures, the methods were used no sooner than about 10 years later.

Nowadays, realization of work within the framework of projects is more and more often necessary. It is the result of changing requirements of clients as well as technological progress.

There are many definitions of a project. It should be also emphasized that literal meaning of the word "project" in Polish is other than in the case of translating the word "project" from English, where it is close to the meaning of the word "venture". The present article assumes the definition provided by J.P. Lewis, who defines a project as multipurpose commission carried out only once and for which requirements concerning efficiency, costs, time and scope have been specified [27, p. 13]. Projects are characterized by high degree of complexity. The following features characterizing them can be distinguished [26, p. W-2]. A project:
− is innovative,
− concerns a lot of people (co-workers / specialists),
− is encumbered with high degree of risk,
− requires large expenses and time,
− has strategic meaning,
− requires dynamic realization.

The aim of projects' realization is to achieve all their parameters, which include [worked out on the basis of: 34, p. 20-21]: fulfilling expected requirements, not exceeding planned costs and time of their realization. Obtaining all parameters at the same time is very difficult. Costs rise when trying to achieve highest quality. Similarly, in the case of time of realization, costs rise as time shortens (e.g. because of necessity to buy more expensive materials or implementation of shift work). For this reason, it is necessary to define acceptable project parameters.

In economic practice, a great variety of projects can be seen. The examples of ventures realized inside an organization can be e.g. [32, p. 18]:
− implementing a new information system,
− working out a new product,
− building production plant or a building intended for administration,
− entering a new market,
− opening a branch abroad,
− changing organizational system,
− preparing and realizing the process of joining enterprises,
− implementing new system of costs account or planning system,
− obtaining quality certificate.

Projects realized outside economic organizations include, in turn [32, p. 19]:
− running election campaign,

– organizing tour of an orchestra or an artist,
– sending a spaceship to another planet,
– working out a new medicine.

Due to large variety of projects, it is necessary to divide them according to certain criteria. In literature, a lot of typologies of projects can be found. The example is D. Lock, who divides them into: engineering, construction, petrochemical, mining and extractive industry projects; managerial and research projects [29, p. 16-17].

In the course of project realization, the following actions always occur [34, p. 26-27]: operational, support (e.g. legal, administration and IT service) and managerial, whose task is to harmonize operational and support actions. They include assigning aims, planning, organizing, motivating, controlling and coordinating. Each project is, therefore, a kind of organization and requires professional management. Basic tasks of project management include [26, p. W-3 and W-4]:

– planning and then coordinating the course of project processes and its resources,
– defining project framework conditions and taking them into account in realization phase,
– instructing, motivating and controlling project performers,
– protecting project from influence of project environment,
– identifying and getting rid of unexpected difficulties,
– bearing responsibility for a project and representing it outside.

Several areas of project management can be distinguished. They are: functional, institutional, instrumental and personal area. The management is characterized by big specificity and difficulty in realization. Each project is loaded with high risk of failure. That is why proper planning and finding symptoms of improper management of such ventures early is essential. They are presented in table 1.

Table 1. The characteristics of project management

Characteristic features of projects	Characteristic features of project management	Symptoms of improper project management
exceptionality	uncertainty	exceeding costs
sustainability	unpredictability	deviation from plan
complexity	realization difficulties	not fulfilling technical requirements
significant share of external performers	dependence on external partners	problems with execution of agreements
intensive cooperation	planning difficulties	communications disturbances

Characteristic features of projects	Characteristic features of project management	Symptoms of improper project management
multisided dependencies	necessity for visualization	coordination difficulties
high risk	special control of top management	criticism of public opinion, reluctance to make bold decisions
big potential advantages	special interest of top management	attacks of competitors

Source: [34, p. 27].

Observation of projects' progress in time resulted in noticing certain regularities, which served working out project life cycle [19, p. 68]. The cycle is divided into phases. Researches dealing with projects are not unanimous as far as unequivocal definition of number of these phases and their scope is considered. Table 2 presents a model of project life cycle divided into four phases.

Table 2. Model of project life cycle

Phases	defining a project	planning and organizing	realizing (performing)	closing
Type of activity	conceptual	organizational and planning process	performance, controlling and coordinating	reporting and implementation
Stages	• initiating a project • defining a project; • organizing project team	• building project structure; • planning project progress; • planning project resources; • organizing project performance.	realizing, coordinating and controlling a project	closing a project
Costs, expense	insignificant	medium	high	medium
Participants	employer, management, specialists responsible for a project	project teams, management of executive bodies	executive units, project team	executive units, project team, management of an enterprise, employer

Source: [34, p. 32].

Insufficient communication can turn out a weak point of projects [30, p. 315]. Proper communication in project team can be ensured by:
− indirect meetings,
− contemporary electronic tools enabling communication.

Due to appropriate project management, planning and control of all actions leading to accomplishment of project goals is made easier. It is often the case that inexperienced project management disregards some of the phases of a venture, e.g. planning or closing, trying to perform all the works fast. The result of this behaviour is completely contrary to expected effect. In these cases, realization of projects is extended and its individual phases involve much higher expenses as a result of correcting mistakes [27, p. 16-17].

