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Information Sector in the new economy

Summary

This study highlights the possibilities of distinguishing the new sector - the information sector of the economy, generated in particular by information technology. Emphasis has been placed on its significance in economic development. Surveys on the economics of this sector have been highlighted.

Introduction

The technological progress that has taken place over the last few decades in information technology (IT) and electronic media have resulted in significant changes in practically all areas of human activity – social and economic.

We are currently living in the Information Age. Many terms have been proposed to describe this concept more succinctly, such as: the post-industrial society, the information economy, the global village etc. The terms mentioned are commonly substituted by “information society”. Literature also contains expressions with similar meanings, such as information-based economy (knowledge-based economy, society), which I interpret in my works (Dziuba 2000) as “economies and societies saturated with information”, and understanding the significance of the knowledge, also as “economies and societies saturated with knowledge.”

Recently, the term New Economy has been used with increasing frequency, which illustrates the changes in modern economies, that are the effects of the reaction of the new information technologies (IT), in particular the Internet. An important role in the New Economy is being played by the production of information goods and services, generating economic development and creating new jobs. The significant role of the concept of the New Economy is afforded to information, the treatment of information as the basic economic category and the significance of the new sector in the economy - the information sector.

The information sector as the quaternary sector of the economy

According to Kaldor (1967), it is possible to distinguish three consecutive stages in the processes of social and economic development, in which the dominant share of the economy is the primary sector (I), the manufacturing sector (II) and the service sector (III).

The first stage features a dominant share of primary economic activities, the so-called primary sector (I), which in the statistics includes the areas of agriculture, hunting, forestry, fishing, fisheries, mining and quarrying. The second stage is related to the rapid development of industrial production, leading to the relative satisfaction of demand for industrial goods. The manufacturing sector (II) encompasses production activities, construction and the supply of electricity, gas and water. A dominance of the services sector (III) is noticeable in the third stage of social and economic development, which includes the remaining activities. The individual stages are mutually conditional, leading to further, higher and more mature stages of development.

The intensive development of information and communication technologies and their growth in significance in economic development indicates a need to supplement this classification with a new, quaternary sector of the economy - **the information sector (IV)**.

We are proposing the distinction of the quaternary sector of the economy - the information sector from the primary sector, the production sector and the services sector, which would include fragments of the three sectors of the economy mentioned, including the area of education and scientific studies, state administration, telecommunications, the pulp and paper industry, publishing, information services etc. The information sector is a sector of intangible goods (the goods from this sector feature a large amount of information content). The information activities are among the most important elements of the modern scientific and technical revolution. Areas that “create” information, although varied according to the technologies used and types of products and services produced, all have the purpose of producing, using, protecting and distributing information and therefore, they are connected into one type of activity - information activities. This area comprises the information sector. The concept of the information sector was included in economic research by Marc Uri Porat in

his works “Defining an Information Sector in the U.S. Economy” (1974) and “The Information Economy” (1976) (1977). In the further discussions, we propose the following definition of the information sector:

The information sector of the economy comprises all activities in the economy used to produce, protect, gather, store and transmit information. The information sector encompasses all employees in

- production,
- use and
- transmission of information, as well as
- those creating the information infrastructure.

The information sector encompasses: (1) the production of information products (e.g. production from the electrical apparatus, electronics and precision electronics and paper industries, the production of computers etc.), (2) the provision of information services, e.g. information processing, telecommunications services, consulting etc.

The definition presented appears to reflect the significance and share of the information branches in the economy to a sufficient degree.

M. Porat’s concept of the information sector

The purpose of M.U. Porat’s research (1977) was to define the share of information activities in the US economy, bearing in mind the existing areas of economic activities, based on the existing statistical classifications and the statistical reporting system.

Porat distinguished six sectors of the economy: three information sectors, two non-information sectors and the household sector. Within the information sectors, he distinguished the primary information sector and the secondary information sector.

