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ECONOMIC EFFICIENCY OF TELEWORK IMPLEMENTATION FOR IT TEAMS. METHODOLOGICAL BACKGROUND AND A CASE STUDY

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The paper looks into selected problems relating to the evaluation of economic efficiency of telework implementation for IT teams. Telework is a form of employment which can be successfully used in most of IT activities and professions. The need for rationalizing constantly growing labor costs makes it necessary to implement telework programs in IT teams. The author presents the methodological background for a study of economic efficiency of such programs based on the Cost-Benefits Analysis (CBA). Estimates of expected benefits are based on Key Goal Indicators (KGI) and Key Performance Indicators (KPI) recommended in the PO7 Manage IT Human Resources process of the COBIT® (Control Objectives for Information and related Technology) 4.1 model. The validity of a suggested approach is then verified on a real example of IT telework program implemented in a large organization, with detailed effectiveness assessments included in the article.

Keywords: COBIT®, economic effectiveness assessment, IT human resources management, IT teams, telework, telework program implementation.

1. Introduction

A global financial crisis which has affected Polish economy since the second half of 2008 resulted in deterioration of the economic situation in the majority of companies and institutions. The evidence has been provided by current business

statistics, economic and social analyses or by monitoring tendency changes in the economy (see, e.g., a profound diagnosis included in the report [12]). Implications of the crisis have been observed in the information technology sector as well, with clear signals coming from producers and providers of IT products and services or their customers.

This situation has affected the functioning and informatization programs of a large percentage of Polish companies and institutions. The author's surveys from 2009-2011 on the impact of the global crisis on IT projects and systems in 375 companies and institutions showed that many of those had modified their informatization strategies. Apart from cuts in IT seminars and training expenses, the respondents most frequently indicated the following as visible symptoms of the change: postponed IT investments, reduced IT investment spending and reduced budgets of IT departments (see, e.g., [5, pp. 110-112], and [6]).

With shrinking IT budgets, the interest in calculating effectiveness of IT solutions has been growing. This includes looking for ways to rationalize the labor costs of employed IT professionals. Many factors contribute to high and ever rising labor costs for almost all IT professions in Poland. One of particular importance in the context of telework discussed in this article is the comparative facility with which Polish IT professionals can enter the labor markets of countries with much higher salary levels, often without even having to emigrate. Not only "does the work come to them," with many companies setting up branches or competence/service centers in Poland, but also technologies for developing most of IT products and services enable their "trouble-free" remote maintenance. As a result, salaries of IT professionals are leveled up to those of more developed countries. Combined with high and constantly increasing charges on salaries (such as, e.g., social security levies), this produces a rise in labor costs in IT sector in Poland.

The aim of this paper is to test the working hypothesis that telework is a pro-efficient form of employment that can be successfully applied to IT teams. Organizational flexibility along with social and environmental orientation are those characteristics of telework which are most often cited as favoring its increasingly widespread use (*cf.* [14] and [18]). But also economic effectiveness of telework attracts more and more attention. Thus, the American association TelCoa proposes the following formula for "successful work today and tomorrow" [19]: $IT + P^3 = E^3$. According to it, improvement of the *economy*, rationalization of *energy* demand and protection of the *environment* (E^3) depend on the degree in which continuously developed information technology (*IT*) goes together with appropriate *policies*, *processes* and *procedures* (P^3).

The following sections of the paper discuss some of the problems associated with implementation of telework in IT along with a methodological basis for the analysis of the economic effectiveness of telework programs based on the so-called

mixed (or alternating) model. A suggested approach is then tested using the example of a pilot implementation of such program which took place in 2011.

2. Implementing telework in IT teams

Before we speak about economic effectiveness assessment, it is necessary to consider the major problems posed by implementation of telework in IT professions or teams.

