CRACOW UNIVERSITY OF ECONOMICS

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KNOWLEDGE ECONOMY SOCIETY

BUSINESS, FINANCE AND TECHNOLOGY AS PROTECTION AND SUPPORT FOR SOCIETY

Edited by
Paweł Ulman, Paweł Wołoszyn

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Reviewer

Anna Brzozowska

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Introduction

Knowledge, economy and society – the central motive of the conference of which this book is one of the outcomes – are three dimensions of human life and activity, inseparably interrelated. Each of them provides important values and at the same time derives support from the other two. The mutual relations of those dimensions can be analysed from many different points of view. To the works collected in this monograph we would like to assign the common context of society as a sensitive structure which requires protection. Harmonious and stable society is able to develop economy, create knowledge and build new technologies. On the other hand, these products of civilisation can pose a threat to society on different levels of its organisation, from individuals to large organisations. Therefore, we need a discussion about such directions of development and the use of technology, knowledge and financial resources which will protect and support social space: indirectly, for example through the provision of healthy and safe development of new forms of entrepreneurship, or directly, for example owing to the use of new technologies to strengthen social bonds.

One of the characteristics of contemporary economy is its transition from material-consuming economy to knowledge-based economy applying the latest technologies. At present, intangible assets (knowledge and technologies) are more and more often of more fundamental significance for the competitiveness of the economies of countries or regions than tangible assets. The term Knowledge-Based Economy is related to the notion of information society. According to Alvin Toffler's theory of technological waves, the third wave of the development of economic activity (the contemporary phase), is characterised by the mass use of information and communication technologies (ICT), as well as closer and closer relationship between economy and science and its latest achievements in economic processes. Nowadays, modern information and communication technologies are primarily becoming the driver of the economic development of countries and societies, and in the case of individual enterprises they give them a greater chance for success in business activity. These technologies, innovativeness and risk management are the leading topic of the first part of this monograph. The articles included in it tackle the problems of the significance and influence of ICT in shaping business models and the choice of the information strategy of an enterprise. With regard to risk management it will present the problem of insurance as an instrument of financing variable risk and the importance of legal acts in limiting the risk of losing financial liquidity. Moreover, it presents how to design a special instrument of management control aiming at the comprehensive assessment of the financial standing of an enterprise.

The idea of sustainable development was spread owing to the 1987 report of the World Commission on Environment and Development entitled "Our Common Future". It also refers to such a way of managing in which addressing the needs of the present generation will not compromise the chances of meeting the needs of future generations. The aim of sustainable development is the welfare of society, which is achieved through economic development, respecting limitations

arising from maintaining care for the natural environment. What results from the above is that broadly understood social issues of management should be the main subject of a scientific discourse about the directions of the shaping of developmental policy of states and societies. The second part of the monograph includes articles discussing the problems of improvements in the broadly understood standard of living: the use of modern technologies to support communication between citizens and administration units, the importance of the Internet of Things used for the development and support for human society, maintaining economic safety for the creation of socially-oriented market economy, as well as raising funds and winning loyal donors by non-profit organisations.

Information on which modern economies are based is obtained, on the one hand, as a result of processing huge data resources and, on the other hand, it itself serves to produce knowledge in the processes undergoing higher and higher level of automation. This cascade process is the thematic axis of this monograph, which focuses on information and its processing. Information, being something more than raw data, refers to the context of active communication and spreading without which the adaptation of organisations to their environment through conscious decisions and building data-based strategies is not possible. It brings a conflict with the values of privacy and anonymity and requires simultaneous development of not only legal regulations but also sophisticated algorithms and anonymisation methods maintaining the business value and usefulness of data. It is particularly important in the face of rapid development of the methods of machine learning specialised in grouping or separating data, especially multidimensional data. In the development a significant role is played, among others, by copying natural, biological systems which are part of the general tendency to build virtual equivalents of physical reality serving as a research tool, an approach in controlling or an independent product.

As the above short overview shows, the papers collected in this book are thematically varied and present different perspectives and research approaches characteristic for individual fields. We believe that an attempt to find sometimes subtle relationships with social problems will be not only an interesting intellectual challenge for the Reader but also the source of inspiration and motives for further research.

Paweł Ulman, Paweł Wołoszyn

PART I

BUSINESS

Chapter 1

Information and Communication Technologies Based Business Models[1]

Zora Arsovski, Slavko Arsovski, Dragana Rejman Petrović

1. Introduction

In era of digital economy business performances depend on *ICT (Information and Communication Technologies)* based business models. A relationship between *ICT* based *Business Models (BM)* and *Business Performances (BP)* is not sufficient determined and quantified. In literature are described separately sub-models of business model (including *ICT* based) and business performances (Cao, 2015; Abdelgawad, 2013; Weiblen, 2015; Teece, 2010; Weiblen, 2014). Based on case studies and previous literature analysis for each economy sector is necessary to couple both sub-models.

In transition economics it is very important because lack of financial resources and competitiveness, especially in high risk environment. That means is necessary to include in composite model aspects of risks, type of industry, and size of enterprise, as control variables.

The purpose of the paper is to analyze role and impact of *ICT* in process or project of creating business models and, after that, to monitor and improve desired appropriate business model.

The goals of the paper are research and develop the model of relationship of *ICT* and business for small and medium enterprises (*SME*) with existed constraints and relative low business performances.

In research are used methodologies in area of business modeling, *ICT* modeling, process modeling, and performance management.

Using proposed methodology in case study for small and medium enterprises (255 in total) in Serbia is presented results of research using statistical analysis. These results pointed out that between elements of *ICT* and business models have correlation. Also, using proposed methodology is proved impact of *ICT* elements and performances of business models in case of constraints.

In transition economics it is very important because lack of financial resources and competitiveness, especially in high risk environment. That means is necessary to include in composite model aspects of risks, type of industry, and size of enterprise, as control variables.

[1] The research presented in this paper was supported by the Ministry of Science and Technological Development of the Republic of Serbia, Grant III-44010, Title: *Intelligent Systems for Software Product Development and Business Support based on Models*.

The paper is organized on following kind. After introduction in chapter two is presented literature review from different research areas, as *ICT*, business models, and business performances. In chapter three is presented general approach to the *ICT* based business model (*ICT/BM*), business performances model, and integrated model. Results of the verification of the proposed model is presented in chapter four, started from description of sample, description of methodology based on statistical software *SPSS* v.21, results of analysis, and discusion about results of research. In chapter five is presented conclusions.

2. Literature review

The research is provided by using four groups of previous investigations in areas:

1. Business models,
2. *ICT*,
3. Business process performances, and
4. Risks.

Cao (2015) analyzed business model innovation (*BMI*) as another of firm performance and competitive advantage. He find links between entrepreneurial flexibility, Seizing capability and value capture and relation to aspiration-driven SUB dynamic capability for *BMI* (with sensing capability, market research ability and R&D ability) and flexibility-driven SUB (with seizing capability for upstream design ability and downstream design ability). At the end of the process framework are *SUB BMI* in value creation (with value opportunity and product innovation) and *SUB BMI* in value capture (with novel revenue architecture and novel cost architecture).

The integrative framework of *BMI* is realized through four stages:
Stage 1: Exploring (identity customer needs, in terms of novel value proposition),
Stage 2: Experimenting (develop products/services to embody novel value proposition),
Stage 3: Constructing (innovating marketing and distribution channel design), and
Stage 4: Consolidating (consolidate local value chain for cost advantage).

Weiblen (2015) also analyzed the effect of network elements and customer centrism on performances of open business models in three case analyses for *ICT* services. Variables were solution customer centrism (from 1/5 to 5/5), tie strength (from 2/5 to 5/5), centrality (from 5% to 95%). Firm performances were delta *ROA*/*NPM* above industry (from 1.8% to 16.2% / from 1% to 16.5%).

Bonakdar (2015) analyzed novelty – centered design in function of independent variables (tie strength, network closeness) and control variables (openness, *R&D* intensity, industry, firm site, network size). He found relative low correlation among variables (0.015-0.500). Also, in analysis of enterprise level he defined portfolio of analyzed firms with axis 1- strategic focus (value-driven and price driven) and axis 2- degree of vertical integration (high and low).

Osterwalder (2007) defined four pillars i.e.: (1) product, (2) customer interface (target customer, distribution channel, and relationship), (3) infrastructure management (value configuration, capability, and partnerships), and (4) financial aspects (cost structure and revenue model) and related anthologies, emphasized by other authors. He also defined related *ICT* infrastructure service alignment and application portfolio. For purpose of organizational alignment he defined three business strategies (1- infusion: alignment through business leadership, 2- alliance: alignment through partnering, and 3- utility: alignment through low cost delivery) and information systems (*IS*) strategies described by *IS* role, *IS* sourcing, and *IS* structure.

Lambert (2008, p. 287) defined elements of business model (*BM*) as part of *BM* ontology, i.e.: (1) value proposition, (2) customers, (3) value in return, (4) channel, (5) value adding process, and (6) suppliers and allies. A value proposition consists from products, services, and information, and value adding process from resources, capabilities, activities, strategy, and organization structure.

Burkhart et al. (2011) emphasized trends in *BM* literature and identified patterns through the analysis of classification, i.e.: (1) *BM* are a high-level aggregation of a company's business logic, (2) the concept is applicable to all kind of business, (3) it considers static as well as dynamic aspects, etc. Also, they find major research gaps, i.e.: (1) insufficient knowledge on business model components in particular regarding interdependence within and between them, (2) absence of formalized means of representations as well as procedure model to allow a structured and comparable visualization of business models, (3) limited insights on criteria and metrics for an appropriate evaluation of business models, which is mainly caused by the small quantity of (large-scale) empirical studies.

Osterwalder, Pigneur, Tucci (2005) analyzed evolution of the business model (BM concept through five phases: (1) defines and classify (*BM*), (2) list *BM* components, (3) describe *BM* elements, (4) model *BM* elements, and (5) apply *BM* concept. In their research *BM* is in triangle of: (1) business strategy, (2) business organization, and (3) *ICT*. They also analyzed process of planning, changing and implementing *BM*.

Gray (2014) emphasized five BM derived from analysis, i.e.: (1) customer led, (2) cost driven, (3) resource led, (4) partnership led, and (5) price led.

Van Looy et al. (2013) defined model for BPMM selection using following criterions: (1) presence of capabilities, (2) number of business processes, (3) type of business processes, (4) functional role of respondents, (5) purpose, (6) validation methodology, (7) architecture type, (8) architecture details, (9) data collection techniques, (10) rating scale, (11) assessment availability, (12) direct costs, (13) number of assessment items, and (14) assessment duration.

Besides previous literature in area of *ICT* with business models are analyzed works related to digital economy, impact of *ICT* on business performances, *ICT* leadership.

According to Loebbecke and Picot (2015), digital economy on *ICT* support is practically emerging every day in purpose of:

- Doing things faster,
- Doing things better,
- Doing things smarter, and
- Doing things cheaper.

An impact of *ICT* on competitive forces in digital era becomes higher because of:

- Competition in price, product distribution and services,
- Increased capacity utilization in industry, reduced costs,
- Reduced lead time,
- Better customer relationship management,
- High quality and business excellence,
- High agility,
- High resilience, etc.

An *ICT* support in digital era has gone through many radical changes in area of hardware, software, and communications (Valacich & Schneider, 2012). For purpose of analyzing an *ICT* support as process, authors considered four aspects:

1. Information quality,

2. Quality of *ICT* systems,
3. Quality of services, and
4. *ICT* security.

Other aspects of *ICT/BM* are related to digitalization and digital business strategy (Setia et al., 2013; Burkhart et al., 2011; Schmidt et al., 2015; Bharadwaj et al., 2013; Loebbecke & Picot, 2015; Huther, 2016; Lindgen & Taran, 2011; Markidakis, 2017; Helu, Hendberh Jr. & Feeney, 2017).

A literature relating to business process performances is very broad. Depends on purpose and goals of research business performances are different. In our research are included following performances:

1. satisfaction of clients,
2. financial performances expressed by annual income,
3. added value, and
4. market share.

Business performances are closed to quality approach (Tadić et al., 2013; Nestić et al., 2015; Arsovski et al., 2012; Stefanović, et al., 2010; Tadić et al., 2015).

Researches related to risk, vulnerability, and resilience are emerging because concept of risk is significant part of globalization and free trade (Aleksić et al., 2013; Tadić et al., 2014; Aleksić et al., 2014; Stefanović, et al., 2015; Arsovski et al., 2012).

3. The model

3.1. ICT based business model (ICT/BM)

The review of previous researches pointed out that exist relationship between sub-models of Business Model (*BM*) and Business Performances (*BP*).

Sub-model of *BM* is still in phase of development, especially for different type and aspects of business and maturity of enterprises. Generally, *BM* could be based on:

BM1 – Material resources,
BM2 – Quality,
BM3 – Supply Chain,
BM4 – Innovation/Agility,
BM5 – Human Resources,
BM6 – Just-In-Time,
BM7 – Environmental protection,
BM8 – Financial resources,
BM9 – Close-To-Market,
BM10 – Price/Costs,
BM11 – ICT support, and
BM12 – others.

A BM1 is developed in case of lot of material resources (direct material, equipment, logistic to material source). This *BM* is appropriate for some enterprises in food industry, construction industry, mining, etc.

A quality based *BM* (BM2) is very broad because is oriented on improving key business processes which lead to satisfaction of key stakeholders. Generally it is implemented more or less

in all enterprises, especially in era of globalisation and consumerism. Assumption for this *BM* is that bigger quality of products and services has impact on competitivity and sustained success.

A supply chain based *BM* (BM3) is based on position of enterprise in value chain and exploitation of mutual success of supply chain through competitiveness of OEM (Pavlovic et al., 2011; Rankovic et al., 2012; Arsovski et al., 2012). This model is applied especially in manufacturing, food industry, tourism, etc. Also, this model is based on specialisation of enterprises and it is most appropriate for small and medium enterprises (*SME*).

Innovation/agility based *BM* (BM4) is based on market needs for new or "refreshed" products for fulfilling new or extended needs. Enterprises have to improve innovation potential through improving processes, which lead to enhancing level of innovativeness. In most cases focus is on faster, not expensive and innovative products/service with higher quality. This type of *BM* will be expanded in future.

Human resources based *BM* (BM5) is classical type of *BM*. It is grounded on human potential in each enterprise, as generator of business performances. In many cases high competences of people (new technologies, skills, availability of *HR*) are good basis for achieving business performances. Because that elements of this *BM* is included in other BMs, especially BM2, BM4, BM11.

Just-In-Time based *BM* (BM6) is oriented to factor of time to market, based on new production philosophy developed in Japan. In many cases and industries/services for sustained success of this *BM* is dominant (mobile phones, cosmetics, drugs, cars, etc.). For implementation of this *BM* is necessary to use elements of other business models, especially BM2, BM3, BM4, BM9 and BM11.

Business models based on environmental protection and/or product safety (BM7) are relative new and appropriate for enterprises which exist in cases of high social requests for it. A product safety is covered by appropriate *EU* directives and nation laws, as well as environmental protection. Also, environmental friendly enterprises are recognised on market and buyers like to bay its products and on this way include in environment protection and better life for now and future.

Business models based on financial resources (BM8) exploit financial strength of enterprises or their possibility to use cheap credit line for faster and cheaper realization of production, improving of competiveness and share of the market. This *BM* is complementary with other BMS and in many cases is also included in its.

Business models based on *Close-To-Market* solution (BM9) are appropriate in cases of direct communication to customers and provision of products/services. This type of models are more introduced in service and industries based on "*voice of customers*". A closeness is not constrained only on customers' requests. Much more, it covers mutual development, financial support, social inclusion, etc.

Business models based on price/costs (BM10) are "*classical*" models grounded on impact of price/costs on competitiveness and business performances. It could be achieved through productivity improvement and higher level of Business Process Management (*BPM*) or Business Process Reengineering (*BPR*). This type of model is very used especially in case of small enterprises and high competition based on price on markets.

Business models based on *ICT* support (BM11) use *ICT* as resource for achieving competitive advantage. For analysis, in the article, *ICT* support is divided into four sub-sub-models:

1. Information Systems (*IS)* based,
2. Communication Systems (*CS*) based,
3. Strategic *IS* resources based, and
4. Business Intelligence (*BI*) based.

IS based models exploit *IS* infrastructure for achieving business goals. This type of BM11 is most used.

Communication system based *BM* now is emerging phase because communication of enterprises (intra and extra) is condition "*sine qua non*" of surviving and achieving business performances of enterprises in digital era.

Business models based on using strategic *IS* resources use local or state *IS* resources for purpose of development, marketing, purchasing etc.

Business model based on Business Intelligence now is in emerging phase, especially in service, manufacturing food industry with high impact of smart technologies.

3.2. Business Performances Model

A Business Performances (*BP*) models are developed in last thirty years (Tadić et al., 2013; Nestić et al., 2015; Arsovski et al., 2012). For purpose of the research the business performances in transition economies are divided into:

1. satisfaction of clients/consumers/users,
2. financial performances,
3. added value, and
4. market share.

Satisfaction of clients/consumers/users is very frequent used, based on impact of quality on surviving, competitiveness, resilience and sustainability enhancement. Satisfaction is measured by appropriate techniques and tools (Stefanović, et al., 2010; Tadić et al., 2015). It World Class Manufacturing (*WCM*), Total Quality Management (*TQM*), Business Excellence (*BE*), Sustainable Success (*SS*), etc.

Financial performances (*FP*) in many cases represent goals of business activities. In literature financial performances cover revenue, costs, profit, etc expressed by different indicators as profit per employees, profit rate, revenue trends, etc. With financial performances are related financial risks (Aleksić et al., 2013; Tadić et al., 2014).

Added Value (*AV*) as financial performance is emerging in literature and practice. It emphasize new value through business expressed by financial results (Aleksić et al., 2014; Stefanović et al., 2015).

Market Share (*MS*) is classical business performance. It is based on impact of market shope (expressed as percentage of revenue in total sale in this type of market on future business performances (Arsovski et al., 2012).

3.3. Control variables

For analysis of impact of *ICT* based business model on business performance in literature are analyzed impact of:

C1- size of enterprise,
C2- type of industry,
C3- level of risks

as well as:

C4- level of process maturity,

C5- level of innovativeness,
C6- level of human resources, etc.

In the research are included impact of C1, C2 and C3 as control variables.

Size of *SMEs* in many cases has impact on business performances through management and organization, effectiveness of resource utilization, etc. In different types of industry an enterprise size is different. For example bakeries are micro enterprises, for process industry big enterprises, for *OEM* big enterprises. In the research enterprises are divided into six sizes (expressed by number of employees):

- 1: 1-5
- 2: 5-25
- 3: 25-50
- 4: 50-125
- 5: 125-250
- 6: more than 250.

In the research is analyzed industry divided into sub-sectors:

M − Manufacturing,
F − Food processing,
W − Wood processing,
C − Construction,
E − Electro, and
O − Other sub-sectors.

Level of risk in global economy has also more impact on business performances. In the research are analyzed following types of risks:

r_1 – business environment risks,
r_2 – business processes risks,
r_3 – risks related to Human Resource Management (*HRM*), and
r_4 – risk related to innovations.

Using expert assessment of each type of risks for each analyzed enterprise and weighting of assessed values of risks is calculated average level of risk, using formula:

$$r_a = \sum_{i=1}^{4} r_i \, w_i \tag{1}$$

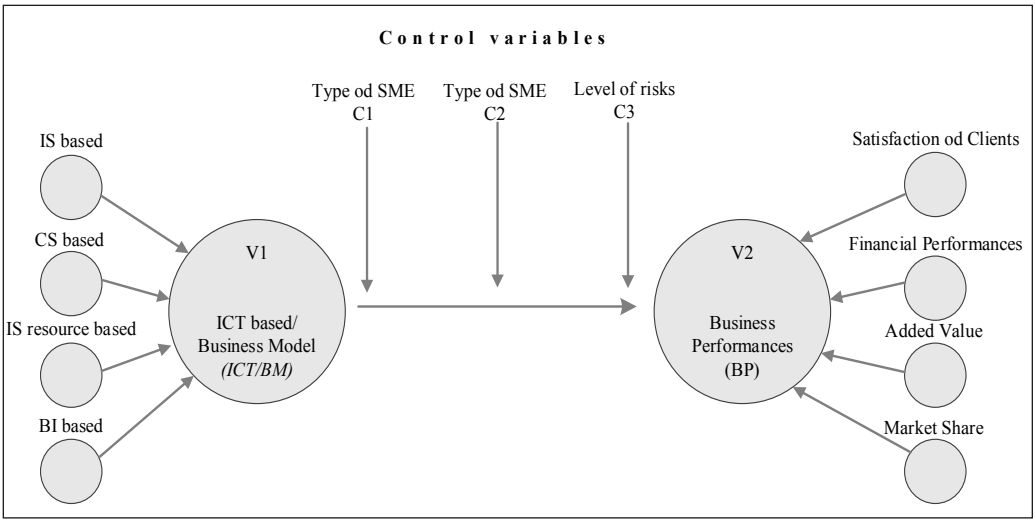
where:

r_a – average risk for each enterprise,
r_i – assessed type of risk for each enterprise,
w_i – weight of each type of risk for each enterprise ($\Sigma \, w_i = 1$).

3.4. Integrated model

Based on previous research is stated base model of impact of *ICT* based business model on business performance (Fig. 1).

Figure 1. Base model



Source: own study.

The model is developed using integration procedures based on *GERA* methodology (*ISO* 15704).

4. The model verification

Verification of model is realized statistical analysis sample of 255 industrial enterprises in Serbia. It is related based on statistical methods.

4.1. Description of sample

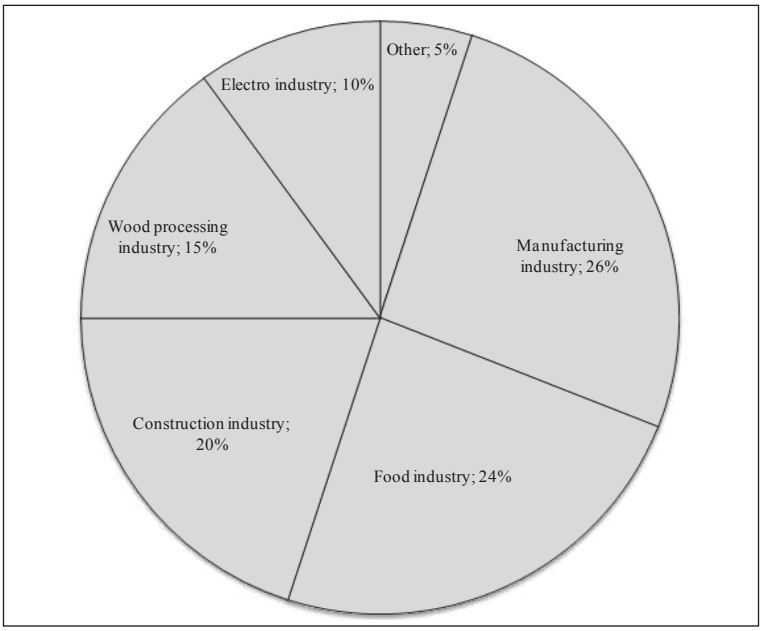
The sample of enterprises is near representative relating to share of type of industry (Fig. 2) and size of enterprises (Fig. 3).

Distribution of risk across size of *SMEs* and type of industry are presented in Figure 4 and Figure 5.

After analysis of business models is calculated share of *ICT* based model. In analyzed sample its share is 6.2%. In this sample share of type of *ICT* support is presented in Figure 6.

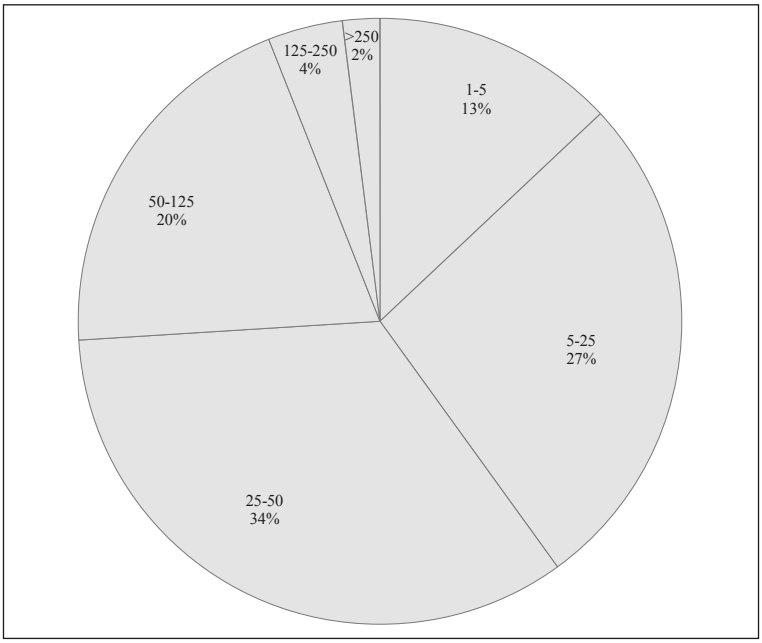
In transition economy, as is in Serbia, dominant types are BM11.1 (*IS* based) with share of 62% and BM11.2 (*CS* based) with share of 28%.

Figure 2. Share of industrial enterprises by types in sample



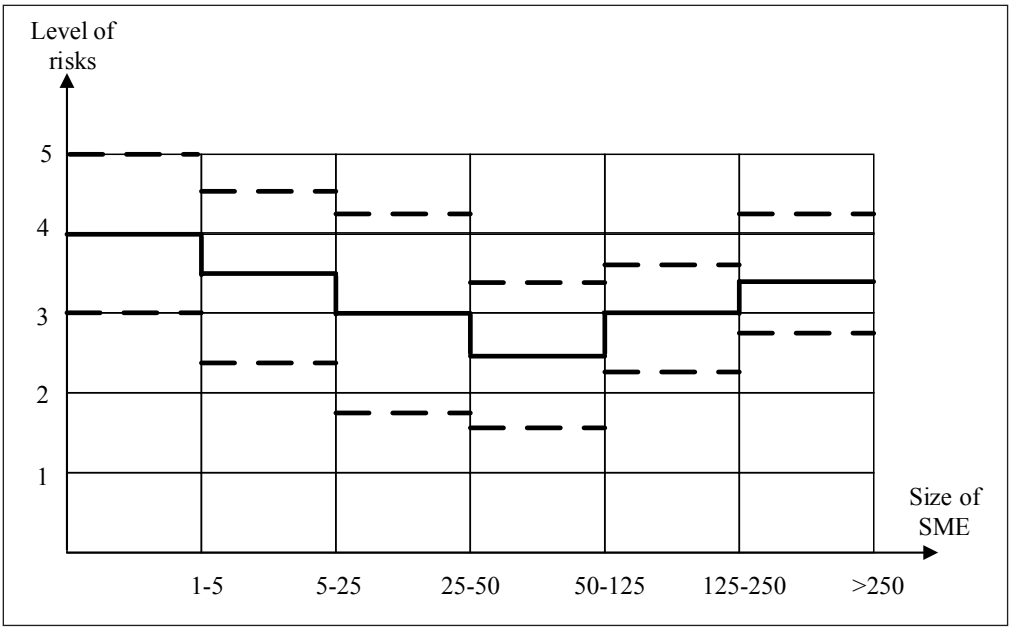
Source: own study.

Figure 3. Share of industrial enterprises by size of enterprises in sample



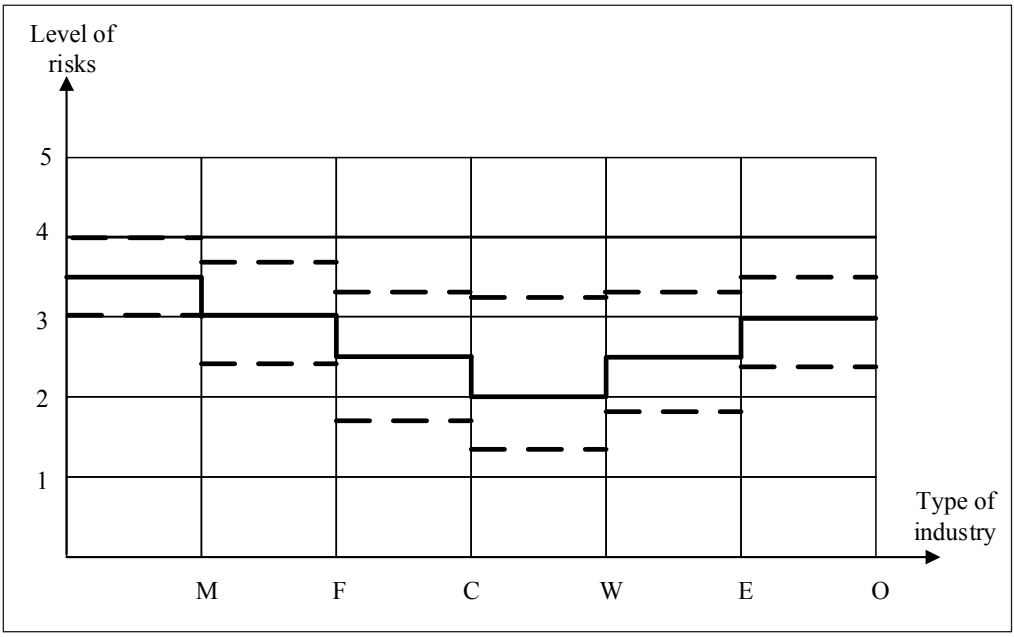
Source: own study.