High degree of complexity of realization of ventures was the reason for working out ready-made methodologies of acting when dealing with projects, which would be useful particularly for inexperienced project managers. They are helpful in professional management of such ventures [31, p. 103]. The most often applied methodologies are: PRINCE 2[1] and PMBOK. The first one was created as a result of evolution of previous solutions and elaborated on the basis of experience of project managers [1, p. 1]. One of the assumptions of this method is to achieve proper quality and results fulfilling project conditions assumed earlier, without it the work is not considered as completed [3, p. 132].

PMBoK[2] methodology is focused around task areas. It distinguishes ten areas of project management focused on a particular aspect of managing [31, p. 106].

8.3. Telecommunications in project realization

Information system is defined as a set of spatially organized senders, recipients and points of information processing. Such system processes and organizes data, creates information which is next passed on to appropriate recipients – users of the system [8, p. 48]. Figure 1 presents the scheme of such system.

---

[1] The abbreviation PRINCE stands for Projects IN Controlled Environments; British company Office for Government Commerce is the owner of this methodology, after: [17, on 14.03.2010 r.].
[2] The abbreviation PMBOK stands for Project Management Body of Knowledge.
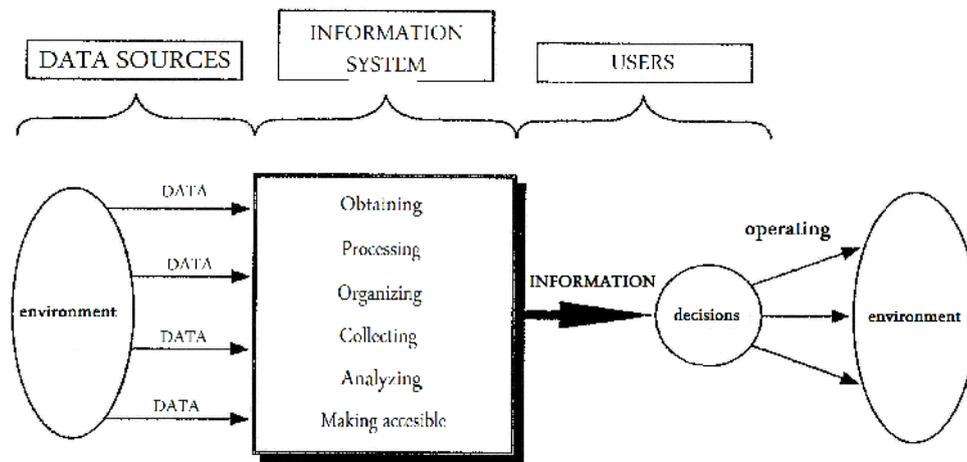
Fig. 1. The role of information system in an enterprise
Source: [8, p. 48].

Among a lot of elements distinguished in information system, the following can be singled out [20, p. 11]:

− technical equipment used to send, receive, process and transmit information. Physically, it is a collection that consists of many various tools such as: processor, memory, input devices (keyboards, scanners) and output devices (VDUs, printers);
− software is a set of programs and instructions written in special languages, intelligible for the computer;
− databases, which are specially organized sets of mutually linked data and serve one or many applications in optimized way. They can be of use to one or a lot of users and are organized in such a way that using them is not dependent on applied software and equipment used;
− telecommunications ensuring physical flow of data in space;
− staff consisting of IT specialists and a person controlling, designing, programming, operating and maintaining a system;
− organization of the very system including principles and rules of behaviour and development strategies.

Information system should ensure among the others efficient flow of data supporting the flow of materials and products in logistics processes realized both inside an enterprise and in logistics networks. For that reason, its significance for logistics is considerable [6, p. 125].

In order to ensure proper communication, information system needs to take into account and be consistent with organizational structure of management [22, p. 208]. When designing such systems, one should also aim at shortening

the way of sending information by means of eliminating indirect links, which causes diminishing information loss and prevents its distortion [21, p. 259].

The tasks of information system are realized by means of teleinformation infrastructure. This infrastructure comprises two areas: application (programming) and "equipment" area. Its main task is to ensure proper information flow.

The level of functioning of information system as well as its possibilities is always determined by teleinformation infrastructure existing in an enterprise. Development of this system is only possible provided that its infrastructure becomes extended and modernized.

Teleinformation infrastructure must ensure:
− fast information flow,
− proper range of information,
− maintaining proper information structure,
− meeting deadlines of transmitting information.

Teleinformation infrastructure can be divided into two main elements: telecommunications and information infrastructure. The first one includes sending, receiving and transmission of information of any kind, e.g.: signals, signs, writing, pictures or sounds, by means of wires, radio waves, optical or other means using electromagnetic energy [35]. According to this definition, telecommunications is every physical transfer of information from one place to another.

Together with the development of telecommunications services, the degree of their application increases in all areas of applications, including project management. From the point of view of efficient management of ventures, the main task of telecommunications is to provide information system with information. Information systems, on the other hand, ensure their processing, analyzing, collecting data, etc.

Local communications networks and those that cover large areas are necessary for informatization of any processes in organizations to be carried out. Requirements of most of contemporary information systems are very big and in order to function properly, information supplied by means of telecommunications systems needs to be transmitted [23, p. 3]:
− in real time,
− without disturbances and distortions.

Contemporary telecommunications is divided into two main groups: fixed and mobile (movable). The first is based on wire lines made of metals (usually copper alloys) or optic fibres.

Various types of fixed telecommunications services are used to support realization of projects. They are most of all:
− phone calls,
− leased lines (digital or analogue),

– combination of fixed virtual channels between two or more localizations (e.g. use of Frame Relay protocol[3]),

– outsourcing of telecommunications tasks to specialized enterprises.