Table 1. The main advantages and disadvantages of telework for the employer and the employee

Advantages of telework for the employer	Advantages of telework for the employee
▪ Reduce operating costs (office space, furniture and equipment, office supplies, replacement costs, cost of employment, etc.) ▪ Enhance productivity ▪ Reduce the number of sick leaves ▪ No being late for work ▪ Possibility of employing disabled workers or workers on maternity/parental leave ▪ Recruit skilled labor ▪ Payment by results and not by time ▪ Reduce the negative influence of employees on one another	▪ Greater employment opportunities ▪ Flexi-work (employment, contract, time, places of residence and work) ▪ Flexibility ▪ Reduce indirect costs (higher earnings) ▪ No commuting or shorter commute (save time and money) ▪ More time for the family ▪ Dependence on technology may result in the improvement of professional skills ▪ Age and appearence are no longer important, what counts are skills
Disadvantages of telework for the employer	**Disadvantages of telework for the employee**
▪ High initial costs ▪ Difficulties in ensuring the necessary level of security and confidentiality of information ▪ Management problems (it is necessary to redefine internal regulations, managerial staff may oppose) ▪ No direct control over the employee ▪ Loss of the firm's identity ▪ The employee is more likely to leave the company to work as a freelance	▪ (Feeling of) isolation and alienation ▪ Longer working day (the lack of structure of the working day may disrupt work) ▪ Stress in the family (difficulties in separating work and family life) ▪ Additional costs ▪ Fear of having less chance of promotion and being more likely to be dismissed

Source: [13, pp. 34-35]

To begin with, it should be remembered that the idea of telework in IT sector is already fifty years old (*cf.* [12]). In consequence, we can draw not only on the

experiences of numerous IT firms, but also on the best practices worked out by organizations whose aim is to develop telework as a form of employment. This provides us with both some concepts of telework and programs of its implementation in various professions (including IT professions) and different organizational structures (such as, e.g., project or task teams). From the perspective of this paper, the benefits identified as a result of implementing telework are of particular interest. Thus, TelCoa (*The Telework Coalition*) has identified 10 major groups of potential benefits, each associated with one of three categories of beneficiaries: the employer and the economy, the employee or the environment and society [17]. Having studied numerous reports available, P. Sienkiewicz and H. Świeboda listed the main advantages and disadvantages of telework for the employer and the employee (see Table 1). Most important, some of these advantages and disadvantages can be measured. Once recorded, the values of the indicators characterizing them can be used in standard methods of measurement and evaluation of effectiveness.

Second, it must be stressed that the idea of telework is now not only being promoted by "specialists in management" or "the business world," but also getting support from politicians. A good example is Barack Obama's speech at the White House Forum on Workplace Flexibility on March 31, 2010. The American president declared that "work is what you do, not where you do it," emphasizing the integral role of telework in achieving flexible, resilient workplaces [13, p. 7]. The political support is essential insofar as it is leading to development of telework implementation strategies and programs (see US initiatives, e.g., [6] and [7]). Another example is provided by the European Union, which has been including telework in successive strategies and programs of the development of information society (e.g., *eEurope – An Information Society for All* and *Telework* programs) which it finances as far as research and development as well as implementation projects are concerned. Telework has also been an important element of successive informatization strategies and numerous central (e.g., *Telepraca* [Telework] I and II) and regional programs and projects in Poland. Most important, the support from politicians is resulting in new regulations on flexible forms of employment. Thus, regulations on telework as a form of employment were introduced into the Polish Labor Code in August 2007 [15]. Legal definitions of telework and teleworker helped to specify the character of this form of employment, as well as the relationship between the employer and the employee, including the rights and obligations of both. Moreover, the regulations have provided new opportunities for women, the disabled and people living far from economic/administrative centers to (re-)enter the job market. All this means that IT sector can more often take advantage of telework, also in regard to those who have limited employment opportunities. With more potential candidates for a job, IT firms and institutions looking for IT professionals may be able to make the recruitment process quicker,

reduce their dependence on key employees, lower the costs associated with the creation of stationary jobs, and so on.

Finally, IT professions seem to lend themselves well to the implementation of teleworking. The characteristics of the latter match, to a great extent, those of IT products and tasks that are completed in the course of their creation, maintenance and use, that is tasks that are carried out by IT professionals. Accordingly, IT products can largely be created and maintained – and IT services provided – at a distance, even globally. Furthermore, IT professionals have the knowledge and skills in information and communication technologies needed to implement telework, while IT firms have the necessary equipment, application and network infrastructures. What counts in teleworking is not the action itself or the way it is carried out but the result. It is likewise in IT, where the greater part of provided solutions are developed as projects, with a scope, parameters, time (limits), expenditure and costs well defined for final products or services, as well as their elements. This greatly facilitates changing development, provision or servicing technologies from stationary into remote and/or mobile. Both telework and IT work are often described as "conceptual," which makes it possible for different actions that make them up to be carried out simultaneously. But this also imposes some requirements, which can be met thanks to the so-called simultaneous management including: planning, management, synchronization of processes and information, information linking, motivation and evaluation. Like complex IT projects or IT task teams' work, telework implementation requires keeping the so-called big picture of a project coherent in a situation where each worker controls a different part of it. In both cases, what can greatly help is task management, result-oriented, with the exact specifications of final and intermediate products, procedures for change management and information access and exchange platform management, and a good support system. Let us add at the end that IT professions require, but also develop, the same qualities as those needed for teleworking, i.e. self-discipline, conscientiousness, regularity, capacity for task work, result-orientation or ability to organize one's work while keeping in view teamwork requirements.