Figure 4. Variances of risks across different size of SMEs



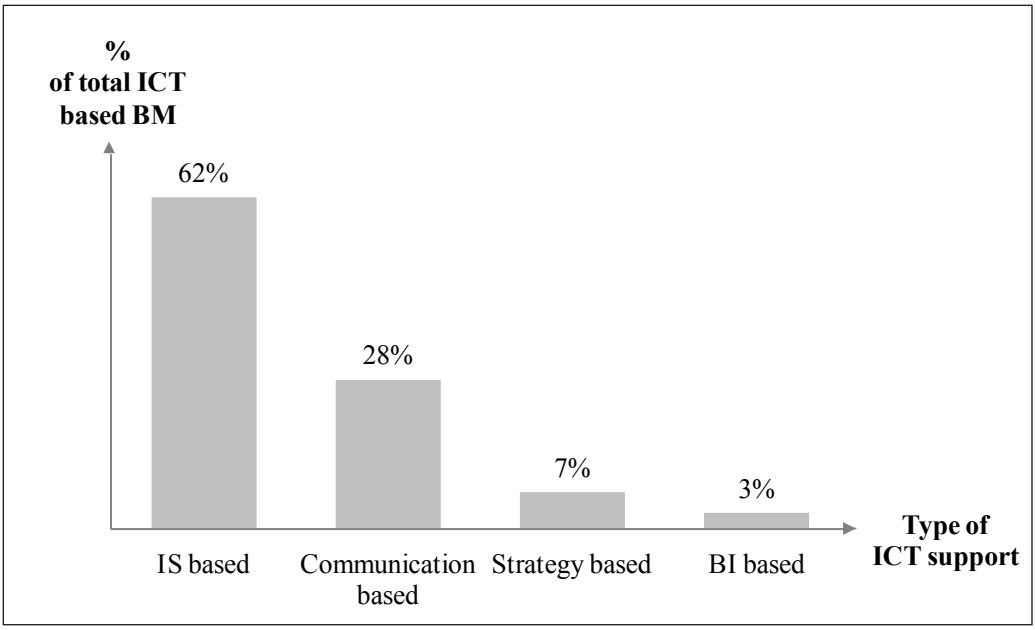
Source: own study.

Figure 5. Variances of risks across different type of industry



Source: own study.

Figure 6. Share of ICT based business models



Source: own study.

4.2. Methodology

For analysis of impact of *ICT* based *BM* on *BP* is used statistical method using software *SPSS* v.21 in four steps:

1. Calculation the descriptive statistics for base model,
2. Calculation the correlation analysis for base model,
3. Defining the new model for *ICT* based business model,
4. Analyzing of the new model.

In Table 1 is presented results of descriptive statistics for base model.

After analysis of descriptive statistics for base model we concluded:

- Some variables have high variance,
- Dispersion of values of sub–variables were because impact of control variables,
- The greatest variance was in smaller enterprises,
- Also, high impact has level of risks as control variable.

Next step in our research was analysis of correlations among sub-variables and business performances.

Table 1. Descriptive statistics

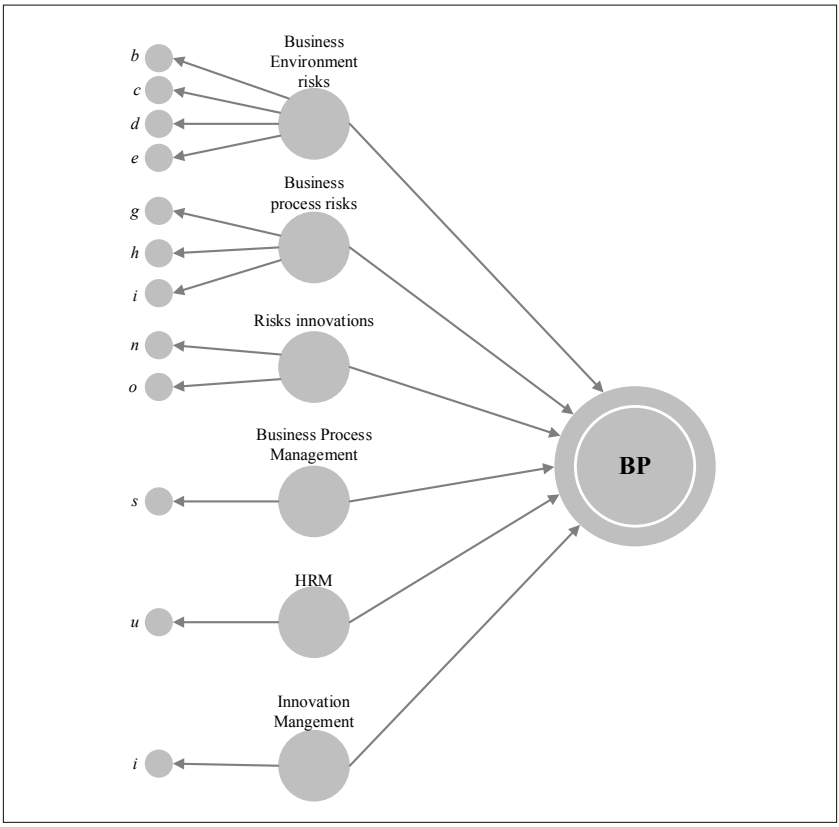
	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
a	255	4.00	1.00	5.00	1.8627	.04199	.67052	.450
b	255	3.00	1.00	4.00	2.4471	.05316	.84889	.721
c	255	3.00	1.00	4.00	2.1412	.06048	.96579	.933
d	255	2.00	1.00	3.00	2.0431	.04947	.79001	.624
e	255	2.00	1.00	3.00	2.0000	.04812	.76847	.591
f	255	1.00	1.00	2.00	1.4549	.03124	.49894	.249
g	255	2.00	1.00	3.00	1.7490	.02886	.46082	.212
h	255	2.00	1.00	3.00	1.7922	.03558	.56813	.323
i	255	2.00	1.00	3.00	1.9176	.04031	.64378	.414
j	255	1.00	1.00	2.00	1.3176	.02921	.46648	.218
k	255	2.00	1.00	3.00	1.7412	.04763	.76054	.578
l	255	1.00	1.00	2.00	1.5255	.03133	.50033	.250
m	255	2.00	1.00	3.00	1.7059	.03215	.51337	.264
n	255	2.00	1.00	3.00	2.2000	.03353	.53536	.287
o	255	6.00	1.00	7.00	2.2118	.03979	.63545	.404
p	255	4.00	5.00	9.00	7.1294	.06769	1.08085	1.168
q	255	5.00	4.00	9.00	7.0980	.05250	.83842	.703
r	255	4.00	4.00	8.00	6.5843	.07434	1.18710	1.409
s	255	4.00	4.00	8.00	6.0549	.08584	1.37072	1.879
t	255	72.00	5.00	77.00	8.6588	.72200	11.52937	132.926
u	255	4.00	5.00	9.00	6.5098	.06234	.99551	.991
v	255	4.00	5.00	9.00	7.6510	.05906	.94314	.890
w	255	3.00	6.00	9.00	7.7725	.04596	.73390	.539
i1	255	6.00	3.00	9.00	5.9608	.09378	1.49751	2.243
i2	255	5.00	4.00	9.00	6.2588	.07039	1.12404	1.263
i3	255	5.00	4.00	9.00	6.2314	.06352	1.01436	1.029
i4	255	4.00	4.00	8.00	5.8471	.06100	.97414	.949
p1	255	4.00	5.00	9.00	8.0314	.04840	.77294	.597
p2	255	6.00	3.00	9.00	6.3647	.09140	1.45954	2.130
p3	255	6.00	3.00	9.00	5.9725	.09388	1.49909	2.247
p4	255	7.00	1.00	8.00	4.0000	.11141	1.77914	3.165
Valid N (listwise)	255							

Source: own study.

After analysis are emphasized sub-variables with higher correlations with *BP*. They are:

1. sub variables: b, c, d, and e for variable: business environment risks,
2. sub variables: g, h, and i for variable: business process risks,
3. sub variables: j, k, are less correlated in both,
4. sub variables: n, and o for cases variable: risks of innovations,
5. sub variables: s for variable: business process management,
6. sub variables: u for variable *HRM*, and
7. sub variables: i3, and i4 for variable: innovation management (Fig. 7).

Figure 7. Research model



Source: own study.

After introduction data for enterprises with dominant *ICT* based business model, using new values of independent variables, are calculated correlations and descriptive statistic for *ICT*/*BM*. They are presented in Tables 2, 3, 4, 5 and 6.

Table 2. Descriptive statistics of ICT/BM

	Mean	Std. Deviation	N
BP	6.1667	1.18423	39
BusinessEnvirRisk	2.1385	.56597	39
BusinessProcesRisk	1.7436	.32183	39
RiskInnovations	2.0171	.40428	39
BPM	6.6090	.91909	39
HRM	8.0769	4.14465	39
INM	6.1923	1.01868	39

Source: own study.

Table 3. Correlations for ICT/BM

	Business EnvirRisk	Business ProcesRisk	Risk HRM	Risk Innovations	BPM	HRM	INM	BP
BusinessEnvir Risk	1	.641**	.194	.802**	-.606**	.083	-.184	-.809**
BusinessProces Risk	.641**	1	.285	.692**	-.670**	.110	-.473**	-.627**
RiskHRM	.194	.285	1	.225	-.134	-.358*	-.197	-.258
RiskInnovations	.802**	.692**	.225	1	-.542**	.169	-.248	-.712**
BPM	-.606**	-.670**	-.134	-.542**	1	.108	.544**	.460**
HRM	.083	.110	-.358*	.169	.108	1	.337*	-.038
INM	-.184	-.473**	-.197	-.248	.544**	.337*	1	.173
BP	-.809**	-.627**	-.258	-.712**	.460**	-.038	.173	1

Source: own study.

Table 4. Correlations

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics	
					R Square Change	F Change
1	.835[a]	.698	.641	.70958	.698	12.307

Model	Change Statistics			Durbin-Watson
	df1	df2	Sig. F Change	
1	6[a]	32	.000	2.415

a. Predictors: (Constant), INM, BusinessEnvirRisk, HRM, BPM, BusinessProcesRisk, RiskInnovations

b. Dependent Variable: BP

Source: own study.

Table 5. ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.179	6	6.197	12.307	.000[b]
	Residual	16.112	32	.504		
	Total	53.292	38			

Source: own study.

Table 6. Relations in proposed model

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	13.107	2.015		6.506	.000
	BusinessEnvirRisk	-1.400	.379	-.669	-3.697	.001
	BusinessProcesRisk	-.998	.606	-.271	-1.647	.109
	RiskInnovations	-.319	.526	-.109	-.607	.548
	BPM	-.222	.198	-.172	-1.123	.270
	HRM	.029	.032	.100	.900	.375
	INM	-.053	.157	-.045	-.336	.739
Model			**Correlations**		**Collinearity Statistics**	
		Zero-order	**Partial**	**Part**	**Tolerance**	**VIF**
1	(Constant)					
	BusinessEnvirRisk	-.809	-.547	-.359	.289	3.465
	BusinessProcesRisk	-.627	-.280	-.160	.348	2.870
	RiskInnovations	-.712	-.107	-.059	.293	3.411
	BPM	.460	-.195	-.109	.401	2.496
	HRM	-.038	.157	.087	.762	1.312
	INM	.173	-.059	-.033	.520	1.925

Source: own study.

4.3. Results of analysis

After analysis results from Tables 2, 3, 4, 5, and Table 6 is possible to conclude:

- Impact of business environment risks for all *BMs* and *ICT*/*BMs* have negative correlations. In second case correlation is stronger.
- Impact of business process risks is also negative correlated with all *BMs* and *ICT*/*BMs* with stronger correlation in second case.
- Impact of *HRM* is insufficiently correlated in both cases, and because that is eliminated in final model.
- Impact of risks innovativeness is also negative correlated in both cases, but stronger correlation is in second case.

- Impact of *BPM* is positive correlated with *BP* in both cases, with small differences in correlations in both cases.
- Impact of *HRM* has low level of correlation in first case, except sub-variable u with positive correlation (more than 0.5). Using mean values impact of *HRM* on *BP* for *ICT*/*BM* was near zero, and because that is not included in final model for *ICT*/BM.
- Impact of innovation management on *BM* has positive relative correlation for is and i4 for sample (cca 0.45), but for *ICT*/*BM* mean impact is much smaller (0.173).

5. Conclusion

A share of *ICT* based business models (*ICT*/*BM*) is growing in era of digital economy. It is also fact in transition economy, as in Serbia. A share of *ICT*/*BM* in 12 kind of business model is significant. In sample of 255 production enterprises 39 enterprises based business on *ICT*, or 15.3%. It is less only related to quality based *BM* (20.8), and *HR* based (15.17).

Based in literature review are selected variables: (1) business environment risks with five sub-variables: *a, b, c, d,* and *e*, (2) business process risks with four sub-variables: *f, g, h*, and *i*, (3) risk of *HRM* with three sub-variables: *j, k* and *l*, (4) risks of innovations with three sub-variables: *m, n* and *o*, (5) level of four sub-variables: *p, q, r* and *s*, (6) level of *HRM* with four sub-variables: t, u, v and (7) level of innovation management with four sub-variables: i_1, i_2, i_3, and i_4.

Dependable variable is level of business performances with four sub-variables: p_1, p_2, p_3, and p_4.

A control variables are size, kind of *BM*, and sub-sector of industry.

That base model was tested using *SPSS* statistical software and identified variables with Pearson correlations coefficient higher than 0.4. On this way is stated model for analysis of *ICT* based business models (*ICT*/*BM*). Using this model are calculated impacts of variables and correlation coefficient on sample of enterprises with dominant *ICT*/*BM*. Only correlation of *HRM* risks on *BP* was less than 0.4. Impacts of risks were negative with relative high correlation coefficients (-0.809, -0.627, and -0.712). Impacts of *BPM*, and *INM* were positive with coefficient of correlation 0.460 and 0.173, and near zero for *HRM*.

Based on this analysis is obviously that in case of *ICT*/*BM* management have to emphasize business activities on reduction or control: (1) business environmental risks, (2) risk innovations, and business process risks, as well as improving level of: (1) business process management, and (2) innovation management.

Impact of *HRM* and *HRM* related risks were smaller on business performances. The explanation for it is insufficient motivation and *HRM* based on experienced staff with dominant *IS* based *ICT*/*BMs*.

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Chapter 2

Impact of the Rapid Development of Information Technology on the Choice of Enterprise Information Strategy

Milena Tvrdikova

1. Introduction

The consequences of the development of information systems have led to a number of changes in both production and non-production technologies, which have begun to be offered as innovative or new products and, in particular, as services. Business practices have changed as well as employees' approach to ICT, which has affected a variety of business processes, models, and enterprise architectures. Business has become an essential part of the solution and part of the IS applications of companies and institutions. The purpose is to increase financial potential through more efficient use of ICT. Companies require solutions matching their financial possibilities, respecting the use of modern ICT capabilities and their efficient operation. This means reducing costs through integrated and optimized business processes and expanding revenue from the sale of new or innovated products and services. The view of the life cycle of an enterprise information system is also changing. The interest of IS users in its quality does not end strictly when it is commissioned but it continues with its efficient operation and further development. This is based on the knowledge of managers and other employees about the contemporary information technologies they have acquired through the use of these technologies in their personal lives, translating them into the work process. Although there are currently many options for addressing IS design, IT transformation into the service sector continues to be a really significant trend.

Business IS trends stimulate supplier IT companies as well as qualified users to create new business models. They emphasize the potential use of the latest ICT in delivering their products and their operations. Current information systems also offer support for e-business and business with the support of mobile devices and technologies. Trends include virtual reality, automation, robotics, and changing access to the use of information technology.

2. Knowledge constituting the theoretical basis for changes in the use of information technology

2.1. Virtual reality – decentralized networks

Virtualization allows for the development of communication technologies, largely through the re-use of existing infrastructure. This greatly reduces the economic barrier of its technological development. The very aim of virtualization is to develop a systematic and general approach to a virtualized network. Virtual networks are therefore ideal for enabling the coexistence of different network architectures. In addition, virtualization has a significant potential to reduce the need for broad agreement between a variety of different stakeholders with different interests that are typical of today's internet. By disconnecting infrastructure from the services and by offering individual parts of virtualized network infrastructure, it can provide the opportunity to deploy new architectures, protocols and services without going through a slow and difficult process of creating such agreements. In the network layer, Internet is seen as homogeneous network protocols and applications which usually do not have the specific properties of underlying layers.

It also provides a general framework for network sharing, such as the provision of network services from different providers on a common physical infrastructure. This approach is particularly beneficial for network domains where the cost of deploying a user network is growing significantly due to technology exchange costs, as is the case with access networks. The success of virtualization depends, in particular, on the ease of deployment of new virtual networks on a potentially large scale (Niebert et al., 2008).

We know from practice that we come across a number of information architectures within organizations. These architectures include a whole range of heterogeneous applications, each of which is focused on a specific business area. Most business processes are typically supported by more than one application; the interface between applications must be designed to support corporate decisions. This has led to the creation of a universal interface that was designed to intensify the link between increased complexity and maintenance efforts. The creation of the interconnected system thus enabled mutual communication between systems within a single interface.

2.2. Automation

According to Zlatuška (2000), the use of computer technology for the automation of production and administrative activities has become one of the dominant factors contributing to increased productivity of human activity and accompanying social changes during the twentieth century. IT thus becomes a universal technological innovation.

Business Process Automation connects the process environment with application integrated services to facilitate the automation of enterprise implementation processes, and allows for workflows that include enhanced heterogeneous applications.

The need for a closed and balanced business process of integration and integration capabilities at the IT level has led to the convergence of enterprise modelling processes and enterprise application software within the company's automation processes (Melchert, 2004).

The main reason to begin modelling business processes is company documentation. Typically, this happens in the context of business processes of re-engineering and improvement of projects.

In this regard, the enterprise model can be used as a template for workflow design and the coordination of activities, resources and data with respect to the appropriate business model. Process specification must be transferable from business models to management tool workflows. This can be provided by standardization formats for business processes, such as Business Process Modelling Language (BPML), which can greatly facilitate this exchange of information.

The defined workflows can be performed using a Workflow Management System (WFMS), whose functionality is now integrated into a large number of solutions thanks to the close relationship between application integration at the technical level and process-level collaboration. As a result, along with the standard process definition interface, it becomes technically possible to use the process model as a guideline for workflows and also to build an application integration scenario. The use of frameworks in enterprise applications then allows managers to focus on strategic business analysis, which allows us to identify the technological capacities and hence the need for IT structures in the enterprise. With regard to the development of IT and the increasing complexity of IT systems, it is appropriate to apply IT governance frameworks such as Cobit, ITIL, and also apply the principles used to integrate the IT governance frameworks (TOGAF or Zachman) (Rozehnal & Novák, 2016).

2.3. Robotics

Robotics largely influences the contemporary business processes. Nowadays, the use of robots is increasingly common, especially in manufacturing plants, which offer a wide range of applications for the use of robots. At present, special attention is paid to the development of robotics for services and non-industrial activities. There are mobile robots which are characterized by varied handling and technological features. These can find use for example in nuclear power plants, medicine, transport, etc. It is also appropriate to mention the use of robots by security authorities such as fire brigades and police, especially in emergency situations. Very promising are service robots that are undergoing dynamic development. This is mainly caused by the unattractive nature of certain human activities in different professions (Hajduk, 2003).

Technological development over the last decade in the field of robotics, computing and communication has led to the design of robotic and automation systems made up of virtual networks and communication devices. This development has enabled researchers and engineers to design new robotic systems that can interact with users as well as other robots. This new technology is referred to as Network Robot Systems. It can be defined as a group of artificial autonomous systems. They are mobile and work on the principle of wireless communication between each other or with other living systems to meet the required assignment.

A network robot is a robotic device connected via a communications network. In general, there are two types of network robots. The first is referred to as teleoperating robot, where users send commands and receive feedback over the network. Such networks primarily support research and education, particularly to enable the access of general public to valuable resources. The other is referred to as autonomous robot. The main activity of this type of robots is to exchange data over the network. Autonomous robot systems primarily focus on communication between devices (over long distances) through the coordination of activities (Sanfeliu, 2008).

3. ERP – enterprise resource planning, enterprise information systems

Traditional important features of ERP systems include automating and integrating business processes, sharing data, processes, and standardizing them across the enterprise. They also include creating and making available information across the enterprise, along with the ability to process historical data. As a result, we get a comprehensive approach to ERP solutions. A distinctive feature of ERP systems is their modularity. This is particularly desirable in terms of selecting individual application modules that provide functionality in various areas of enterprise management. As a result of the different information needs of different businesses or institutions, the end user can then only select those application modules he or she really needs. These modules, as elementary ERP components, are divided into three basic categories, namely into application modules, application management modules, and system managing modules. However, ERPs may also include other modules, primarily operation modules or auxiliary modules (Tvrdíková, 2011).

At present, some companies and institutions are willing to invest up to CZK millions in information systems. However, they expect an adequate implementation project for this money, which will take into account the specific aspects of the value-creation processes, possibly also consultancy services, which will help to improve and standardize them.

Integrated 3rd generation ERPs have changed business information systems from designing technology-focused domains to business-focused domains, and from designing systems to programming business configurations, process mapping, and re-engineering.

3.1. How ERPs increase efficiency

ERP solutions increase efficiency by automating business processes, by providing integrated applications that share data and provide employees with instant access to the information they need. They also allow them to use Business Intelligence applications for analyses to support decision-making and planning.

IT vendors already know that they can use IT to increase the efficiency of the enterprise information system.

In particular the following activities improve efficiency:

- standardization and automation of business processes will greatly speed up business operations,
- it offering fully integrated set of business management solutions that are shared, also offering data in a commonly available data file and its propagation through a common network. This provides overview and collaboration among departments, but also between the suppliers and their customers, partners, suppliers and remote users,
- offering a flexible and customizable presentation of results to improve business reporting, analysis and comprehensibility of these results.

Standardization

Manual spreadsheet-based processes can be lengthy and time-consuming. Employees may lack the knowledge of certain important steps and can then provide customers with incomplete or misleading information. New solutions standardize and, by automation, speeds up processes. That is why most suppliers are offering standardised ERP implementation. The others try to standardize their solutions.

Consolidation and integration makes management easier

Modern ERP solutions can streamline processes and improve collaboration within one company but can do the same for enterprises and institutions that operate across multiple locations, multiple countries, or collaborate within an expanded supply chain. Consolidated ERPs are solutions that can support multiple languages, currencies, companies, and consolidate diversity in legislation, allowing individual divisions or countries to adhere to their own business rules when sharing common processes and information.

Businesses can easily adapt to transactions that cover multiple companies through ERP solutions, which automatically divide transactions between two or more companies, reducing costs and eliminating erroneous, random and time-consuming processing. ERP can consolidate information from individual companies or from several global locations. It enable companies to cost effectively manage multiple businesses and achieve comprehensive reporting on several business entities.

Managers or executives have to collect information from different business applications used to obtain relevant information from analyses for designs of the global and information strategy of a business or institution. Current ERP solutions store data from all modules in one place. Information is entered once and automatically propagates in real time to all parts of the enterprise that need it. This increases accuracy and helps employees meet customer requirements more quickly. Current ERP systems also manage electronic documents. Users save time and money by effectively work with electronic documents. Role-based policies protect data so users have access to necessary data in a safe, efficient way.

Reporting and flexibility increase IT efficiency

Modern ERP solutions provide flexible reporting that selects real-time data to increase the efficiency and accuracy of the decision-making process. Users can save these reports for their personal use or share them with other users. Ad-hoc query features provide users with instant access to information and to provide an overview of the progress of trading and a better overview of the enterprise's performance. Applications of Business intelligence provide portals or graphical interfaces to present Key Performance Indicators (KPIs) to quickly and easily identify unusual events that require attention. Drill-Down features allow managers to quickly see details of transactions to identify trends or the main reasons for exceptions for more proactive business decisions.

Today's ERP systems are flexible, adapting the system to the requirements of today's users. Users are bringing about Information technologies knowledge from personal life. ERP solutions that use modern web architectures and web services and support wireless and mobile wireless devices give organizations the opportunity to further increase efficiency by extending their internal systems to remote mobile users, partners, and vendors. Users simply log into the system using smart self-service applications.

4. Conversion of Information and Communication Technologies into the Services Sector

A very desirable solution for obtaining an efficient ERP is the transition to flexible ICT architecture by using Cloud Computing services.

The National Institute of Standards and Technology has defined Cloud Computing in relation to increasing competitiveness as follows: "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g.,

networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models." (NIST, 2018).

Businesses and institutions can benefit from various forms of cloud technology. The basic features of Cloud Computing are: self-service on-demand, universal network access, resource sharing, elasticity, and measurable consumption.

CC can be deployed as: public cloud, private cloud, hybrid cloud, and community cloud. Cloud computing is available in multiple service models, such as: Software as a service, Platform as a Service, Infrastructure as a Service and their combination.

Cloud computing brings benefits due to its simplicity, reliability, and reduction and restructuring of its purchase cost. As a disadvantage, users' concerns include data security and slower response times. There are also concerns about dependence on service providers and Internet connectivity.

At present, both suppliers and users of integrated IS are massively focused to cloud computing technologies. It is reason, why necessary to pay attention to this transformation. Identify possible pitfalls and design procedures and recommendations for successfully managing transformation to CC services individually to suit the needs of the business.

4.1. Artificial Intelligence – Data science platforms

Recently, many vendors have added "data science platforms" to their marketing offers. These platforms are commonly used by "data scientists". But there are many problems in the practical life, which companies use to address by this approach too. These include predicting demand, predicting demand failure, identifying the customers' determination to buy or choose, and detecting fraud.

Gartner Inc. defines the data science platform as follows: A cohesive software application that offers a mixture of basic building blocks essential for creating all kinds of data science solutions, and incorporating those solutions into business processes, surrounding infrastructure and products. Cohesive means that the core building blocks of the application are well integrated into a single platform, provide a consistent "look and feel" and that the modules are reasonably interoperable to support analytical processing. Aplikace, která není Cohesive se podle definice nepovažuje za platformu pro vědeckou informatiku (Mell & Grance, 2017).

There are already a number of scenarios that can be used to improve business and production strategies with IT support: production improvements, business survey (exploration of the unknown), advanced prototyping, new machine learning solutions and more enhance traditional approaches.

4.2. Criteria for assessing the suitability of ERP solutions for strategic management of businesses and institutions

To support the development of an appropriate information strategy for businesses and institutions, the following selection criteria are important:

- Access to data: the platform supports access and integration of data from various sources (including the cloud) and various types (such as text, transaction, streaming, link, image, sound, time series and location data).

- Data survey and visualization: the product allows performing a number of survey steps, including interactive visualization.
- User Interface: the product has a uniform "look and feel" and provides an intuitive user interface and visual compositional framework.
- Further advanced analysis: other methods of analysis (including statistics, optimization, simulation, and text and image analysis) are integrated into the development environment.
- Flexibility, scalability and openness: open source libraries can be well integrated into the platform, users can create their own functions, the platform works with laptops.
- Delivery: The platform supports the ability to create interfaces that can be used for faster deployment in business scenarios.
- Platform and project management: the platform supports management. For example security, computing resources administration, workflow, reuse, and project version management, reproducibility control.

If these criteria are adhered to, a role in selecting a supplier is also played by specific requirements depending on the user's activity.

5. The four phases of digital business transformation into a new information strategy

Many manufacturing companies have long been pursuing digitization activities. The difference from the past is above all the change that the digital transformation is undergoing today. The expectations of digitization are always the same – increased production, minimizing errors and reducing production costs.

- The first phase of digitalization – meeting the requirements for digitization. Requires the introduction of new manufacturing processes such as digital production and quality control, predictive maintenance, robot use in production processes, etc. – there is a need for the transmission of large amounts of data. This data must always be kept securely in the right place, in the required format, and without errors. Only in this way can the digital transformation be successful. In the first phase, the company should concentrate on data collection across logistics and production to create its complete digital image. Data is collected directly from machines and equipment, using sensors, internet or mobile devices.
- In the second phase, the data sources logically interconnect and integrate with the systems. The individual activities are control on the basis of data outputs from previous operations. The goal is the horizontal integration of all processes in the company, from task acceptance to the dispatch a message about its termination.
- The third phase is the vertical integration of collected data, their analysis, reporting and process visualization. Data analysis results help to eliminate process inefficiencies and optimize them, graphical outputs then serve as the basis for top management decision-making.
- The fourth phase is final. Devices and systems perform own process optimization on the basis of collected big data. Machines learn, autonomously decide and adjust. Processes are managed digitally within the company.

Integration started is primely transmission simple data from place to place; later, logic that reflects the complexity of business processes is added. Data from different sources is combined,

transformed and evaluated. As the company becomes more digital, the number and variability of such integrations will reach such an extent that it is appropriate to choose the right integration strategy.

In principle, there are two ways to go:

- We can build integration logic within specialized ERP, MES, WMS, etc. The solution is particularly suited for smaller companies or for those that do not have too many interdependent manufacturing processes.
- The second solution is to use an integration platform. The platform allows the creation of integration outside of systems and independently of them. The advantage is the use of one technology, a complete overview of data flows, critical data control and security. This approach is suited for businesses that have a large number of systems and data sources, or more follow-up manufacturing processes (Aimtec – Digital Factory, 2018).