Leased lines and combining fixed virtual channels serve among the others building intranet network, which is used by employees and managers involved in a project.

Leased lines consist in combining connections with a certain capacity between two points. These lines can be adjusted to analogue or digital transmission and can be used in many different ways. They are, for example, used to:

– ensure data transmission between various devices (e.g. terminals, workstations or servers),

– combining two private branch exchanges,[4]

– combining local exchange with[5] private branch exchange.

Building networks on the basis of Frame Relay technology is the example of combining virtual channels. They are usually used for joining smaller networks in various geographical localizations. In this solution, packet transmission is used, in which information is divided into smaller portions of data called packets and transmitted by the fastest, although not the shortest way, with the use of intermediate computers called routers [7, p. 72]. Individual packets can be, therefore, transmitted in various ways.

A very intensive development of advanced technologies causes that new services arise faster and faster. It also concerns services rendered by telecommunications operators. [25, p. 161]. Due to them, still wider possibilities of their application arise, among the others, for realization of projects. As a result of increase of competition in telecommunications sector, permanent changes of offers of the services take place as well as lowering of their prices. After all, this situation poses a range of problems for enterprises. In order to have modern, properly adjusted to real needs and possibly the cheapest telecommunications services, companies would need to have good specialists knowing the field of telecommunications. It is difficult to find workers with relevant qualifications in the market. That is why enterprises outsource the choice, configuration and maintenance of necessary services to specialized entities (among the others to telcos). The most often outsourced tasks in telecommunications area include:

– service of private branch exchanges,

---

[3] Frame Relay – technology enabling efficient, broadband data transmission with small acceptable delays, after: [2, p. 3].

[4] Private branch exchange – telephone exchange whose task is to realize telephone movement of subscribers on the premises of a given institution, after: [5, p. 49].

[5] Local exchange – public telecommunications exchange belonging to telecommunications operator.

– maintaining internal communications network,
– purchase of services that substitute the functioning of private branch exchanges and internal networks.

Fixed telecommunications is the oldest type of telecommunications. However, it is still characterized by advantages such as low price of services as well as high quality and application parameters (e.g. fast data transmission).

This type of telecommunications is also characterized by significant limitations such as full dependence on network infrastructure. This barrier results in completely static nature of its usage. When building network infrastructure becomes necessary, long time of realization of such investment is additional problem. Another serious drawback is low level of safety of fixed networks due to the fact that wire lines are easy to break. This feature can have enormous, negative meaning in case of using this kind of telecommunications in realization of projects.

Mobile telecommunications is nowadays a market segment that develops dynamically. The situation is first of all the consequence of significant technological progress. It caused that prices of telecommunications devices needed for rendering such services decreased. The mobile telecommunications market, increasing very fast, also needs to be emphasized.

Considering the scope of action, mobile telecommunications can be divided into: wireless local area, cellular and satellite networks.

Wireless Local Area Networks (WLAN) operate on the premises of e.g. a given workplace, where employees move about and appropriate devices are installed [9, p. 138]. Wireless Local Area Networks are now realized in practice with the use of several digital systems. The first one was DECT[6] system, worked out by European Telecommunications Standards Institute [16, on 24 March 2010]. It has been since applied in many areas of functioning of enterprises and realization of projects all around the world. The system is characterized by great universality. Due to that, it finds application in wireless networks intended among the others for [15, on 24 March 2010]: households, offices, production and warehouse enterprises as well as public places such as railways, airports, etc.

Bluetooth is another telecommunications standard that can serve building wireless local area networks. It is most often used for short-range wireless communications between various devices. It was invented by an organization-Special Interest Group (SIG) [10, on 24 March 2010]. This technology is extremely cheap and is characterized by low power consumption. Low emission of electromagnetic radiation is its additional advantage [10, on 24 March 2010]. These advantages caused that Bluetooth system has become a standard commonly used in various types of applications such as for example:[7]

---

[6] DECT – Digital Enhanced Cordless Telephony.
[7] L. Phifer, *Boosting business productivity with Bluetooth*, on: [13, on 24 March 2010].

− a lot of mobile phone accessories (wireless headphones, microphones, etc.), − in wireless combination of various short range devices,
− accessories for desktops, laptops, palmtops, communicators such as keyboards, mice and other peripherals,
− sets for wireless video cameras applied in households and industry e.g. input and output zones of warehouses, overseeing the work of devices, building protection, etc.,
− ensuring communication between wireless devices used in production enterprises e.g. for sending steering signals or communication between sensors and receiving devices.

Wireless Fidelity (Wi-Fi) is the latest system that is now becoming more and more popular. It was worked out and is still developed by international association – Wi-Fi Alliance. Nowadays, several standards of Wi-Fi system function, of which the latest (marked as 802.11n) enables data transmission at the speed of up to108 Mb/s with the range of the so called hotspot equalling even a few hundred meters. This version of Wi-Fi system is ideal for building Wide Area Networks (WAN) that consist of a lot of hotspots and comprise large areas (e.g. the whole agglomeration). Wi-Fi system found its application among the others in [18, on 24 March 2010]:
− wireless networks covering the range of both individual enterprises and whole city areas (e.g. Rzeszow),
− street monitoring system,
− traffic steering system,
− ensuring communication with mobile devices (e.g. notebooks, palmtops, communicators).