As a result, IT (or ITC) sector employees and IT professionals working with companies and institutions, whether around the world or in Poland, are among those who are the most likely to become teleworkers.

3. Measuring and evaluating the economic effectiveness of implementing telework in IT teams

Having briefly presented the general idea of teleworking, we can go on to discuss the main problems associated with measurement and evaluation of the economic effectiveness of implementing this form of employment in IT teams.

In the literature of the subject, we can find various approaches to the measurement and evaluation of the economic effectiveness of IT projects and products, with examples of their application (see, e.g., [2] and [3]). This multitude is due to the complexity of the problems which may be considered from different theoretical and practical perspectives.

First of all, the methodology of effectiveness assessment will largely depend on whether we have to do with a commercial project (also IT project), a commercial project with social elements, a social project with commercial elements or an entirely social project. In each case, there will be differences in decision criteria, cost-effectiveness evaluation methods and measures, as well as the approaches to risk [8, p.144]. This paper focuses on teleworking programs, in which commercial and social aspects are equally present. So the adopted approach should, on the one hand, be based on an effectiveness financial analysis and, on the other hand, take social factors into account, integrating the results into a coherent evaluation system. This is illustrated in Figure 1.

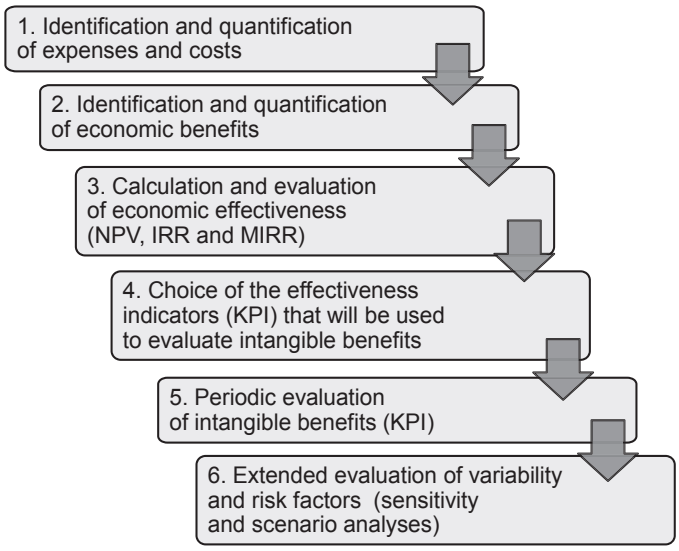

Figure 1. Generalized scheme of economic effectiveness analysis extended to include evaluation of intangible benefits and of variability and risk factors

The procedure presented schematically in Figure 1 consists of six steps. The first three are standard steps in economic effectiveness analysis methods based on CBA (Cost Benefit Analysis) which may well be used in IT field, as many authors have demonstrated (see, e.g., [2] and [3]). The expenditure and cost side of the equation is transparent and relatively easy to identify and quantify, with TCO

(Total Cost of Ownership) best practices providing a basis for the analysis in IT field. It is much more complicated to identify and quantify economic benefits, especially in the case of "to-be" scenarios. It is therefore advisable to create repositories of historical and comparative data on tangible benefits and/or opportunity costs. It is also recommended that the analysis be extended to include the KPI (Key Performance Indicators) characterizing organizational or business processes being supported. By modeling the expected values of KPI on the basis of comparative data, we are able to estimate the achievable increase in productivity (cost reduction and change in efficiency indicators) in an indirect way. If we then want to apply measures recommended for financial analysis (such as NPV, IRR and MIRR) to the evaluation of effectiveness, the changes in KPI values must be expressed in terms of financial quantities. This is usually possible as many of the indicators are correlated to specific cost and/or revenue objects. However, the process is complicated, and so requires a lot of time and effort, especially in the case of evaluating social costs and benefits, which are often equally important as economic and financial results.