Now they have new possibilities, higher computing capabilities, cheaper data storage, more affordable mobile devices, and smart sensors that allow for rapid growth in digitization activities.

6. Conclusion

The implementation of the new approaches is not only a matter of technologies or information's and communicate technologies. In spite of speed digitization and automation, creativity and experimentation remain irreplaceable.

Companies will always be confronted with a development of knowledge of skills of their managers. The future lies in the creative development of new solutions. New solutions need to be found by novel thinking. We need to be able to consider the pros and cons of our own business model, as well as the business models of our customers, competitors and sales agents. SW and digitization can only deliver as much as out creativities and human intelligence allows – and that is the key to tomorrow's success. Digitization is a tool. If modern and admirable algorithms are to be successful, they must be matched with the relevant personal know-how and experience of managers (Tomek & Vavrova, 2017).

Without understanding the challenges in management and economic areas, even the best technical and technological solution will be unsuccessful. The concept of today's management is based on marketing, but well understood in its cognitive and implementation aspects, not the deformed abuse of this term.

The new approaches it has other dimensions too, such as focusing on customizing customer needs, tackling complex competitive issues, as well as legal issues related to technology, data protection and, of course employment.

What is the future of small and medium-sized enterprises? It must not be overlooked that, for small and medium-sized enterprises, intelligent, digital systems offer great opportunities. In a number of these topics, they should use the expertise of digitization experts to find out their cooperative capabilities.

Management which responds to the fact that the market's mission is to provide not only products but also services and information changes the initial conditions for research and development, is an inexhaustible source of innovation.

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Chapter 3

Changeability of Insurance Cover under Variable Start-up Business Risks

Ryszard Pukała

1. Introduction

Contemporary economy is characterised by a high dynamics of multi-layered changes and the quest for new innovative concepts that enable enterprises to activate innovative business solutions. Their development, based on new and often unique technologies, contributes to providing durable and sustainable economic growth.

As demonstrated by developed countries, the development level of national economies is mainly determined by the momentum and quality of implementing new ideas, new technologies, new management systems and new products that result from the development of science and innovative activity. The economy falls into stagnation if it fails to regularly implement innovative changes. As shown by Lambin (2001, p. 24), if the global economy undergoes a downturn, it can be overcome by a new wave of innovations, as they can offer a long-term incentive for the next growth phase. Therefore, the main problem of the contemporary management ideology is a question of innovative activity of enterprises and innovative orientation of a state economy.

Innovation capacity, which becomes a basis for achieving a higher development level and increasing both creativity and readiness for innovative development within an economic system, is a generator of intense innovative activity.

The innovation capacity defines the level of innovativeness of all business entities, in particular those with the highest potential for innovation, including start-ups, which through their innovative undertakings aimed at finding unique paths of development can quickly dominate domestic and global markets. However, we need to underline that start-ups belong to business entities burdened with high risk that is changeable over time, and as such require particular financial protection. Insurance is one of the financial instruments that can be used as part of start-up business risk financing, which is optimal in this scope from the point of view of efficiency and cost. This study focuses on the topic of using insurance as an instrument for financing volatile risk faced by start-ups.

2. Innovation capacity of start-ups

We need to note that much attention is paid nowadays to shaping the innovation capacity, however the existing information is often inconsistent. Capacity is identified as scientific, intellectual, creative and technical one, which greatly simplifies the reality and narrows down the scope of application of this economic category. Therefore, it is best to refer the term "innovation capacity" to enterprises, which form the main component of each country's economic development. The innovation capacity of an enterprise is defined in various ways in the source literature. According to Poznańska (1998), this is a capability of efficiently introducing innovation, that is, new products, technologies, organisation methods and marketing innovations. Capacity understood as such can be defined by four key elements (Poznańska, 1998, pp. 40-41):

- financial capacity, consisting mainly of own funds and funds offered by various financial and non-financial institutions operating in the region where the enterprise operates as well,
- human capacity, i.e. number of employees as well as their structure, qualifications and skills,
- capacity in kind, which mainly includes a structure of the production facilities along with their flexibility, i.e. their ability to quickly adapt production to the changing market needs as well as age and level of mechanization and automation of machinery,
- knowledge, with particular attention to technical knowledge and information generated by the market.

Żołnierski (2005) believes that innovation capacity is determined by internal innovation capacity and access to external sources of information. The internal innovation capacity comprises (Żołnierski, 2005, pp. 5-6):

- staff (their knowledge and experience, skills and qualifications, a method of managing available resources and information management),
- research and development (separate R&D units, performed R&D work, commissioned work, etc.),
- technology (computers and ICT, machines and devices as well as state of the art of machines and devices).

On the other hand, the external sources of innovation include, above all, higher education and research and development institutions as well as competitive companies, recipients and suppliers. Therefore, the innovative activity of start-ups can be examined two-dimensionally:

1. as an entrepreneur's participation in the scientific and technological progress, which has impact on the level of technological development of the entire society through efficient use of resources,
2. as the use of scientific and technological achievements within one's own business activity, which can contribute to reaching competitive advantage on the market.

The innovative activity cannot be a one-off, partial or spontaneous act. It should have a strategic character and be based on the assessment of all possible forms of innovative activity, manifesting itself through all sorts of innovations used as part of conducting business.

Depending on a specificity of market relations (between competitors and clients) and stakeholder relations (mainly between co-operators and suppliers), an entrepreneur can choose between an innovation strategy based on adaptation or a creative one. In the case of start-ups, we can only analyse a creative strategy, as for such entities innovations form a point of departure and a platform for increasing competition of production or offered services, strengthening their market position and

introducing new methods of using knowledge. As a result of this type of activity, an entrepreneur has an opportunity of obtaining maximum results at minimum outlays.

3. Start-up business risk

Risk is an inseparable element of each business activity. It accompanies its every aspect. However, there is no such thing as a uniform definition of risk, as this phenomenon is hard to harness. Various domains of science define it differently and formulating a single universal definition is truly difficult, if possible at all. Regardless of interpretative difficulties, though, Kowalewski (1998, p. 17) indicates that "the term 'risk' is fundamental both from the point of view of the theory of insurance and the everyday practice". Ronka-Chmielowiec (2002, p. 133) also believes that "risk and understanding of its essence is fundamental both for insurance theory and practice".

There are plenty of definitions of risk in practice. For the purpose of this study, the definition coined by Tepman (2002, p. 20) shall be used. It stipulates that "risk is a possibility of an emergence of an unfavourable situation while implementing plans and executing enterprise budgets". This very definition, which assumes a possibility of achieving success or experiencing failure, is optimal for start-ups, which acting in conditions of risk that they are exposed to as part of their operations need to take account of a possibility that an initiated undertaking might fail. On this plane the risk is defined as a possibility of an event that will adversely influence the execution of assumed objectives. On the other hand, taking a risk is also connected with possible benefits, which in the case of enterprises in question often becomes an essence of their activity.

We need to stress that corporate risk sources differ in nature. According to the Society of Actuaries (US), they can be divided into four major types[1]:

- hazards, including civil liability risk, risk of damage to property and natural disasters,
- financial, including risk related to valuation of assets, foreign exchange, liquidity risk,
- operational, including risk of defective product, fraud, client dissatisfaction or loss of reputation,
- strategic, including risk of competition, access to capital or change in social trends.

Despite certain generality, they refer to all areas of start-up activity, both internal and external.

Noteworthy is the fact that the scope of corporate risk is subject to constant evolution. New technologies or use of new raw materials (which is often the case with start-ups) generate new risks. According to Ortyński (2010, p. 13), we can distinguish three groups of corporate risk:

1) at manufacturer's facilities, which is linked to his/her and employee activity,
2) outside manufacturer's facilities, which is caused by human activity and natural forces (related to warehousing and transporting products to co-operators, distributors or final recipients),
3) related to the impact of a product at the final recipient's facilities.

Risk that accompanies the business activity is triggered by macro-, meso- and microeconomic factors. Macroeconomic factors result from the globalisation of economic processes and a general economic analysis of a given country and international relations; mesoeconomic factors include an analysis of a sector where a given entity operates; and microeconomic factors are determined based on a situation inside a given enterprise (Ostrowska, 2002, p. 39). Risk sources have been classified in a similar manner by Wilimowska (2001, pp. 20-22), who distinguished the following:

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[1] Casual Actuarial Society – CAS, Standard zarządzania ryzykiem w 2003 r., after: (Monkiewicz, 2010, p. 72).

- macro-surroundings, i.e. broader surroundings of an enterprise that determine the emergence of a systemic risk and covering such elements as, in particular: capital market, business cycle, central bank policy, governmental policy, inflation and unemployment;
- micro-surroundings, also known as narrower surroundings of an enterprise that determine the emergence of a systemic risk and consisting, among others, of competition intensity, demand on a given sector's products and a sector's lifecycle;
- an internal situation of an enterprise, also determining the emergence of a systemic risk, consisting of: an enterprise's competitive position and its development possibilities, marketing policy, income generating capacity, own capacity management.

As regards start-ups, the last category of risk sources is of key importance to their activity and survival in a turbulent market environment.

Application of an efficient risk management system at an enterprise requires the introduction of appropriate procedures to monitor the performance of a risk management strategy in all relevant fields. Monitoring of the risk management system can be performed by operation workers responsible for activities dealing with management of a given type of risk as well as the managerial staff of the enterprise. Basic tasks of the personnel and managers of an enterprise include:

- cooperation in the field of developing and implementing the risk management system at an organisation,
- monitoring the implemented system with regard to potential improvements and detecting changes,
- preparing emergency plans for the most probable risk that can appear regardless of the activities aimed at preventing it,
- documenting risks, especially preparing reports dealing with the efficiency of undertaken activities.

When it comes to start-ups, burdened with high risk, the issue of risk management defined as such often remains only in the theoretical domain. In practice, their approach to risk management is volatile, as it depends on emerging business risks and focuses on reacting to current hazards. Therefore, start-ups usually concentrate on selective risk management, mostly accepting it and financing it only partially.

4. Insurance as an instrument of financing start-up business risk

Talking about risk materialisation, there is a question of methods of risk financing. In a market-based economy there are relevant entities that bear the burden of each risk. Those entities are usually enterprise owners, who accept the uncertainty and bear the burden of unexpected losses. However, the developed societies have created numerous institutions that assume those risks. Insurance is such an institution, as its essence lies in transferring the risk (Arrow, 1979, pp. 142-143). However, the sole fact of using insurance by an enterprise does not determine the role of insurance in the start-up risk management process. What is highly important in this case is an appropriate selection of insurance products adjusted to individual needs of an enterprise. In this regard the key issue is an optimal selection of the scope of insurance cover, aimed at tangible financial benefits for the enterprise, including, among others (Froot, Scharfstein & Stain, 1992, pp. 2-5):

- increased opportunities of raising capital,

- possibility of increasing financial lever,
- reducing capital costs,
- avoiding costs of temporary poor financial situation or bankruptcy,
- gaining fiscal benefits,
- providing stability of funds allocated to strategic investments of the company.

Unfortunately, the following issues constitute serious problems for start-ups when it comes to selecting an optimal insurance cover:

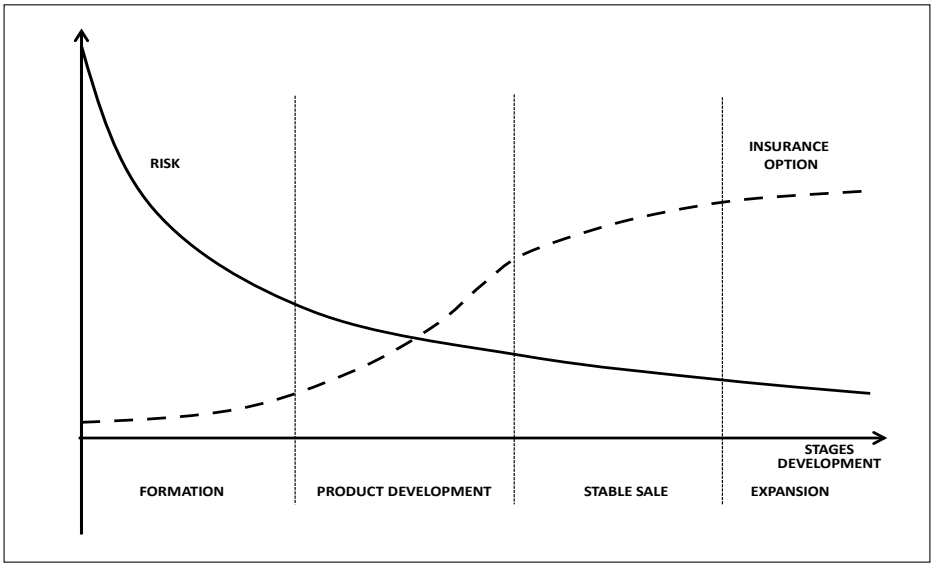
- a wide collection of risks not insured as part of standard products offered by insurance companies,
- lack of developmental stability, especially at the scaling stage, which can lead to the emergence of new, previously unknown risks,
- high risk volatility over time,
- absence of funds, especially at the initial development stage, that could be used for safeguarding an optimal insurance cover.

We need to highlight here that the application of risk limiting instruments is particularly complicated for start-ups, since their business specificity and in many cases a long period of reaching scalability can lead to a situation where insurance needs are very often ignored or underestimated.

Risks not covered by standard insurance company offers also have a key impact on start-up activity in the majority of cases. This makes the matching of insurance options to start-up needs and the use of insurance by those entities highly difficult. But at the same time the development of appropriate insurance solutions for those entities can represent a challenge for the insurance sector and an origin of additional premiums.

When analysing risks faced by start-ups, we need to pay attention to the fact that their greatest impact is observed in two initial developmental stages: formation and product scaling (development). At those stages, apart from risks related to the enterprise development, there is a broad spectrum of abovementioned risks related to business specificity, which triggers an increase in funds necessary for start-up development. Such an accumulation of risks makes this period critical for each start-up development process, which requires a high degree of founders' involvement and the best possible use of all resources in stock to keep the enterprise on the market and guarantee its further growth. It also makes the non-insurable risks prevail in their activity – see Fig. 1 below.

Figure 1. Start-up business risk level and insurability



Source: own study.

Start-ups belong to high-risk entities and thus require particular financial protection against risk they are exposed to. It is particularly important in a situation where one of the basic conditions of continuity and development of business activity on a competitive market is to provide financial security. Without it, a given economic unit cannot present itself as a reliable entity that fulfils its obligations towards stakeholders, i.e. owners, managers, creditors, employees, clients or suppliers, strategic partners and the local community (Karbownik, 2012, p. 64).

We need to stress that the business risk faced by such entities is highly volatile in the process of development and striving for scalability. This volatility concerns both insurable and non-insurable risks and directly influences start-up operations and minimisation of losses in case the risk has materialised. Therefore, necessary insurance should be to a great degree tailored to start-ups' needs, both at the moment of concluding an agreement and while taking account of risk changeability over time. It should be even more, since the amount of insurance premium, i.e. financial burden imposed on the enterprise, depends on a number of risks included in the insurance cover and on sums insured in the case of property insurance and guaranteed amounts in the case of civil liability insurance. Thus, it is important to precisely define what sorts of risks a start-up should insure in the first place to cover losses to the greatest possible extent and to monitor risk over time on a regular basis in order to adjust insurance to risk changeability and the emergence of new, previously non-insurable risks related to the activity of this type of enterprises.

5. Conclusion

Start-ups play an ever more important role in the national and global economy. Their dynamic development is one of the drivers behind innovation. In the quest for optimal methods of scalability

they are exposed to a broad range of changeable risks that can disturb their operation or cause their insolvency in an event the risk becomes reality. Therefore, selection of risk financing methods, with insurance being the most popular one, is an important aspect for this type of enterprises.

Despite definite advantages, the use of insurance has a number of limitations as well. The most significant ones include the insurance cover and sum insured that are not tailored to a given start-up's needs, the lack of insurance offer dedicated to this group of enterprises, low concern in presenting an offer to such entities showcased by insurers due to a high and often poorly recognized business risks and consequent high protection costs, which is yet another barrier that limits the demand on the insurance cover among start-ups. In spite of these limitations, though, start-ups should as widely as possible use risk financing instruments, including insurance, for they can certainly help them develop and achieve market success.

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Chapter 4

The Risk of Losing Financial Liquidity and the Legal Institution of art. 13 of the Act on Enforcement Proceedings in Administration

Nina Dubiel

1. Introduction

Changes in the field of market economy and tax regulations have forced Polish enterprises to evidently change their management systemp. The business environment has become more volatile and demanding, and businesses are under constant pressure to reduce costs to be competitive. Even a small stop or a mistake in the operation in such business conditions can lead to a financial breakdown of the company (Mikołajczyk, 2006, p. 302).

The risk occurs in broadly understood business activities. It is not a homogeneous phenomenon and hence the need for its systematization. The risk applies to all basic areas of economic activity, i.e. production, trade and financing of this activity (Kaczmarek, 2008, pp. 58-59).

The risk management process, aimed at its proper identification and undertaking activities related to maintaining it at an acceptable level, has become one of the key aspects of modern business operations (Jajuga & Jajuga, 2012, p. 328).

Risk management also means limiting the amount of damage that it can cause. It is important to keep in mind all possible measures that apply in a situation of risk and what is anticipated before the risk arise. All risk areas that are still in spite of the removal of causes should also be limited, and measures should be taken to limit their size (Kaczmarek, 2008, pp. 103-104).

The main objective of the article is to analyze the enforcement measure in the form of seizure of the bank account by the enforcement authority, listed in the financial obligations catalog provided for in the Act of 17 June 1966 on enforcement proceedings in administration and legal institution art. 13 upea, i.e. exemption from execution for a definite or indefinite period, in whole or in part of certain assets of the obligor.

The article decided to verify the hypothesis, which says that the enforcement authority in administrative proceedings, guided by the choice of an enforcement measure in the form of seizure of a bank account, it blocks all available funds on the account belonging to the obligor, thus depriving the legal institution of exemption from the execution of certain assets of the oblige.

From the point of view of the creditor who asserts his rights to the claim, the effectiveness of the enforcement is important, which affects the effectiveness of the enforcement proceedings and the recovery of the debt, while from the point of view of the entrepreneur it is important to maintain financial liquidity at all time.

2. Risk and risk management

Risk is one of the most important theoretical concepts in economic sciences, especially in financial science. It is also a category present in the everyday life of people and in their business. The vast majority of people and business entities notice the necessity of risk analysis, as well as its reduction or even protection against it. This means that the role of risk management increases, by which we mean decision-making and implementation of activities leading to the achievement of a level of risk by a man or an economic entity that can be accepted by him (Jajuga, 2007, p. 9).

Risk is the possibility of something undesirable becoming a negative consequence of an event (Rowe, 1977, p. 24). Reilly (1997, pp. 463-464) defines the risk as uncertainty whether the investment will bring the expected rate of return. The risk occurs even when only one of the factors of the situation is unknown and there is a probability of its occurrence (Waściński & Krasiński, 2010, p. 34).

The scale of financial risk increases as the debt increase. The risk of losing financial liquidity, i.e. the ability to timely settle liabilities by the company, is a particularly visible form of financial risk and is dangerous for the enterprise. It appears in the distraction of the terms of cash inflows and maturing deadlines for the benefit of the creditor. The risk of losing financial liquidity, also meaning lack of ability to obtain credits and loans, occurs not only in the case of lose. It may also appear in enterprises that achieve high profits even if the balance between the dates of cash inflow and necessary expenses for liabilities is violated, e.g. due to excessive involvement in new investments without prior securing certain sources of financing them (Bień, 2002, p. 19).

The liquidity risk results directly from the understanding of the liquidity concept. This concept can be understood in at least two way. With regard to an entity, liquidity means the possibility of changing assets to cash in a short time at the expected price. The liquidity risk can be considered in both a negative and neutral sense, but this is more often a negative approach.

The liquidity risk is the possibility that there will be an unexpected drop in the liquidity of the business entity. However, it should be noted that the liquidity risk is a consequence of other types of risk and often manifests before the bankruptcy of the entity. Liquidity management is a process of making current decisions, the aim of which is to keep assets convertible to cash at an optimum level (Wędzki, 2003, p. 34).

The liquidity risk also occurs in terms of transactions made on the financial market. In this case, the risk means that it is not possible to close a position on the financial market in a short time at the expected price (Jajuga, 2007, pp. 24-25).

The company becomes insolvent when its income is not enough to cover its fixed obligation. So the probability of a difficult financial situation and, as a consequence, insolvency depends on two factors (Smithson, Smith & Sykes, 2000, p. 140):

- the level of coverage of fixed liabilities (because the probability of insolvency increases when the level of coverage of fixed liabilities decreases),

- income volatility (because the probability of insolvency increases with increasing volatility of the company's income).

The concept of risk management includes conducting a policy related to risk in the enterprise and it covers not only the insurance risk, understood as the danger of losing something, but also as an opportunity to make a profit from the company's activity. The main goal of risk management is, on the one hand, to improve the company's financial results and, on the other hand, to ensure that the institution does not incur larger losses than assumed. In practice, the idea is to minimize and protect the risk as much as possible against its consequence. Risk management involves identifying the type of risk with which a company may deal, its control and measurement (Kaczmarek, 2002, p. 59).

Management is defined as a process, that is, a systematic way of proceeding, consisting of many subsequent steps: planning and decision-making, organizing, motivating and leading and controlling, forming a certain cycle. It is directed to the use of the organization's resources (Zakrzewska-Bielawska, 2017, p. 25).

Management should be treated as a form of practical related activity with the decision making process regarding the best use of available material, capital and human resources, in order to achieve the assumed tasks, ensuring the continuous development of the enterprise (Weiss, 2008, p. 102).

3. The scope of administrative enforcement

In the Polish system, the public administration is empowered by itself to perform public-law obligations without having to go to court for enforcement measure. The public character of the duties subject to administrative enforcement is determined primarily by art. 2 acts on enforcement proceedings in administration in 1966 (Jędrzejewski, Masternak & Rączka, 2013, pp. 7-8).

Bringing the actual situation in line with the binding legal acts is one of the most important tasks of public administration (Zimmermann, 2012, pp. 5-6).

Enforcement is to be understood as compulsory recovery from the debtor by the enforcement authorities, based on the enforceable title, in the manner provided for by the law, due to the creditor of the benefit. Enforcement is a way to conduct enforcement proceedings, which cannot take place otherwise than within its framework (Marciniak, 2002, pp. 1096-1097).

The concept of administrative enforcement has not been directly regulated in Polish law, but its essence can be derived from the provisions of the Act of 17 June 1966 on enforcement proceedings in administration[1]. The Act on Execution Proceedings in the Administration of 1966 is a procedural

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[1] European Union:

1) Directive 2001/44/EC of June 15, 2001. amending Directive 76/308/EEC on mutual assistance for the recovery of claims arising from activities forming part of the system of financing the European Agricultural Guidance and Guarantee Fund and the agricultural and customs duties and in respect of value added tax and excise duties (Official Journal EC No L 175 of 28.06.2001);
2) Directive 2002/94/EC of December 9, 2002. laying down detailed rules for the implementation of certain provisions of Directive 76/308/EEC on mutual assistance for the recovery of claims regarding certain levies, duties, taxes and other measures (OJ L 337 of 13.12.2002).

Data regarding the announcement of European Union law acts, included in this Act – as of the date of obtaining Common Membership in the European Union by Rzeczpospolita – concern the announcement of these acts in the Official Journal of the European Union – special edition.

act, but it can also contain provisions of substantive law authorizing the use of enforcement measure. As a procedural act, this Act is also linked to the act of the Code of Administrative Procedure (Act, 1960), in cases in security proceedings with the Tax Ordinance Act (Act, 1997).

The Act on enforcement proceedings in administration includes a catalog of obligations to be performed by the oblige in the event of a specific obligation on it, however, it will not be performed voluntarily within the prescribed period and in a specified manner.

Administrative enforcement may be initiated if the creditor, after the deadline for the obligation to fulfill the obligation, sent him a written warning, containing a call to fulfill his duty with the threat of referral to the way of enforcement proceedings, unless specific provisions state otherwise. Enforcement proceedings can be initiated only after 7 days from the date of delivery of this warning (Act, 1966, art. 15 § 1).

The basis for initiating and carrying out enforcement proceedings is the enforceable title. The definition of this concept is included in art. 776 sentences 2 k.p.c., according to which the enforceable title is an enforceable title provided with an enforcement clause, unless the Act provides otherwise (Dumnicka, 2010, p. 141).

The enforcement title defines the boundaries in which enforcement proceedings can be initiated and carried out. It defines the content and scope of the enforceable enforcement and the person for whom and against whom the execution can be carried out (Marciniak, 2008, p. 111).

The Act of June 17, 1966 on enforcement proceedings in administration determines by means of which means the enforcement authority may claim overdue obligations in an administrative manner. According to art. 1 a point 12 lit. and the law established by means of administrative enforcement in the field of monetary claims are:

- execution from money,
- execution of remuneration for work,
- execution of benefits from pension and social security services, as well as social rent,
- execution from bank accounts,
- execution from other monetary claims,
- enforcement of rights from financial instruments within the meaning of the provisions on trading in financial instruments, recorded on the securities account or other account, and from receivables from the cash account used to service such accounts,
- enforcement of securities not recorded in the securities account,
- execution with a promissory note,
- enforcement of proprietary copyrights and related rights and industrial property rights,
- execution from participation in a limited liability company,
- enforcement of other property rights,
- execution of movable property (Act, 1966, art. 12a).

The division into monetary obligations generates certain consequence. In particular, this applies to the material property of the enforcement authorities.

By virtue of the seizure itself, the enforcement authority becomes entitled to exercise all rights for example, to review documents, request clarifications, and in particular to file an action against the debtor, and subsequently to institute enforcement proceedings (Hauser & Skoczylas, 2012, p. 388).

One of the ways to enforce cash benefits is to collect debts from the debtor's bank account. This method is one of the most commonly used in practice due to its uncomplicated nature and effectiveness (provided that the debtor has cash on the bank account (Sikorski, 2011, p. 11).

For the purposes of this article, an enforcement measure from a bank account will be discussed.

The enforcement authority seizes the receivables from the bank account by sending to the bank a notice of attachment of the debtor's monetary liability to the amount of the enforced monetary claim together with interest due to non-payment of the claim and enforcement cost. The enforcement authority at the same time asks the bank not to make withdrawals from the bank account without the consent of the enforcement authority, but promptly transfer the seized amount to the enforcement authority to cover the enforced debt or notify the enforcement authority, within 7 days of receipt of the request, about the impediment making a payment, including not carrying out the bank account of the obligor (Act, 1966, art. 80 § 1).

The enforcement authority is guided by the choice of the enforcement measure, based on the data available to the tax office, including registered bank accounts belonging to the obligor (Act, 1966, art. 80 § 1).

After receiving the claim, the bank is obliged to block the account of the given customer on behalf of the creditor. Notification about the attachment concerns both the funds that are on the account and those that will only be credited to the account. The bank cannot act on its own on its own, but only on behalf of an authorized enforcement body.

All customer accounts are subject to payment. In the case of attachment issued to a natural person, both the person's bills and bills for business operations are subject to payment. In the case of attachment issued to a legal entity, only the accounts of that entity are subject to retention. In principle, all client deposit accounts are also taken into account. Only the court bailiff has the option of narrowing down the execution to the indicated accounts, but rarely such situations occur, most often all bills are taken.

Statistics show that the number of bank accounts seized in Poland increases every year. In 2017, it was 9,242,645, which accounted for almost twice as much as in 2014, when 4,854,341 locks were made.

Table 1. Number of bank account classes in 2014-2017

YEAR	The impact of cases on bailiffs	Number of classes of bank accounts
2014	5 607 163	4 854 341
2015	7 958 864	5 032 884
2016	4 445 528	5 319 421
2017	4 958 597	9 242 645

Source: (*Przybywa…*, 2018).

There is a derogation from the principle of immediate absorption of the amount to be paid to the enforcement body. The ban on withdrawals from the account resulting from seizure of the bank account receipts without the consent of the enforcement authority does not apply to payments for current remuneration for work and for adjudged alimonies and maintenance payments awarded as damage. Payment for work remuneration may take place after submitting to the bank a copy

of the payroll or other plausible proof, and payment of alimony or maintenance allowance – a title stating the obligation to pay child support or disability pension. The bank pays alimony or annuity to the person entitled to these benefits (Act, 1966, art. 80 § 4). The provision of § 4 shall also apply to personal income tax and social security contributions due from current payout.

At the moment of blocking bank accounts, the entrepreneur may lose his financial liquidity. Financial resources are needed for the smooth running of the company. In such a situation, it becomes necessary to use the legal institution, which is provided by art. 13 upea, according to which the enforcement authority, at the request of the obligor and for the sake of its important interest, may exempt, for a fixed or unlimited period of time, the assets of the obligor in whole or in part. To be able to use this institution, the entrepreneur must meet the conditions contained therein.