The criterion for distinguishing the spheres in the information sector is that of the market or non-market exchange of information. The primary (market) information sector consists of companies supplying goods and services to the market, which are related to production, distribution and the transfer of information. The secondary (non-market)

information sector consists of companies¹ that produce goods and services for the internal organisational needs of institutions or companies for the purpose of internal consumption (within the organisation), e.g. company departments developing software on the instructions of other departments. The information products and services are used in the secondary sector for creating other goods and services. They are not traded on the market, while their price is a constituent part of the price of final product. The primary information sector (I) consists of all information goods and services offered on the market. Information here is a normal economic commodity that is subject to the laws of supply and demand. The secondary information sector (II and III) consists of all information goods and services produced by a company or a country but not offered on the market. The information activities of the state (II) and the information activities of companies (III) have been distinguished within the secondary sector.

E.g. if a company prepares an advertising campaign within its own Marketing Department, then such activities are considered to be included within the secondary sector, but if the campaign is contracted out to an advertising company - this is the primary sector.

In recent years, there has been a noticeable trend to reduce expenditure at all levels of state administration. Therefore, many information activities used initially only within state administration, are available on the information market. These include publication of reports, surveys, the results of censuses, legal services and research and development activities. These should therefore be included in the primary sector.

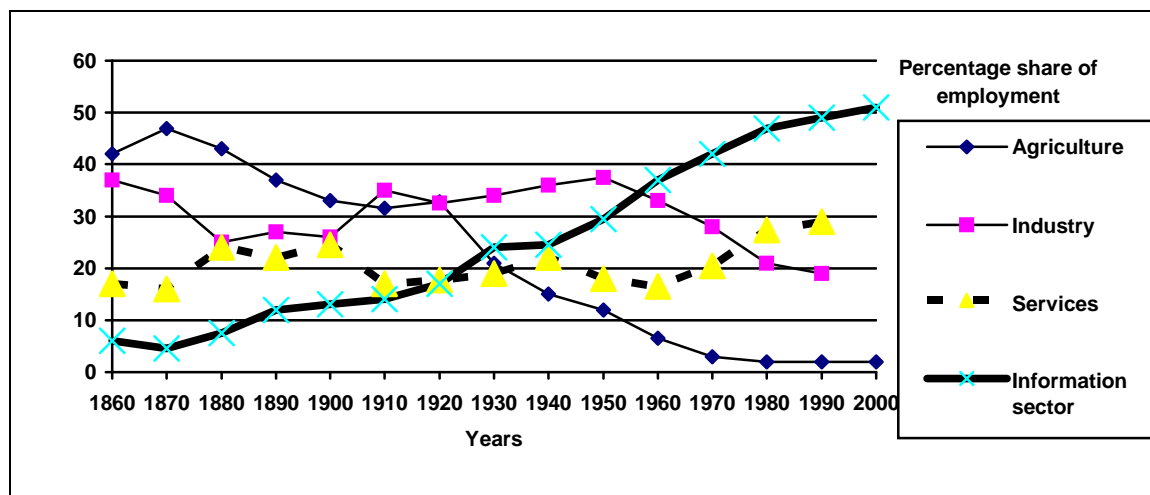
Information sectors comprising sector IV (production of company goods – the whole of production less the primary and secondary information sector), sector V (production of state goods – e.g. construction of roads, bridges, military structures etc.), sector VI - households (final consumers) – as the supplier of the factor of work for all sectors and the customer of all goods and services produced (both information and non-information goods and services).

According to M. Porat, the primary sector represented 25.1 % of the US gross national product (GNP), while the secondary sector represented an additional 21.1 % of GNP (1967). Therefore, information activities (market and non-market) encompassed a total of **46.2 %** of

¹ Porat describes such companies as quasi-firms.

GNP. Employment in the information sector (already approximately 47% of total employment in 1980) also has a high rate of growth.