Because the analysis of the effectiveness of implementing telework programs involves evaluation of social costs and benefits, steps 4 and 5 of the proposed procedure (Figure 1) modify the way KPI are used. As regards intangible benefits, the analysis may be limited to recording the values of the indicators, whose conformity with the planned target and/or intermediate values is then examined. A similar approach can be found in procedures aiming at continuous improvement of a process. The difficulty lies in selecting an appropriate set of KGI (Key Goal Indicators) and KPI. In the case of the implementation of telework programs, it seems that the choice may be based on the COBIT (Control Objectives for Information and related Technology) model [1]. This is a globally accepted IT governance framework developed by ISACA and ITGI (IT Governance Institute), containing a set of good practices, including control objectives for information and related technology. It provides organizations with a clear and coherent framework for IT management. The COBIT version 4.1 defines objectives and indicators which may be used in the teleworking field in the process PO7 Manage IT human resources [1, p.57].

From a survey of the process PO7 performance indicators it appears that the following KPI could be used to evaluate the effectiveness of telework implementation:

- Number of job positions included in a teleworking program
- Number of employees under a telework arrangement
- Cost of maintaining job positions included in a teleworking program
- Turnover rate (number of staff leaving compared to the average number of staff employed)

– Number of employment contracts terminated on the initiative of the employee
– Number of employment contracts terminated by agreement of the parties
– Average number of days to recruit
– Number of days off work
– Absence rate (%)
– Number of working days lost due to unplanned absence
– Percentage of tasks completed on time
– Employee satisfaction index (satisfaction, confidence and loyalty)
– Employee interest in telework (%)

The above list is not closed and, depending on the situation, may be lengthened or shortened. Some of the KPI from the list have been used in the case study presented in the next section of the paper.

The sixth and last step of the analytical procedure shown in Figure 1 consists in an extended evaluation of variability and risk factors, which, except discount and NPV profile analysis, were not included in the earlier steps. This means complementing the study with a sensitivity analysis („what-if") and an analysis of OBP (optimistic, base and pessimistic) scenarios. As both of them are well-known tools, we will not describe them here and will only show how they can be used in the case study presented below.

4. Case study

4.1. General description of the implementation environment

The adopted methodology of evaluating the economic effectiveness of implementing telework in IT teams has been tested in a large institution which started a pilot teleworking program based on a mixed model in 2011. The testing was carried out in cooperation with T. Kordecki who discussed some of the problems associated with telework implementation in a thesis supervised by the author of this paper and written as a part of a postgraduate course in *Effective IT Management in a Company* in the Warsaw School of Economics [10].

The institution in question did not have much recourse to teleworking before taking interest in it for economic and social reasons. It is located in the center of a big city where office space rental prices are high. This results in high costs of stationary jobs. Moreover, many employees complain about a time-consuming commute to work, asking their superiors for a change in their working hours or flextime. The institution's IT department employs almost 100 people. It has a system for recording work time and a system for assigning tasks and monitoring their completion. All tasks to complete have precisely defined goals and results.

Technically and organizationally, the institution is prepared for telework implementation, having developed and been using secure solutions for remote access to internal IT resources, defined standards for stationary and mobile workstations and set up a 24 hour Service Desk.

4.2. Measuring and analyzing the implementation effectiveness with discounting methods

In line with the conception of effectiveness assessment presented earlier (Section 3), the calculations and analysis should begin with application of standard discounting methods (*cf.* steps 1-3 in Figure 1) based on CBA. Table 2 shows the parameters of the telework implementation program, which served as a basis for quantifying the values of necessary expenses and costs, as well as expected benefits.

Table 2. Basic parameters of the telework implementation

Item	2012	2013	2014	2015
Average total annual cost of maintaining a job position in the institution's offices	13,000 PLN			
Average total annual cost of network access for a teleworker	960 PLN			
Average cost of adapting a workstation in the institution for a teleworker (a hot desk)	2,000 PLN			
Annual cost of training a group of teleworkers and their managers	50,000 PLN			0
Percentage of a teleworker's work time outside the institution	60%, i.e. 3 days a week			
Costs of the teleworking program implementation (first year) and maintenance (next years)	100,000 PLN	30,000 PLN		
Number of teleworkers	10	20	30	30

Source: own presentation based on [10, p. 24]

Table 3 presents the values of necessary expenses and costs, estimated on the basis of these parameters. Table 4 provides an overview of the values of expected direct economic benefits. Following our earlier argument (*cf.* steps 4 and 5 of the procedure in Figure 1), because of unreasonable costs of a monetary valuation of benefits and its later updating, we did not undertake such a valuation of benefits associated with increase in staff efficiency and staff recruitment and retention. These benefits were, however, included in the telework implementation indicators that have been regularly monitored.