In the jurisprudence of administrative courts, it is assumed that the concept of an important obligated interest is a specific general clause, the assessment of which may be made after a detailed explanation of the facts of the case. The existence of an important interest of a party is not determined by its subjective conviction about the existence of the above interest, but by specific and objectified facts that support the application of an exemption from the execution of a given asset. The application of the institution of exemption from the enforcement of certain assets of the obligor should be considered mainly in the light expressed in art. 7 § 2 of the Act on enforcement proceedings in administration, the principle of using the least onerous enforcement measure, which is expressed in the fact that among the envisaged enforcement measures should be used the one that will interfere as little as possible in the rights and freedoms of the oblige. Thus, the application of the exemption from the enforcement of certain assets does not exclude the possibility of conducting administrative execution against the debtor from other assets not covered by this exemption. The use of this institution is only allowed in the situation of the possibility of conducting administrative execution from another property of the obligor. Therefore, it is assumed that by requesting release from enforcement, the obliged party should indicate not only the arguments for positively considering such an application, but also show that the execution and enforcement of the enforced receivables is possible from its other asset. The provision of art. 13 § 1 of the Act on enforcement proceedings in administration is aimed at protecting the interests of both the debtor and the creditor, and therefore the exemption from enforcement cannot lead to a situation in which enforcement will be ineffective[2].

Other assets include, among others: movables, property rights, including shares, stocks and bonds as well as unpaid debts confirmed by invoices that have not been paid by the contractor of the obligor.

4. Conclusion

There is a risk associated with every activity and every economic decision. It is impossible to completely eliminate it. However, knowing the risks associated with the performance of individual tasks, you can not only minimize them, but manage them in a way that uses the right tools to stimulate potential benefits and mitigate adverse effects (Grabowska, 2012, p. 9).

[2] III SA/Łd 1099/15 – Judgement WSA in Łódź (2016/02/04); I SA/Gd 499/15; A similar position was taken by the Courts in: Judgement WSA in Gdańsk (2015/06/09); III SA/Wa 1223/15 – Judgement WSA in Warsaw (2016/02/03).

Lack of familiarity with the tools allowing to avoid financial conditions of risk and traditions associated with the use of risk management systems causes that Polish enterprises still cannot cope with the changing and demanding business environment (Mikołajczyk, 2006, p. 309).

Loss of financial liquidity caused by lack of or delays in payment also translates into the company's image vis-à-vis other contractor.

The fact that the decision of the obligor to use the legal institution, as provided in art. 13 upea, to some extent it will ensure the improvement of the quality of the company's operation without the risk of losing financial liquidity and the company's image.

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Chapter 5

Management Control Development in Knowledge Economy: Financial Statement Assessment Instrument (FSAI)

Svitlana Kuznetsova, Andriy Kuznetsov

1. Introduction

The goal of the business (not company resources) and requirements (specifications) of the environment should be the only constraints of management control because management control must be seen as a means of solving conflicts between the goals and capabilities of the company at any given time.

Targeting each of the developed models of information support of management control should be determined by the general aim of the management as a guideline which is specified in the process of development and implementation of concepts gradually approaching towards a particular goal. In accordance with each guideline of the company a concept, which is the means for achieving goals, is developed.

To choose information support of the management control model which corresponds to the company's mission it is necessary to develop a specific component of the management control of a certain level, the totality of which creates the tree of the management control development, for each target.

The decisive parameter in selecting the model of information support of management control is the determined direction of its overall strategy.

The objective of this study is to create special instrument of management control for employees to fill the gaps mentioned above by realizing limited results of the financial statement analysis theoretical models, which eliminate comprehensive measurement of financial health. This instrument is aimed to design benchmark assessment as an element of management control through determination and investigation of current financial health configuring.

The proposal of this paper is to fill the gaps mentioned above by realizing limited results of the financial statement analysis theoretical models, which eliminate comprehensive measurement of financial health in order to design benchmark assessment as an element of financial statement analysis through determination and investigation of current financial health configuring.

The result of implementation of this assessment instrument must be in finding an answer to the central research question within each observed company: how preferred financial health configuration corresponds with the current one in company? To make this model effective and efficient, it must be determined specific functions, methods, technologies and regulations.

2. Data and methodology

2.1. Functions of Financial Statement Assessment Instrument

The basis for Financial Statement Assessment Instrument should put Organizational Culture Assessment Instrument (OCAI) proposed by Cameron and Quinn (2005, 2011). In support of this choice the following arguments are demonstrated. Firstly, use of OCAI is aimed at profiling organizational culture based on values determined by the designed framework and provides assessment of organizational culture within the four types of organizational values: clan, adhocracy, market, and bureaucracy. Various financial ratios show that similar approach of financial statement analyses are formed by financial values. Therefore, OCAI can be improved in the context of its use for evaluating types of financial health. The authors noted (Cameron & Quinn, 2011, p. 46) that their theoretical model has been developed for the compilation of an idea of the types of culture but it does not purport to be exhaustive description of the phenomenon of culture itself. Secondly, OCAI has several advantages which are crucial for building financial statement analyses model including: practical orientation, timeliness, extent of involvement, access to management, and validity.

Given this scientific background, the FSAI functions can be derived. The information function provides permanent or systematic collection of information about the form of financial health in the company from various sources, its detailed elaboration by components (types of management activities, responsibility centers, and managers), systematization, and grouping, summarizing and providing for the optimization of financial decisions as a whole.

The identification function means identification of the existing current, retrospective and predictive financial configuring, determining their characteristic features, advantages and disadvantages and matching the overall mission of the company.

The warning function involves evaluation of the prerequisites for changes in "financial health" configuration and is aimed at identifying possible risks and threats in the current period and predicting potential crises in the future in the context of compliance of current "financial health" configuration (including corresponding accounts) with the existing ideas and needs of the enterprise.

The directing function is designed to help eliminate identified deficiencies, deviations, existing problems and develop appropriate measures for the relevant detailed profiles, based on the obtained results and evaluation aimed at improving "financial health" configuring.

2.2. Procedure of "financial health" configuration assessment

The symptomatic function involves detection and interpretation of the 'symptoms' of current 'financial health' configuration to determine whether this form is optimal in comparison with the preferred one detailing the relevant profiles.

The various financial ratios could be structured according to different classification criteria (see: Gibson, 1990; Desai et al., 2015; Han & Chen, 2014; Li & Mohanram, 2014; Penman & Penman, 2007; Schmidlin, 2014; Stickney et al., 1990). Given this scientific background, we have summarized these financial ratios to six groups: Liquidity; Profitability; Financial leverage (debt); Valuation and Growth; Activity (Management Efficiency); Coverage. Liquidity ratios are Current Ratio; Acid Test (Quick) Ratio; Cash Ratio. On the other hand Gross Profit Ratio, Return on Sales, Return on Assets and Return on Stockholders' Equity could be identifying as Profitability ratios. Financial leverage (debt) ratios are represented by Debt-Equity Ratio; Equity Ratio; Debt Ratio;

Times Interest Earned. The next group is Valuation and Growth ratios with Earnings per Share; Price-Earnings Ratio; Dividend Pay-out Ratio; Dividend Yield Ratio; Book Value per Share ratios. Activity (Management Efficiency) ratios include Receivable Turnover; Inventory Turnover; Accounts Payable Turnover; Total Asset Turnover. And lust but not list group is Coverage ratios which includes Times interest earned ratio; Fixed charge coverage ratio; Debt service coverage ratio.

Thus, evaluating the Financial Statement Assessment Instrument involves the construction of financial health configuration investigated on the basis of preliminary evaluation of financial points by 24 financial ratios.

The consulting and advisory function of the assessment instrument of "financial health" configuration involves consideration of multiple alternative measures that may be developed to address the problem of the efficiency of "financial health" configuration of the company.

Procedure of "financial health" configuration assessment includes 13 steps:

Step 1. Determining the subjects of evaluation
Step 2. Assessment of current "financial health" by 24 financial ratios
Step 3. Construction of the current "financial health" profiles on current types of "financial health" by 6 classification criteria
Step 4. Interpretation of 6current "financial health" profiles
Step 5. Construction of the current "financial health" configuring
Step 6. Interpretation of current "financial health" configuring
Step 7. Assessment preferred types of "financial health" by 6 classification criteria
Step 8. Construction preferred "financial health" profiles on current types of "financial health" by 6 classification criteria
Step 9. Interpretation 6 desirable "financial health" profiles
Step 10. Construction of preferred "financial health" configuration
Step 11. Interpretation of preferred "financial health" configuration
Step 12. Comparative analysis of the current and preferred "financial health" configuration
Step 13. Evaluation preconditions changing "financial health" configuring

As already mentioned, our Financial Statement assessment instrument is based on the use of the mathematical method of investigation.

To calculate the total of ratings Table 1 has been used. It is necessary to fill separate entries of assessment results for the existing types and separately – for the preferred types of "financial health" configuring.

Table 1. Calculation of ratings for overall Financial Statement Assessment Instrument surveys for each period

The period measured: current/ preferred (cross out unnecessary)
Types of ratios
Liquidity ratios
Profitability ratios
Financial leverage (debt) ratios
Valuation and Growth ratios
Activity (Management Efficiency) ratios
Coverage ratios

Source: own work.

The next step is evaluation of "financial health" configuration to determine the mean estimates for each profile of "financial health" of the company. This step is performed when more than one period has been involved.

It is necessary to conduct a final evaluation of each ratio for their selection. For this analysis, compliance should be made between the actual indicators for a certain period of time of their standard values. Mismatches between actual and standard values may have two reasons for.

Firstly, the deviations can be purely accidental, caused by accidental factors to investigated issues. Secondly, the difference can be substantial, due to the mismatch of the current situation for each financial indicator of its normal value. The consent criterion – lambda should be used to ensure the objectivity of a comprehensive assessment of the financial health (Kolmogorov, 2009). Actual and normative values of the indicators should be compared in the evaluation process. Then consent criterion – lambda is calculated by the following formula:

$$\lambda = \frac{D}{\sqrt{Oqai}} \tag{1}$$

where:
D – maximum value of the accumulated difference between actual and benchmark (or normative, standard) values.

The probability of proximity between the actual and benchmark values for different values of consent criterion (lambda) is determined by using a specially designed table (Kolmogorov, 2009).

3. Building of "financial health" profiles by different classification criteria

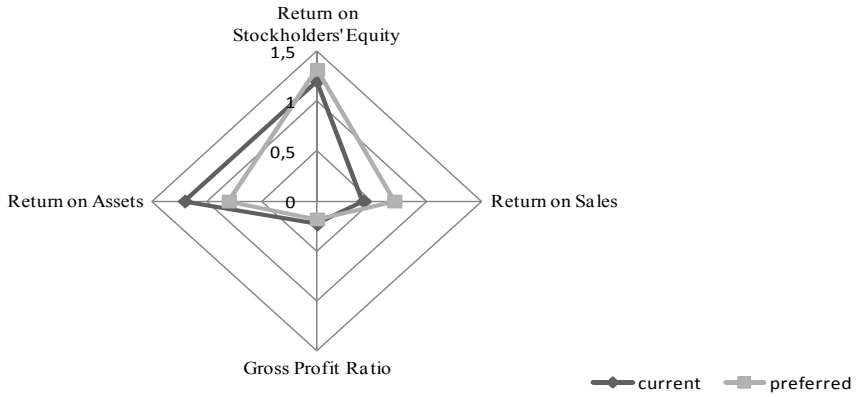
3.1. Procedure of "financial health" configuration assessment quantitatively and graphically

Based on the obtained results the profiles of "financial health" are built as polyhedrons (see the example in Fig. 1) by 6 classification criteria (Liquidity; Profitability; Financial leverage (debt); Valuation and Growth; Activity (Management Efficiency); Coverage).

The number of corners of each profile corresponds to the number of alternative types of "financial health" for each financial point. The form of polygons is determined by combining the results of general line of estimates indicated on the diagonals. The solid line represents the current profile of "financial health" in the company, and the dotted line represents the preferred one for the companies.

As a result of the use of the FSAI the company receives 12 profiles of "financial health" (6 current and 6 preferred ones).

Figure 1. Example of current and preferred "financial health" profiles by Profitability



Source: own work.

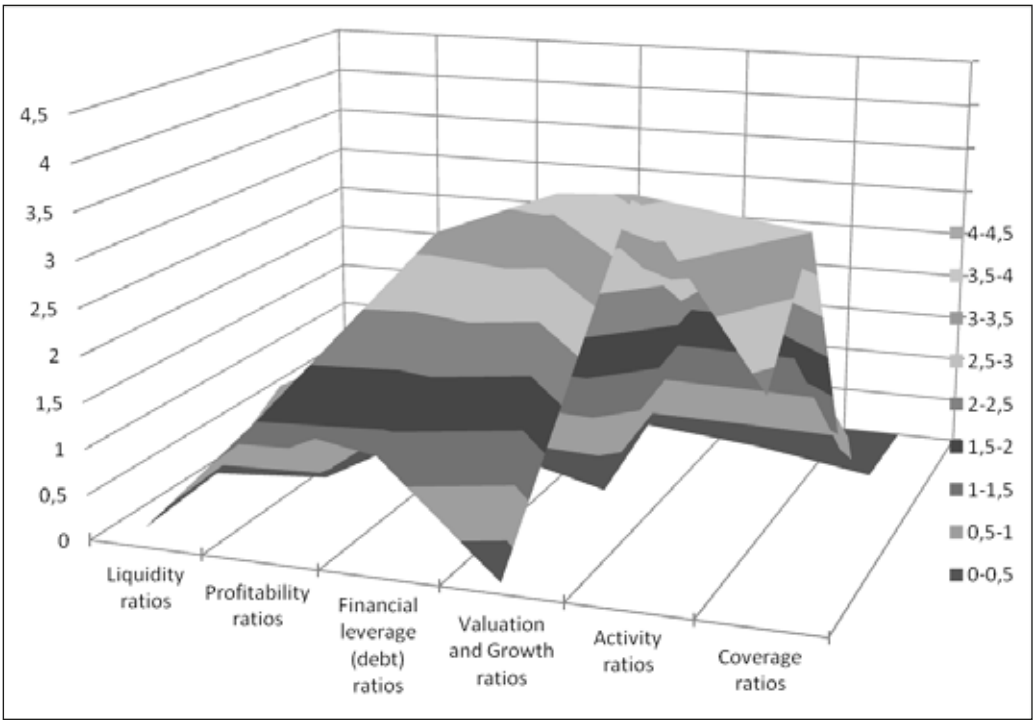
Based on the profiles of "financial health" by different financial points "financial health" configuration of the enterprise is built, which can be presented quantitatively in Table and graphically depicted in three dimensions, every corner of which corresponds to a defined sign of "financial health" of the studied enterprise.

The form of polygons is determined by combining the results of the general line of estimates indicated on the diagonals. By the scale Z (height) the value of rating assessments for each of the alternatives is depicted in the normalized order. In case of three-dimensional image "financial health" configuration can be schematically represented as Figure 2.

For a comparative analysis of the existing base and "financial health" configuration at the enterprise it is necessary to make two tables of parameters for "financial health" configuration by the designed FSAI and builds separate figures for the present and preferred "financial health" configuration for the investigated company.

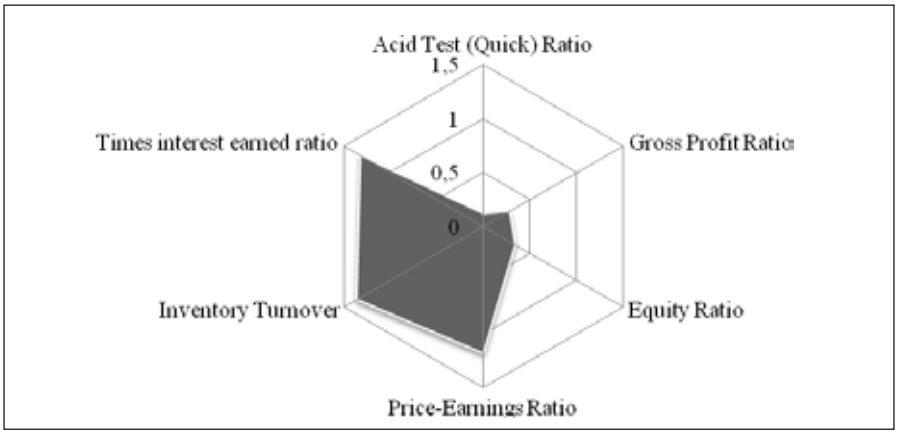
At the final stage prerequisites for changing "financial health" configuration are estimated. For this purpose, it is advisable to use two pyramids with six corners: dominant types of "financial health" in the company by 6 classification criteria and preferred domination whose example is presented in Figure 3.

Figure 2. The model of "financial health" configuration by the designed FSAI



Source: own work.

Figure 3. Example of dominant types of "financial health" set in the company by the designed FSAI



Source: own work.

Using the designed FSAI provides visual information base for decision-making on reformatting "financial health" configuration taking into account evaluation of the existing forms and determining tendencies of its development.

4. Conclusion

The objective of this study was to create special instrument of financial statement analysis to fill the gaps mentioned above by realizing limited results of the financial statement analysis theoretical models, which eliminate comprehensive measurement of financial health. This instrument is aimed to design benchmark assessment as an element of financial statement analysis through determination and investigation of current financial health configuring.

Designed model of "financial health" configuration is directed to understand how preferred "financial health" configuration corresponds with the current one. More specifically, we developed the instrument for assessment of financial statement to close the gap between both current and preferred "financial health" in companies, particularly through visual assessment.

The designed FSAI involves the construction of "financial health" configuration of the investigated companies and is aimed at performing 6 functions (information, identification, warning, directing, symptomatic, consulting and advisory).

Our study was directed at the systematic analyses of various financial ratios in six groups: Liquidity; Profitability; Financial leverage (debt); Valuation and Growth; Activity (Management Efficiency); Coverage. It is give possibility to build "financial health" configuration for company quantitatively and graphically. As a result, we show that current "financial health" is relatively weak and weak points are outlined to close the gap between both current and preferred "financial health" configuration in the companies.

This analysis could include compliance between the actual indicators for a certain period of time of their benchmark (or normative, standard) values too. In this case, the consent criterion – lambda is proposed to use. It is way to ensure the objectivity of a comprehensive assessment of the financial health. Actual and normative values of the indicators are compared in the evaluation process.

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PART II

SOCIETY

Chapter 6

Possible Improvements in Information Management Processes in C2A Relations[1]

Michał Teczke

1. Introduction

The problem area of information management is increasingly becoming a key matter not only to entrepreneurs interested in efficient and effective management of their enterprise, but also practically to each inhabitant of the world. Effective competition on the dynamically changing market is more and more dependent on the possessed information resources. Since the functioning of contemporary organizations is more and more determined by the quality of information processes (Nowicki & Sitarska, 2010) it can be assumed that information (like knowledge) in today's times is treated as capital and one of the most important "engines" driving the organization's actions. "In a dynamic environment only these organizations that quickly learn and create organizational knowledge can survive and effectively compete. The boundaries between processing information and creating knowledge become increasingly blurred, the reason being continuous technical progress in information technologies. Information technologies significantly support creation of knowledge" (Stonehouse et al., 2001, p. 87).

The main goal of the study is to try to find possible improvements in the processes of information management in the consumer-administration relations (C2A). The contemporary system of information connections is extremely complex and spreads between simple messages, private conversations (including those running through modern media) and a network of global relations between national economies, the financial system and big business. The breakthrough being the digitization of content transfer started along with the inception of the Internet and has been going on until now. Contemporary media are able to report live all significant events and provide content to each user within their range of action. Information flow is the foundation for creation of knowledge, which itself is a broader category than information, but at the same time is inseparably connected with it. While in the initial phase of the information revolution information stream flows were focused mainly on creating additional value for companies' commercial operations, presently it can be noticed that modern technologies are used to support communication and facilitate relations established between customers (often citizens) and government administration entities.

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It is beyond doubt that modern technologies are able to significantly streamline a number of actions performed by citizens in various types of offices. On the one hand, such actions allow time savings both to officials and citizens, on the other hand, they increase the effectiveness of performing statutory obligations imposed on the government offices. Building databases about citizens is also of considerable importance, as they can store all official procedures, applied towards a specific user of the administrative apparatus. As it can be easily imagined, the development of a modern information system supporting C2A relation (consumer/citizen to administration) should be treated with due attention by the central authorities. The development of information technologies and data communication is also consistent with the policy of the European Union, in particular with the strategy of the digital single market which includes direct reference to support for the development of e-administration and digital public services.

2. Contemporary view on information management – theoretical approach

The deliberations regarding the possibilities of improving information management processes should begin with a precise definition of information. From the etymological point of view, the term information comes from Latin and, as Kieżun (1997) claims, means in common speech "message". One of the first researchers who examined the subject area of the theory of information was Shannon, however his deliberations were applicable to the stream of data communication and cybernetics. As claimed by Abramson (1969, p. 11) "The beginnings of the theory of information date back to the publication by Claude E. Shannon in Bell System Technical Journal in 1948. Shannon, perhaps being aware of the possibly misleading sense of the word "information", assigned to his work the title: Mathematical theory of telecommunication. using the word "information" in the colloquial sense, it may be said that Shannon's work applies rather to transfer of signals conveying information, rather than information as such. This work applies rather to telecommunications and telecommunication means than the hardly captured final outcome of telecommunication being information". Mazur (1970), in the work "Qualitative theory of information", noticed that in terms of the method of treating the term "information" three groups of publications can be distinguished in the subject literature:

- Publications in which the amount of information is simply called "information" e.g. in such expressions as "the greatest information",
- The second group are publications the authors of which use the phrase "information" without any additional explanations, in such expressions as "transferring information", "information included in the set of symbols" etc., as if they assumed that the term does not raise doubts,
- The last group are publications the authors of which try to explain somehow to the readers what should be considered information in their opinion. Some of them are limited to a few sentences explaining "information" by other terms (with equally vague sense) as "message", "content" or "communication". The others conduct discussions on different aspects of information, compare various authors' views to finally present the case as open and allow the recipients to develop their own view in the maze of ambiguities and controversies.

Most today's researchers believe that it has not been possible to clearly define the notion "information" so as to entirely exhaust all its characteristics. It is among others caused by the fact that the term "information" itself was in common use already before the introduction of Shannon's theory of information and seemed fully understandable. This resulted from the fact that this notion was used in specifically defined and relatively few situations such as providing guidelines, or giving

warnings in interpersonal relations. As a result, it was not necessary to think what "information" is and what is not or when it is possible to use the term and when not. Another important factor contributing to vagueness of the term "information" is the fact that this notion is now commonly used in various meanings depending on the context. First, in the meaning "reflection of what exists in the material sense" (reflection relation), second, as an element determining "future things and phenomena" (Olejniczak, 1989). An overview of selected definitions and the context they are embedded in have been presented in Table1.

Table 1. Selected definitions of information

Definition	Source/Author	Context
Message, rumor, novelty, communicated thing, notice, communication; warning, notification, communication about something; data (...)	www.slownik-online.pl/kopaliński	Reflection relation
Element of knowledge communicated, transferred to someone by means of language or another code; also what may deliver some knowledge in the given situation; message, communication, guideline	Dictionary of the contemporary Polish language 1998	
Iinformatio [Latin] image, explanation, notice – property attributable to a material information carrier (known as signal), the essence of which is uncertainty reduction; popularly: ascertainment of the state of affairs, message	(*Wielka Encyklopedia PWN*, 2002)	
Meaning (content) that by means of appropriate convention is assigned to data, i.e. numbers, facts, notions or commands phrased in a way convenient to be sent, interpreted or processed	Polish Standard 1971	
Name of content taken from the external world in the process of our adaptation to it and the adaptation of our senses to it (...) information is information, and not energy or matter	(Wiener, 1961, p. 24)	
Name of the content of sensual and mental experience of a person	(Ciborowski, 2005, p. 32)	
Content with a specific meaning about something, for someone and because of something, expressed by language and/or non-language signs	(Lyons, 1984, p. 60)	
Type of resources which allows our knowledge to be expanded about ourselves and the surrounding world	(Kisielnicki, & Sroka, 2005, p. 13)	Performing relation
Properties of the signal or message consisting in reducing vagueness with regard to the state of a situation or its further development	(Gackowski, 1974, p. 37)	
Content taken from the external world which increases knowledge or reduces ignorance of the decision maker, uncertainty and vagueness of the decision-making situation	(Wierzbicki, 1981, p. 9)	
Data about business processes and phenomena, used in the decision-making process	(Mesner, 1971, p. 10)	

Source: (Czekaj, 2012, p. 14).

To sum up the discussion about the term "information" one cannot ignore the role of psyche, after all being the exclusive characteristic of thinking creatures. When this role is ignored, the whole problem becomes only a fragment of a greater whole. When it is taken into account, the term becomes unclear. How can information processes realized between machines be analysed (and they are the basic component of digitization mentioned in these deliberations) from the point of view of such notions as "content", "sense" or "meaning"? Another question which also is difficult to be clearly answered is the question whether these notions are clear and precise towards the man? It seems that problems in interpretation would at least be the same as for "information".

The modern approach to the problems of information management, treating this aspect of business operations as one that should allow a knowledge resource to be created, being helpful in pursuing the company's goals, creating business strategy and strengthening the company's position and competitive advantage (Malara & Rzęchowski, 2011 p. 11) is not fully reflected in the case of public administration organizations. For obvious reasons, the problem area of maintaining the market position or competitive advantage does not have such importance for these organizations as for companies functioning under the conditions of market competition. Closer, in terms of the meaning, may be deliberations with regard to the third sector. As indicated by Dąbrowski (2013, p. 9) these organizations should master efficient data collection and data processing, and only after that perform information management in order to achieve a higher level of development, being knowledge management and building a learning organization. Without it, the organizations will not be able to effectively operate and fulfill their positive role in the society. A broader definition is proposed by Choo recognizing that information management is a cycle of processes that support organizational learning: identification of information needs, acquisition of information, organization and storage of information, development of information products, distribution of information and its use (Zygała, 2007, p. 45). As noticed by Rybińska (2005), in the created model Choo presents the information management process as a cycle of six internally related actions:

- identification of information needs namely identification of changes taking place in the environment and search for necessary information for decision making and problem solving,
- acquisition of information is controlled by information needs and must adequately address these needs,
- organization and storage of information, building an active repository of organizational knowledge and expertise,
- development of information products and services intended for various groups of users and information needs in the organization,
- distribution of information, its purpose is to increase the number of information users, because information sharing is a catalyst for information learning,
- information is used at the time of:
  - creating knowledge,
  - applying knowledge,
  - interpreting knowledge,
  - forming the decision.

However, in order to effectively introduce the whole cycle to the organization, it is necessary to use proper IT tools supporting the information management process. It should be emphasized that they must be regarded solely as a supporting element in the operations of administration bodies. Technology cannot fully replace the commitment of employees or the company's organizational

culture. However, digitization is the only reasonable way to improve the effectiveness of operations of administration bodies and increase citizen commitment e.g. to participate in local initiatives.

3. Digitization as a determinant of improved quality of C2A relations. Search for areas of potential improvements

The conviction that the Polish administration, both on the local and central level, should use modern information and communication technologies much more than now is fully justified. In this context reference usually is made to digitization or IT introduction to the public administration. The key to understanding what is the true transformation of the traditional administration into electronic administration is awareness of the effects of dematerialization of information, namely changing its form from paper to electronic, on the administration organization and the way it operates (Cellary, 2007a). In administration, the formal information is a document. In fact, administration is a machine the role of which in the operational layer is production and processing of documents: permits, decisions, rulings, notifications, confirmations, explanations, certificates, etc. The administrative machine is activated by a document, for example an application, and the result of its operations is a document, for example a decision. Document, being the result of operations of administration bodies, results in specific socio-economic effects (Cellary, 2007b). The essence of digitization of public administration will therefore be conversion of the circulation of paper documents into their digital equivalents. As a result of using appropriate security and authorization mechanisms, the system users (citizens) will be able to perform the major part of communication with competent offices without going away from their household computers or proper portable devices.

In 2016, the Ministry of Digitization presented a program of integrated introduction of information technologies to the state, a significant part of which was devoted to making the process of information flow between the administrative offices themselves and between citizens and offices more efficient. The sources of digitization activities were documents which were to activate projects performed by member states. "Europe 2020 strategies" was identified as the basic document which, among 7 leading initiatives, contained also among others "European Digital Agenda" and "Innovation Union". The Program was additionally detailed in 2015, when the European Commission published the new key European strategy being Digital Single Market (Digital Single Market, DSM). As part of the strategy, initiatives were presented to make the European Union an integrated digital economic area, capable of competing on the global digital market. This strategy has three pillars, consisting of an extensive list of actions, the most important including:

- Better access of consumers and companies to digital products and services.
- Creating proper conditions for development of digital networks and services.
- Development of the European digital economy and the digital society with long-term growth potential.

The executive document in the electronic administration area is the new Action Plan, programmed for the years 2016-2020. The purpose of the document is to remove existing digital barriers, create a single digital market and prevent fragmentation which took place in connection with modernization of public administration systems. The EU Action Plan for electronic administration is supposed to combine the expenses of European and domestic institutions. While the member states pursue their own strategies and tasks, the Action Plan determines, based on

the common long-term concept, a number of principles to be followed under future initiatives. As a result, electronic administration may bring significant benefits to companies, citizens and the public administration systems themselves (Program of Integrated Introduction of Information Technologies to the State, PZIP 2016).

