

# Changes in informatization strategies of Polish companies and institutions in reaction to the economic crisis.

## Summary of the surveys from the years 2009-2011

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**Abstract**—The paper discusses results of comparative surveys from years 2009-2011 which aimed at determining how the recent economic crisis influenced informatization strategies in Polish companies and institutions. The obtained results supported a working hypothesis that the economic crisis affected – to smaller or greater extent – short- and long-term informatization strategies in majority of companies or institutions. Even if relative importance of identified changes, intensity of their visible symptoms or areas of IT applications where they were the most noticeable differed from year to year, those variations were minor and concerned some elements of informatization strategies and of IT applications only. Details are included in this paper.

### I. INTRODUCTION

THE global financial crisis which has affected Polish economy since the second half of 2008 resulted in deterioration of an economic situation in majority of companies. The evidence was 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 domain as well, with clear signals coming from producers and providers of IT products and services or from their customers. That the situation had grown worse was also acknowledged by nearly all major companies monitoring IT industry, including DiS, Gartner, Forrester Research, IDG, and PMR. According to PMR surveys, in 2009 not only had the IT market not increased for the first time in recent years, but it shrunk by 9.2% (from PLN 26.9 billion to PLN 24.5 billion), and although 2010 saw a year-on-year increase by 5.8% in the market's value, the 2008 level had never been reached (with the market being worth 1.0 billion less than in 2008). The forecasts for 2011 proved to be more optimistic with a predicted double-digit growth (10.9%) to PLN 28.7 billion, i.e. 1.8 billion more than in a record 2008. Nonetheless, it is not certain whether the change in the trend will persist as neither the Polish nor the world economy has overcome the financial and economic crisis yet. The PMR numbers are shown in Figure 1.

The observed situation confirmed the authors' belief that it was necessary to continue the study initiated in 2009,

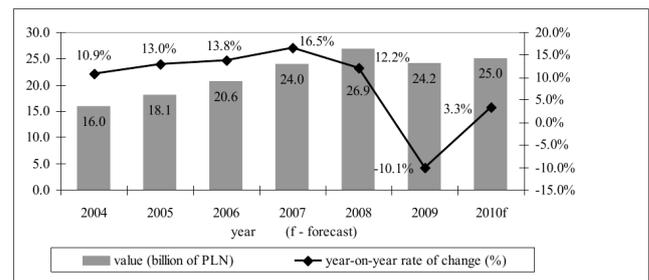


Fig. 1 Value and year-on-year rate of change for IT market in Poland according to PMR data and forecasts from August 2011; own presentation based on [11, p. 2].

which investigated an impact of the economic and financial crisis on informatization strategies and IT projects in selected companies and institutions. The same conclusion resulted from presenting outcomes of that study at several conferences where they earned marked attention (see [2], [3], [4], [5]).

This paper will present various data breakdowns and analyses which help to assess an impact of the economic and financial crisis on business informatization strategies and to detect related changes in the three consecutive years. The first part of the paper presents assumptions of the research and a methodology applied. The next section characterizes briefly the examined objects and influence of the crisis on their economic standing. In that context the following parts discuss qualitative and quantitative modifications of informatization strategies, their most notable symptoms and intensity of their manifestation. The paper is concluded with major research results.

### II. ASSUMPTIONS FOR THE COMPARATIVE STUDY

A selection of the area for the comparative study followed the authors' conviction that awareness of ways in which business organizations and institutions respond to the prolonged economic crisis (with the focus on IT-related activities) is important in order to counteract results of the crisis more effectively. Such knowledge should enable the IT industry to return on track of dynamic growth observed in

prior years (see Figure 1) much quicker, which is essential, considering long-range strategies for developing e-society, e-government and e-economy in Poland (see e.g. [18]).

The study has an interregional reach, and reflects situation of companies and institutions located mostly in Warsaw (Mazovia) or in Wroclaw (Lower Silesia) and in areas adjacent to those two centers. All surveys, which provided data for the comparison, were carried out by students of the postgraduate managerial program "IT Projects Management" at the Faculty of Management of Warsaw University, and by part-time master-level students of Information Technology and Econometrics at the Faculty of Management, Computer Science and Finance of Wroclaw University of Economics.

All studies were conducted in April and May, the first in 2009, the second in 2010 and the third in 2011 – as already mentioned in the introduction. Selection of those periods resulted, to some extent, from schedule of the academic years. Yet, the far more important reason was the authors' belief – substantiated by other sources – that at that time forecasts drawn up at the turn of 2008/2009, 2009/2010 and 2010/2011 were modified, and already incorporated information on crisis development, figures from financial statements for years 2008, 2009 and 2010 as well as data from closing reports for the first quarters of 2009, 2010 and 2011 respectively. The companies and institutions reflected the most recent data in their strategies, including those of IT area, by either sticking to or modifying prior plans.

The overall number of collected – and duly filled in – questionnaires amounted to 139 in 2009, 109 in 2010 and 127 in 2011. All questionnaires formed a repository of 375 sets of data, including: 38 quantitative and qualitative characteristics describing how the economic crisis affected IT strategies and what changes in strategies were adopted, 6 descriptive and typological features of the surveyed objects, and 5 other which allowed to verify collected data (including sources of information). The repository is stored and proceeded in two file formats: primarily as workbooks of Statistica, and secondly as MS Excel files. The repository contains data on a very diverse group of companies and institutions, which differed also in subsequent years. A detailed presentation of that group is, therefore, required.