Fig. 1. Percentage share of employment in four sectors of the US economy



Source: Own analysis based on (Porat 1977) and (Dordick 1987)

Figure 1 presents changes in the employment structure by the four sectors of the economy in the USA. During stage I (1860-1906), the largest group of employees was in agriculture. At the turn of the century, employment started to increase rapidly in industry in order to become the leading employer during stage II (1906-1954). The agricultural society “ended” in the USA in 1906 in order to “make way” for the industrial society. Employment from 1954 (stage III) started to dominate in the information sector; the American society entered into the stage of the “information society”. At present, employment in the information sector has stabilised at a level of more than 50%.²

The proposed study approach has already been used many times in statistical studies on the information sector. Based on Porat’s concept, the OECD prepared a summary of the share of employment in the individual sectors of selected economies. The first domestic statistical system related to the information area was introduced in the USA. Such statistics enable the observation of growth and changes in these activities, allowing for significant

² Some authors estimate the current employment in the information sector of the US economy to be approximately 55%. The trends for the remaining sectors have been shown in figure 1 as growth in services, declining in industry and stabilisation at a very low level in the primary sector. Data from 1990 and 2000 are estimates.

decisions to be made, e.g. related to labour efficiency in the information sector. Studies of the information sector have already commenced in many countries: Great Britain, Singapore, South Africa, Australia, Japan and the region of the Pacific, Ireland, and Hungary etc.

have defined the size of the information sector in Poland by applying Porat's concept. The calculations and the various methods of distinguishing and diagnosing the information sector have been published in such publications as (Dziuba 1998, 2000).

Distinguishing the information sector

We introduced the concept of the information sector in the preceding reflections and illustrated the significant role of this sector in generating economic development processes. Since the information sector is so important, the question arises as to how to distinguish (classify) and diagnose it. Economists in general do not question the essential significance of information and the information sector in the modern economy. The production and distribution of information play a key role, particularly in highly developed countries. Even so, no widely accepted methodology of distinguishing the information sector has appeared so far. Various methods of distinguishing this sector are presented in the literature on the subject (which is highly distributed and fragmented).

In its broadest meaning, the information sector includes the whole of the electronics industry, telecommunications services (including postal, radio and television services), users and "producers of information" from the area of industry, finance, commerce, administration and individual users. In the narrower context, the information sector contains only a portion of industry (manufacture of computers and their hardware and software "packaging", as well as telecommunications hardware), as well as computer services and computer-aided office work. The narrow approach to the definition of the size of the information sector is based on the identification of only the knowledge workers.

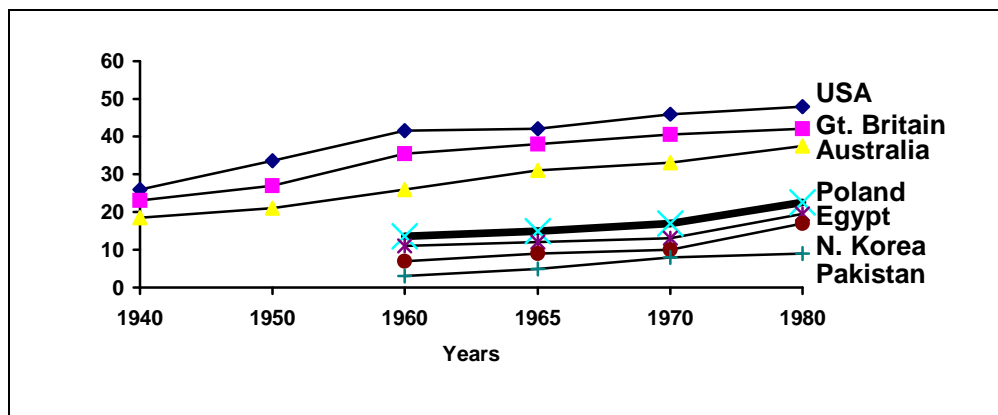
Let us review some example methodologies for distinguishing and measuring the information sector. I have included a full set of methods in (Dziuba 1998, 2000).

The information sector in Poland

I have presented the concepts of the information sector, selected methodologies of its distinction, my own proposed methods and analysis of employment in various employee groups in such publications as (Dziuba 1998, 2000).

Figure 2 illustrates the proportion of the information sector to total employment in selected countries, including Poland. The proportion of the information sector to the total structure of employment (including with respect to employment and the total of professionally active people) in the Polish economy is significantly **lower** than in highly developed countries.