When thinking about the level of our country's digitization, it is necessary to remember the development difference separating us from the Western European countries. Delays caused by the political and economic situation prevailing in Poland until 1989 and the later problems related to adjustment of the economic system to the requirements of the European Union have not allowed a sufficiently fast reduction in the distance between Poland to the countries of the "Old European Union". A similar opinion about this topic is expressed by Doktorowicz (2005) claiming that when EU implemented the eEuropa initiative, Poland was in a completely different position at the time. The basic difference consisted in that the process of introducing information technologies to the country had only just begun. In other words, it may be said that the Western Europe countries already had and had to modernize at most the data communications infrastructure necessary for development of the information society, while such network in Poland had to be created practically from scratch.

The program of integrated introduction of information technologies to the state recommends many areas in the scope of e-administration, in which significant steps have already been taken, and research has been conducted, based on which the services can be specified that seem to be most urgent from the point of view of citizens in terms of implementation. The results of research conducted in 2012 indicate that for 89% of the surveyed persons Internet access to job offers, including Employment Agencies' databases (A), is important or rather important. For 81% of the participants of the research, very important is the possibility to arrange a doctor's visit online/by e-mail. Other areas very important for the web users are: Internet access to their health history/diseases (77%), possibility for parents to contact the school online (74%) or online participation in social consultations concerning laws, regulations and resolutions of local governments (62%). The increasing need to use the available public resources can be noticed. The importance of online access to library catalogs is declared by 75%, a similar percentage of those surveyed regarded as important access to any information, data, reports, etc. Full research results are presented in Table 2.

Table 2. Answers the question: "How important for you are the following matters?"

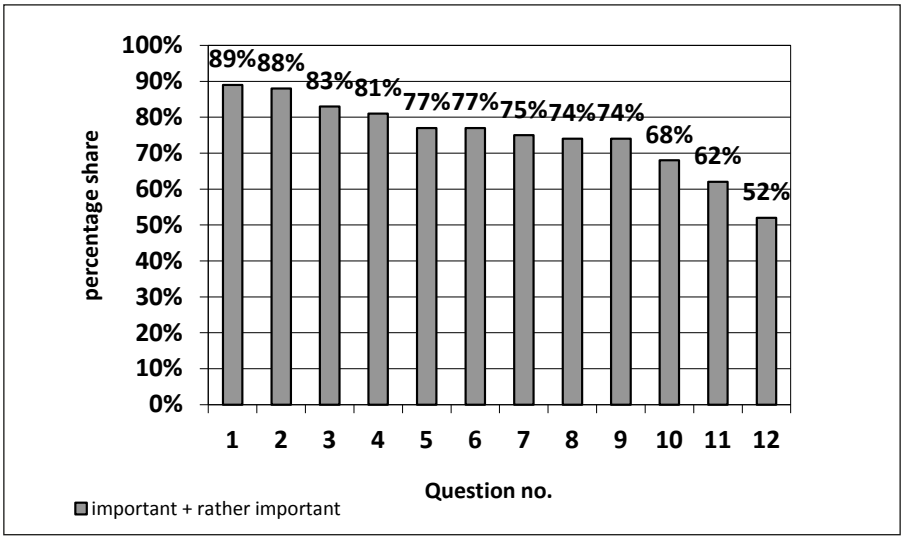
Question:		Percentage share of answers				
		Important	**Rather important**	**Rather unimportant**	**Unimportant**	**Don't know**
1	Online access to job offers	57	32	3	2	6
2	Online access to information about consumer rights	46	42	2	1	8
3	Possibility to perform remote work	45	38	4	2	10
4	Online arrangement of a visit to the doctor	47	34	6	3	10
5	Possession of one document with a chip (replacing ID, transport tickets, ID cards, health booklet and other)	48	30	5	4	14

6	Online access to one's disease history	42	35	6	3	13
7	Online access to library catalogs	36	39	7	3	15
8	Possibility for parents to contact the school online (e.g. virtual class register)	41	33	7	6	14
9	Online access to reports, information and statistical data published by state offices and institutions	33	40	7	3	17
10	Online voting in elections	35	32	10	7	15
11	Online participation in social consultations concerning	25	37	11	5	22
12	Watching collections of museums and galleries online	18	33	17	6	25

Source: author's own study on the basis of: e-administration in the eyes of web users – 2012 (access 05.05.2018).

The summary percentage of answers important and rather important has been presented in Figure 1.

Figure 1. Share of answers important + very important (2012)

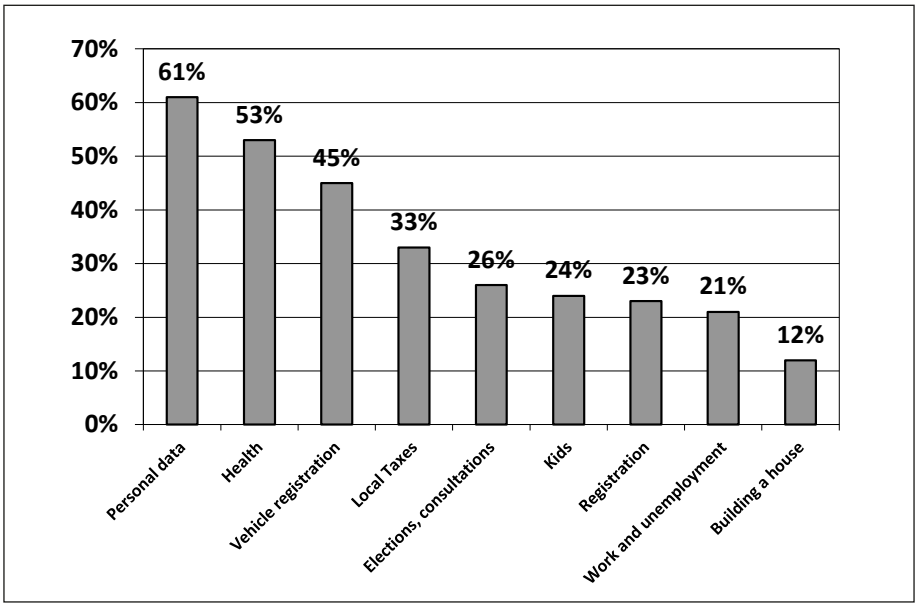


Source: author's own study on the basis of: e-administration in the eyes of web users – 2012 (access 05.05.2018).

The presented research results may seem slightly surprising. According to the respondents, the most important public administration areas which they would like to have online access to are

those related to looking for a job and health care. While health care very often occupies a high place in the lists of social needs, free access to job offers can be thought-provoking and should be analyzed particularly from the perspective of the research carried out in 2016. In the report E-administration in the eyes of web users (2016), the most important type of matters which the respondents would like to handle online included the possibility of online implementation of the procedures related to issuing or replacement of documents (passports, driving licenses, personal ID cards), this answer was indicated by 61% of the respondents, the second position were matters related to health (arrangement of a visit to the doctor and electronic prescriptions) 53%, while the third place, according to the respondents, was the possibility to handle matters related to vehicle registration (registration documents, vehicle sale reports, duplicate documents, validation tags and other) 45%. Further positions were occupied by matters related to local taxes (e.g. real estate taxes) 33%, participation in elections and possibility to hold consultations on-line 26%, matters related to parental duties (registration of giving birth to a child, applications for child birth benefit, applications to nurseries, kindergartens and schools) 24%, address registration matters 23%, work and unemployment (including sickness benefits) 21% and the possibility to handle formalities related to house construction (determination of building conditions, obtaining the building permit, notification of the beginning and end of construction). The full distribution of citizens' expectations from the 2016 research has been presented in Figure 2.

Figure 2. Most important expectations of e-administration (2016)



Source: (*Raport*..., 2016).

As underlined, the results presented in the reports from 2102 and 2016 cannot be the basis for a direct comparison. The research projects differ in methodological terms, the questions asked to the respondents were different and some of the questions appeared only in one of the two reports. In spite of the indicated problems, some general conclusions can be drawn from the two research

projects. Special attention should be paid to quite a considerable decrease in interest in solutions concerning work and unemployment. In the first research the respondents assessed it as the second most important problem, while in the second research only the matters related to house construction were regarded as less significant. It is difficult, without an extremely detailed analysis, to indicate the cause for such changes. In the first place it can be verified whether, in the period of the first and the second research project, there was any considerable difference in the number of job-seekers. On the basis of the data concerning registered unemployment between 1990-2018 presented by the Central Statistical Office (2018)[2] in January 2016 the unemployment rate was 10.2% while in July 2016 it was lower, being 8.5%. The difference is noticeable and may be the reason for such an express difference in respondents' opinions. However, without a thorough investigation, it is impossible to draw unambiguous conclusions. From the point of view of public activity, we can be happy with a relatively high rank of the matters related to taxes and the possibility to participate in national and local elections and referendums.

4. Conclusion

To sum up the presented considerations, it should be strongly emphasized that the subject matter is very extensive and cannot be fully discussed in a single paper The more so, the addressed topic seems to be significant from the point of development of both the civil society and research on the possible improvements in consumer (citizen) administration relations. Despite the fact that Poland has made very significant progress in digitization of the country, still, as compared to European Union member states, we are closer to outsiders than leaders in respective reports. In the report The State of Data Innovationin The EU (2018) Poland was ranked 20th among the analyzed 28 countries. The leaders of this ranking are Denmark, Finland and the Netherlands. When looking for a comparative point, it can be compared how Poland looks in comparison to countries which joined the Union on 1 May 2004 along with Poland. From among those countries, the highest place in the list is held by Estonia (6), followed by Malta (9) Lithuania (15) Slovenia (17) Latvia (18) Slovakia (19) Czech Republic (22) Hungary (26) and Cyprus (28). There is no denying that we look like rather weak in the list, also when compared to the countries with technological underdevelopment similar to Poland's. Construction of a digitization network supporting information flow between the administration and the citizen should be a priority for persons holding power. Without further investments and actions informing citizens about their possibilities, any improvement in information management processes in C2A relations will not be possible.

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[2] Data can be found at: http://stat.gov.pl/obszary-tematyczne/rynek-pracy/bezrobocie-rejestrowane/stopa-bezrobocia-rejestrowanego-w-latach-1990-2018,4,1.html.

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Chapter 7

The Society of Things – A Novel Approach to Social Role of Interactive Objects[1]

Paweł Wołoszyn, Przemysław Płyś, Jacek Wołoszyn

1. Introduction

Current trends in the development of information technology, digital electronics and telecommunications are focused on the development of interactive systems communicating with the means of computer networks. These systems are becoming smaller, simpler and inexpensive, without losing access to opportunities resulting from belonging to the global Internet and services offered by it. Instead of creating a separate world of simple devices limited in their capabilities, the current world of full-sized computers expands to include also the simplest devices. This approach underlies the concept of the Internet of Things, in which these Things become more and more diverse and reach further into the everyday life of people (Gubbi et al., 2013). The paper presents detailed analysis how interconnected devices of "Internet of Things" need to be considered as a Society of Things which enriches human society.

The Internet of Things (IoT) is typically seen as a highly technical conceptof devices connected to the Internet, collecting and serving data from different type of sensors and the ability to interact with devices. IoT is closely related to computer science and modern technology. Nevertheless, the impact of IoT on the society, economy and human culture is very prominent, especially because it is the man who is the owner or user of things that become part of the Internet. It is not only computers, industrial machines or specialized automatons that become nodes of the global network, but it also includes everyday objects, furniture, buildings, merchandise or toys. IoT not only affects the Information Technology (IT) sphere – although it obviously has a very strong influence on the direction and dynamics of its development – but at the same time the impact extends in the opposite direction, towards the human being.

Undoubtedly, the rapid development of cyber-physical systems, characteristic of the new Economy 4.0 model, creates completely new challenges for both industry, technical and engineering sciences as well as the economy of production and services. At the same time, IoT also poses a challenge for the man himself and his culture and society (Roblek, Meško & Krapež, 2016). Human

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civilization has developed as a result of clever use of objects and tools that have always played the role of servants to man. Now, however, material objects gain autonomy that they have never had before. It may, on the one hand, create completely new, previously unknown risks and threats, but on the other, provide chances and opportunities for human societies to develop even more.

In order to balance opportunities and threats, a wider and more holistic approach to the Internet of Things and its role in the everyday life is needed. So far, many concepts and more or less formal IoT approaches have been created, focused mainly on the technological and network layer, treating things as members of a parallel community existing besides people (Camarinha-Matos et al., 2013). In this paper we propose a different approach. We focus on the possibilities of engaging interactive and interconnected things in the development and support of human society. This means restoring the servile role of material objects in the lives of people, the community and the entire civilization – a role enriched by new abilities of communication, observation and influencing the environment.

2. Things in human society

Human society and the whole civilization are associated with material things from the very beginning. Some animals can use objects as tools or at least use them as a material for building structures such as nests or lairs. However, it was only man who gained the ability of creative use of material objects, unprecedented in evolution. At the beginning it was just a simple use of branches, bones or stones as primitive tools. After that, people learned how to shape and work items and give them desirable traits, such as sharpening of edges. And later, they gained the ability to create completely new objects, entirely created through artificial processes not occurring naturally in nature (Brown et al., 2009). The production of metal tools is a good example.

In this way, civilization based on things gradually developed, where things not only began to fulfill useful roles, but even gained their own special status complementing the status of the people themselves (Meskell, 2015). Material items augmented humble traits of the human body. Tangible objects provided security and protection. Things were the carrier of information, knowledge, truth and trust. They provided opportunities to observe, study and learn. Things have also become a way of expressing feelings and emotions, turning into the subject of admiration and the foundation of human culture and art. Man has become a designer and creator of things actively shaping his surroundings in a way that is not found anywhere else in nature.

However, simultaneously with the development of civilization, there were also developed economic systems, in which things began to play an increasingly important role. The concept of private property was created, which dominated the society and set a reference point for culture and legal order. The material world ceased to be an objectively available resource and the surrounding reality, and instead it became the object of production and trade. Things have ceased to be seen as human products and have become mere commodities that meet the needs of consumers. The component of human work and commitment was detached from its material result (Fuchs, 2018).

Things became more and more private and began to serve only their owners and not the whole society. What's more, ownership has become more important than use. Even if a thing is unnecessary and unused by someone, it still remains ones private property, which no one else can use. Such ineffective allocation of goods causes the need for excessive production and becomes the basis for many negative phenomena in economic systems. However, the most important effect from the point of view of this article is breaking the relationship between things and the whole society

and replacing it with relationships between things and single individuals. In modern society, things have very limited participation in building social bonds.

It is worth noting that this is not a completely irreversible effect, as there are tendencies to return to previous socio-economic models that have been functioning for centuries, based on shared ownership and shared use. The trend of sharing economy places strong emphasis on preferring access to things and resources and the ability to use them instead of possessing them. This trend is more oriented towards the social aspect of human nature and allows to feel the participation in building the society afresh – a feeling difficult to experience in commodity-oriented systems, where social ties are treated mainly as prerequisites not requiring maintenance.

Sharing economy allows people to meet anew on the occasion of creating, transferring, using and managing things. What.s more, this approach allows to reduce cost and impact on the society and its environment, while at the same time providing better satisfaction of needs and access to services. These effects can be beneficial from the point of view of the entire society, although from the perspective of individuals and companies, who sell products and services, this of course can be seen as a loss and a threat (Martin, 2016).

3. The digital era

The development of the idea of sharing economy in contemporary economic systems would not be practically possible without the participation of digital technology (Liao, Li & Chen, 2017). It is an interesting observation that the same technological development, that led to the emergence of new methods of mechanized production and detachment of goods from their producers, after subsequent decades of progress has opened the way to returning to shared use of goods, albeit in completely different reality and with entirely new technical means.

The transition to the digital age was associated with the emergence of technology allowing for free exploration of a completely new dimension in the history of human civilization: the dimension of data. The digital age is marked by dominance of information over matter, as in the information society the data and resulting information has become a good analogous to traditional physical commodities. Analogously to the industrial revolution, when the introduction of mass production machines caused separation of things from human physical labor, in the digital revolution the emergence of data processing machines leads to separating information from human intellectual work (Leonhard & von Kospoth, 2017).

Observing, acquiring, processing and transferring information was earlier the domain of humans and served to build social bonds, without which efficient flow and use of data would not be possible. The invention of electronic computer, and then another invention of computer network, made it possible to generate and exchange information as if it was a material resource mass-produced without participation of humans. Once again, technological development has brought, at least initially, the danger of society erosion.

After the advent of digital age, intangible things began to compete with material objects. The process of virtualizing successive areas of reality began, and real things were gradually replaced by their digital counterparts retaining partial similarity and simulated properties of the originals. This can be seen clearly especially in such areas as media, entertainment or computer games. Digital metaphors have also replaced such tangible activities as writing letters, shopping or attendance at school.

Digital equivalents of material things are more abstract and therefore more universal. They can be parameterized and customized, and the illusion of their realism can be created using general-purpose devices. This means that a multitude of diverse virtualized things can be simulated using but one real object. In this way, hyper-things are created, such as a smartphone which can simultaneously imitate dozens of everyday objects, and still gain new applications.

It could be predicted that the development of digital technology will reduce the need to use material things and replace them with their virtual counterparts (Rose, 2014). However, the actual direction turned out to be different. Computer technology is becoming cheaper and more available in an embedded form, therefore it is possible to create more and more specialized interactive and intelligent things, which are separate material and not virtual entities. Thus the idea of the Internet of Things has developed, which will be considered in the next section.

It is significant that it was the digital revolution that made it possible to return to the practice of sharing resources, with the difference that in the digital age, intangible data resources and computational processes are shared instead of material things. Data, unlike physical resources, can be easily copied, duplicated and made available to a wide group of people. The culture of sharing software and data began to develop even before the Internet was created and initially included a small group of IT specialists. At present, it is difficult to imagine a modern society without free and open software, free services and publicly available data repositories.

It is this very model of computer science based on shared and open access that allows to develop an analogous model of sharing material goods (Hamari, Sjöklint & Ukkonen, 2016). The sharing economy is not limited to free and open access to data, information, algorithms and software, but goes beyond the digital world. Thanks to social media, mobile applications, information exchange systems, cooperation and coordination of team activities, people can share food, work, entertainment opportunities, shopping promotions, a place in the car or even a home.

4. The Internet of Things

The development of the world of digital technology in relation to material things is two-fold. On the one hand, as already mentioned above, material things have become the attention focus of digital systems, which are no longer limited to processing numerical data, as it was at the beginning of the digital age. On the other hand, material objects themselves gain participation in the digital world, because they are equipped with active digital components and connected to the global Internet (Holler et al., 2014).

The Internet of Things is the result of such a two-way progress. This is qualitatively novel direction, because before one could get the impression that the development of civilization will be focused on virtualization, abstraction and pure information. Currently, however, as the process of the fourth industrial revolution is taking place, it turns out that the combination of both worlds, digital and material, brings positive effects and opens up new possibilities for control and optimization in the industry. Cyber-physical systems are an example of such a dual reality, in which parallel processes take place simultaneously on both the physical side, where material products are created, and digital, where decisions are made.

Both domains, digital and physical, are not equal and the Internet of Things can be treated not so much as the unification of these domains, but rather as an attempt to strengthen one of them by using the opportunities offered by the other. For example, the digital world can gain even more

data sources by recording data from sensors placed in objects. From this perspective it seems like colonization of new areas by digital systems. On the other hand, highly interactive objects can get the opportunity of domination over other goods thanks to the exploitation of the information world accessed through digital interfaces.

Although these two visions bear clear signs of anthropomorphic approach to objects or systems – the colonization or exploitation of a territory is rather a human trait – it is justified, however, given that both domains are backed by people represented by their capital, enterprises and social groups. Sometimes these are even the same organizations operating simultaneously in the digital and material world. Obtaining an advantage or strengthening a position means a tangible benefit and profit for each party.

Among these opening opportunities, a natural question arises, which component of the world, material or digital, is more important? Should the Internet of Things be more focused on the Internet or on the Things? The answer depends on the assumed reference point. In our opinion, it is necessary to recognize man himself as such a reference point because it is human being who is the ultimate subject and user of both material and non-material goods.

Recognition of man as the most important element of the systems emerging as a result of the fourth industrial revolution is not quite obvious. With the current direction of development, it can be seen that things connect with each other in order to even more efficiently produce or manage things or data – while human beings, apart from some consumer conveniences, do not gain apparent qualitative benefits. Material objects and their digital counterparts begin to function more and more on their own, sometimes for the benefit of the user, and sometimes even omitting it.

It seems, therefore, that the development of the Internet of Things and intelligent industry brings similar threats as previous industrial revolutions. As a result of ever-progressing automation of industrial processes, material goods can begin to produce themselves without human intervention. The value of human labor will be smaller and smaller, and the relationship of people with the objects they produce will become weaker (Rifkin, 2014). However, such a scenario can be counterbalanced by putting emphasis on building social ties between people by participation in the process of shared use of already produced goods. The concept of Society of Things described below can help to achieve this goal.

5. Human-centered Society of Things

The key message of the proposed approach can be expressed simply: the development of the Internet of Things should benefit neither the Internet nor the things, but the human society. It is the same society that has built a civilization that technology is the product of, and so it seems reasonable to expect the technology to serve this very society. At the moment, however, one can have a different impression resulting from the observation of dominant IoT applications, which are focused either on industrial operations or on an individual customer of a larger enterprise.

Society is more than just the sum of individual members of a population living in the same place and time. Society is primarily a complexity of multidimensional relationships between these individual people. Currently, the popularized applications of IoT strengthen the relation between the consumer and the producer of goods, enhance goods production and distribution, or optimize the operation of enterprises (Mattern & Floerkemeier, 2010). If society at all benefits from IoT

applications, these are rather systemic effects, for example on the environment, public transport, quality of life and health or education, but not on social relations.

People are material beings and thus material objects also belong to the broadly understood society (Schillmeier, 2009). This creates a good opportunity to use digital interactions between things to strengthen and develop interpersonal relationships. However, this means the need to overcome the current trend in IoT, which favors the merging of things into their own, hermetic communities that exist independently of people and treat people as irrelevant surroundings or at most users, as for example in (Karimova, Shirkhanbeik & Alvares, 2015). Another example is an ambient assisted living system based on IoT solutions that is itself a community of devices and subsystems, and for which people are only data sources and additional control parameters (Dohr et al., 2010).

Yet interactive things can change their model of action assuming that people are exactly at the focus of attention, and that things belong to them and serve them. It would be equivalent, in a sense, to returning to the primary state of civilization, but no sooner than after completing a long cycle of technological development enabling such a return. Interactions between material things would then build relationships between people again and not only be limited to enriching the things themselves.

In this way it could be possible to overcome the detrimental tendency to atomize and dissociate highly developed information societies, where authentic social ties are increasingly being replaced by virtual acquaintances and digital contacts. The essence of a true society are, after all, physical relationships between people resulting from using the same or similar material things, staying in the same physical places and having the same real friends. All these cases can be perfectly recognized and augmented by IoT technology.

As an example, one can imagine the behavior of interactive things which facilitate making new acquaintances between people who have common interests, jobs or needs, and yet do not know about themselves. Currently, numerous social networks, especially those accessible through mobile applications, can serve this purpose, but this is an artificial solution because it requires explicit user activity and transfers social interactions back to the virtual space.

However, the material things used and worn by people meet as often as they do. Moreover, things can meet other things or structures which provide even longer chains of relationships connecting people to each other. For example, people with the same interests and hobbies can visit the same stores, buy services in the same workshops, or spend most time at the same items on exhibitions. Interactive things that accompany people can register this information and exchange it among themselves (Thierer, 2014). Owing to this, people who at first are connected by things only, can later establish direct acquaintance.

Such a relationship between interactive things and people can be described as the Society of Things. The term has a few diverse meanings and is sometimes used to name distant concepts, from anthropology to advanced IoT technologies. The name is therefore extensible and in our opinion it is difficult to reserve it only for one narrow discipline. Instead, we suggest adding one more meaning to it: the Society of Things can mean the human Society bound together by Things, and not Things connected into their own non-human Society.

6. Conclusion

In this paper we propose a new vision of the Society of Things as a direction for the development of the Internet of Things focused on serving human society by simplifying and facilitating the creation of new social bonds and by strengthening existing relationships. The development of technology makes it possible to enrich material objects with the ability to interact, communicate and coordinate their behaviors, so that they can create their own artificial communities. However, we are convinced that instead of equipping things with personality and social bonds, it is better to use them so that people can better develop their own personalities and bond directly with each other.

It should not be forgotten that building a civilization and inventing technology would not be possible if it were not for strong social bonds connecting individual people to a coherent whole functioning as a single organism. Material items have helped in achieving this cohesion from the very beginning. The development of digital technology has brought a number of threats to social cohesion, nevertheless the further development of the Internet of Things can mitigate these threats or even strengthen social bonds, provided that one key assumption is made: things should remain nothing more than just things, and their value should result primarily from to what extent they serve to build human society.

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Chapter 8

Place and Role of Financial Secutity in the Economic Secutity System

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1. Introduction

The Law of Ukraine "On the Fundamentals of National Security of Ukraine" states that one of the principles to ensure national security is the timeliness and adequacy of measures to protect national interests of real and potential threats. Among the priorities of national interests, the creation of a competitive socially oriented market economy and the constant growth of living standards and welfare of the population are proclaimed.

At the same time among the main directions of the state policy of the Ukraine's national security in the economic sphere are as follows:

- ensuring conditions for sustainable economic growth and increasing the competitiveness of the national economy,
- accelerating progressive structural and institutional changes in the economy, improving the investment climate, improving the efficiency of investment processes,
- stimulating the advance development of high-tech industries,
- improving antimonopoly policy,
- creating an effective mechanism of state regulation of natural monopolies,
- overcoming the "shadowing" of the economy through reforming the tax system, improving the financial and credit sphere and stopping the outflow of capital abroad, reducing the extra-money circulation of the money supply,
- ensuring balanced development of the budget sphere, internal and external protection of the national currency, its stability, protecting the interests of depositors, the financial market,
- implementing a well-considered policy of internal and external borrowing,
- providing energy security on the basis of sustainable functioning and development of the fuel and energy complex, including the consistent and active implementation of the policy of energy conservation and diversification of energy supply sources,
- food security,
- protecting the domestic market from ill-fated imports – supply of products that could harm national producers, people's health and the environment,

- strengthening the Ukraine's participation in the international division of labor, development of the export potential of high-tech products, deepening of integration into the European and world economic system and activation of participation in international economic and financial organizations.

In our view, to the above areas should be added efficiency of the financial system on the basis of maintaining public spending on current resources and budget allocations keeping to such priorities as target investment in high technology and high-tech sector production, conducting effective monetary, currency, anti-inflationary, debt policy, stimulating foreign investment into the manufacturing sphere.

Consequently, in today's conditions, the importance of maintaining economic security becomes of paramount importance. No wonder article 17 of the Constitution of Ukraine declares that, along with the protection of the sovereignty and territorial integrity of Ukraine is ensuring its economic security.

2. The Concept of Economic Security

Economic security is a complex multi-dimensional category. So, a number of researchers believe that the turbulent period of economic development in many countries of the world, scientific and technological progress and informatization of all spheres of the society, the emerging transnational economy, make it possible to identify new contours of four basic system-based structures, within which problems of economic security are solved: the state; regional association of economic structures; sufficient autonomous world economy of money, credit and investments; various kinds of multinational enterprises.

Kostenko (1995) emphasizes that economic security "must guarantee the development of the society on the basis of scientific and technological progress, and in addition:

- ensure the preservation or rapid reproduction of production in the conditions of the cessation of external supply or the internal crisis,
- provide stable work of the entire financial system in adverse internal and external economic conditions".

Voropay, Slavin and Cheltsov (1998) point out that economic security is developing from the general economic, financial, foreign economic, technological, energy, raw material, food, labor- and resource, water and statistician.

According to Shlemk and Bink, the main components of economic security are raw material – and resource, energy, financial, military-economic, technological, food, foreign trade (export and import) security. According to the authors of the analytical report "Issues of economic security in Ukraine", prepared by the Ukrainian Center for Economic and Political Studies, economic security includes industrial-technological, military-economic, fuel and energy, food, foreign economic security and the security of the monetary and financial sphere. In the interpretation of Pasternak-Taranushenko, economic security is divided into demographic, ecological, food, military, resource, drinking water, energy, price, financial and monetary security. According to Gorodetsky, depending on the specific spheres and sectors of the economy, types of threats can be distinguished concrete specifications of economic security, such as: production and technological, financial, inflation, currency, customs security. According to Muntiian, the internal components of economic security include raw material – and resource, energy, financial, social, demographic and environmental security (Voropai, 1998).

In the Concept of Economic Security of Ukraine legal among the components of economic security there is energy, technology, military-economic, food and financial security.

It is also considered that economic security as a systemic concept has a complex internal structure that includes such elements as: budget, debt, foreign economic, currency and monetary, financial and credit, tax, structural – and production, legal – and economic, investment, defense and economic, food, power and fuel safety, etc.

In the Methodological Recommendations on Assessing the Level of Economic Security of Ukraine, the following components of economic security there are the following ones to be mentioned: investment, innovation, financial, energy, foreign trade, social and demographic securities.

At the same time, Lovtsov and Sergeev include financial security along with economic, food, resource, technological, ecological and other in the system of physiological safety. Makhmudov distinguishes budget, credit and debt security and investment security of the state.

There is an economic literature and a reference to the existence of security in the financial and credit system of the state, as well as financial and banking security (Voropai, 1998). The term "monetary and financial security" is also used.

At the end of 1998, the President of Moldova issued a decree containing a series of measures to overcome the financial crisis and ensure the country's financial and economic security. The presence of this type of security also says Fayer. Some authors use the notion of financial and economic security of the production complex.