### III. GENERAL CHARACTERISTICS OF THE SURVEYED OBJECTS

Before selected results of the study are discussed, the examined objects – companies and institutions – will be analysed briefly. Table 1 presents a breakdown of objects surveyed in 2009, 2010 and in 2011 by their areas of operations and their sizes. The table includes: importance of clusters in whole samples, dominating values (cells with digits in bold), and substantial differences between the examined years (cells shaded in grey). Sizes of companies and institutions were determined in a simplified manner, and considered number of employees only. Though, classification criteria complied with both national (GUS) and European statistic systems (Eurostat).

Table 2 links sector profiles with informatization level in the examined objects. The latter was quantified by describing to what extent IT solutions supported processes in such areas as: core business, administration and office work or in other activities. It can be observed (see cells with bold digits in the 'Total' row) that the surveyed objects (76.26% in 2009, 80.73% in 2010 and 81.10% in 2011) were characterised by high or very high values of the said parameter. This stemmed from the sector profile of the samples, and particularly from the biggest share of ICT companies – where business operations are computerised in general. One has to realise also that assessments of informatization level were prone to subjectivity.

Having considered basic characteristics of the objects for which data were successfully collected, the following parts of the paper will analyse influence of the crisis on their economic situation.

### IV. INFLUENCE OF THE CRISIS ON ECONOMIC SITUATION OF THE SURVEYED OBJECTS

Table 3 compares sector profiles of the examined objects with evaluation of an impact which the crisis had on their economic standing. The assessments were based on a 5-grade scale. Considering information presented in Table 3, it can be observed (see cells with bold digits) that the most frequent response was that a situation of an object became 'slightly worse' (51.8% of all answers in 2009, 53.21% in 2010 and 49.61% in 2011). Nevertheless, the significant share (32.37% in 2009, 23.85% in 2010 and 32.28% in 2011) of responses suggested a stable economic position. It should be pointed out that a slight increase of both neutral ('nothing has changed') and positive answers ('it is slightly...' and 'it is much better') was detected in the following years. That was particularly evident in 2011 comparing to 2010 (rise by 10.68%). At the same time a share of negative responses ('it is much...' and 'it is slightly worse') decreased considerably. The share of such responses dropped by 10.67% last year (including 7.07% decrease in the most negative answers i.e. 'it is much worse'). All that entitles to formulate a statement that the economic crises has been affecting current situation of the examined objects to smaller and smaller extent.

Table 4, in turn, compares size of the surveyed objects with assessments of an impact of the crisis on their economic situation. It becomes apparent that changes in economic situation of an entity in reaction to the crisis are not determined by size of an object.

Having considered all basic characteristics of the impact of the crisis on economic situation of the surveyed objects, the following parts of the paper may focus on analysing influence of the crisis on their informatization strategies – which is the major point of interest of this paper.

TABLE 1.  
STRUCTURES OF THE SURVEYED OBJECTS BY SECTOR AND SIZE – THE COMPARATIVE ANALYSIS

Sector	Object size (percentage of the sample)									Total		
	Small			Medium			Large					
	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011
Banking, finance, insurance	0.00	0.00	0.00	1.44	0.92	1.57	6.47	12.84	7.09	7.91	13.76	8.66
Commerce (commodity trade)	7.91	10.09	<b>14.96</b>	3.60	3.67	5.51	3.60	1.83	6.30	15.11	15.60	26.77
Industry	1.44	6.42	1.57	4.32	3.67	2.36	7.91	6.42	6.30	13.67	16.51	10.24
Public administration	0.72	1.83	0.00	2.88	4.59	7.09	6.47	8.26	0.79	10.07	14.68	7.87
Other	<b>21.58</b>	<b>15.60</b>	<b>14.17</b>	<b>12.23</b>	<b>7.34</b>	<b>11.81</b>	<b>19.42</b>	<b>15.60</b>	<b>20.47</b>	<b>53.24</b>	<b>38.53</b>	<b>46.46</b>
Total	31.65	33.94	30.71	24.46	20.18	28.35	43.88	45.87	40.94	100.00	100.00	100.00

TABLE 2.  
STRUCTURES OF THE SURVEYED OBJECTS BY SECTOR AND INFORMATIZATION LEVEL – THE COMPARATIVE ANALYSIS

Sector	Informatization level (percentage of the sample)											
	Low (< 45%)			Medium (≥ 60%)			High (≥ 75%)			Very high (≥ 90%)		
	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011
Banking, finance, insurance	0.00	0.00	0.00	0.72	0.00	0.00	<b>5.04</b>	3.67	1.57	2.16	<b>11.01</b>	7.09
Commerce (commodity trade)	2.16	2.75	2.36	2.16	2.75	<b>8.66</b>	5.76	6.42	<b>7.87</b>	5.04	3.67	<b>7.87</b>
Industry	0.72	0.92	0.00	2.16	5.50	0.79	<b>8.63</b>	5.50	4.72	2.16	4.59	4.72
Public administration	2.16	0.92	0.79	<b>4.32</b>	2.75	2.36	1.44	<b>5.50</b>	3.94	2.16	<b>5.50</b>	0.79
Other	2.16	0.92	3.15	<b>7.19</b>	2.75	0.79	<b>12.95</b>	10.09	<b>17.32</b>	<b>30.94</b>	<b>24.77</b>	<b>25.20</b>
Total	7.19	5.50	6.30	16.55	13.76	12.60	<b>33.81</b>	<b>31.19</b>	<b>35.43</b>	<b>42.45</b>	<b>49.54</b>	<b>45.67</b>