Mobile local telecommunications systems also include Radio Frequency Identification (RFID) systems, which no doubt will be of wider usage in the future also in realization of projects.

The first network of cellular telecommunications was started in the 1970s by co-founder of the Motorola company – dr. M. Cooper[8]. Nowadays, Global System for Mobile Communications (GSM), is the most widely spread generation in Europe, which is used for voice communication between people and data transmission. Mobile telecommunications is widely used in project realization due to the following advantages:
− mobility and universality,
− attractive prices as compared to satellite telephony.

When choosing mobile communications, one should also take into consideration its biggest drawback which is disturbing the work of other devices and also negative influence on people's health, still not fully explained.

---

[8] *Martin Cooper - Inventor Of The Cell phone* – on: [14, on 24 March 2010]

Satellite telecommunications is presently more and more widely used in project realization. The 1960s saw the beginnings of this type of telecommunications. At present, after several decades of its fast development, two kinds of satellite communication systems used in projects can be distinguished. In further part, only some of them, chosen out of a wide range of presently functioning satellite telecommunications systems, are presented.

VSAT[9] system enables fast, safe and reliable data transmission. The following telecommunications services are currently realized with the use of this system [37, on 24 March 2010]:
– sound transmission, making phone calls and sending faxes,
– videoconferences,
– access to the Internet and data transmission,
– LAN building,
– TV and radio for enterprises,
– e-learning,
– bank operations,
– remote control,
– managing points of sale, etc.

Mobile systems of satellite communication are able to ensure contact even with object in motion, e.g. cars, ships or planes. A lot of such systems function currently, Inmarsat was one of the first, which at the beginning was useful only for sea transport. This system has been expanded and modernized a lot of times. As a result, the range of this network's services has been significantly extended and can be used for projects' realization. Services rendered by Inmarsat network include among the others:
– Inmarsat A, an analogue system that enables transmission of sound, faxes, e-mails, data, audio and video signals as well as alarm signals,
– Inmarsat B Premier, ensures good digital quality of phone, fax and telefax calls as well as data transmission,
– Inmarsat P, characterized by small sizes of used terminals and the possibility to automatically choose cheaper network from GSM and satellite networks (switched on in the case of lack of range of cellular network),
– Inmarsat GAN and Inmarsat BGAN, ensure fast data transfer, access to the Internet, local computer networks, high quality radio transmission and videoconferences,
– Inmarsat AERO, used in aviation, it can be used by passengers (as opposed to mobile phones),
– Inmarsat E ensures informing about disasters and provides help in rescue actions.

---

[9] VSAT – Very Small Apparatuses Terminal.

Irydium is another interesting satellite network. It is a fully commercial satellite cellular network. It enables digital telephone communication, paging services and data transmission. Terminals (also including telephones) used in this system can also work in mobile networks. It covers a range of the whole globe. Satellite telephones operating in this system have the size of those operating in GSM networks.

Globalstar is a network competitive to Irydium. However, it does not cover the range of the whole globe, but it allows conducting calls without delays typical for satellite networks.

Satellite telecommunications has seen a rapid decrease in price of services for a few years. Due to that, this type of telecommunications becomes more and more competitive in relation to others. Satellite telecommunications plays still bigger role in contemporary project management regarding its range, possibility to use in aviation transportation and resistance to damage.

The role of transport in contemporary economy is significant [28, p. 14-15], similarly to the situation in project realization. In these cases, the role of transport also becomes more and more significant. It is also because of that reason that project realization is impossible currently without applying contemporary telecommunications solutions. The necessity to ensure a proper information flow between many points, which are often in motion, e.g. lorries, is the challenge for information system of every venture. Telcos constantly work out new services or even the whole systems, which are intended to be a support for transport management in time of project realization. These systems are usually based in most part on GSM and satellite telecommunications.

Global Positioning System (GPS) is the most widely spread system, which is a basis for many solutions helpful in transport management in realization of projects. It covers the range of the whole Earth and is managed by the United States Department of Defence. A very essential advantage of GPS is the fact that there are no charges for its usage [36, on 24 March 2010].

Provided that properly suited devices (terminals) and software are used, it is possible to use GPS in project management extensively [4, p. 28-29]. Possibilities of services offered in the market relying on this system are quite broad. For example, optimal route can be determined according to required parameters or even complicated logistics solutions can be built [38, on 24 March 2010].

In order for systems supporting transport management to work correctly, proper choice of both mobile devices (installed in means of transport) and those in dispatching centre, is essential. Another important element is also the use of proper software, suited for the needs. This software consists of several components, for example electronic maps created on the basis of cartographic data. In order to manage transport while realizing projects efficiently, it is essential to update this software, which should take into account e.g. temporary

obstacles in the streets as well as new routes. Possibilities of the systems based on GPS include among the others:

− determining location of an object (e.g. a car),
− optimal route setting,
− calculating actual velocity of the object,
− recording the covered distance, fuel consumption, velocity of a vehicle and many other parameters as well as the possibility to generate reports,
− data transfer and text information,
− possibility to conduct calls with the driver,
− enhancing security of a driver e.g. by means of quick information about assault, turning on listening watch in cabin, etc.