Fig. 2. Percentage share of employees in the information sector of various countries³



Own analysis based on (Katz 1986), (OECD 1978), (Schmoranz 1980) and (Simonov 1990).

In the study (Dziuba 1998), I distinguished the information sector in the Polish economy for the years 1980-1996. Because of the time period, I proposed two fundamental methods of distinguishing the information sector:⁴

- for the years 1980-1993, the methodology based on the National Industrial Classification (KGN);

³ Reliable data was not available to illustrate the dependencies in all the countries mentioned for each of the years in this figure, although the fundamental trends have been maintained – in particular the distance between Poland and the highly developed countries.

⁴ Various methodologies due to the Central Statistical Office using two completely different methodologies of statistical analysis in this period (see further discussions).

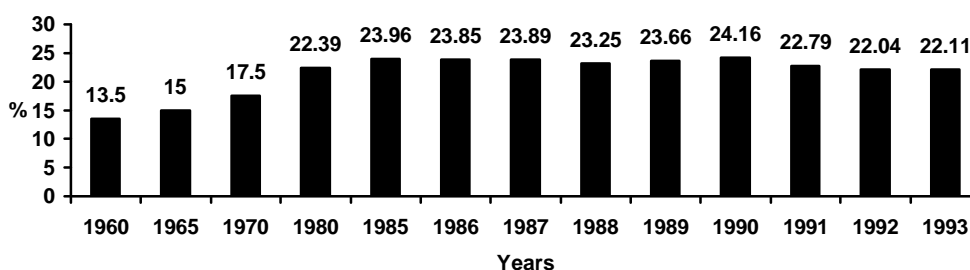
- for the years 1992-1996, the methodology based on the General Industrial Classification

of Economic Activities within the European Communities (NACE);

Data on the information sector of the Polish economy generated by using the methodology proposed earlier is contained in the study (Dziuba 1998).

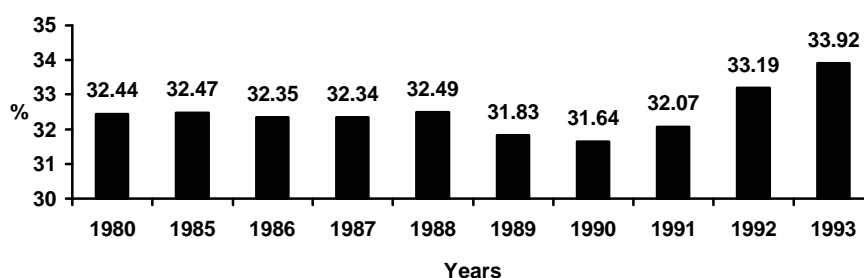
Figures 3 and 4 contain the percentage shares of employees and employment in the information sector to total employment in Poland.⁵

Fig. 3. Percentage share of employees in the whole of the information sector in Poland (according to KGN)



Own research

Fig. 4. Percentage share of the information sector to total employment in Poland (according to KGN)



Own research

The percentage share of employees (employment) in the primary information sector is demonstrating a growth trend throughout the whole of the period studied, whereas in the

⁵ It is neither possible nor sensible to include further series of data into figures 3 and 4, because the Central Statistical Office introduced a new methodology of classification in 1994 – NACE (see further discussions). There is a lack of official statistics converting the NACE data to the earlier years (i.e. the years of use of KGN) and earlier data from the KGN to the later years (i.e. the years of use of NACE).

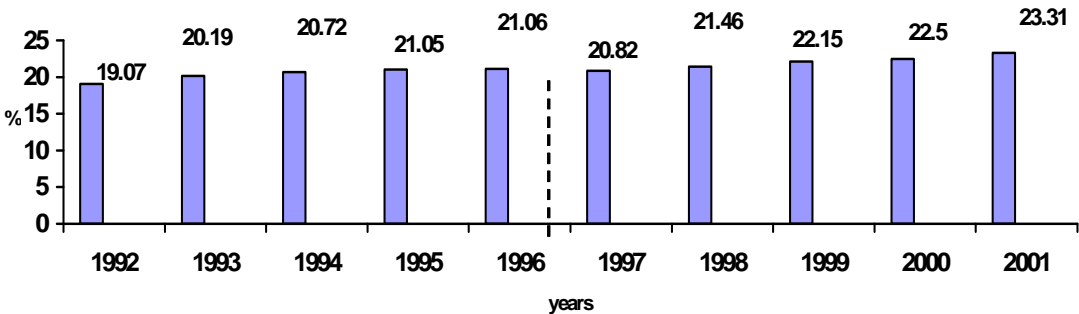
secondary sector - there is a declining trend (these sectors have been included collectively on the figures). These trends were also found to have continued in subsequent years.