Table 3. Predicted expenses and costs of the teleworking program implementation (in PLN)

Item	2012	2013	2014	2015
Total expenses and costs of the program implementation	100,000	0	0	0
Total costs of adapting workstations	12,000	12,000	12,000	0
Total costs of network access for teleworkers	9,600	19,200	28,800	28,800
Training and workshops for teleworkers and their managers	50,000	50,000	50,000	0
Costs of the teleworking program maintenance	0	30,000	30,000	30,000
Overall expenses and costs	171,600	111,200	120,800	58,800

Source: own presentation based on [10, p. 25]

Table 4. Predicted economic benefits of the teleworking program implementation (in PLN)

Item	2012	2013	2014	2015
Reduced costs of maintaining jobs	39,000	156,000	234,000	234,000
Reduced costs of teleworking staff absence	1,800	7,200	10,800	10,800
Overall benefits	40,800	163,200	244,800	244,800

Source: Own presentation based on [10, p. 25]

Table 5 shows the cash flow for the implementation, which served as a basis for calculating the values of NPV, IRR and MIRR. Table 6 presents the values of these effectiveness measures, calculated for a 3 and 4-year life cycle of the teleworking program.

Table 5. Cash flow for the teleworking program implementation (in PLN)

Item	2012	2013	2014	2015
Capital outlay and costs	171,600	111,200	120,800	58,800
Benefits (predicted benefits and cost reduction)	40,800	163,200	244,800	244,800
Net cash flow (NCF)	– 130,800	52,000	124,000	186,000
Discounting factor (CO = 10%)	1.0000	0.9091	0.8264	0.7513
Discounted cash flow (NCF x CO)	– 130,800	47,273	102,479	139,745

Source: Own presentation based on [10, p. 26]

Table 6. Indicators of the economic effectiveness of the teleworking program implementation

Economic effectiveness indicator	2012-2014	2012-2015	Change (%)
NPV	18,952.07 PLN	158,696.62 PLN	837.4%
IRR	19.25%	57.39%	298.1%
MIRR	18.04%	43.94%	243.6%

Source: Own presentation based on [10, p. 27-28]

The sixth and last step of the proposed procedure (*cf.* Figure 1) consists in an extended effectiveness evaluation which includes variability and risk factors and uses sensitivity and scenario analysis methods. The results of a sensibility analysis are found in Table 7. The data show that, especially for a 4-year analytical period, the project's safety margins prove to be wide.

Table 7. Selected results of a sensibility analysis for the teleworking program implementation

Indicator	2012-2014	2012-2015	Change (%)
Safety margin for expenses and costs	5.09%	38.08%	748.1%
Safety margin for benefits	–4.84%	–27.58%	569.9%

Source: Own presentation based on [10, pp. 27-28]

Finally, in Table 8, the results of a scenario analysis, which are the values of NPV, IRR and MIRR calculated for particular scenarios, show that, in all cases except the pessimistic scenario for a 3-year analytical period, the project fully meets the so-called absolute cost-effectiveness criterion, as $NPV \geq 0$ while IRR and MIRR ≥ MARR (minimum acceptable rate of return) (*cf.* [3] and [8]).

Table 8. Results of a scenario analysis for the teleworking program implementation

Scenario / Effectiveness indicator	Optimistic	Base	Pessimistic
3-year analytical period (years 2012-2014)			
NPV (in PLN)	63,571.40	18,952.07	–23,667.27
IRR	44.55%	19.25%	–0.69%
MIRR	37.87%	18.04%	0.97%
4-year analytical period (years 2012-2015)			
NPV (in PLN)	212,512.05	158,696.62	105,378.56
IRR	80.77%	57.39%	39.08%
MIRR	57.13%	43.94%	32.30%

Source: Own presentation based on [10]

It should be stressed in closing that, in the case studied, all the conditions and all the resulting effectiveness criteria are fulfilled so that, economically, we may consider that the project is cost-effective and recommend starting to implement telework in the institution's IT teams.