The existing systems supporting transport management which can be used in project realization, are continuously improved and brand new ones are also created. The Galileo European Satellite Navigation System is one of the new systems. It allows exact specification of the location of static or moving objects, together with detailed data about their movements. The possibilities of the system are as follows [11, on. 24 March 2010]:

− precise control of flights of planes (also in areas lacking air traffic control infrastructure),
− automatic identification of cars, airships and sea ships with the possibility to control their routes and warning against potential dangers and the possibility to correct routes by changing speed and/or lane,
− monitoring loads during their transport in real time,
− help in moving in unknown area by means of providing actual information about it,
− keeping control over the sick, who need continuous monitoring,
− monitoring employees, e.g. in cases of danger,
− aid in search-and-rescue operations e.g. by supporting management in crisis situations such as floods, earthquakes, woods on fire,
− management of electrical energy transfer by means of optimalization of flow of electric correct in individual network,
− fast restoration of energetic network to proper functioning after a failure has occurred,
− lowering the chances of abuses in financial, bank and insurance sector, due to the so called certified time markers that ensure authenticity and security of electronic system of data transfer and accomplishing electronic transactions,
− support in searching and extracting crude oil and gas,
− support of management and control of natural resources (green areas, water basins, etc.),
− support of planning and management in agriculture and fishing industry.

Activation of Galileo system is no doubt going to create new possibilities for the application of satellite telecommunications services in realization of projects.

8.4. The characteristics of the research sample

The research sample consisted of a group of projects chosen purposely, realized in particular enterprises or other organizations. 1012 projects were subject to the research. Territorial area where analyzed projects are realized is very important information. Table 2 presents the number and percentage share of researched projects in individual districts and in the whole Poland. The greatest number of projects was definitely realized on the area of the łódzkie district – more than 77%. Out of the remaining districts, the most of analyzed ventures were carried out in the neighbouring mazowieckie district. As few as 6% of all analyzed projects covered the range of the whole country. Relatively high number of researched projects took place in the following districts: śląskie, wielkopolskie and also pomorskie district, in spite of its remote geographical location.

Table 3. The number and percentage share of realized projects
in individual districts in Poland

No	district / whole country	analyzed projects	
1	**łódzkie**	**787**	**77,77**
2	mazowieckie	91	8,99
3	whole country	61	6,03
4	śląskie	17	1,68
5	wielkopolskie	15	1,48
6	pomorskie	14	1,38
7	małopolskie	8	0,79
8	świętokrzyskie	5	0,49
9	dolnośląskie	4	0,40
10	lubelskie	4	0,40
11	zachodnio-pomorskie	3	0,30
12	kujawsko-pomorskie	2	0,20
13	warmińsko-mazurskie	1	0,10
	in total	*1012*	*100,00*

Source: [24, accepted to print].

For the sake of further analyses, only projects realized on the area of łódzkie district were singled out.

Project managers, members of project teams and employees of enterprises or organizations which realized projects, filled in survey questionnaire. Figure 3 presents the number of individual groups of respondents, worked out on the basis of the obtained data. It appears that the greatest part of those filling in survey questionnaire, were members of project teams. They constituted more than a half of all respondents. The next group as far as the number is considered, included employees of enterprises or other organizations which took part in realization of projects. They were not members of project teams. The next
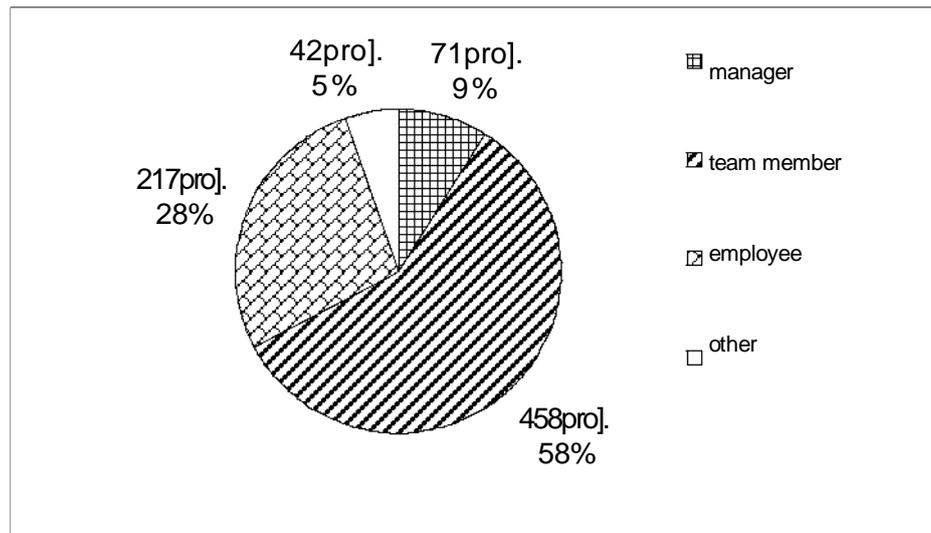
numerous group (70 people) consisted of managers.

Fig. 3. Function fulfilled by the respondents in the researched projects
Source: [24, accepted to print].

The least numerous group of respondents consisted of people who are described in the chart as "others". They were mostly:
– employees of organization ordering realization of a project,
– people dealing with assurance of financing of a project from European Union means,
– workers of enterprises cooperating with executers of a given venture e.g. dealing with training of members of project teams,
– trainees delegated to learn and help at doing projects,
– employees of institutions controlling the progress of a given project, e.g. workers of Borough Office,
– external consultants whose task is to evaluate the progress of a project and its effect.

Analyzed projects were realized in organizations which functioned in different areas of functioning. The following sectors were singled out for the sake of the research:
- production,
- building industry,
- services,
- trade,
- administration,
- education.