The development of the market economy and Poland’s progressing integration with the EU member states has created defined requirements to classify the types of economic activities, goods and services etc. A need arose during the transformation of the Polish economy in 1989 to introduce classifications into the statistics that are consistent with the international classifications used by the EU member states. The fundamental premise of such a decision was the development of economic cooperation with the European Union member states and the related need to exchange comparable statistical data.

The General Industrial Classification of Economic Activities within the European Communities - NACE (currently valid)⁶; has been in the process of being implemented in Poland since 1990; it groups the types of activities according to the idea of the three functional economic sectors, i.e.:

- I. the primary sector (agriculture, hunting and forestry, fishing, mining and quarrying),
- II. the manufacturing sector (production activities, construction, electricity, gas and water supply) and
- III. the service sector (other types of economic activities).

Fig. 5. Percentage share of the information sector to the total number of employees in Poland in the years 1992-1996 and 1997-2001 (according to NACE)

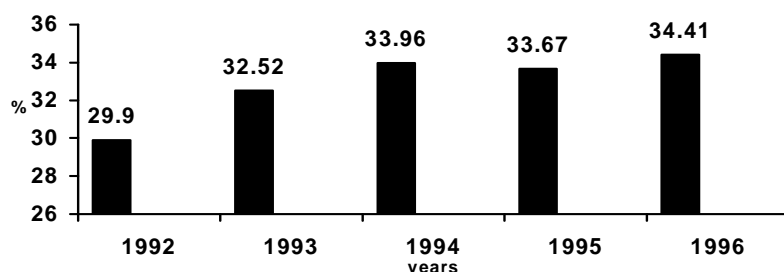


Own research

⁶ The first edition of NACE was introduced in Poland in 1990. It has been used in statistical publications since 1993 (in parallel with KGN), **while since 1994, it has been the only valid classification (substituting KGN).** NACE has been valid in the countries of the European Community since 1990.

Figures 5 and 6 illustrate the percentage shares of the information sector to the number of employees and employment defined under NACE.⁷

Figure 6. Percentage share of the information sector to the average number of employees in total in Poland in the years 1992-1996 (by NACE)



Own research

The number of employees in the information sector includes data for the years 1997-2001. Since 1992, the information sector has been showing an increasing trend in both quantitative terms and in terms of its share of employees and total employment (which is confirmed by the calculations using KGN). The estimates for the years 1997-2001 also confirm a growing trend in employment.

Based on the available statistical data, the information sector was distinguished in the Polish economy and its main values were defined, illustrating that the share of the information sector as a proportion of the Polish economy is **significantly lower** than countries with highly developed economies (cf. figures 1 and 2). Even so, a trend is materialising in the transformation process of the Polish economy, making the employment structure in the information sector similar to structures typical of developed market economies, which was indicated in (Dziuba 1998).⁸

The proposed methodology based on NACE allows the information sector to be distinguished and analysed in quantitative terms (measured by the number of employees), and also in value terms. The share of the information sector as a proportion of GDP is significantly lower than in countries with a highly developed market economy. The positive symptom of the changes is the increase in its share.⁹

⁷ Because of the organisational limitations of this study, we have not included any details on the methodology used. I have presented the full methodology in the publications (Dziuba 1998, 1999, 2000).

⁸ The structure of the information sector was analysed in Great Britain and selected post-socialist countries.

⁹ E.g. in the years 1992-1994: 19.41% (1992), 20.93% (1993), 21.24% (1994).