5. Conclusion

Institutions and business organizations are constantly looking for ways to rationalize IT spending and labor costs of employed IT teams, being faced with a decrease in the former as a result of, among others, the economic crisis and a steady increase in the latter. One of the options is a more widespread use of teleworking as a socially- and environmentally-oriented, organizationally flexible and economically efficient form of employment.

The author hopes that the reflections contained in this paper – particularly the conception of effectiveness measurement and evaluation along with the case study based on it – will help to spread knowledge on such an important subject as telework, thus encouraging more frequent recourse to this form of employment with regard to IT teams.

REFERENCES

[1] *COBIT® 4.1* (2007) IT Governance Institute, http://www.isaca.org/Knowledge-Center/cobit/Pages/Downloads.aspx (accessed 20.07.2012).

[2] Cypryjański J. (2007) Metodyczne podstawy ekonomicznej oceny inwestycji informatycznych przedsiębiorstw. Uniwersytet Szczeciński, Szczecin.

[3] Dudycz H., Dyczkowski M. (2007) Efektywność przedsięwzięć informatycznych. Podstawy metodyczne pomiaru i przykłady zastosowań. Akademia Ekonomiczna, Wrocław.

[4] Dyczkowski M. (2011) Zmiany strategii informatyzacji polskich obiektów gospodarczych pod wpływem kryzysu gospodarczego. Podsumowanie badań z lat 2009-2011. [in:] Informatyka Ekonomiczna no. 22/2011, Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu no 212, Wrocław, pp. 102-117.

[5] Dyczkowski M., Dyczkowski T. (2012) Changes in informatization strategies of Polish companies and institutions in reaction to the economic crisis. Summary of the surveys from the years 2009-2011, [in:] Federated Conference on Computer Science and Information Systems FedCSIS 2012, Wrocław 2012 (in print).

[6] Government's Telework Program (2011), http://www.telework.gov (accessed 10.07.2012).

[7] Guide to Telework (2011) *in the Federal Government*, United States Office of Personnel Management, April 2011,

http://www.telework.gov/guidance_and_legislation/telework_guide/telework_guide.pdf (accessed 10.07.2012).

[8] Kasiewicz S., Rogowski W. (2009) Inwestycje hybrydowe – nowe ujęcie oceny efektywności. Szkoła Główna Handlowa w Warszawie, Warszawa 2009.

[9] Polska 2011 – Raport o stanie gospodarki, Ministerstwo Gospodarki, Warszawa 2011, www.mg.gov.pl/files/upload/8436/RoG2011.pdf (accessed 5.10.2011).

[10] Kordecki T. (2011) Ocena efektywności ekonomicznej programu „Telepraca szansą dla Ciebie i Twojej firmy". Diploma thesis, supervised by M. Dyczkowski, Postgraduate Studies "Effective IT Management in a Company", XI edition, Szkoła Główna Handlowa, Warszawa (manuscript).

[11] Nilles J. (2003). Telepraca, strategie kierowania wirtualną załogą. Wydawnictwo Naukowo-Techniczne, Warszawa.

[12] Status of Telework (2011) in the Federal Government – Report to the CONGRESS, United States Office of Personnel Management, February 2011, http://www.telework.gov /Reports_and_Studies/Annual_Reports/2010teleworkreport.pdf (accessed 2.07.2012).

[13] Sienkiewicz P., Świeboda H. (2004) Analiza systemowa telepracy. [in:] Społeczeństwo informacyjne – wizja czy rzeczywistość? L. H. Haber Ed., AGH, Kraków, tom II, pp. 27-40, http://winntbg.bg.agh.edu.pl/skrypty2/0096/027-040.pdf (accessed 2.07.2012).

[14] TelCoa's Top 10 Reasons (2012) to Telework©. http://www.telcoa.org/about-us/telcoas-top-10-reasons-to-telework/ (accessed 10.08.2012).

[15] Ustawa Kodeks Pracy z dnia 26 czerwca 1974 roku z późniejszymi zmianami – tekst ujednolicony, stan prawny na dzień 28.07.2011, http://www.prawopracy.pl/graf/Kodeks_pracy.pdf (accessed 10.08.2012).

[16] Why do we keep (2012) trying to solve today's economic, energy, and environmental problems… with *yesterday's transportation-based solutions?*, http://www.telcoa.org/ (accessed 10.08.2012).