There were cases when a given organization functioned in more than one of the mentioned sectors e.g., trade and production enterprise. Figure 4 presents sectors in which the researched enterprises and other organizations functioned. Services were the most often led activity among the researched enterprises while
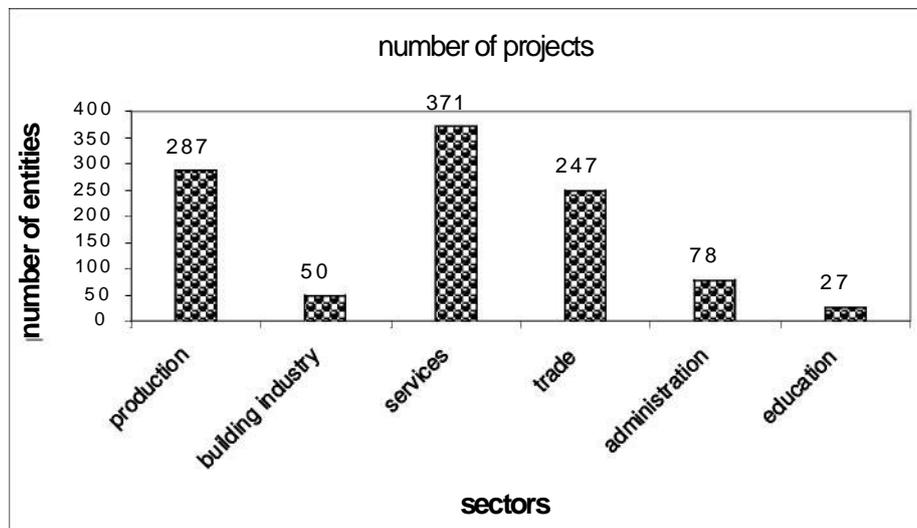
education was the least numerous sector.

Fig. 4. Sectors in which organizations realizing the researched projects functioned
Source:[24, accepted to print].

The number of employed workers in the course of project realization is the significant parameter characterizing the researched organizations. This number included workers with employment contract, with mandate contract and those employed in any other forms acceptable by Polish law.

In order to define the structure of the size of the researched enterprises, the criterion of division of enterprises into micro, small and medium entities was assumed according to the number of employed workers in the following way:

– micro-entities employing up to 9 persons,
– small entities counting from 10 to 49 employees,
– medium entities employing from 50 to 249 persons, –
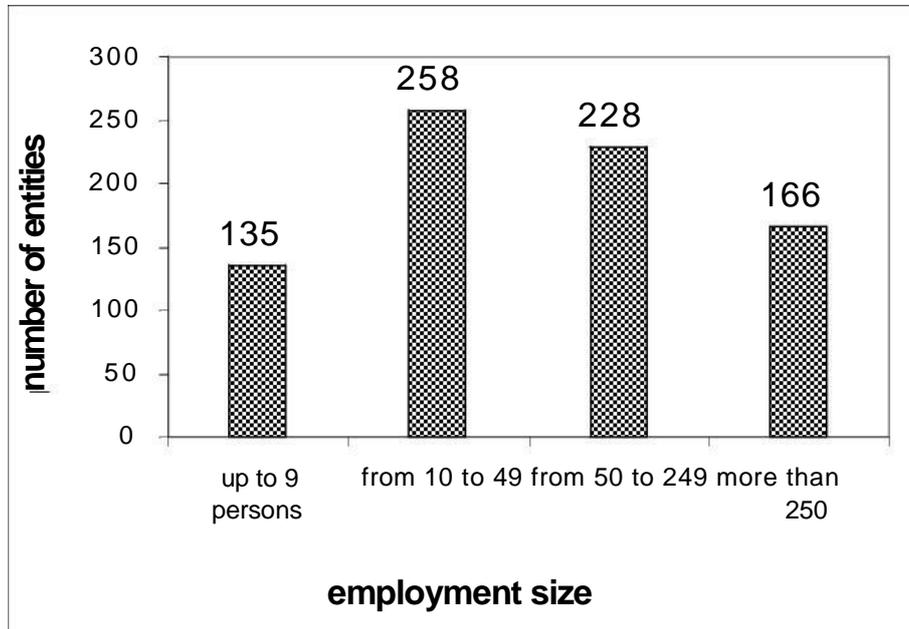

large entities counting at least 250 employees.

Fig. 5. The number of the researched organizations according to employment size criterion *Source: [24, accepted to print].*

On the basis of obtained results, it can be seen that projects are realized by all organizations independently of their sizes measured by the number of employees. However, the number of small entities employing from 10 up to 49 persons were the highest.

In the next subsection, the results of the research in the scope of using telecommunications services in the analyzed projects by the group of micro and small entities are presented.