The methodology provided reflects all information activities in the economy (without differentiating between the primary and secondary sectors), just as it was required when using KGN. The methodology is, furthermore, based on available statistical data; such data exist, while the issue of access to them remains. The consistent results, which characterize the information sector, are made available by using a methodology based on the Classification of Goods and Services.

The calculation of the share of the information sector in the Polish economy using methods based on KGN and NACE are comparable. The relatively lower share of the information sector obtained in accordance with the NACE arises from the lack of access to more disaggregated data. The NACE methodology confirmed the trend in the information sector that was indicated using the KGN methodology.

The extension in the tools would increase the opportunities of measuring the information sector. We are able to propose other methods related to e.g. a definition of the time (cost) of the work of specific activities of employees or posts in order to define the share of the information sector in the economy. We propose special purpose research on the type of activities and the type of units. The use of the “Classification of professions and specialisations” is also recommended.

From the concepts presented, it may be concluded that the measurement of the information sector is possible. Here we propose the following measures evaluating the information sector as a whole:

- the number of employees or workers or professionally active,
- the level of GDP or GNP,
- the rate of change of GDP (GNP) and employment,
- the level of GDP per capita.

Apart from the obvious advantages of using the number of employees as the measure of the information sector, it is necessary here to draw attention to certain limitations in its use. The number of employees is a function of technical progress and therefore the number of employees in the information sector ten years ago is not equal to the number of employees today. Those employed presently create incomparably more information goods and services

than during the earlier period. Growth in efficiency took place during the transformation process after a stage of low labour efficiency in centrally planned economies. This makes it difficult to model the information sector by using the number of employees. The basic advantage of using the number of employees is that it is possible to analyse the total size and structure of the information sector, as well as the structure of the model economy – sectors I, II, III and IV. The methodology of statistical surveys changed during the research (the move from KGN to NACE; from SNA to MPS), which created a significant difficulty. The problem of the later research is e.g. the possibility of measuring the level of education of the employees in the information sector. In the study (Dziuba, 1998), I distinguished 4 groups of employees: producers, distributors, users and the support of the information infrastructure. These can be used to refer to e.g. the number of employees with higher or secondary education etc. Such research would be an excellent illustration of the importance of a high level of qualifications to the development of this sector.

The economics of the information sector – guidelines for development

The research into the level of development of the information sector is of particular importance from the point of view of economics. According to M. Rubin (1983), in the most highly developed countries in the world:

- a large proportion of investment outlay is assigned for the information sector;
- A significant proportion of spending on the information area is financed by the state;
- The information sector brings about large benefits to society, not only those who take direct advantage of its effects;
 - The production of certain types of knowledge is limited due to the lack of qualified personnel, which indicates a need to reallocate funds in the economy;
 - The production of only one of the types of knowledge - technology - results in changes to the methods of production of many goods and services;
 - It is possible to make the hypothesis that new knowledge in the area of technology and techniques causes a shift in demand on the labour market towards white collar jobs;
 - A systematic change in the structure of employment is noticeable, being based on the increase in employment in the information sector in comparison with other areas of the economy;

- The conviction remains that often, the growth in employment in the information area is consistent with Parkinson's law, which states that bureaucracy has the tendency of creating work for its own sake;
- On the other hand, the hypothesis is formulated that the growth in employment in the knowledge production area is directly related to the increase in labour efficiency and the degree of economic development.

Empirical research indicates that there is a strong causal relationship between the development of the information sector of a given country and the state of its economy. The conclusion can therefore be drawn that information activities are of significance to the development and the functioning of the economy.

The work (Dziuba 1998), proposed the establishment of a separate research subject within economic sciences, named the economics of the information sector. Modern economic problems cannot be reviewed without taking the issues of information and information technology into account. It is therefore possible to propose a new subject area - the economics of the information sector - within the specific economic disciplines, by means of an analogy with industrial economics. The fundamental research objective of the economics of the information sector is the evaluation of a part of the national economy - its information sector. We shall concentrate our interests on the information sector in the economy, as well as on specific aspects of the process of management in this sector, on selected parts of this sector.