TABLE 3.  
STRUCTURES OF THE SURVEYED OBJECTS BY SECTOR AND BY IMPACT OF THE CRISIS ON THEIR ECONOMIC SITUATION – THE COMPARATIVE ANALYSIS

Sector	Impact of the crisis on economic situation of an object (percentage of the sample)														
	It is much worse			It is slightly worse			Nothing has changed			It is slightly better			It is much better		
	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011
Banking, finance, insurance	2.16	2.75	2.36	3.60	<b>6.42</b>	<b>4.72</b>	2.16	3.67	0.00	0.00	1.83	0.79	0.00	0.00	0.79
Commerce (commodity trade)	1.44	0.00	0.79	<b>8.63</b>	<b>10.09</b>	<b>14.96</b>	4.32	4.59	<b>7.87</b>	0.72	0.92	3.15	0.00	0.00	0.00
Industry	0.00	2.75	0.00	<b>8.63</b>	<b>9.17</b>	<b>4.72</b>	4.32	3.67	<b>3.94</b>	0.72	0.92	0.00	0.00	0.00	0.00
Public administration	0.00	2.75	0.00	<b>5.04</b>	<b>7.34</b>	1.57	<b>5.04</b>	3.67	<b>5.51</b>	0.00	0.92	0.79	0.00	0.00	0.00
Other	2.88	2.75	0.79	<b>25.90</b>	<b>20.18</b>	<b>23.62</b>	16.55	8.26	14.96	7.91	5.50	6.30	0.00	1.83	0.79
Total	6.47	11.01	3.94	<b>51.80</b>	<b>53.21</b>	<b>49.61</b>	32.37	23.85	32.28	9.35	10.09	12.60	0.00	1.83	1.57

TABLE 4.  
STRUCTURES OF THE SURVEYED OBJECTS BY SIZE AND BY IMPACT OF THE CRISIS ON THEIR ECONOMIC SITUATION – THE COMPARATIVE ANALYSIS

Object size	Impact of the crisis on economic situation of an object (percentage of the sample)														
	It is much worse			It is slightly worse			Nothing has changed			It is slightly better			It is much better		
	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011
Micro	1.44	0.92	0.00	<b>7.19</b>	3.67	5.51	1.44	<b>4.59</b>	<b>6.30</b>	1.44	0.92	0.00	0.00	0.00	0.00
Small	0.72	1.83	0.79	7.91	<b>12.84</b>	<b>9.45</b>	<b>8.63</b>	8.26	3.94	2.88	0.92	4.72	0.00	0.00	0.00
Medium	2.16	0.92	0.00	<b>11.51</b>	<b>10.09</b>	11.81	8.63	6.42	<b>14.17</b>	2.16	1.83	2.36	0.00	0.92	0.00
Large	1.44	3.67	1.57	<b>11.51</b>	<b>11.01</b>	<b>14.96</b>	7.19	0.92	5.51	2.88	2.75	4.72	0.00	0.00	0.79
Very large	0.72	3.67	1.57	<b>13.67</b>	<b>15.60</b>	<b>7.87</b>	6.47	3.67	2.36	0.00	3.67	0.79	0.00	0.92	0.79
Total	6.47	11.01	3.94	<b>51.80</b>	<b>53.21</b>	<b>49.61</b>	32.37	23.85	32.28	9.35	10.09	12.60	0.00	1.83	1.57

## V. INFLUENCE OF THE ECONOMIC CRISIS ON INFORMATIZATION STRATEGIES AND IT PROJECTS

Results of the analysis, showing how the economic crisis affected informatization strategies and IT projects, will be presented in the following sequence. In the beginning it is going to be examined whether – and, if yes, than to what extent – informatization strategies were modified; firstly, in particular industries (Table 5), secondly, in objects of certain

sizes (Table 6), and thirdly, in objects grouped according to informatization levels (Table 7). Subsequently, it will be analysed in what ways changes in economic situation of companies or institutions influenced their informatization strategies and ongoing IT projects (Table 8). The following tables present: importance of clusters in the whole sample, dominating values (cells with bold digits), and important differences between examined years (cells shaded in grey).

TABLE 5.