8.5. The results of the research

On the basis of data collected in the course of the conducted research, types of services used by analyzed micro entities were defined. A graphical illustration
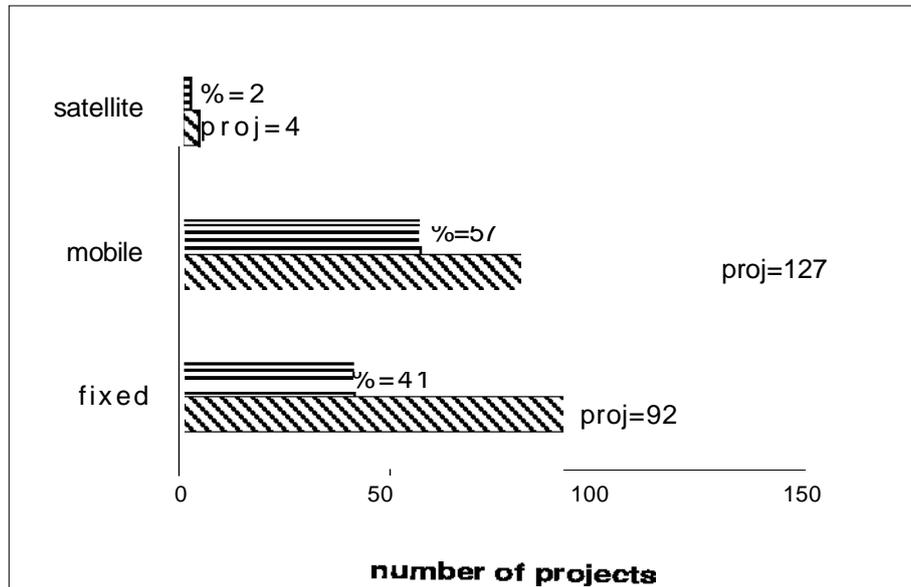
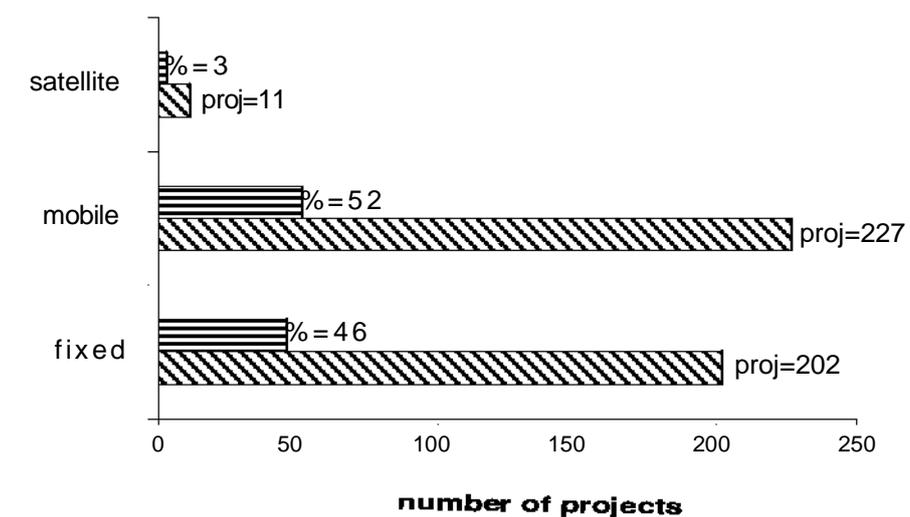of the results is presented in Figure 6.

Fig. 6. Application of individual types of telecommunications services by the researched micro entities *Source: worked out on the basis of own research.*

Services of mobile and fixed telecommunications were mostly used in realization of projects by enterprises of this size. It should be emphasized here that cellular networks have become more popular than fixed networks. As much as 57% out of 137 analyzed ventures used services of mobile telecommunications. There are many reasons for this situation. When realizing projects, apart from voice connections, data transmission is more and more often used. Data transmission is essential for the functioning of e.g. internal intranet networks or computer programs supporting the processes of project management. A few years ago, data transmission with parameters sufficient for the functioning of the above mentioned systems, was provided only by fixed telecommunications. The situation changed, however, in the course of time. Telcos started to introduce new services more and more frequently, allowing for data transmission with better parameters. It was accompanied by lowering prices of their services. It turned out as a result that data transmission in fixed networks

with given parameters is, indeed, cheaper in relation to solutions offered by mobile telcos but the difference is not significant enough to influence users' decisions, taking into considerations advantages of mobile systems. Mobile telecommunications first of all ensures mobility. Its users can do works connected with project realization in any place within range of the network. It significantly makes organization of processes of projects' progress more flexible and it raises the efficiency.

However, fixed telecommunications was used by as many as 41% of the researched micro-entities. The share of this type of services ensuring communication in analyzed projects is, therefore, significant. It should also be stressed here that some of solutions concerning communication while project realization are designed to use services of fixed telecommunications. There are also solutions that, in regard of communication safety, require big certainty of keeping continuity, which is often realized in practice by using lines of both fixed and mobile telecommunications at the same time.

Comparing the results of the research concerning types of telecommunications services used for project realization of micro and small

entities (Figure 7), it can be well seen they are almost identical.

Fig. 7. Use of individual types of telecommunications by the researched small entities
Source: worked out on the basis of own researc

The research proved that there are no differences in the ways of ensuring communication between micro entities and small entities in the analyzed group. The other reason for this situation may be a relatively big universality of telecommunications and information technologies, which causes that there are

certain solutions dedicated for given cases and that is why they are used by both groups of organizations.

Insignificant use of services of satellite telecommunications is greatly visible. The lack of necessity to apply solutions of satellite communications by both groups of entities can be the reason for the research results.

8.6. Summary

Realization of projects always requires using good systems ensuring communication. It also concerns entities employing small number of workers. Telecommunications services make up one of the necessary elements of these systems. The market offers more and more varied solutions, which enables to make the choice of services that could be adjusted best to the needs of realization of a given venture.