It is believed that a wide range of problems associated with the economic security of an enterprise that requires their system classification according to the following types: technological, resource, financial, market and social security. For each subsystem there are parametric estimates-indicators. In the section "Strengthening the economic security of Ukraine", the message of the President of Ukraine to the Verkhovna Rada of Ukraine in 2000 was identified as components of the Ukraine's economic security.

D. Artemenko in the general system of ensuring the economic security of banking activities allocates the following components: financial, technical, legal, informational and technological, socio-psychological, organizational.

Thus, in the vast majority of cases, researchers among the components of economic security of various economic agents distinguish financial security.

However, many researchers talk about the existence along with financial and such varieties of economic security, as inflation, currency (monetary, monetary and financial), customs, budget, tax, debt (credit), investment, price ones. However, the rest ones in nature, according to our belief, are not independent elements of economic security, but only varieties of financial security of economic agents.

Thus, in our opinion, it is right to speak about such forms of manifestation of economic security as raw material – and resource, energy, food, financial, scientific and technological, innovation, demographic, personnel, military-economic, foreign economic, etc.

3. The Concept of Financial Security

Among the arguments for the separation of financial security into an independent form of state security, the first fact consists in the fact that in the financial sphere there are factors, which pose a threat to the national security of Ukraine (imbalance and low efficiency of public finances,

the fiscal orientation of fiscal policy, the inconsistency of tax legislation with EU law, lack of strict control over the use of public finances, debt dependence of the state, imbalance of the currency market, etc.). Secondly, in addition to the list of internal and external threats, financial security has its object, subjects; characterized by qualitative and quantitative indicators; has a security strategy specific to it only. Thirdly, financial security has a special, extremely important place in the state security system, since it directly affects the political life of society, the implementation of economic policies, the implementation of social programs, strengthening the defense and security of the state, solving environmental problems. And therefore, the necessity of the legal regulation of public relations on financial security as an independent kind of state security, first of all, the definition of the concept of "financial security", is emphasized.

Financial security is one of the most important (and according to some estimates, and the most important) components of economic security. And that's why. In modern conditions, the influence of geophonics, world financial systems on a separate state passes to a qualitatively different level. Given the dominant position of the financial component in the modern economy, one can characterize the latter as a financially driven economy, through financial mechanisms, with financial leverage and incentives and for financial purposes. According to some estimates, today about 70% of all capital in developed countries is formed precisely in financial markets. And globalization, which is now demonstrated by economic civilization, creates the conditions for the establishment of a special financial power, which, thanks to the possession of world money and the management of financial flows, can influence both the entire world economic space and the economy of individual states.

According to Italian experts, Carlo Jean and Paolo Savon, geophonics is a major component of geo-economics, because it is in this area to be the most vulnerable to state sovereignty.

At the same time, it is believed that the international financial market, which has been in a state of turbulence for many years, is turning into a stage of permanent crisis. The collapse of the system based on financial mega-speculation and the expansion of the dollar, is inevitable.

Without providing financial security, it is virtually impossible to resolve any of the challenges facing Ukraine. Moreover, "power structures are destroyed when the economic, financial basis of their existence is undermined. Financial adventurers are much more effective than fighters with automatic machines capable of overthrowing any power and destroying statehood".

Arsentiev, developing this opinion, emphasizes that "in terms of ensuring economic security, even, conditionally speaking, the brilliant, at some point in time, the state of the production subsystem can be destroyed in a very short period of time, for example, through the credit and financial subsystem, if the latter performs a non-safeguarding role, but operates independently for the sole purpose of capital accumulation in banking structures, and the source of which will be the same production subsystem. It can be ruined by ill-conceived tax or customs policies ... ".

Along with this, according to the definition of the famous Italian expert on international finance Fulcher Bruni Roccia, finance is a channel of penetration that allows the outside control of the debtor country. Moreover, external control can quickly spread to all aspects of economic, and then social life. Thus the features acquire new forms of vassalism and colonialism. And the more the state has the ability to control the scope of finance within its activities, the more confidently one can speak about the existence/continuation of the traditional sovereign prerogatives of the state and, therefore, its special space. And Soros in the book "The crisis of world capitalism" draws attention to the fact that the countries that will catch on the hook foreign creditors, it is difficult to get rid of it, as well as the fact that lenders are much easier to give advice to the international debt crisis than the debtors. Then the idea of direct dependence of the periphery (the recipient of capital) from

the center (capital provider) is monitored, that is, the behavior of the center can cause a banking, stock or investment crisis with all their consequences.

The attention paid to financial security today is not accidental. After all and this is obvious, for the functioning of the state, especially during the restructuring of financial relations, huge amounts of financial resources are needed. In addition, the credit and stock markets do not ensure the efficient transfer of financial resources from industries to their surplus (mainly export-oriented raw materials and those which issue semi-products) to high-tech industries, high-tech manufacturing.

Among the key tasks of ensuring economic security, in the Strategy of Economic and Social Policy for 2000-2004, there was also a significant strengthening of the Ukraine's financial security, the primary strengthening of the financial potential of the real sector of the economy, business entities, households, ensuring balanced development of the budget sphere, reliable the internal and external protection of the national currency, the interests of depositors, the financial market, the implementation of a well-balanced policy of internal and external borrowing of states and, the maximum improvement of the investment climate.

The need to build an effective system of financial security in a sovereign Ukraine is determined by the fact that in the Soviet times the financial system fulfilled only the accounting and distribution functions, and in 1992 it was completely inseparable from its institutional unpreparedness for the regulation of transitional economic processes, the issue of its first transformation, the financial system of the former USSR did not have such an element as local finances. In addition, effective forms of the state's influence on the financial condition of certain industrial and non-productive sectors had not yet been developed. The growth of the importance of the formation of the financial security system in Ukraine is due to the recent negative dynamics of the development of processes in the socio-economic sphere, in particular the disruption of the system of public finances and finances of business entities, which in recent years has been increasingly exacerbated and manifested in the chronic non-execution of budgets of all levels, and external creditworthiness, as well as an increase in disadvantage in the settlement sphere and the escalation of the payment crisis, insufficient development of the banking system we and underdevelopment of the stock market, a large amount of arrears of wages, various aid has not yet restored confidence in the financial institutions, "flight" of domestic capital abroad, "laundering" of "dirty" money and so on.

The history shows that in post-war Japan, the biggest threat to the economy was considered to be a non-payment of wages – the most important source of domestic investment. In Ukraine, according to the State Statistics Service, as of January 1, 2017, arrears of wages amounted to almost 1.8 billion UAH.

The financial capabilities of the state are determined by the volume of financial resources. A generalized assessment of the financial state of the state provides a consolidated balance of financial resources, which reflects the volume of financial resources generated and their use in all sectors of the domestic economy. The main sources of financial resources in Ukraine are the profits remaining at the disposal of enterprises, revenues of budgets of all levels, depreciation deductions and resources of trust funds (without funds credited to the State Budget of Ukraine). However, the listed sources do not yet provide full financing of even the minimum required expenditures. That is why long-term credit resources provided by Ukrainian banks, foreign investors' funds and international financial institutions loans and bilateral loans are attracted.

Even in the calculations that need to be clarified, Ukraine has in recent years constantly faced with a lack of financial resources, despite the tendency towards its reduction.

Destabilization of public finances also contributes to a significant proportion of non-tax temporary revenues (from the sale of inventory, weapons, fines and sanctions, etc.) in the revenue side of the budget.

Moreover, the fact that the ratio of volume of financial resources and GDP (which determines the degree of state interference with the help of finance in the regulation of wages, the amount of production costs and the amount used for the production of fixed capital, as well as redistribution of income legal and individuals) in recent years is not significantly reduced. In addition, even in the near future, it is expected to increase. This indicates that the redistributive processes in the state economy are not reduced. And, as a result, the negative impact of distributive processes on the change in costly macroeconomic data is maintained.

The number of unprofitable enterprises has become alarming in Ukraine. For example, according to the State Statistics Service of Ukraine, at the beginning of 2017, 26.5% of large and medium enterprises of all sectors of the economy were loss-making, and the amount of losses they received amounted to 253.3 billion UAH. The balance profit of large and medium-sized enterprises in 2016 in the economic complex of Ukraine amounted to only 328.9 billion UAH.

In addition, due to the deepening of the gap between the real and financial sectors of the domestic economy, the outflow of cash resources from the production to the financial and credit sphere is taking place. And the financial and credit system, in its turn, in the modern form cannot provide not only extended but also simple reproduction.

In Ukraine, today there is no efficient market for debt, which creates an additional burden on the money market. You can talk about the existence of a debt economy ("the debts"), in which everyone is to blame for all.

The result of the liberalization of prices and the periodic freezing of deposits, as well as the enormous devaluation of the national monetary unit for the destruction of accumulated savings, led to the loss of one of the most important sources of investment financing. At the same time, the role of lending sources of capital investments was almost destroyed. Tax and interest policy depresses the investment activity of business entities by squeezing out financial resources from the manufacturing sector to the sphere of mediation and financial speculation.

Indirect evidence of the progressive escape of the domestic economy from the legal field is the contrast between legal incomes in real terms and the level of consumption and accumulation. Obviously, the informal component of the national economy had reached such limits, that according to the state of its official part it was simply impossible to judge the level of economic activity in general.

However, the lack of funds for large payments on domestic and external debt, limited NBU resources to support the hryvnia is only a visible part of the problems of the financial market. Another, hidden part of the problem is the lack of proper order in the organization of the financial market as appropriate one. The underdevelopment of the financial market infrastructure – stock and over-the-counter trading systems, depositaries, registrars, settlement chambers, etc. – led to the fact that the financial market instead of becoming the main instrument for collecting taxes, attracting investment and effective property management, turned into a zone for speculative games with the highest possible rates of profit.

The problem of financial security becomes a system that affects and binds together individual countries and their various groups, regions, sectors of the economic complex, business entities, households, politics, economics, finance, etc.

The difficulties of creating an effective financial security system in Ukraine are conditioned by the need for the simultaneous development of complex theoretical and practical issues. Firstly,

unlike the command-and-control economy, in which economic security in general and financial in particular were provided by vertically-built methods of total centralized management, the processes of ensuring security in market conditions are sprayed on many entities and areas of activity that have their own, often opposite interests not inherent to the previous system. Under the new conditions, a horizontally built, scattered security system begins to dominate.

In this case, the task of theoretical substantiation and development of methods for practical solution of these problems becomes the most important one, taking into account the creation of new or well-adjusted adaptation of previously created structures adequately to new security functions and search for the resources necessary for their implementation.

Secondly, in order to construct a truly system, and not to artificially combine separate distinct elements, it is necessary, first of all, to clearly define the subject of protection, and then to find out its concrete methods and means.

It can not but affect the financial security of Ukraine and the globalization of financial processes, which is growing in the world community. As the experts point out, "the world has generated grandiose flows of "world money", which are not subject to either national governments or any other political institutions. They were not formed as an expression of the needs of production, trade, investment or consumption. Their main source is mainly trading in money ... Already at the end of the last century during the year the circulation of the world currency market was 8-10 times higher than the volume of the world gross product, daily exceeding 1.5 trillion USD. This "world money" does not fulfill any real economic economic functions, and therefore its behavior is not determined either by economic logic or economic rationality" (Sikora, 1998).

Financial globalization has led to a complete "liberalization" and, above all, such frankly aggressive and speculative segments of the market as "derivative financial products". It should be emphasized that the growth over the past decades of the gap between the real economy and the financial system has generated at the beginning of this millennium a speculative "soap bubble" of fantastic proportions – at least 300 trillion USD.

Financial security is a part of economic and national security. The question arises: does this duplicate the concept of existing terminology? Responding to it, the researchers note that the special consideration of this term is aimed at analyzing and predicting a wide range of factors that determine the stability of the financial and banking system, identify threats and weaknesses in its functioning in order to make more structured and transparent the functioning of all elements of this systems. This approach allows us to determine to what extent the sustainability and security of economic and social development depends on the factors that lie in the field of finance, and which – from the peculiarities of the economy and technologies of the development of the sectors of the real sector. For the economy and social life of a person dangerous are as follows: underestimation, and a reassessment of the significance of the financial system and instruments of fiscal and monetary policy.

Hence, financial security is a state of the financial and banking system, in which the state can guarantee, to certain limits, the economic conditions of the functioning of state institutions of power and market institutions (Senchagova, 2005). With regard to the banking sector, this means the need for an objective assessment of the central bank as a body of monetary regulation and "bank of banks", its legally established functions and the reliability of the practical mechanism for their implementation. From this depends the provision of economic (financial) security, which is achieved through the stability of the banking system as a whole, the development of fair competition in it, the possibility of effective management of bank risks at the level of credit organizations,

etc. From the standpoint of financial security, taking into account the specifics of the activities of commercial banks and their legal status, the central bank should be, first of all, not punitive, but the official body that protects them. For their part, commercial banks need to interact effectively with each other and with the central bank in order to ensure optimal banking strategy and tactics for their safety and risk optimization (Chemykh, 2007).

4. Conclusion

Thus, the separation of financial security into an independent form of state security is conditioned by the existence of factors that pose a threat to national security. It occupies a special, extremely important place in the state security system, since it directly affects the political life of the society, the implementation of economic policies, the implementation of social programs, the strengthening of defense and state security, and the resolution of environmental problems. Consequently, there is a need for a legal regulation of public relations regarding financial security as an independent type of state security, first of all, the definition of the concept of "financial security".

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Chapter 9

Fundraising as One of the Pillars of Financial Security of Non-profit Organisations on the Example of Anna Dymna's Foundation "Mimo Wszystko"[1]

Maja Jaworska

1. Introduction

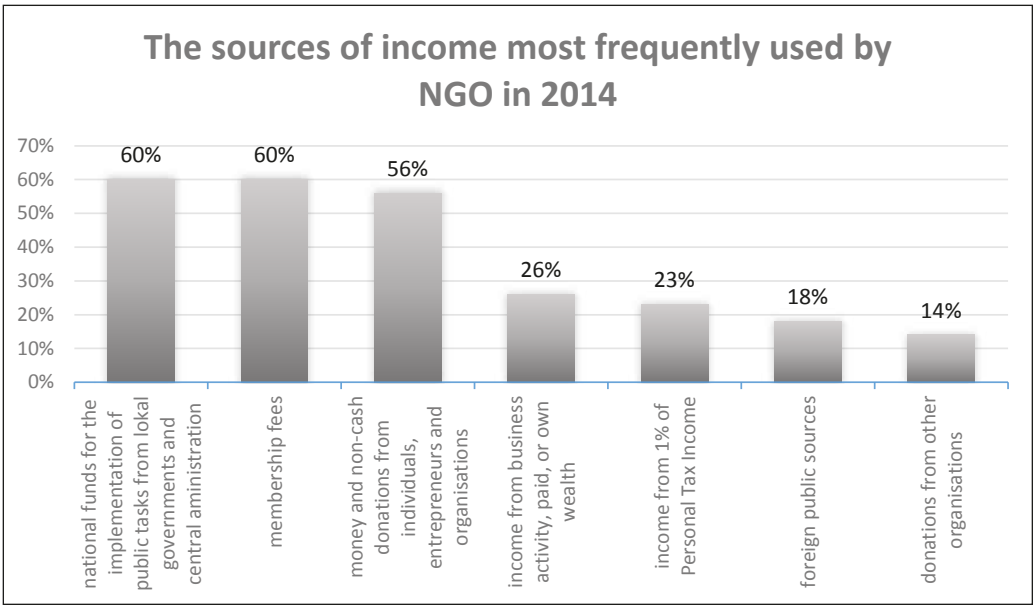
Over 22,000 foundations and almost 112,000 associations were registered in Poland at the beginning of 2018. Based on the results of the research of Klon/Jawor Association, as well as the data of the Central Statistical Office (Gumkowska, 2018), it is estimated that about 70% of the registered organizations are active. If we adopt the activity rate of the registered organizations at the level of 70%, it will mean that there are about 90,000 associations and foundations operating in Poland.

According to Jerzy Hausner, non-governmental organizations occupy a niche between the state and the market and have the character of complementary but not alternative organizations. The emphasis on the active role of civil society and non-governmental organizations results from the critical assessment of the role of the state in solving social problems (Hausner, 2008, pp. 82-89). Thus in the state budget, special financial resources are reserved to support financially the areas which are not "looked after".

Both foundations and associations are non-governmental organizations. In order to be able to function, they must secure adequate financial resources. State institutions, such as the Ministry of Culture and National Heritage, the State Fund for Rehabilitation of Disabled Persons (PFRON) and many others, offer various types of special grants to organisations so that they could conduct activity in the areas of interest of these institutions. However, these are not sufficient to provide organizations with the necessary resources to fulfil their statutory tasks.

[1] The study was prepared within the statutory research of the Department of Management of Cracow University of Economics.

Figure 1. Main sources of income of Polish non-profit organizations



Source: http://fakty.ngo.pl/finanse-ngo.

From the data concerning sources of financing in non-governmental organisations in Poland in 2014, it results that 56% of organizations accept financial and material donations from individuals, entrepreneurs or institutions. This kind of support is obtained thanks to fundraising activities. This is the second highest rate, right after membership fees. It should be noted that membership fees can only be used by associations. And as many as 60% of NGOs use the national funds allocated for the implementation of public tasks – it is also a widespread form of financing among NGOs.

2. Description of the organization

The described non-governmental non-profit organization – Anna Dymna's Foundation "Mimo Wszystko" – was registered in the National Court Register on September 26, 2003, by its founder Anna Dymna. This foundation was established because, as a result of the 17th amendment to the Law on Social and Vocational Rehabilitation and Employment of Disabled, 26 charges from the nursing home in Radwanowice run by Father Tadeusz Zaleski, were deprived of the opportunity to participate in therapy workshops. In 2004, Anna Dymna's Foundation "Mimo Wszystko" enabled those people to take part in the newly established Art Therapy Workshops financed without the participation of the Polish state. The situation of adults with intellectual disabilities was the direct reason why Anna Dymna established the Foundation.

The Foundation "Mimo Wszystko" operates on the basis of the Constitution of the Republic of Poland (Journal of Laws 1997 No. 78 item 483), the Act on Foundations (Journal of Laws 1984 No. 21 item 97), the Act of law of April 2003 on Public Benefit and Volunteer Work (Journal of Laws 2003 No. 96 item 873), as well as on the basis of other regulations applicable to non-profit

organizations in Poland. The Foundation mainly deals with adults with intellectual disabilities, responds to the needs of the weak, the sick and the lonely.

The mission of the organization is "to restore dignity and provide support to disabled and sick people, as well as those who are helpless and cannot ask for help" (internal documents of the Foundation).

The key tasks of the Foundation "Mimo Wszystko" include: caring for adults with intellectual disabilities, building, equipping and maintaining rehabilitation and therapeutic centres, organizing competitions for people with disabilities, promoting disabled people, promoting the foundation's activities (public relations) and permanent fundraising for the implementation of statutory goals of the organization.

The Foundation implements wide statutory activities in several fields. The tasks are divided into projects. Each of the implemented projects has its leader, plan and schedule of tasks, as well as the budget and a specific financial goal to achieve. The projects are evaluated depending on their duration and the variables that are specific to them.

The largest project that the Foundation has been implementing every year for the last 14 years is the Enchanted Song Festival.

Currently, the Foundation has a budget of over 10 million per year for the implementation of its statutory objectives. In almost 15 years of its activity, it has financially or materially supported 23,000 sick and disabled people. In the two centres, built by the Foundation, from funds obtained from donations and 1% of tax campaigns, various types of workshops and therapy sessions are conducted every day for over 200 people. Through its actions, the Foundation emphasizes the importance of people with intellectual disabilities and the areas that should be constantly supported.

The Foundation has 62 workers on employment contracts. Many employees have been with the Foundation for at least 10 years. The Foundation "Mimo Wszystko" is characterized by a low rate of employment fluctuation.

However, the NGO market is becoming more and more difficult because there are new organizations every year and they are also trying to raise funds for their operations. Anna Dymna's Foundation has recorded a steady decline in income from 15 to 25% per year for the last 5 years. The Foundation diversifies the methods of raising funds and is still training in this area to keep up with current methods.

3. The knowledge of the brand of Anna Dymna's Foundation and the founder

According to public opinion, Anna Dymna, a Polish actress and the founder of the Foundation "Mimo Wszystko", enjoys high recognition and is regarded as an ethical and moral authority in many matters, in particular those concerning people with disabilities. The survey "Knowledge of charities and their leaders" conducted by Kantar Public in December 2017 showed that the most recognizable organizations in Poland are Caritas and the Great Orchestra of Christmas Charity. Urszula Krassowska, an expert from Kantar Public, states in the survey report that their leaders enjoy greater popularity than the organizations themselves. The most recognizable person associated with activities for the benefit of others is Jerzy Owsiak (the president and founder of the Great Orchestra of Christmas Charity). Anna Dymna (the founder and president of Anna Dymna's Foun-

dation "Mimo Wszystko") took the second place and Ewa Błaszczyk (the founder and president of Ewa Błaszczyk's Foundation "Akogo") the third one (*Znajomość organizacji…*, 2017, p. 7).

One can read on the Foundation's website (https://mimowszystko.org): "I have been the president of the Foundation "Mimo Wszystko" since 2003. It has my face, my heart, my soul and I am fully responsible for all its actions".

4. Fundraising in Anna Dymna's Foundation "Mimo Wszystko"

Fundraising is a planned and organized process of raising funds for a given organization or social enterprise. This process requires planning, methodical approach, knowledge, experience and time. Fundraising consists in, besides raising funds, acquiring other types of resources: equipment, services, goods, and also building relationships with the donor. Sharing the passion of helping and skilful, cultural thanking for support (Rząsa & Szmyt-Boguniewicz, 2012).

In Anna Dymna's "Mimo Wszystko" Foundation, 25 people are involved in fundraising, almost all employees and volunteers are fundraisers.

Fundraising activities related to the implementation of the largest project of the Foundation – the Enchanted Song Festival

The Enchanted Song Festival is a nationwide competition consisting of many stages, dedicated to disabled people with vocal talents. Disabled people from all over Poland apply for it. Every year around 300 people take part in the qualifying rounds. 100 people in two age categories – under 18 and above – go to the next stage. Then, 16 people in each age category qualify to the semi-final, which takes place in Łazienki Park in Warsaw, and 12 finalists, 6 in two categories, receive tickets to the final, which takes place on the Main Market Square in Krakow.

People with disabilities perform 2 songs in the final. The first one is sung together with a star of the Polish music scene, and the second one on their own. Polish stars are invited to participate in the festival to give support to people with disabilities, to show them how to present themselves on stage. The 14th Enchanted Song Festival will take place in 2018.

The winners will receive prizes in the amount of: 24,000 PLN for the first place, 10,000 PLN for the second place and 5,000 PLN for the third place. The fundraisers raise financial rewards from companies with whom the Foundation has been building relationships for many years.

The cost of the entire project exceeds 1,200,000 PLN. The fundraisers together with the accounting department and the Board prepare applications for co-financing the project to the Ministry of Culture and National Heritage and PFRON. In total, for 750,000 PLN. The remaining funds are obtained from individual donors, an SMS action and a crowdfunding campaign, conducted on the Internet.

In addition, the employees of the Foundation obtain dinners for 900 people for two days, large discounts in hotels on hotel rooms and rooms for weekly music workshops which happen before the final in Krakow. Disabled people, festival finalists, their guardians, musicians, singing teachers and a speech therapist participate in these workshops. Anna Dymna also gives guidance on stage presentation and interpretation. The founder is a volunteer of the foundation and holds the position of the president without remuneration. The jury of the festival, made up of the most outstanding musical and theatrical personalities, perform their responsible tasks for free. In 2018, they will be: Elżbieta Zapendowska, Ewa Błaszczyk, Jacek Cygan, Adam Sztaba, Włodzimierz Pawlik and others.

The Foundation receives discounts on the majority of services and goods as well as equipment that should be provided in order to ensure a correct and well-executed spectacle.

The number of logotypes on the materials promoting the project also shows that the project is supported by various types of companies, institutions and media.

Anna Dymna's Foundation applies a code of ethical principles for fundraising, which was elaborated on with the Polish Fundraising Association in 2005-2009. As a result, 5 universal rules for each fundraiser were created:

- honesty,
- respect,
- consequence,
- empathy,
- transparency.

Each fundraising collection run by Anna Dymna's Foundation's fundraisers is purposeful, it also has a specific financial goal, budget, assigned people for implementation, a leader, password and visual identification.

In the financial report of Anna Dymna's Foundation "Mimo Wszystko" for 2016 (Financial Report, 2016) it was noted: "2016 was a difficult year for the Foundation, there was a reduction in income from statutory public benefit activities by 22.6%. This, despite the reduction of statutory activity costs, resulted in a loss on public benefit activity in the amount of PLN 1,236,363.10.

The decrease in the income was related to:

- smaller income from the campaign on 1% of tax by 16.4%,
- reduction of cash donations by 22.6%,
- a decrease in income from inheritances and donations by 100% (in 2016 there was no inheritance),
- a decrease in income from public collections by 91.5%.

It can be read further on that in spite of significantly worse financial results in 2016, the Foundation has a stable financial and material situation and there is no threat to the carried out activities.

In order to protect itself against the possibility of a drop in income from individual projects, the Foundation's Board diversifies income. It makes use of many available and well-known methods of obtaining funds, materials and services.

The examples are:

- going around with collections boxes – actions organized after obtaining appropriate consent for public collection and submitting it to the Ministry of Digitization;
- auctions, obtaining items and then auctioning them during events organized by the organization;
- Payroll giving – money paid voluntarily by employees of various companies;
- charity text messages, starting a charity number from available mobile network operators and obtaining funds for a specific purpose, directly designated;
- payments made directly through websites, Facebook;
- direct mailing – letters to potential donors, personalized, describing the situation of the organization and used to build relationships over a longer period of time. Since the beginning, the foundation has been creating database of donors, after obtaining approvals from the interested parties, and then preparing 4-5 shipments per year with personalized information. Each letter contains real, emotional information about the charges of the foundation, a photo of Anna

Dymna with the charges, the purpose of the collection, the number of the personalized bank account assigned to the donor;
- barter – barter agreements signed with companies, consisting of mutual exchange of services,
- 1% – joint PR, marketing and fundraising action in order to reach the largest group of recipients,
- soliciting grants from public sources and other sources.

Table 1. The structure of income of Anna Dymna's Foundation 2016-2014

Description	2016	2015	2014
Money donations	2,192,005.59	2,833,928.18	1,913,536.01
Income from 1% of Personal Income Tax	4,474,146.95	5,350,360.80	5,274,137.29
Income from inheritances and bequests	0.00	657,752.45	330,931.33
Income from Public Collections	12,279.35	144,859.06	288,148.19
Income from Compensatory Damages	43,049.94	32,382.40	70,870.31
Income from Public Sources	1,683,337.62	1,784,624.97	1,693,941.93
Income from the National Health Fund	578,083.20	595,863.80	587,391.00
Other statutory income	144,396.78	636,855.81	2,477,513.62
Income from paid statutory public benefit activities (other than from the National Health Fund)	234,394.01	56,391.77	36,901.98
Income from selling services, goods and materials	310,074.50	466,869,07	485,010.11
Other operating income	237,459.20	476,873.57	347,621.68
Financial income	163,186.11	158,909.09	119,293.29

Source: own elaboration on the basis of financial reports of Anna Dymna's "Mimo Wszystko" Foundation of 2014, 2015, 2016: http://www.bip.mimowszystko.org/bip/majatek.

Table 2. The structure of used income according to the percentage share

Anna Dymna's Foundation The structure of used income according to its kinds and sources				
Description	**2016**		**2015**	
	amount	**%**	**amount**	**%**
Income from the statutory activity (together)	**10,072,413.25**	**100**	**13,195,670.97**	**100**
1. Income from unpaid statutory public benefit activity	**9,127,299.43**	**90.61**	**11,440,763.67**	**86.71**
Money donations	1,403,199.98	13.93	2,125,369.56	16.1
Money donations obtained from by the fund raising department – legal persons	120,000.00	1.19	130,000.00	1
Money donations obtained by the fund raising department – mailing	668,805.61	6.64	578,558.62	4.38
Income from 1% of Personal Income Tax	4,474,146.95	44.42	5,350,360.80	40.55
Income from inheritances and bequests	0	0	657,752.45	4.98
Income from Public Collections	12,279.35	0.12	144,859.06	1.1

Income from Compensatory Damages	43,049.94	0.43	32,382.40	0.25
Income from public sources	1,683,337.62	16.71	1,784,624.97	13.52
Income from the National Health Fund	578,083.20	5.74	0.00	0
Other statutory income	84,005.71	0.83	87,700.00	0.66
Other statutory income – non-cash donations obtained by the fund raising department	60,391.07	0.6	549,155.81	4.17
2. Income from paid statutory public benefit activities, including:	**234,394.01**	**2.33**	**652,255.57**	**4.94**
Income from the National Health Fund	**0**	**0**	595,863.80	4.51
3. Income from the sale of services, goods and materials, including	310,074.50	3.08	466,869.07	3.54
Income from the sale of services (barters)	310,074.50	3.08	248,850.58	1.89
Income from the sale of materials and goods	0	0	218,018.49	1.65
4. Other operating income	**237,459.20**	**2.36**	**476,873.57**	**3.61**
5. Financial income	**163,186.11**	**1.62**	**158,909.09**	**1.2**

Source: own elaboration on the basis of financial reports of Anna Dymna's "Mimo Wszystko" Foundation of 2015, 2016: http://www.bip.mimowszystko.org/bip/majatek.