INFLUENCE OF THE ECONOMIC CRISIS ON INFORMATIZATION STRATEGIES AND PROJECTS IN THE SURVEYED OBJECTS ACCORDING TO SECTORS – THE COMPARATIVE ANALYSIS

Sector	Influence of the economic crisis on IT strategies and projects (percentage of the sample)								
	No change			Slight change			Radical change		
	2009	2010	2011	2009	2010	2011	2009	2010	2011
Banking, finance, insurance	1.44	0.92	0.79	<b>4.32</b>	<b>13.76</b>	<b>6.30</b>	2.16	0.00	1.57
Commerce (commodity trade)	5.04	6.42	11.02	<b>8.63</b>	<b>9.17</b>	<b>15.75</b>	1.44	0.00	0.00
Industry	6.47	3.67	1.57	<b>7.19</b>	<b>12.84</b>	<b>8.66</b>	0.00	0.00	0.00
Public administration	2.88	4.59	<b>4.72</b>	<b>6.47</b>	<b>9.17</b>	3.15	0.72	0.92	0.00
Other	20.86	11.01	18.90	<b>28.78</b>	<b>21.10</b>	<b>24.41</b>	3.60	6.42	3.15
Total	36.69	26.61	37.01	<b>55.40</b>	<b>66.06</b>	<b>58.27</b>	7.91	7.34	4.72

TABLE 6.

INFLUENCE OF THE ECONOMIC CRISIS ON INFORMATIZATION STRATEGIES AND PROJECTS IN THE SURVEYED OBJECTS ACCORDING TO THEIR SIZES – THE COMPARATIVE ANALYSIS

Object size	Influence of the economic crisis on IT strategies and projects (percentage of the sample)								
	No change			Slight change			Radical change		
	2009	2010	2011	2009	2010	2011	2009	2010	2011
Micro	4.32	<b>4.59</b>	<b>8.66</b>	6.47	<b>4.59</b>	3.15	<b>7.91</b>	0.92	0.00
Small	8.63	4.59	7.87	<b>10.79</b>	<b>18.35</b>	<b>11.02</b>	0.72	0.92	0.00
Medium	5.76	<b>11.01</b>	10.24	<b>16.55</b>	9.17	<b>16.54</b>	2.16	0.00	1.57
Large	<b>12.23</b>	1.83	7.09	9.35	<b>13.76</b>	<b>18.90</b>	1.44	2.75	1.57
Very large	5.76	4.59	3.15	<b>12.23</b>	<b>20.18</b>	<b>8.66</b>	2.88	2.75	1.57
Total	36.69	26.61	37.01	<b>55.40</b>	<b>66.06</b>	<b>58.27</b>	7.91	7.34	4.72

TABLE 7.

INFLUENCE OF THE ECONOMIC CRISIS ON INFORMATIZATION STRATEGIES AND PROJECTS IN THE SURVEYED OBJECTS ACCORDING TO THEIR INFORMATIZATION LEVELS – THE COMPARATIVE ANALYSIS

Informatization level	Influence of the economic crisis on IT strategies and projects (percentage of the sample)								
	No change			Slight change			Radical change		
	2009	2010	2011	2009	2010	2011	2009	2010	2011
Low (< 45%)	<b>4.32</b>	2.75	3.15	2.16	<b>2.75</b>	<b>3.15</b>	0.72	0.00	0.00
Medium (≥ 60%)	4.32	3.67	5.51	<b>11.51</b>	<b>10.09</b>	<b>7.09</b>	0.72	0.00	0.00
High (≥ 75%)	12.95	7.34	12.60	<b>17.99</b>	<b>22.02</b>	<b>19.69</b>	2.88	1.83	3.15
Very high (≥ 90%)	15.11	12.84	15.75	<b>23.74</b>	<b>31.19</b>	<b>28.35</b>	3.60	5.50	1.57
Total	36.69	26.61	37.01	<b>55.40</b>	<b>66.06</b>	<b>58.27</b>	7.91	7.34	4.72

TABLE 8.  
CRISIS-RELATED CHANGES IN ECONOMIC SITUATION OF THE SURVEYED OBJECTS AND THEIR INFLUENCE ON INFORMATIZATION STRATEGIES AND PROJECTS – THE COMPARATIVE ANALYSIS

Impact of the crisis on economic situation of an object	Influence of the economic crisis on IT strategies and projects (percentage of the sample)								
	No change			Slight change			Radical change		
	2009	2010	2011	2009	2010	2011	2009	2010	2011
It is much worse	0.72	0.00	0.00	1.44	<b>9.17</b>	<b>3.94</b>	<b>4.32</b>	1.83	0.00
It is slightly worse	10.07	10.09	11.81	<b>38.85</b>	<b>40.37</b>	<b>34.65</b>	2.88	2.75	3.15
Nothing has changed	<b>20.86</b>	<b>13.76</b>	<b>18.90</b>	10.79	9.17	13.39	0.72	0.92	0.00
It is slightly better	<b>5.04</b>	0.92	4.72	4.32	<b>7.34</b>	<b>6.30</b>	0.00	1.83	1.57
It is much better	0.00	1.83	1.57	0.00	0.00	0.00	0.00	0.00	0.00
Total	36.69	26.61	37.01	<b>55.40</b>	<b>66.06</b>	<b>58.27</b>	7.91	7.34	4.72

The data presented in Tables 5÷8 requires short comment.