The conducted research proved that analyzed micro and small entities use at least one type of telecommunications service for realization of their projects More than a half of these groups used mobile telecommunications services, which became more often used than fixed networks. The conducted analyses showed that micro and small entities are not different from each other as far as types of used telecommunications networks are considered.

The researched entities extremely rarely use services of satellite telecommunications. However, taking into account development directions of these technologies, their growing possibilities as well as decreasing prices of services, they should become objects of interest of micro and small entities in the nearest future and become much more widely used in projects realized by them.

References

[1] **Bentley C.:** *Practical PRINCE2*, The Stationery Office, Norwich 2005.
[2] **Buckwalter J.T.:** *Frame Relay: Technology and Practice*, Addison Wesley Publishing Company, Reading 2000.
[3] **Chong Y.Y., Brown E.M.:** *Zarządzanie ryzykiem projektu*, Oficyna Ekonomiczna, Kraków 2001.
[4] **Ciesielski M.:** *Rynek usług logistycznych*, Difin, Warszawa 2005.
[5] **Czerni S.:** *Leksykon naukowo-techniczny*, Wydawnictwa Naukowo-Techniczne, Warszawa 1972.
[6] **Fechner I., Szyszka G. (eds):** *Logistyka w Polsce – Raport 2005*, Instytut Logistyki i Magazynowania, Poznań 2006.

[7] **Gołaczyński J.**: *Umowy elektroniczne w prawie prywatnym międzynarodowym*, Wolters Kluwer Polska - Oficyna, Kraków 2007.

[8] **Gołembska E., Szymczak M.:** *Informatyzacja w logistyce przedsię-biorstw,* PWN, Warszawa – Poznań 1997.

[9] **Green J.H.:** *The Irwin handbook of telecommunications*, McGraw-Hill Professional, New York 2006.

[10] http://bluetooth.com/Bluetooth/SIG/.

[11] http://galileo.kosmos.gov.pl.

[12] http://portalwiedzy.onet.pl.

[13] http://searchmobilecomputing.techtarget.com/tip/0,289483,sid40_gci1339 643,00.html.

[14] http://www.cellular.co.za/cellphone_inventor.htm.

[15] http://www.dect.org/index.aspx.

[16] http://www.dectweb.com/Introduction/answers.htm.

[17] http://www.prince-officialsite.com/home/home.asp?text=large.

[18] http://www.wi-fi.org.

[19] **Kerzner H.:** *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, wydanie X, John Wiley and Sons, Hoboken, New Jersey 2009.

[20] **Kisielnicki J., Gwiazda T.:** *Wstęp do informatyki w zarządzaniu,* Wydawnictwo Naukowe Wydziału Zarządzania Uniwersytetu Warszawskiego, Warszawa 2004.

[21] **Kisielnicki J.:** *Zarządzanie organizacją. Zarządzanie nie musi być trudne*, Oficyna Wydawnicza Wyższej Szkoły Handlu i Prawa im. Ryszarda Łazarskiego, Warszawa 2004.

[22] **Kortan J.:** *Podstawy ekonomiki i zarządzania przedsiębiorstwem*, Wydawnictwo C.H. Beck, Warszawa 1997.

[23] **Kozłowski R.:** *Przeobrażenia struktur organizacyjnych przedsiębiorstw zaawansowanych technologii (na przykładzie operatorów telefonii stacjonarnej)*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź 2006.

[24] **Kozłowski R.:** *Wykorzystanie zaawansowanych technologii w zarządzaniu projektami*, Wydawnictwo Uniwersytetu Łódzkiego, przyjęto do druku.

[25] **Lachiewicz S., Zakrzewska-Bielawska A. (eds.):** *Restrukturyzacja organizacji i zasobów kadrowych przedsiębiorstwa*, Oficyna Ekonomiczna, Kraków 2005.

[26] **Lent B.:** *Zarządzanie procesami prowadzenia projektami. Informatyka i Telekomunikacja*, Difin, Warszawa 2005.

[27] **Lewis J.P.:** *Podstawy zarządzania projektami,* Wydawnictwo Helion, Gliwice 2006.

[28] **Liberadzki B., Mindur L.:** *Uwarunkowania rozwoju systemu transportowego Polski*, ITE-PIB, Warszawa – Radom 2007.

[29] **Lock D.:** *Podstawy zarządzania projektami*, PWE, Warszawa 2003.

[30] **Mingus N.:** *Zarządzanie projektami*, Wydawnictwo Helion, Gliwice 2003.

[31] **Nowosielski S.:** *Procesy i projekty logistyczne*, Wydawnictwo Uniwersytetu Ekonomicznego w Wrocławiu, Wrocław 2008.

[32] **Pawlak M.:** *Zarządzanie projektami*, PWN, Warszawa 2006.

[33] **Roszkowski H., Wiatr A.P.:** *Zarządzanie projektem. Istota, procedury i ich zastosowanie przy korzystaniu ze środków Unii Europejskiej*, Wydawnictwo SGGW, Warszawa 2005.

[34] **Trocki M., Grucza B., Ogonek K.:** *Zarządzanie projektami*, PWE, Warszawa 2003.

[35] *Ustawa o łączności „Prawo telekomunikacyjne"* z dn. 16 lipca 2004 r. Dz. U. Nr 171, poz. 1800.

[36] www.defenselink.mil

[37] www.eutelsat.org

[38] www.gps.gov