In the income structure of Anna Dymna's "Mimo Wszystko" Foundation, 2,192,005.59 PLN was obtained from fundraising activities, which accounts for 24.84% of all income, and 4,474,146.95 PLN was received from the campaign on 1% tax, which makes 44.42%.

5. Conclusion

If an organization wants to be able to carry out its tasks effectively, it needs a specific plan, determination and a budget. Foundations do not have permanent sources of income. Therefore, they must always seek resources needed to carry out their tasks, search for sources of financing, constantly learn and develop skills of efficient and ethical fundraising for the implementation of the organization's mission. A reliable and strong position of the leader is important in the process of raising funds. Implementing training, planning, analysing the situation on a regular basis and reacting, or changing plans. It is necessary to know how to raise funds and convince donors to long-term activities.

Knowledge of communicating with people helps to ask for money more effectively. Marc Pitman (2013, p. 19) offers a useful scheme of R.E.A.L.: Research, Engage, Ask, Love.

The ngo.pl portal provides all interested parties with information on the ethical collection of funds. It also placed a joint code of fundraising for NGOs, from which interested organizations can derive knowledge on a regular basis.

1. To collect money, you need money, you must plan it in the budget.
2. Be faithful to the mission of the organization and its goals and never give in to the needs of the sponsor (donor).
3. There is no single best strategy for raising funds, there are as many as there are activities.
4. Finding a large sponsor requires more time than finding a few small sponsors.
5. Small amounts you can collect/large amounts you need to work for.
6. Make sure that collecting money does not become the main activity of your organization.

7. Sponsorship is governed by market laws – whether you yield to them depends only on you.
8. The selection of a sponsor is a moral decision of every organization and depends on the values that this organization adheres to.
9. We all need to have our eyes and ears open to information about the funds, but it is good if there is one person responsible for raising funds in the organization.
10. If you can, appoint one person responsible for fundraising.

Fundraising in Anna Dymna's Foundation "Mimo Wszystko" is a very important pillar of the business. It provides stable income from various sources of financing and extends access to donors through the use of modern technologies. The Foundation also applies fundraising benchmarking in its work, analysing ways to obtain funds, for instance via the Internet as is done by organizations from the USA, such as Charity Water. Fundraising representatives of Anna Dymna's Foundation also use available trainings, and organize themselves trainings for smaller organizations that are just starting their activity.

In Poland, fundraising is not yet a sufficiently popularized form of raising funds. However, it can be seen that the demand for such skills and resources will continue to grow. Modern, advanced technologies help the fundraiser reach more recipients with their message in a shorter time. However, many variables determine the effectiveness of the action. It is worth remembering to build relationships with the donor and provide him/her with current data on the needs, and also to use the funds received.

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PART III

DATA AND INFORMATION

Chapter 10

Role of Information Brokers in Strategic Management of a Contemporary Enterprise[1]

Janusz Czekaj, Tomasz Kafel

1. Introduction

B. de Wit and R. Meyer have formulated a number of strategic management problems that have not been unambiguously solved since the time of their inception. Should strategic thinking be based on logic or creativity? Should the process of strategy formulation be more deliberate (synoptic) or spontaneous (emergent)? Should strategic change be revolutionary or evolutionary in nature? (de Wit & Meyer, 2007, p. 33). Unfortunately, the growing turbulence of the environment shakes the unique symmetry of the aforementioned, already classic paradoxes. Uncertainty, especially in strategic planning, which, by its nature, involves a long time horizon, is a troublesome characteristic of the contemporary strategic management context. It seems that the main problem for the discipline "strategic business management" will be fast pace of changes and the scale of novelties concerning enterprises and their environment. These phenomena disclose the need for a new approach to information. The dependences between business strategy, the methodology of its creation or improvement and the information function are not always noticed and fully realized by managers. Information resources are a strategic factor and therefore their management is an element of the created and implemented business strategy. this fact is confirmed by among others the words of M.D. Skipton that "...a strategic plan is as good as the information it is based upon" (quot. after Gierszewska & Romanowska, 2017, p. 29). The complexity of the environment of contemporary enterprises makes it significantly difficult for the managers to select and acquire information resources that are particularly important in the strategy formulation process[2]. Unfortunately, this complexity often also applies to information and theories created by scientists involved in strategic management. Therefore, managers reach for help of the so-called information brokers (business consultants), to deal with this complexity and use proper information in forming the business strategy. In the face of phenomenal growth in the quantity of information, managers'

[1] Publication financed from funds granted to the Faculty of Management of the Cracow University of Economics in Cracow from subsidies to maintain the research potential.

[2] The problem of information as a strategic resource of the enterprise has been extensively described in the chapter so entitled in the monograph by Czekaj J. (2000). *Metody zarządzania informacją w przedsiębiorstwie*, pp. 13-70.

cooperation with infobrokers seems to become increasingly important in the future. The purpose of the article is to point out which information resources concerning the macro-environment will be particularly important in the upcoming years in the business strategy formulation process and what will be the role of information brokers in providing this information to the managers responsible for strategic choices. The main research method used by the authors in determining the areas of information support for the strategists was the analysis of secondary sources, where changes in the macro-environment of the contemporary enterprises have been described and key trends have been indicated that might possibly affect the competitive position of enterprises in the future.

2. The concept of strategic diagnosis of the information management system

The strategy forming process includes both its formulation, namely formation of the planned strategy, and action, namely pursuing the strategy (de Witt & Meyer, 2007, p. 80). Strategy formation is thus the whole process leading to specific strategic behaviors. In practice, the key questions for strategy formation are: how the process of strategy formation should be managed so the organization would work more efficiently, who and what activities should be involved, to what extend can strategy be formulated in advance, how to adapt to possible new conditions. It should be noted that strategy formation is usually not "one-man show", but constitutes a significant part in the scope of obligations of any manager. Furthermore, some operations in this field can be ordered to specialized consultants, namely information brokers (Tab. 1).

Table 1. Entities involved in the strategy formation process

Source: authors' own study based on (de Witt & Meyer, 2007, p. 80).

Determination of the level of support for the strategy formation process by information brokers requires the decision whether the enterprise delegates a selected diagnosis to them (e.g. of the macro-environment), or they will support the whole strategy formation process, or perhaps take the ultimate responsibility for preparation of possible options of conduct. These decisions should result from the information function strategy adopted in the given company, being the result of the strategic diagnosis of information management. The design of the information function strategy should be based on two basic assumptions:

- strategic diagnosis of information management taking account of the global business strategy,

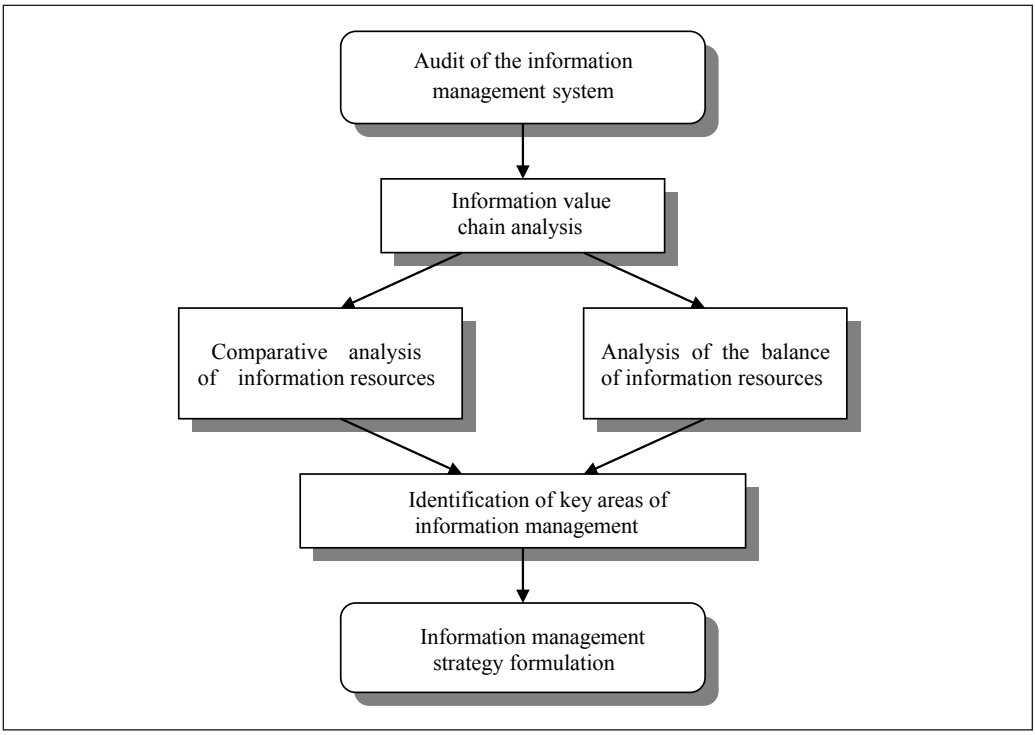
- take account of the potential of information and communication technologies as the basic factor for achieving information-based competitive advantage (Klotz & Strauch, 1990; Czekaj, 2000).

The strategic diagnosis of information management can be considered as a special case of strategic business analysis; unique, because it refers to the function determining in principle the business position. The purpose of this diagnosis is to determine the strategic capabilities in management of information both in as a product and a process. They are inherent in technology and the information and communication technologies, organization and human resources, understood as fundamental factors in shaping the relation company – environment. This diagnosis should demonstrate to what extent the company will be able to manage information independently and which actions in the scope of information management should be delegated to information brokers. The scope of the strategic diagnosis of information management, in the perspective proposed by the authors of this publication, has three fundamental areas namely is: macro-environment, competitive environment and the organization itself. The first one leads to developing a development vision of the information function. The second one may turn out the source of the created value added or the company's information alliances (opportunities for involving information brokers should be particularly sought here). In this field there are most opportunities and threats, but also opportunities for implementation of effective information management methods (e.g. standby strategy, business intelligence, information benchmarking). And finally, the third area is formed by the company, where one can find the greatest reserves of strategic capabilities, mainly associated with shaping "carriers" of value added of information and information-based competitive advantage (Czekaj & Kafel, 2003).

Using the presented conceptual proposal, a framework concept of strategic diagnosis of the information management system has been proposed (Fig. 1), according to which, the identification of key information management areas incorporates:

1) audit of information resources, namely identification and analysis of information understood as a product or process from the point of view of their strategic importance,
2) information value chain analysis which allows factors that create information-based competitive advantage to be identified,
3) comparative analysis of information resources using the historical, industry criterion as well as comparison with the model (namely benchmarking),
4) analysis of the balance of information resources indicating absence/excess of some of types of information (the role of information brokers should be indicated here, in eliminating information deficiency and satisfying information demands),
5) identification of key information management areas and their assessment, in particular determination of strengths and weaknesses in the analyzed company,
6) information management strategy formulation.

Figure 1. The concept of strategic diagnosis of the information management system



Source: own study.

The proposed concept involves the need introduce strategic management of information to business practice as originating from the strategic analysis perceived, on the one hand, as an instrument supporting a particular organization's strategy building and, on the other hand, as an element integrated with this strategy and subordinated to it. Its outcome should also be determination of the role of information brokers in the process of information management strategy implementation. The authors of this study, referring to the above proposed concept, have carried out a strategic analysis of the macro-environment, specifying, as a result, the information needs of contemporary enterprises in this area. In the further part of the study potential support areas have been presented that information brokers can grant to the managers responsible for strategy formulation in contemporary enterprises.

3. Importance of the information broker in strategic business management

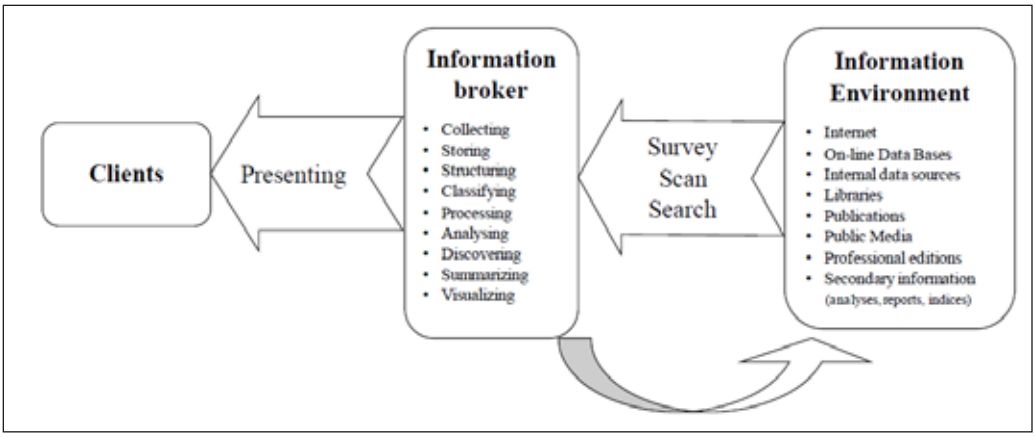
The term information broker most commonly refers to "an individual who provides the service of finding and procuring information, such as locating primary and secondary information on competitors" (Lesky, 1994, p. 22). In the opinion of Jeusfeld, Papazoglou (1998, p. 265) "in large human-computer networks, information brokers provide links among syntactically and semanti-

cally heterogeneous information sources with information users who are equally diverse in their interests and capabilities". For the notion information broker, such terms are applied alternatively in the subject literature as: business researcher, contract researcher, independent information specialist, information consultant (Lesky, 1994, p. 22). In the further deliberations in this study, according to the convention, the application of the notion information broker has been assumed.

To some extent the word broker introduces ambiguity in interpreting the role of the information broker, as it suggests that he is an agent in selling information, while in fact he sells the services of searching for or acquiring information. Infobroker is rather an agent between information resources and persons and institutions, who need them. Their work also consists in adding value to the obtained data by: synthesis, analysis, creating reports containing conclusions from conducted studies In the opinion of Christozov and Toleva-Stoimenova (2014, p. 113) the business process of an infobroker's job includes the following activities (Fig. 2):

- "surveillance of the information environment – identifying relevant to the problem domain information sources,
- researching the sources from the point of view of relevance and accessibility, including price,
- collecting (obtaining) subjectively defined relevant information among what's available,
- analyzing obtained information from the point of view of relevance, trustfulness, consistency, cause-and-effects relationships, etc.,
- synthesizing knowledge – an information product by formulating the obtained content to serve the client – via creative generalization and abstraction,
- presenting information to the client (teaching)".

Figure 2. The position of information broker in the process of information acquisition



Source: (Christozov & Toleva-Stoimenova, 2014, p. 114; Denchev & Christozov, 2012).

Implementation of these tasks requires respective competences. According to Denchev and Christozov (2012), key competencies required from the information brokers include:

- "to be able to survey, scan and search the information sources, by exploring all of the components of information environment,
- to collect and store the obtained information and to structure, analyze, summarize and visualize it in a form suitable to serve the client,

- to map available information to the problem in a creative way by combining data from different sources to discover the potentially best solution,
- to prepare information suitable for use by the general public or particular client (presentation skills)".

Success of organization is very often associated with the role played by information brokers as intermediaries between researchers and users, viewed as a means of improving the exchange of information between the two communities (Ziam, Landry & Amara, 2009, p. 492). Information brokers often bridged the gap between practitioners and representatives of the world of science (academia). Noticing changes in the environment, practitioners turned to them for help in their interpretation. Results of research scientific were often not helpful in solving daily problems of practitioners, because scientists were expected (and are expected) to conduct research following the principles of scientific rigor, methodological correctness of natural sciences, and proficiency level of using statistical methods. A result often was (and is) use of a different language (difficult for practitioners to understand) acting as spectator in the business arena (Jelenc & Vdorljak Raguz, 2016, p. 8). In principle, information brokers were not an inspiration for strategists right from the outset of the strategic management concept. Explaining the nature and importance of strategy, Newman admitted that used the experience of consultants from McKinsey company (Jelenc & Vdorljak Raguz, 2016, p. 7; Mintzberg, 1990, p. 172). Not being able to fully use scientists' theoretical models, practitioners used situational approach and created their own business models. Working with clients, observing their problems and the conditions in which they operate, consultants noticed some similarities between companies (and problems), which gave them grounds to state that the same business tools (principles) can be implemented in them. In order to meet practitioners' expectations, information brokers began creating methods, approaches and even strategic management theories. It is in this period that the portfolio methods are developed, prepared by Boston Consulting Group, McKinsey Company or consulting company A.D. Little as well as 7 S and experience curve concepts were created (Jelenc & Vdorljak Raguz, 2016, p. 8). Information brokers also developed (thanks to their presence in enterprises) the ability to explain their solutions and convince the management staff to them. At the same time, the profitability of management consultant's profession resulted in the emergence (in bookstores) of worthless guides explaining how to become a successful manager in 5 minutes. Ginsberg and Abrahamson noticed that information brokers, with their skills, play a particular role in unbiased environment analysis (Jelenc & Vdorljak Raguz, 2016). Decades of work on the part of strategic management researchers have brought some benefits to strategists too. Thanks to conferences and publications, knowledge in strategic management has allowed practitioners to face more firmly turbulent (disruptive) changes in the business environment. Jelenc and Vdorljak Raguz (2016, p. 8) explain that "some scientists serve as consultants and use the information from practitioners' platform but rarely stay with the company while implementing solution/models". Unfortunately, the (recently) growing requirements and more difficult criteria to be fulfilled to publish in scientific journals make researchers (academia) devote definitely more time to meet these requirements, at the expense of close contacts with business practice. A rigor has won over relevance (Jelenc & Vdorljak Raguz, 2016). This, among other things, changes the role of information brokers, who are expected to translate or transform scientific "products" of researchers into knowledge being useful for business practitioners. For many authors of management science, the role of information brokers goes beyond intermediation since it contributes to innovation by facilitating the integration of knowledge (Ziam, Landry & Amara, 2009, p. 491). In their opinions information brokers are

true innovators since they identify, process and use the ideas developed in different industries or fields to the advantage of their organization (Ziam, Landry & Amara, 2009, p. 492). Information brokers become knowledge brokers and the demand for their services seems to be growing fast in recent years (Meyer, 2010; Pielke, 2007). Jelenc and Vdorljak Raguz (2016, p. 9) inform that in the United States in the assessment of scientific projects a criterion has been introduced taking account of the impact of a project on broader substantive development (equal to intellectual merit-broader impact) which is, in our opinion, identical with the increasing role of knowledge brokers.

4. Areas of information brokers' support for the strategy formulation process in enterprises in the age of the fourth industrial revolution

New challenges faced by entrepreneur at the beginning of the 21st century have huge consequences for the strategic management process. Among those challenges the most important ones are mainly the effects of the recent industrial revolutions being difficult to anticipate (both the third, but particularly the fourth one) and the consequently growing uncertainty of business operations. Other important processes which managers will have to face include pressure on corporate social responsibility, increasing potential of emerging markets and shrinking natural resources.

The period of intensive economic and technological changes started at the end of the 20th century referred to as the third industrial revolution shows its new face, which has already been named the fourth industrial revolution. The beginning of the 21st century brought about subsequent fundamental changes in the conditions of business operations. They are above all a consequence of the political processes (particularly military conflicts, e.g. in Ukraine), social processes (particularly migration), economic processes (particularly the growing income disproportions), technological processes (particularly the effects of the so-called fourth industrial revolution). Bissociations of digital technology, new communication tools (such as e.g. cellular telephony, the Internet) with new economic trends (globalization, privatization, deregulation, trade liberalization, investment in renewable energy sources, increasing social inequalities) give rise to outcomes that are difficult to anticipate. Started in the 1970s, the third industrial revolution was based on the processes of manufacturing automation and computerization, using such scientific and technical achievements as: transistors, semiconductors, integrated circuits, optical fibers. The consequences of these changes which managers must deal with are first of all reduced labor demand, access to scientific facilities and qualified workforce. On the other hand, the fourth industrial revolution is the idea according to which manufacturing competitiveness can be ensured based on new technologies combined with the Internet (the so-called business networking). Here we are talking about realization of the idea of intelligent factory through the application of technologies and principles of organization of the value chain together using and utilizing cyber-physical systems, internet of things (intelligent mobility) and cloud processing (Hermann, Pentek & Otto, 2015; Kagermann, Wahlster & Helbig, 2013). Other equally important elements of the fourth industrial revolution are: internet of persons (social and business networks), internet of services (smart networks and logistics), internet of data (smart buildings and apartments) and, in consequence, a lot of information for which the term "big data" is used. The digitization of information processes along with the popularization of mobile devices as well as growing data transmission speeds (5G technology) make managers being attacked by a sort of "information tsunami". The quantity of data

generated by the man until 2003 is estimated at five exabytes (namely five billion gigabytes). The same amount of data was generated in 2010 alone. In 2014 2 days were enough to produce this quantity of information. Cautious estimates show that in 2020 we will generate approx. 40 zettabytes of information (40 000 exabytes = 42 949 672 960 000 gigabytes, i.e. almost 43 trillion GB) (Schmidt, 2016)[3]. The tsunami wave is not stopping and soon we will measure the quantity of generated information by subsequent further units, such as e.g. Yottabyte (1 million exabytes), Brontobyte, Geopbyte (Penumuru, 2016).

It seems that the main problem for the strategic management discipline will be fast pace of changes and the scale of novelties concerning enterprises and their environment. Entrepreneurs and managers will have to develop competences and acquire relevant knowledge in order to take advantage of the benefits from innovative business models, such as among others: scattered and cooperation research and development strategies, free software (open source) and network trade[4], performance contracting, shared savings, sustainable, low-carbon logistics and supply chain management (Rifkin, 2012)[5]. Strannegård and Friberg (2001, p. 106) envisage that "perhaps we are heading towards new ways of running an enterprise (methods of management?) where boundaries between innovation and profit, fun and seriousness as well as work and free time will be erased" (Strannegård & Friberg, 2001, p. 106).

In the opinion of Mesjasz (2014, p. 336) "forecasting on the strategic level is one of the greatest challenges for management, as one of the specific characteristics in the functioning of contemporary enterprises is increased uncertainty of the conditions in which they operate". Therefore, it seems that strategists should be particularly supported by information brokers in this area, namely future operating conditions for businesses. The analysis of the above mentioned secondary sources, both scientific papers and consulting companies' reports, where changes occurring in the environment of contemporary companies have been described, as well as key trends affecting their situation in the future has allowed the authors to prepare the list of areas of (potential) support that strategists can soon expect from information brokers (Tab. 2).

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[3] In order to imagine this value more easily, it can be compared to a Full HD movie lasting 4 million years.

[4] The service provider identifies and evaluates energy saving possibilities in the given company. As a result, he recommends a package of solutions ensuring more economical energy consumption. It is repaid with the money from savings obtained in the future (Rifkin, 2012).

[5] It is a sort of a sale contract, where the seller installs an element (hardware, machine or system) to the client free of charge, but has a share in the savings it provides. It remains property of the seller until its price has been fully recovered from the savings (Rifkin, 2012).

Table 2. Areas of potential support for strategists from information/knowledge brokers

CHALLENGES FACED BY STRATEGISTS	CONSEQUENCES FOR THE STRATEGIC MANAGEMENT PROCESS	SUPPORT AREAS BY INFORMATION/KNOWLEDGE BROKERS
Digitization of information processes and growing data transmission speed	• Change in sources of competitive advantage towards knowledge management. • "Big data" management as key process in an enterprise. • Information process outsourcing. • Preparation of new ways of information support for strategic management.	• Developing new tools for search and discovery of information. • Inventing ways to add structure to unstructured data. • Creating new storage and information management techniques. • Deploying tools and expertise for security and privacy protection.
Third and fourth industrial revolution	• Shortened sector/product/service life cycle. • Hypercompetition – quick and violent competitive actions (faster erosion of competitive advantage) forcing companies to ensure continuous innovation. • Development of virtual businesses. • Blurred boundaries between sectors (e.g. photography and mobile phones). • Intensifying diversification strategy (radical increase in the quality level of offered products). • Value migration from old to new sectors.	• Identification of future conditions of business operations. • Indication of the sources of market efficiency and their determinants in the future. • Application of inventive methods to determine the directions of change/modification of the operational domain (disappearing sectors). • Broader application of cooperation strategies with regard to scientific-development works. • Identification of areas of work outside the office/the company. • Development/modification of the "learning organization" concept. • Designing future business models (for instance: taking account of business value as the strategic goal).

Strategic uncertainty	• Need to make sustainable choices under the conditions of extreme uncertainty leads to the "strategy paradox"[6]. • Business strategy starts resembling a set of options which can be either realized or discarded[7]. • Change in approach to risk: "failure management" instead of risk minimization. • Utilization of the so-called smart failures[8].	• Development of methodologies, improvement in forecasting techniques and algorithms. • Deepening and disseminating knowledge about the real options school. • Improvement of successful strategy implementation methods under the conditions of continuous uncertainty. • Development of mental/cognitive models used to anticipate changes in the environment (the so-called dominating logic). • Popularization of the concept of loose resources (using the metaphor of organism).
Pressure on business responsibility (including change in the approach to the employee and to the natural environment, in view of climate change)	• Redefinition of mission of the organization (dilemma: responsibility versus profitability). • Strategic model of corporate social responsibility as a source of competitive advantage (e.g. Toyota Prius). • Responsive model of corporate social responsibility as a tool for improving the image. • Standardization of CSR actions and formation of stock exchange indexes (CSR's effect on business value). • Dilemma – image or competitive advantage (or perhaps image and competitive advantage?).	• Improvement of business cooperation models with non-governmental organizations and public institutions. • Development of methods for building long-term bonds of the company (owners, management) with the employees. • Development of a model of shared (of the management and employees) accountability for effective operations of the company (e.g. using the employee share ownership concept). • Implementation of the assumptions for full participation in management. • Solutions in the sphere of employee privacy protection. • Dissemination of the business ecosystem concept.

Potential of emerging markets	• Scale effect – emerging markets account for 70% of the future growth of Western international corporations (including China and India being 40%). • Acute competition for clients from the highest (income-wise) market segments – here approx. 20 000 international companies are present on the emerging markets. • Unused potential of segments from the so-called bottom of the income pyramid on the emerging markets.	• Development of market segmentation methods with focus on examination of the so-called bottom of the income pyramid. • Professionalization of researching social and cultural differences. • Identification of communication channels and distribution channels integrated with the segment from the bottom of the income pyramid. • Preparation of models of cooperation with NGOs in order to reach out to the segments from the bottom of the income pyramid.
Shrinking natural resources and absence of highly qualified staff (among others IT engineers)	• Competitive fight enriched with high tech dimension. • New energy sources as foundations of competitive advantage. • Talent management.	• Development of a developed cooperation system model in economic macrosystems (e.g. common policy of purchasing raw materials on the level of the whole European Union). • Works on organizational transformation strategies (alliances, mergers of large business unions, virtual systems).

Source: own study based on (Wąsowska, 2012, pp. 386-393; Stabryła, 2000, p. 31; Banaszyk & Urbanowska-Sojkin, 2007, p. 38; Szczerski, 2012, pp. 399-403; Rokita, 2010, pp. 13-16; Romanowska, 2004, pp. 18-23; Walas, 2007, p. 197; *Trend Compendium 2030*, 2011; Kafel, 2013, pp. 83-102).

5. Conclusion

The above presented areas of potential support for strategists from information brokers have certainly not included all spheres of the macro-environment, where opportunities or threats appear which strategists will have to pay careful attention to. Environmental threats (increased carbon dioxide emission, global warming, changes in the ecosystem) and demographic factors (demographic

[6] It consists, in the opinion of M.E. Raynor, in the fact that "actions and characteristics necessary to achieve spectacular success at the same time increase the risk of total failure", if we hold tight to the perfectly prepared strategy, not accepting any changes during its implementation (Raynor, 2008).

[7] This option is the right to take a specific action in the future on the if-then principle, giving the company freedom to postpone the decision until relevant information has been obtained in the future (Wąsowska, 2012, p. 391).

[8] Making as least costly mistakes as possible by detecting errors early, correcting them, learning from them and building resistance for the future (Wąsowska, 2012).

explosion, ageing society, growing urbanization) are other significant challenges to be faced by theoreticians and practitioners of strategic management, which have not been subjected to a deeper analysis here[9]. All these areas are also the subject of scientific research conducted in various academic centers. The information brokers should play a role of a bridge serving as the translator of research results by helping practitioners to utilize the scientific insights in everyday business environment. The authors of this paper agree with the statement by Jelenc, Vdorljak Raguz that: "filling the gap between practitioners and academia seems to be the crucial role of information brokers, but the bridge between science and practice should be created bidirectionally, providing more efficiency in research process". In the paper, potential areas of this cooperation have been indicated. It is highly likely that, thanks to this, social science in the discipline of strategic management will better serve society and its development.