First of all, the study showing (see the cells with bold digits in Table 5) that as much as 63.31% (in 2009), 73.39% (in 2010) and 62.99% (in 2011) of the surveyed objects adjusted their informatization strategies and IT projects due to the crisis (slightly: 55.40% in 2009, 66.06% in 2010 and 58.27% in 2011; in a radical way: 7.91% in 2009, 7.34% in 2010 and 4.72%) supports results of similar analyses carried out in 2009-2011 (see references in [2, p. 84] and reports [8], [10]). Considering data from Table 5 (see shadowed cells in the 'Total' row) substantial changes in answers obtained in subsequent years can be noticed.

Secondly, the data collected shows that influence of the crisis on informatization strategies and IT projects was only partially related to sectors where the objects operated. Intensity and direction of observed changes differ between sectors and groups of answers (see shadowed cells in Table 5, depicting the biggest changes from year to year).

Thirdly, a similar conclusion may be drawn in reference to the relation between the crisis and sizes of objects (see cells with bold digits and shaded cells in Table 6).

The fourth conclusion is that an impact of the crisis on informatization strategies and IT projects is more visible in objects characterised by higher level of informatization (see shaded range in Table 7). Nevertheless, the changes were recognised as 'slight' in all years.

Finally – as expected – scopes of adjustments in informatization strategies and in IT projects were correlated with a magnitude of changes in economic situation of an object. The growing tendency can be detected among objects declaring evolutionary ('slight') changes in their informatization strategies and in IT projects.

The following parts of the paper will identify and depict the most important symptoms of changes in informatization strategies in reference both to the whole analysed group and to those objects where IT strategies were modified.

## VI. SYMPTOMS OF CHANGES IN INFORMATIZATION STRATEGIES AND IN IT PROJECTS

The data collected in three editions of the research enabled also to detect and to structure major symptoms of changes in informatization strategies and in IT projects, which resulted from the crisis. It should be added that those symptoms were identified by the surveyed objects with a help of a predefined list (see Table 9). The list was open, nevertheless, only 6 objects both in 2009 and in 2010, and only 11 in 2011, presented other reasons than defined. By compiling the list of symptoms, the authors considered various studies (see e.g. [7], [8], [17], [19], [20], [21]). The examined companies and institutions were asked to select all relevant symptoms. The following tables present structures of responses in the whole analysed group (Table 9, columns 2, 3 and 4) and for those objects only where changes in informatization strategies – either 'slight' or 'radical' – occurred (Table 9, columns 5, 6 and 7). Dominating values (those exceeding 20% of indications) were marked – like in previous tables – in a bold type, and substantial changes (over 5%) between results from 2009, 2010 and 2011 were shaded.

Referring to data depicted in Table 9 (columns 2, 3 and 4) it should be noticed that the surveyed objects declared the following symptoms of informatization strategy changes the most frequently (they appeared in over 20% of questionnaires): reduced number of IT seminars and trainings (33.09% of questionnaires in 2009, 33.03% in 2010 and 31.5% in 2011), decreasing spendings on IT investments (30.94% in 2009, 30.28% in 2010 and 22.05% in 2011), reduced budgets of IT departments (25.90% in 2009, 28.44% in 2010 and 28.35% in 2011), postponed IT investments (20.86% in 2009, 38.63% in 2010 and 24.41% in 2011) and IT cost streamlining initiatives using TCO (22.94%-level which exceeded the 20%-threshold was observed in 2010 only).

When the data is analysed, and values from subsequent years compared, several facts become visible.

TABLE 9.  
STRUCTURES OF IDENTIFIED SYMPTOMS OF CHANGES IN INFORMATIZATION STRATEGIES FOR THE ENTIRE GROUP OF OBJECTS – THE COMPARATIVE STUDY

Identified symptoms of changes in informatization strategies	Identified symptoms of changes in informatization strategies					
	All objects			Objects which modified their IT strategies		
	2009	2010	2011	2009	2010	2011
A budget of an IT department was reduced	<b>25.90</b>	<b>28.44</b>	<b>28.35</b>	<b>38.64</b>	<b>38.75</b>	<b>45.00</b>
Spending related to IT investments decreased	<b>30.94</b>	<b>30.28</b>	<b>22.05</b>	<b>48.86</b>	<b>41.25</b>	<b>35.00</b>
New projects were abandoned	13.67	6.42	7.87	<b>21.59</b>	8.75	12.50
Ongoing projects were stopped	7.19	7.34	1.57	11.36	10.00	2.50
A scope of projects was reduced	13.67	13.76	15.75	<b>21.59</b>	18.75	<b>25.00</b>
IT investments were postponed	<b>20.86</b>	<b>38.53</b>	<b>24.41</b>	<b>32.95</b>	<b>52.50</b>	<b>38.75</b>
IT services outsourcing was intensified	2.88	4.59	9.45	3.41	6.25	15.00
IT personnel was made redundant	15.83	16.51	11.02	<b>23.86</b>	<b>22.50</b>	17.50
IT seminars and trainings were cut	<b>33.09</b>	<b>33.03</b>	<b>31.50</b>	<b>51.14</b>	<b>45.00</b>	<b>50.00</b>
IT was financed with external sources	1.44	3.67	3.94	2.27	3.75	6.25
IT costs were streamlined (using TCO)	15.83	<b>22.94</b>	11.81	<b>25.00</b>	<b>31.25</b>	18.75
Other, namely...	4.32	5.50	8.66	5.68	6.25	11.25

Firstly, the most remarkable increase in indications (by 17.67%) refers to the situation when 'IT investments were postponed' – which was also the most frequently selected answer by the surveyed companies in 2010. A considerable decrease in such answers (by 14.12%) in 2011 should be perceived as a positive symptom, since suspension of IT investments might lead to technological slowdown in a longer run. The similar situation was observed in relation to the answer: 'new projects were abandoned', where a substantial decline (by 7.25%) between 2009 and 2010 was identified. This fact proves that a negative tendency of withdrawing from new investments, reported in numerous studies (see e.g. [1], [6], [10], [14], [15], [16], [20]), was reverted both in 2010 and in 2011.