It can be assumed that the economics of the information sector is a review of the rules in the area of the functioning of the information sector in the economy, both theoretically, by observance of the laws of economics and descriptively - by observation of the appearance and the course of the processes. Such rules do not need to appear in other areas of management (and this is frequently how it is), and may be of an autonomous nature. The economics of the information sector is an area that is occupied with the search, analysis, description and analysis of the co-dependencies ensuing in the information sector, in the process of producing, distributing and consuming information.

The assumption was accepted in the definition that some phenomena ensuing in the information sector may be of an exceptional nature, e.g. the asymmetry of the information

market. The existence of such exceptions supports economic research being carried out on the information sector. Research in the information sector is, by nature, interdisciplinary.

The research objectives of the economics of the information sector could include:

- Distinguishing the information sector as the quaternary sector of the economy;
- Analysis of the methods of distinguishing the information sector;
- Definition of the possibilities of diagnosing the information sector;
- Discovering dependencies and rules appearing in the information sector;
- Statistical analyses and evaluations of the information sector;
- Comparative analyses between groups of countries;
- Analysis of the structure of the information sector, its rate of growth, changes and trends;
- Distinguishing professions and specialisations that are typical of the information sector;
- Structuring of the information sector - analysis of the scope and degree of use of IT, e.g. with the aid of information maps of the economy;
- Attempting to forecast the development of the information sector, e.g. through the use of information maps on the economy;
- Assessment of the scale of applications and the influence of IT on the New Economy, which represent a significant impulse for research, development, technical progress and the distribution and use of new knowledge;
- A definition of the level of information (information technology) support in the economy, in particular in using IT;
- Analysis of the processes in which the information and knowledge are created, transmitted, stored and used;
- Definition of the borders between the information sector and the non-information sector.

The proposed list does not exhaust the majority of research problems related to the economics of the information sector. This problem area is a necessary direction for future research. In researching the information sector and the problem area of information in the

economy, further appears to be particularly important at a time of creating information societies and analysing the New Economy.

Our objective is to review this stimulator of the modern economy. The distinction of the information sector is important for a better description of the economic processes. These problems are researched because the information sector is beginning to play an increasingly important role in the real economic processes. We research the information sector during its emergence. This is important for a description of the economic phenomena. This is the inherent dynamism. We research it during its emergence and this is important:

- Because of the sector itself;
- Because of its influence on other areas of the economy.

An analogy is noticeable between the information sector in the economy and the information system in the company. The information system is very important – it supplies all (almost all) of the company's departments. And we study the IT system itself. The analysis of the information system sector is important from the point of view of the sector itself and its reaction to other areas of the economy.

The economics of the information system are inseparably related to the economics of information (information systems). Emphasis is placed on a different problem area in every such situation. The evaluation of information is highlighted in the economics of information, while information and information systems are underlined in the economics of information systems, whereas the evaluation of the part of the national economy - its information sector - is emphasised in the economics of the information sector. The relationship of these research topics indicates that it is possible to use the methods that have been developed in each of them in the remaining approaches. The economics of the information sector does not apply (directly) to the non-information sector of the economy, which is also an area of interest to the economics of the economics of information systems (information). On the other hand, attention should also be drawn to the fact that the scope of the information sector is expanded; non-information areas may in the near future become information areas, e.g. as a result of the introduction of automation and IT into human activities.

The information sector vs. economic growth

Development is a complicated process encompassing economic, social and political matters. There are many factors stimulating economic growth, including information technology (investment in telecommunications, the computer industry etc.). Equally important is the development of the education infrastructure, transport etc. The information sector has major development perspectives and has a significant influence on economic growth:

- It is strictly related to the development of new information technologies and their use in the economy;
- It is an integral element of the concept of the information society and the New Economy.