Secondly, it should be pointed out, that an increase in number of objects (by 7.11% in 2010) declaring that their 'IT costs were streamlined (using TCO)' turned out not to be a permanent trend, as the forgoing number dropped down significantly in 2011 (by as much as 11.13%). This observation was particularly disappointing to the authors, one of whom has been promoting efficiency of IT application (including use of the TCO concept) for many years, and the other one deals with controlling methods used in operational activities of businesses and institutions. The data obtained did not prove growing awareness of TCO methodology among Polish managers and willingness to apply the said method in business practice.

Thirdly, the low significance of IT services being outsourced (only 2.88% in 2009, 4.59% in 2010 and 9.45% in 2011 – which is a better results but still much lower than

average values for technologically advanced markets) along with limited external financing (1.44% in 2009, 3.67% in 2010 and 3.94% in 2011) is another unpleasant surprise. In particular the latter figure is disappointing, considering significant funds for fostering innovations (including ICT) available within EU and nationwide frameworks for financial support. It should be considered, however, that the interviewees might not have been aware of all financial sources used to implement particular projects or that, in certain cases, external support for innovative undertakings was so 'obvious' that it was not mentioned in the research form at all.

Apart from identifying symptoms of informatization strategy changes, the study covered also quantitative and monetary characteristics which reflected 'intensity' of changes. This part of the questionnaire used a 5-grade scale of quantitative and monetary assessments. The surveyed objects declared intensity of particular symptoms as: 'substantial decrease', 'decrease', 'no changes', 'increase' or 'substantial increase'. Among the objects which modified their informatization strategies the most significant decreases were observed in (see Table 10): IT investment budgets (61.36% of answers in 2009, 62.50% in 2010 and 48.85% in 2011 indicated 'decrease' or 'substantial decrease'), seminars and trainings (59.09%, 53.75% and 56.25% respectively), equipment purchases for IT departments (53.41%, 42.50% and 47.50%, respectively) and current spendings on IT (51.14%, 51.25% and 42.50%, respectively). It should be emphasised that in 2010 a number of answers indicating 'decrease' or 'substantial decrease'

went down in case of nearly all the symptoms, and the most significant changes in relation to the previous year included: 'purchases of equipment for end-users' (by 18.18%), 'outsourcing projects' (by 12.27%), 'project implementation' (by 11.70%), 'own projects, carried out by IT department' (by 11.48%) and 'purchases of equipment for IT department' (by 10.91%). The observed tendencies were not confirmed, however, by data collected in 2011, as considerable drops of

negative answers were not detected for any of the aforesaid symptoms. On the contrary, an opposite tendency was observed in certain cases. The year 2011 witnessed, nonetheless, a significant fall (by 13.75%) in the number of indications at 'decrease' or 'substantial decrease' in 'IT investment budgets'. This should be interpreted as an encouraging signal.

TABLE 10.

INTENSITY OF SYMPTOMS OF IT STRATEGY CHANGES (QUANTITATIVE AND MONETARY ASSESSMENTS) FOR THE OBJECTS WHICH MODIFIED THEIR STRATEGIES – THE COMPARATIVE ANALYSIS

Symptoms of informatization strategy changes in the objects which modified their IT strategies	"Intensity" of IT strategy changes (quantitative and monetary assessments) (percentage of the surveyed objects)														
	Substantial decrease			Decrease			No changes			Increase			Substantial increase		
	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011
IT investment budgets	7.95	8.75	0.00	<b>53.41</b>	<b>53.75</b>	<b>48.75</b>	31.82	21.25	41.25	6.82	13.75	10.00	0.00	2.50	0.00
Current spendings on IT	2.27	6.25	3.75	<b>48.86</b>	<b>45.00</b>	38.75	43.18	28.75	<b>47.50</b>	5.68	16.25	8.75	0.00	3.75	1.25
Purchases of equipment for IT department	18.18	8.75	3.75	35.23	33.75	<b>43.75</b>	<b>39.77</b>	<b>42.50</b>	42.50	4.55	12.50	10.00	2.27	2.50	0.00
Purchases of equipment for end-users	10.23	6.25	12.50	32.95	18.75	31.25	<b>50.00</b>	<b>63.75</b>	<b>51.25</b>	4.55	8.75	5.00	2.27	2.50	0.00
Software purchases	11.36	7.50	1.25	27.27	27.50	31.25	<b>54.55</b>	<b>48.75</b>	<b>52.50</b>	5.68	12.50	15.00	1.14	3.75	0.00
Purchases of application software/systems	7.95	3.75	2.50	31.82	26.25	28.75	<b>50.00</b>	<b>50.00</b>	<b>53.75</b>	7.95	16.25	15.00	2.27	3.75	0.00
Purchases of external services	5.68	1.25	2.50	27.27	28.75	23.75	<b>61.36</b>	<b>47.50</b>	<b>50.00</b>	4.55	20.00	23.75	1.14	2.50	0.00
Own projects (carried out by IT department)	3.41	2.50	1.25	19.32	8.75	27.50	<b>56.82</b>	<b>61.25</b>	<b>45.00</b>	18.18	20.00	25.00	2.27	7.50	1.25
Project implementation	5.68	0.00	1.25	27.27	21.25	28.75	<b>56.82</b>	<b>57.50</b>	<b>47.50</b>	9.09	20.00	22.50	1.14	1.25	0.00
Outsourcing projects	5.68	0.00	5.00	21.59	15.00	16.25	<b>63.64</b>	<b>63.75</b>	<b>61.25</b>	9.09	18.75	16.25	0.00	2.50	1.25
IT seminars and trainings	18.18	20.00	15.00	<b>40.91</b>	<b>33.75</b>	<b>41.25</b>	38.64	31.25	33.75	2.27	11.25	10.00	0.00	3.75	0.00

On the other hand, in 2009 a noticeable growth (by 15%) could be observed only in case of projects carried out by own IT departments (20.45% of answers indicated 'increase' or 'substantial increase'), whereas in 2010 such growth was observed for 10 out of 11 symptoms. The most frequent indications of 'increase' were related to the following options: 'own projects, carried out by IT department' (27.50%), 'purchases of external services' (22.50%), 'project implementation' and 'outsourcing projects' (21.25% each) as well as 'current spendings on IT' and 'purchases of application software/systems' (20.00% each). It is worth mentioning that in 2010 shares of answers indicating 'increase' or 'substantial increase' went up for nearly all the symptoms in relation to the previous year. The most significant changes included: 'purchases of external services' (by 16.82%), 'current spendings on IT' (by 14.32%), 'IT seminars and trainings' (by 12.73%), 'outsourcing projects' (by 12.16%) and 'project implementation' (by 11.02%). The data collected in 2011 did not substantiate that trend, though. None of the symptoms experienced an increase in positive indications (i.e. on 'increase' or 'substantial increase'). The observed situation may result from intensified export

operations in Polish IT sector which enabled to counterbalance reduced absorption of IT products and services by the internal market (see [13]). A series of acquisitions of Polish IT companies by international capital groups (the entire change of shareholding structure in TETA group – UNIT4 TETA since 2010 – is a good example here), observed in 2010-2011, is likely to be another reason – according to the authors – for the aforementioned tendencies. The said process resulted in transferring certain parts of operational activities (physically and/or only for tax purposes) to foreign markets.

The data collected in the study enabled also to identify IT domains affected by modifications in informatization strategies and to characterise those changes in quantitative and monetary ways (see Table 11). Among the objects which adjusted their informatization strategies, substantial decreases were observed in the following areas: purchases-stock management-supply chain, supported by SCM applications (34.09% of answers in 2009, 30.00% in 2010 and 31.25% in 2011 indicated 'decrease' or 'substantial decrease'), in information systems, where Q&R tools and MIS/EIS applications were used (26.14%, 22.50% and

27.50%, respectively), accounting-finance-controlling applications (21.59%, 20.00% and 22.50%, respectively), human resources applications (20.45%, 23.75% and 27.50%, respectively) and – only in years 2009-2010 – in case of analytical systems of Business Intelligence class (20.45%

and 22.50%, respectively). That last area witnessed a reverse in tendency of development cease in 2011 (decrease of negative indications amounted to as much as 8.75%).

TABLE 11.  
IT DOMAINS AFFECTED BY CHANGES IN IT STRATEGIES (INCLUDING QUANTITATIVE AND MONETARY ASSESSMENTS) FOR THE OBJECTS WHICH MODIFIED SUCH STRATEGIES – THE COMPARATIVE ANALYSIS