New information and communications technologies have now created different capabilities of accessing information, changing the conditions of the economic decision making processes and leading to the phenomenon known as the reduction in the economic time. The reduction in the economic time allows for a significant acceleration in the economic processes. Economic decisions, particularly on the financial market, may be made in a very short time (in fractions of a second), in groups, as well as automatically (based on models implemented by the computer) without the participation of a person. The speed of implementation of the processes points to a significant reduction in costs. This is illustrated by e.g. the functioning of electronic markets.¹⁰

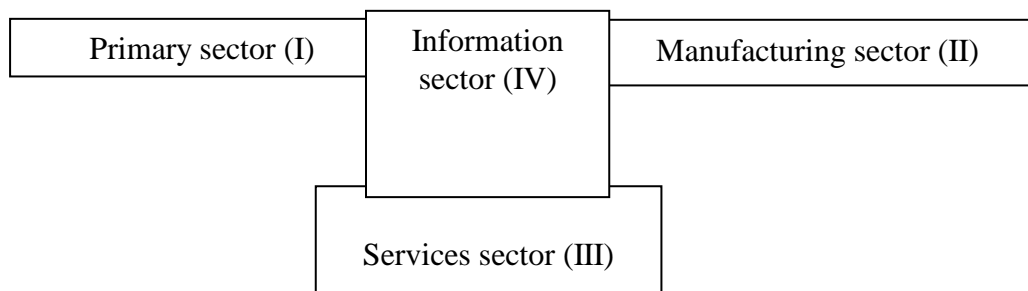


Fig. 7. Four-sector model of the economy

Own research

The sector “cuts across” the existing classifications. The sector includes R&D, education, telecommunications, banking and finance etc. An **economic surplus** required for economic development arises in the information sector. In highly developed countries, this is the

¹⁰ See. (Dziuba, 2001b).

dominant sector (approximately 50 % of employment, approximately 50 % of GDP). The efficient functioning of other sectors and areas of the economy **are conditional upon** this sector (fig. 7). It is its own “economic springboard”. Just like oil, it “greases the market mechanisms”.¹¹ It develops the abilities of the economy to compete and expand.

The sector “cuts across” existing classifications – this is both an advantage and a disadvantage (it is difficult to distinguish it within the framework of the classification). We distinguish this sector, because it features high growth. The information sector determines competitiveness, as well as technical and economic leadership. The information sector is not a medium of technical progress (just as manufacturing was earlier), which arises from the structural and all-encompassing role of information technologies in the economy. It creates an economic surplus.¹² The information sector has a huge **transformation** role in the economy. Its development depends on the active policy of the state (this is both a perspective and a limitation). These result in recommendations for statistical methodologies, as well as the development strategy and policy. The information sector includes:

- The R&D sector – this is where scientific and technical progress and innovation are fuelled; R&D creates new information and generates an economic surplus;
- Information on innovations and technologies.

Therefore, the information sector is a strategic sector determining the state of the economy, society and the country. How to translate this information revolution into its noticeable influence on economic development is the task of the politicians and decision-makers.

Conclusion

¹¹ The description of “oil-like qualities of information” was proposed by D. Lamberton (1997).

¹² In (Dziuba 1998, 2000) I also reviewed that influence of the information sector on economic growth. The size of the information sector does not necessarily determined economic growth. While the share of the information sector in economic growth is noticeable, there is, however, no universal principle for individual countries – this depends on the degree of development of the given country.

A new sector of the economy - the information sector - already exists. The study has attempted to classify it based on KGN and NACE. This area, however, requires standardisation on the new classifications.

The information sector includes many branches that are difficult to compare. Many factors here are immeasurable or their measurement is particularly difficult. From the point of view of statistics, the individual spheres of the information sector are generally analysed separately. Statistical yearbooks generally provide information on agriculture, industry, commerce and services, but not on the information sector. Statistics on the information sector are kept in the USA, and intensive standardisation work is being carried out in Canada (Statistics Canada).

Quantitative methods of measurement are mainly used in research on the information sector. It is necessary to find new methods – e.g. qualitative methods,¹³ to supplement this research. The qualitative differences that exist in the production, consumption and distribution of information should be taken into account. I believe that it is very important to standardise the research methods and tools. This will allow for a more precise comparison between countries. E.g. I imagine the development of a classification from “building blocks” – which the General Industrial Classification of Economic Activities within the European Communities has so far prevented (a number of exclusions were made). Furthermore, the process is long term and related to the agreement on standards.

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