IT domains affected by changes in informatization strategies in the objects which modified their IT strategies	"Intensity" of IT strategy changes (quantitative and monetary assessments) (percentage of the surveyed objects)														
	Substantial decrease			Decrease			No changes			Increase			Substantial increase		
	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011	2009	2010	2011
Office applications	2.27	1.25	2.50	17.05	16.25	17.50	<b>70.45</b>	<b>71.25</b>	<b>70.00</b>	10.23	8.75	8.75	0.00	2.50	1.25
Purchases-stock management-supply chain (SCM class)	5.68	3.75	5.00	28.41	26.25	26.25	<b>61.36</b>	<b>61.25</b>	<b>61.25</b>	4.55	6.25	6.25	0.00	2.50	1.25
Warehousing applications	1.14	2.50	1.25	17.05	8.75	10.00	<b>79.55</b>	<b>82.50</b>	<b>82.50</b>	1.14	3.75	6.25	1.14	2.50	0.00
Sales-distribution applications (ECR class)	2.27	1.25	1.25	15.91	13.75	12.50	<b>73.86</b>	<b>61.25</b>	<b>68.75</b>	7.95	20.00	17.50	0.00	3.75	0.00
Marketing information systems (CRM class)	4.55	1.25	1.25	12.50	11.25	12.50	<b>68.18</b>	<b>61.25</b>	<b>65.00</b>	13.64	22.50	21.25	1.14	3.75	0.00
Human resources applications	4.55	0.00	5.00	15.91	23.75	22.50	<b>70.45</b>	<b>66.25</b>	<b>68.75</b>	7.95	8.75	3.75	1.14	1.25	0.00
Accounting-finance-controlling applications	5.68	1.25	0.00	15.91	18.75	22.50	<b>73.86</b>	<b>70.00</b>	<b>70.00</b>	3.41	7.50	7.50	1.14	2.50	0.00
Manufacturing-production systems (MRP/MRP II class)	1.14	3.75	0.00	13.64	13.75	18.75	<b>82.95</b>	<b>80.00</b>	<b>76.25</b>	2.27	2.50	5.00	0.00	0.00	0.00
Information systems (Q&R tools and MIS/EIS class)	1.14	0.00	0.00	25.00	22.50	27.50	<b>57.95</b>	<b>63.75</b>	<b>58.75</b>	14.77	10.00	13.75	1.14	3.75	0.00
Analytical systems (BI class)	0.00	2.50	1.25	20.45	20.00	12.50	<b>69.32</b>	<b>65.00</b>	<b>67.50</b>	10.23	10.00	18.75	0.00	2.50	0.00
Other, namely...	1.14	3.75	0.00	0.00	1.25	2.50	<b>97.73</b>	<b>91.25</b>	<b>93.75</b>	0.00	3.75	3.75	1.14	0.00	0.00

On the other hand, considerable increases in value and number of projects were reported in the following areas: information systems, where Q&R tools and MIS/EIS applications were used (15.91% in 2009 and 13.75% both in 2010 and 2011 of answers reported 'increase' or 'substantial increase'), marketing information systems, supported by CRM applications (14.77%, 26.25% and 21.25%, respectively) and purchases-stock management-supply chain, supported by SCM applications (only 7.95% in 2009, but 23.75% in 2010 and 17.50% in 2011). There appeared one more area where a considerable growth – between year 2011 and 2009/2010 – in number of positive responses (by 18.75%) was detected. That was the case of analytical systems, of Business Intelligence class. This is a particularly important observation, since the said systems belong to the most technologically advanced ones and, due to offering such functionalities as: decision support, early warning, or monitoring key economic and financial indicators, are recommended to support managers in 'difficult' periods, such as the times of crisis.

## VII. FINAL CONCLUSIONS

The implications resulting from data obtained in comparative surveys carried out in April and May 2009, 2010 and 2011, with a focus on an impact of the economic crisis on informatization strategies and IT projects, entitled to formulate the following main conclusions.

Firstly, the results supported the working hypothesis that the economic crises affected, to smaller or greater extent, long- and short-term informatization strategies in most of the examined objects. Observed modifications in IT strategies (in 63.31% of all surveyed objects in 2009, 73.39% in 2010 and 62.99% in 2011) were the most evident indicator of that situation. In majority of cases the adjustments had a limited scope, though. The examined objects which declared modifications in their informatization strategies chose the answer: 'there was a slight change in the informatization strategy' in a 87.50%-share in 2009, in 90.00% in 2010 and in 92.50% in 2011.

Secondly, the observed frequency and magnitude of changes in IT strategies were – as expected – correlated with informatization levels (see Table 7). Moreover, in the whole research period the interviewees were consistent while pointing out the most important symptoms for modifying IT strategies and projects (see Table 9). Intensity of the observed qualitative and quantitative effects of modifying IT strategies were also considered alike in 2009-2011 (see Table 10).

Thirdly, regarding IT areas which were affected by changes in informatisation strategies a decrease in ‘negative’ and increase in ‘positive’ indications were also observed, but to smaller extent (see Table 11). The most remarkable growth – in the authors’ opinion – was linked to higher number of responses suggesting intensified investments in analytical systems of Business Intelligence class in 2011. As already pointed out, that was the vital finding, since it concerns the most technologically and functionally advanced solutions, which do not merely address issues related to obligatory reporting, but support analytical and decision-making processes, and thus provide managers with business knowledge which is indispensable to enhance operational effectiveness and efficiency. On the one hand, the declared increase in investments in analytical systems of Business Intelligence class – which should be treated as long-term projects, the economic effectiveness of which may be recognized after several years – suggests that companies incorporate positive expectations towards economic tendencies into their business forecasts. On the other hand, the observed interest in BI indicates managers’ growing trust in those solutions and in their economic efficiency.

The authors believe that by monitoring behaviour of companies and institutions and their responses to the economic crisis in IT domain, and by scrutinizing changes in this respect over the three-year period, the following two objectives were achieved. On the one hand, the findings presented in other reports and analyses were confirmed and supplemented, and on the other one – due to new pieces of evidence gained – negative consequences of the crisis in IT domain may be effectively counterbalanced. All these should, at least indirectly, lead to achieve goals of long-range strategies for developing e-society and e-commerce in Poland, both more effectively and much quicker.

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