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[9] More information on these trends can be found among others in the study prepared by Roland Berger Strategy Consultant entitled *Trend Compendium 2030, München, Germany 2011.*

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Chapter 11

Challenges in the Compliance with the General Data Protection Regulation: Anonymization of Personally Identifiable Information and Related Information Security Concerns

Gergő Barta

1. Introduction

The General Data Protection Regulation (hereinafter: "GDPR") is the new directive of the EU (2016/679) which is applicable as of 25th May, 2018 in the European Union and the European Economic Area. The objective of the directive is to regulate and protect the rights of EU residents, controlling the misuse of personally identifiable information what organizations i.e. data controllers[1] or processors[2] are storing and handling, and give the rights to individuals to have an understanding and overview about the nature and extent of data that organizations keep on them. Since the regulation defines a long list of requirements on the use and process of personally identifiable information, organizations have to face high degree of challenges to enforce the compliance which requires the implementation of new IT controls as well as involving legal departments to rethink the general terms and conditions of the organization in order to appropriately meet with the established criteria. Each organization is concerned who stores or processes personal data including customer and employee information, thus compliance is inevitable for almost everyone. Violation of the regulation can result in substantial penalties and reputational risk might be concerned, if the implementation of GDPR is not in place, and e.g. there is personal data leakage as a consequence or the delegated authority on a country level finds gaps between current business operation and the regulation. So as to mitigate the risk of non-compliance, personally identifiable information may be minimized, deleted or anonymized which can be a real challenge, especially for companies where the basic

[1] "controller means the natural or legal person, public authority, agency or other body which, alone or jointly with others, determines the purposes and means of the processing of personal data; where the purposes and means of such processing are determined by Union or Member State law, the controller or the specific criteria for its nomination may be provided for by Union or Member State law" (GDPR, 2016).

[2] "processor means a natural or legal person, public authority, agency or other body which processes personal data on behalf of the controller" (GDPR, 2016).

business model is relying on personal data analysis such as a bank's scoring system. The goal of the article is to discuss the necessity, basic characteristics and information security concerns of anonymization that is a consequence of the regulation and one of the most reasonable actions to enforce and contribute to compliance. The article is also intended to discuss a possible hybrid solution that is, besides, capable of providing anonymization, can be as well utilized to preserve valuable business information.

2. Legal basis and the need for personal data anonymization

There are several reasons why personal data anonymization should be considered to achieve compliance. Anonymization is a technique that aims to make personally identifiable information unrecognizable. Unrecognizable indicates that the database is no longer to be used to identify a natural person by means of any of the data provided considering that the data does not either contain any identifiers that could serve as a key to link it to another database, therefore, the database by itself or in connection to other databases cannot identify natural persons. The following items shall be considered in terms of legal and security perspective that give summarized explanations for the need of data anonymization.

1. In alignment with Art. 5 (GDPR, 2016) there should be a legitimate business reason why personal data is collected and processed, and if there is no legal basis, then current business operation does not meet with the expectations of the regulation. Let's discuss an illustrative example to explain such a situation. Business organizations' operation are dependent on many complex IT systems such as ERPs (Enterprise Resource Planning), CRMs (Customer Relationship Management), reporting systems, contract management systems and so on. These systems are in most cases needed to be developed in order to stay in competition, increase the level of automation, or just new functions are requested by business users to solve specific problems. These developments are tested before being deployed into production environment, but testing requires real world (or closely similar to real world) data to make sure that new developments do not have a negative effect on the integrity, availability and confidentiality on data stored in information systems. Once a development is appropriately tested and approved, it can go to production and business users can operate with it. The problem is that in several cases these new developments are tested on production data, since it is the easiest way to make sure that developments are operating as intended, thus production data containing personally identifiable information may be transported to a testing environment. That means that the organization used the data for another business purpose other than it was agreed with the data subject (the person who provided the data). If the organization wants to continue its operation as described, then data subjects should also approve that their data is being used for testing purposes that cannot be really imagined e.g. when we go to a bank and open a new account, and we see this in the contract. Would there be anyone signing this? Definitely this problem should be solved somehow, and making data unrecognizable could be a possible solution to solve both of the problems. Another example for the legal basis issue when the contract is expired, thus the organization has no further reason to store the data[3].

[3] The applicable laws should also be considered e.g. if the anti money laundering law further requires to keep the data, then still there is a legal basis, namely, to meet with the requirements of other regulations.

2. In alignment with Art. 17 (GDPR, 2016) the data subject has the "right to be forgotten" if she/he withdraws the consent that she/he provided earlier. It can happen in case of subscription for promotions or newsletters, thus, if the consent is withdrawn then data of the customer shall be made unrecognizable after the request. The problem is that organizations tend to store data at various places, let's just think of a company where the daily operation depends on mostly the contribution of excel files, but also backups are made for ensuring data availability. This can indicate new challenges. How to make that specific person's data unrecognizable if the organization does not even know how many copies are stored and where, and maybe only one record should only be made somehow removed. Definitely, the organization can claim that it has complied with the request of the data subject, but if there is a security incident, e.g. external attackers hacked into the system and gained information and it goes to public, the reputational loss is inevitable, and the organization also has to count with the penalties.
3. Data also has to be protected from attackers, as mentioned above, even though the legal basis is appropriate, so as to minimize reputational risks. External threats are showing an emerging trend (Statista, 2017), therefore the level of information security must be assessed continuously and be in alignment with industry standards such as the COBIT 5 (Isaca, 2012), ISO 27001 standard (ISO/IEC 27001, 2013) etc.
4. As a result of a data breach, personal data may be linked to publicly available databases, and it may become recognizable if anonymization techniques were poorly utilized. Data breach can come from various sources. A research paper published by Kroll (2015) pointed out that not only external threats must be considered, but internal fraud is also a major issue as organizations are reporting about internally committed fraud, either performed on purpose or by accident, in an increased manner.

It is important to highlight that the simplest method to make a database unrecognizable is to delete the data it contains, but the major dilemma is that it can have a negative effect on the integrity of internal databases that is likely to result in anomalies in the system e.g. deleting keys that are referenced to another data table leads to consistency issues. Another obstacle might be the resource constraints, e.g. data deletion may result in further expenses and can be time consuming, such as deleting data from backup tapes that has to be first restored to the system, then appropriate records must be deleted etc. The third problem that the data cannot be used later on for further business purposes e.g. statistical analysis. Therefore, data deletion is only recommended to be utilized if it does not cause any business performance or business continuity issues. Those are the reasons why anonymization may be preferred over data deletion, however, anonymization also has disadvantages that should be considered, thus anonymization shall be thoroughly planned before implemented. In addition, there are plenty of anonymization techniques that could be utilized, an assessment is recommended to be performed to understand the nature of different anonymization algorithms, and based on that, organizations could choose the ones that are the most suitable to their database structures.

3. Designing anonymization

The greatest disadvantage of anonymization that it has to be extensively planned and designed, therefore, a strategic plan is needed before employed. Nevertheless, with the appropriate utilization of anonymization techniques, database integrity can be maintained, and also valuable

business information can be saved. Let's just consider a database table that contains the name, age and the city of a natural person. This three information can most probably identify a person. If the record is deleted than there is information loss. If the name is masked with another character e.g. "M" or "F" indicating that the person is a male or a female, the age is generalized to a higher level subset e.g. instead of 26, it is 25-30, and the city is similarly generalized to higher level subset e.g. instead of Krakow, it is Małopolska, then a natural person, with a great probability, cannot be identified anymore, and at the same time, statistical report can be generated to analyze e.g. the segments who buy an organization's products. One mistake, however, has been made here. The age is usually stored in a column that has a type of integer (numerical value) and the subset is no longer an integer, but a text (25-30) that implicates that the database structure should be changed containing the risk of compromised database integrity. In that case a higher subset can be interpreted as bringing each value to a same value e.g. everybody who is between 20 and 29 can be stored in the database as 20.

In database tables, usually records have unique identifiers so as they could be linked to another table to obtain more information. In case of one table is anonymized, but another one is not or poorly, linking the two tables together can result in a new interconnection based on natural persons could be identified. That is the reason why each and every table containing personally identifiable information should be anonymized, or unique identifiers may be masked. A unique identifier can be a tax number or social security number that by themselves can identify a natural person. The first steps shall be to mask these identifiers as these are at high risk of identifying someone by one value.

Anonymization shall be irreversible. The anonymization process that can be decrypted can only prolong the time until the attacker gets to know the real information, therefore the utilized anonymization techniques must be designed on a way that no one could, with the available computing performance, obtain the real personal data recovered. That is also a guarantee to ensure the "right to be forgotten".

The anonymization process must be tested before implemented to the production environment. Since data may be exchanged via interfaces among different systems, anonymized data in the source system might appear not to cause any operational problems, but the target system, at the same time, might be unable to process the data leading to business interruption. In order to ensure that the anonymization process does not have negative impacts in terms of technical and business means, system developers, information security experts, business users, data owners and data protection specialists shall collaborate to meet with each of the expectations i.e. the anonymization achieves its goals to make personal data unrecognizable, business can use the data for reporting or statistical purposes, information systems are adequately operating after the execution of anonymization in alignment with management intention. That definitely rises anonymization to be a complex process in the organization.

Care must be taken to perform anonymization throughout the whole organization. Personal data may exist not only in one database, but at several locations both electronically or physically such as in hardcopy contracts. Reports exported from a data warehouse can contain the same information, therefore personal data can appear not only in structured databases, but in an unstructured format as well. That is even worse in case of organizations which operation is based on excel files that are stored on file shares, on workstations, removable devices and so on. Also, electronic mails must be considered that transmits personal data, therefore, there must be an assessment to appropriately identify each and every possible place where personal data is stored. That can be a headache not only for big organizations, but a small company with fewer employees respectively.

4. Data inventory as a primary source

To gather the information related to personal data, the Art. 30 (GDPR, 2016) requires to prepare the "records of processing activities". Basically, this can be interpreted as a register where the different data processing activities are listed (e.g. payroll, marketing campaign etc.) with other supplementary information such as the purpose of the processing, categories of personal data included, data retention period etc. This can serve as a basis to appropriately assess the nature of personal data at the organization, however, this point does not require to list all the personal data, only the data processing activities. It is important to note that there is a big difference between these two. At the end of the previous section, the need to summarize each and every data and related information was implied in order to adequately collect the information where personal data are stored. The records of processing activities would only state the reason, thus the recommendation of the author is to prepare a comprehensive personal data inventory at first place. The data inventory should contain all the possible data storage where personal data are placed, thus when a specific record shall be deleted or anonymized, the inventory could serve as the first place to verify where that record could exist at all. It is also recommended to detail the number of persons who are affected in a specific database so that in case of an incident the risk could be adequately assessed immediately. In addition, with the aggregation of data in the personal data inventory, the records of processing activities can be easily prepared.

5. A sophisticated method for anonymization – clustering

As it was previously indicated, appropriate balance should be established between anonymization of personal data and keeping its business value after the execution of anonymization algorithms. One of the methods that could be utilized is the generalization that was the process of bringing different attributes to a higher level subset. Besides, generalization can help to keep relevant business information, it makes personal data become unrecognizable.

There are several methods to perform anonymization, however, the information loss is inevitable in each cases. Randomization can be used to update the data with random noises, such as the multiplication of numeric values by random numbers generated between 0 and 1. The disadvantage with randomization is that randomized values can serve slight useful information. Data masking can also be useful when very sensitive information is stored in a database. An example for this is the masking of credit card numbers, when a part of the credit card number is replaced by "*" such as 1234-5678-****-****. Hash functions are primarily used for verification purposes when data integrity is in focus. Hash functions can also be utilized to anonymize personal data, however, after the execution, no business information can be retrieved.

The proposed method in this article for performing anonymization is the hybridization of clustering algorithms and generalization. Clustering algorithms are widely used in market segmentation, when the goal is to find customers that are the most similar to each other, therefore, different marketing strategies can be developed to prevent churn of customers that belong to different segments. One type of clustering is working with distance metrics that objective is to calculate the distance among different records and group the most similar items into one cluster (Raschka, 2015). Personally identifiable information can also be grouped by the available attributes. The columns to be selected for clustering shall be the attributes that are necessary to be anonymized later so that

the algorithm would find the most similar objects that are the closest to each other regarding their personal data. After the execution of clustering on personal data, the records are recommended to be arranged to observe the attributes that are most common in the clusters. For such a grouping Table 1 can provide an example[4].

Table 1. Clustering personally identifiable information

Unique identifier	Age	Salary	Gender	Cluster
0001	26	1400	1	1
0002	28	1600	1	1
0003	27	1900	1	1
0004	27	1750	1	1
0005	35	2000	0	2
0006	36	2000	0	2
0007	34	2000	0	2
0008	36	2000	0	2

Source: own work.

Important to note that usually the number of clusters shall be determined in advance in clustering algorithms, thus empirical experimentation is needed to be performed to find the optimal number of clusters for the available data table. Once the clustering is done, generalization can take place. Since the objects in the clusters are similar to one another, only a lower degree of anonymization is needed, because with slight modification, natural persons cannot be clearly recognized. The subsets in the above example, therefore, can be minimized e.g. for the first cluster the Age column can be 26-28, the Salary 1400-1900. That has already provided more information than just establishing subsets for the ages such as 20-29, 30-39. The second cluster can be interpreted similarly. It is also possible that in different clusters different attributes are showing similarity, thus, depending on the cluster, different attributes would need anonymization e.g. in the second cluster, maybe only the Age attribute would require it. In addition, if there are several persons in the database who are at the same age, same gender and earn the same money, then anonymization might not be needed at all for those specific records. With this kind of hybrid solution, the objective of the anonymization can be achieved, and valuable business information can be maintained that can be used for further analysis.

6. Conclusion

The goal of the article was to analyze the necessity and impacts of anonymization that is a consequence and expectation of the General Data Protection Regulation. It was discussed that anonymization is unavoidable for most of the organizations, since personal data shall be "forgotten" if the data subjects request it from data controllers and data processors, if there is no legal basis

[4] For convinence only numerical values were illustrated in the table, however, with further data transformation, columns containing texts can as well be used in clustering. In addition, the Gender attribute was encoded to identify men by 0, women by 1. In addition, please note that clustering algorithms perform better if data are the same scale e.g. standardized, normalized etc. before processed (Smola &Vishwanathan, 2008).

to store personal data, but business information shall be retained for further business purposes, or just to protect personal information from persons with malicious intentions. The design of anonymization process was also evaluated and concluded that the procedure is not trivial, as it could cause database integrity or business continuity issues. The personal data inventory was suggested to appropriately identify the locations of personally identifiable information as personal data can be localized in many systems in structured or unstructured format such as in databases, electronic mails, file shares, workstations, on hard copies etc. Finally, a hybrid model was recommended to perform anonymization that aims to achieve the objectives to make personal data unrecognizable, but at the same time, minimize the information loss from the database that could be used for further business purposes. It is recommended to continue research on finding optimal algorithms to provide a better balance between anonymization and keeping business value of anonymized databases.

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Chapter 12

A Clustering Algorithm Using Iterative Reduction of Voronoi Diagram with Additional Dimension[1]

Paweł Wołoszyn, Janusz Morajda

1. Introduction

Contemporary processes of data mining and extracting knowledge from data require much computer power and sophisticated, effective algorithms. An important kind of data analysis in such tasks, named *clustering* (or *cluster analysis*), relies on performing a grouping operation on objects, considered as points (vectors) in *n*-dimensional feature space. Such an operation leads to identification of homogeneous, disjoint groups (called *clusters*), so that each group is created by similar elements, i.e. neighbouring points in the feature space. Discovering such clusters is achieved without any *a-priori* knowledge about existence of potential structures and/or about their specification.

A large number of clustering algorithms has been developed and widely described in literature. In general, these methods can be classified as:

- hierarchical methods (top-down or bottom-up) that create a graph called dendrogram,
- *k*-means and derivative algorithms (and other non-hierarchical methods),
- fuzzy algorithms (*c*-means and others).

Cluster analysis methods have been presented in many monographs, e.g. (Anderberg, 1973; Hartigan, 1975; Spath, 1980; Kaufman & Rousseeuw, 1990; Gordon, 1999; Cichosz, 2000; Everitt et al., 2001), as well as in recent books: (de Oliveira & Pedrycz, 2007; Kogan, 2007; Aggarwal & Reddy, 2013; Wierzchoń & Kłopotek, 2015) and others. Also a great number of scientific publications has been devoted to issues concerning both classical and non-standard clustering techniques, see e.g. (Xu & Tian, 2015; Cura, 2012; Jain, 2010; Kou et al., 2014).

Here we submit a new, enhanced clustering algorithm, primarily (as the first version) proposed by us in (Morajda & Wołoszyn, 2015) as *Firefly Clustering Algorithm* (FCA), and next developed and presented in (Wołoszyn & Morajda, 2016). The method described here is based on Voronoi diagram that is initially constructed for all objects undergoing grouping process, considered as points in a metric feature space. The diagram is then iteratively reduced, together with simul-

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taneous decreasing of number of points, when selected pairs of points undergo aggregation. Such a procedure can be regarded as an agglomerative (bottom-up) hierarchical method of clustering, with potential graphical representation of the process in form of a dendrogram, which utilizes additional axis of time. Analysis of such a dendrogram could support the decision concerning the number of clusters, if it is unknown. Nevertheless we do not classify the proposed algorithm either to hierarchical or to non-hierarchical techniques, as it reveals features connected with both groups of clustering methods.

A new concept introduced here is the application of an additional dimension that can be utilised by the processed Voronoi diagram which undergoes reduction. The objects (points) can then take advantage from additional degree of freedom and the diagram can be deformed to a certain extent also along this dimension. Our preliminary research described in this paper proved higher effectiveness of the algorithm equipped with such a solution in comparison to the original FCA algorithm.

The proposed method and the description of the clustering algorithm is outlined in Section 2. Section 3 contains two empirical clustering experiments with applications of the method to selected datasets; the research results and the comparison between the proposed (enhanced) algorithm and the previous (2-dimensional) version of the method have been presented. Final conclusions and indications concerning further research are submitted in Section 4.

2. The proposed clustering algorithm

Let **S** be a set of objects considered as points (vectors) in the metric feature space, with Euclidean metrics. The task of cluster analysis performed by the algorithm relies on identification of groups (clusters) of observation vectors belonging to the set **S**. Each point (vector) in **S** has its original, basic position in the feature space, determined by feature values of the object and treated as coordinates in this space. During the clustering procedure these points are moved and linked according to given rules (together with continuous transformation of the corresponding Voronoi diagram), so the set of observations **S** becomes a dynamic system. Below, description of the proposed model (Section 2.1) and the simulation procedure (the processing of the model) executed by the clustering algorithm (Section 2.2) are presented. The pseudocode of the algorithm is submitted in Section 2.3.

2.1. The model

The model consists of mobile nodes which represent observation vectors from the dataset **S**. Initially each node is located at the same point as original data sample. In the next phase nodes are changing their locations according to a simplified physical model assuming that node mass and inertia are negligible and nodes move as if immersed in linear damping medium where velocity is linearly proportional to the force acting on a node.

Model geometry is also complemented with the concept of node neighbourhood where each node has at least one neighbour. The neighbourhood is determined in the process of generating, possibly multidimensional, Voronoi diagram for the entire set of nodes at initial positions. This results in Delaunay tessellation mesh which serves as neighbourhood graph. Any interactions between nodes occur only if they are direct neighbours in the Delaunay graph, i.e. if they are connected with an edge of the graph.

Nodes can also form mutually closest pairs when two nodes are at the same time their own closest neighbours. Such symmetric kind of pairing plays important role in the simulation phase, during which mutually closest pairs are aggregated into new single nodes. After aggregation the neighbourhood graph is updated by merging corresponding vertices, but the Voronoi diagram is not recomputed again.

Nodes not involved in mutually closest pairs are kept, if possible, at the same distances as in initial configuration despite movement, as if they were connected with some kind of elastic rod. If their separation decreases, a repelling force appears tending to restore the original distance and conversely if they drift away, an attracting force appears.

The elasticity of neighbour links is necessary for allowing some degree of freedom, otherwise the entire graph of neighbours would be completely rigid as composed exclusively of triangles. Moreover, this freedom can benefit from availability of additional dimension (or dimensions) not used in original dataset. As the Delaunay mesh is not recomputed during simulation, it can fold into additional dimension (dimensions) while retaining original neighbourhood relations.

This helps preserve original distances between neighbours. For example two-dimensional dataset can be artificially promoted to three dimensions by assigning random values with small variability to third coordinate. Voronoi cells calculated in initial phase become three-dimensional polyhedra, but Delaunay mesh is still comprised mostly of triangles. This means that when the mesh is contracting in some areas, other nodes can escape to third dimension to keep their distances.

2.2. The simulation process

After initialising the model the next phase of iterative reduction begins. This is the dynamic simulation part of the model life cycle. The simulation consists of several rounds during which the nodes are aggregated into larger units. Simulation mechanism is purely deterministic and no random input is used although in the case of symmetric ambiguity an arbitrary choice is made based on the ordering of input data.

Each simulation round is divided into three stages: node pairing, movement and aggregation. In the first stage all mutually closest pairs are determined according to current distances between nodes and their neighbour relations. Then the second stage begins and node movement is simulated. In each mutually closest pair the nodes actively move towards each other, shortening their distance. All other nodes move passively, as determined by calculating elastic forces between neighbours.

Node movement is simulated in discrete steps with time interval chosen sufficiently small to assure that system dynamics remain stable. The distance-preserving behaviour of nodes cannot be perfect, because as a pair of nodes approach each other, at least one triangle in their neighbourhood degenerates to a line segment. Final length of such segment depends on equilibrium of elastic forces between neighbours.

When nodes in mutually closest pairs become closer than a certain threshold assumed in the model, the third stage occurs, during which pairs are aggregated. Two nodes in each pair are replaced by a single node and their neighbourhood links are updated accordingly with averaged distances. In the next round passive neighbours will try to keep those averaged distances. Before next round starts, however, some extra time is allowed for node positions to settle in equilibrium.

Pairwise aggregation events are recorded in a history log in the order of their occurrence. This allows to reconstruct and analyze the process of cluster formation. The simulation phase ends when

all nodes become aggregated into a single node. Then the recorded aggregation log is analyzed in order to generate clustering tree that can be visualised in form of a dendrogram. Then the clusters are identified exactly according to rules utilised in agglomeration clustering methods.

If the final number clusters is expected (let us denote it by k), the algorithm can be stopped when k nodes are left in the diagram. The clusters are then recognised as sets of objects (points) aggregated in particular k nodes.

2.3. The outline of the algorithm in form of a pseudocode

```
for each record in dataset:
    add node to model M
compute set N of neighbor pairs
while size of M > 1:
    initialize empty set P of node pairs
    for each pair (a,b) in N:
        if (a,b) are mutually closest neighbors:
            add (a,b) to P
    repeat:
        for each (c,d) in P:
            move c and d towards themselves
            if c and d collide:
                create new node q
                replace c and d with q in M and N
        for each (a,b) in N:
            accumulate elastic force
        for each f in M:
            move f
    until equilibrium is reached
```

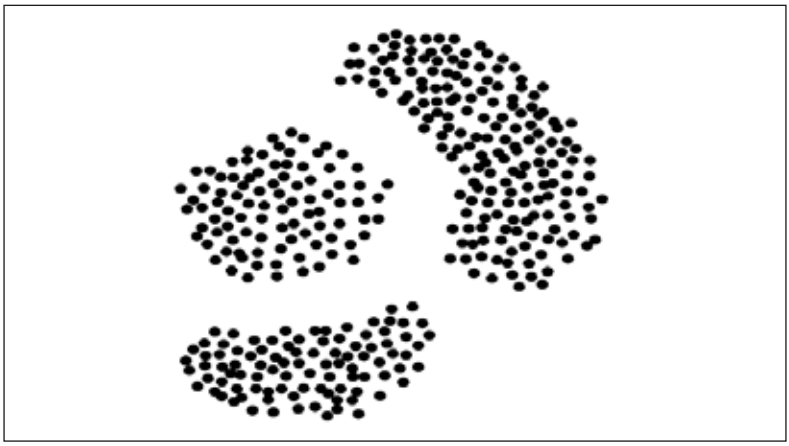
3. Examples of clustering processes with application of the proposed method

Below we submit results of two clustering experiments. We consider only 2-dimensional problems (with only 2 numerical variables), i.e. datasets that can be easily shown in form of points on the plane, however the method is universal and can be applied for any number of features (in n-dimensional feature space).

3.1. Experiment 1 – "3 clusters"

Let us consider an artificially generated set of objects presented in Figure 1. Small circles show original (initial) positions of nodes (related to these objects) on the plane.

Figure 1. A graphical representation of the dataset "3 clusters"



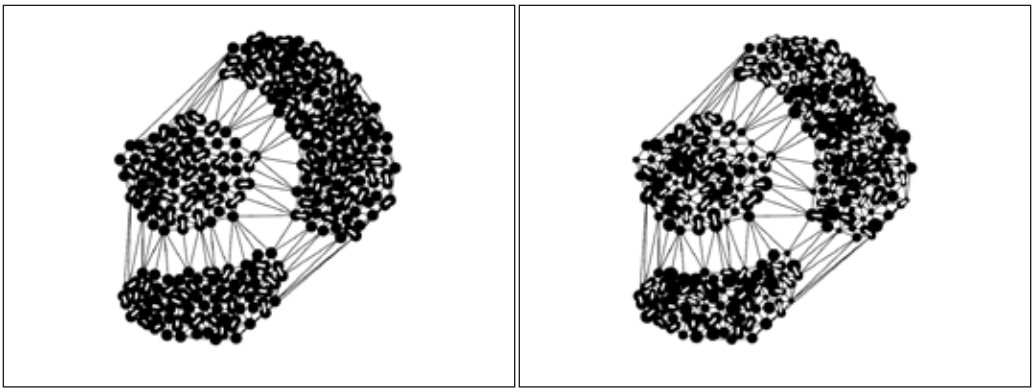
Source: own elaboration.

We have carried out two variants of a clustering process for this set with the use of the proposed algorithm described in Section 2. The first variant (2D) does not use the additional (3rd) dimension during processing of the Voronoi diagram and all the geometrical transformations being executed by the algorithm take place on the plane. The second variant (3D) utilises the concept of a 3-dimensional Voronoi diagram (with 3-dimensional cells), constructed with the use additional dimension, introduced in Section 2. In this variant, at the beginning of the process, the 3rd coordinate of each node is generated as a small random number belonging to a limited range around zero.

Subsequent stages of the process for both variants are graphically shown in next figures. Thin solid lines between certain nodes denote the neighbourhood of these points, determined on the basis of adjacency of respective Voronoi cells. For a 3D variant, diameters of small circles (representing nodes) in right graphs of Figures 2-5 and 8 express their positions on the 3rd dimension (perpendicular to the plane), i.e. bigger circles are placed closer to the observer and smaller ones are positioned farther.

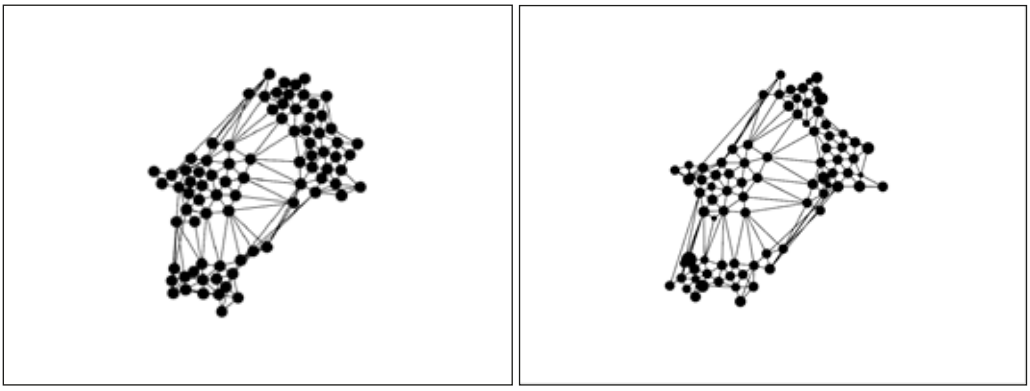
Figure 2 illustrates the beginning stage of the procedure. Short, thick white lines show linkages between nodes currently connected into mutually closest neighbour pairs. Figures 3, 4 and 5 present next stages of clustering, indicating states after selected numbers of iterations. Final results are shown in Figure 6.

Figure 2. Clustering process, stage 1. Variants: 2D (left graph) and 3D (right graph)



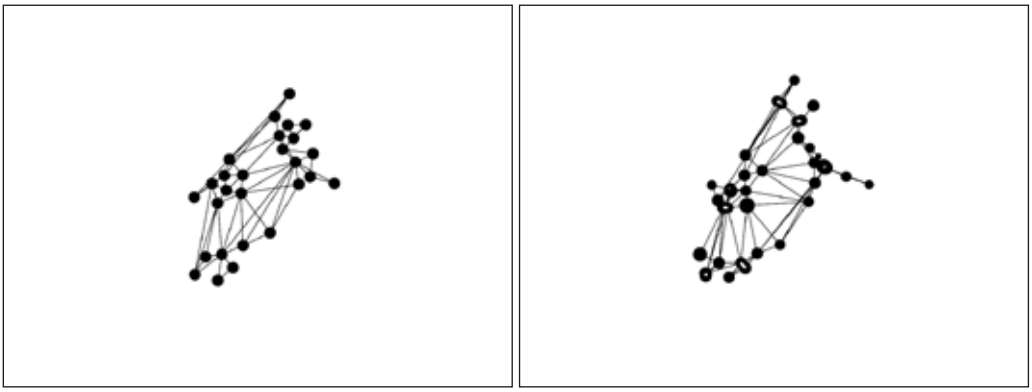
Source: own calculations.

Figure 3. Clustering process, stage 2. Variants: 2D (left graph) and 3D (right graph)



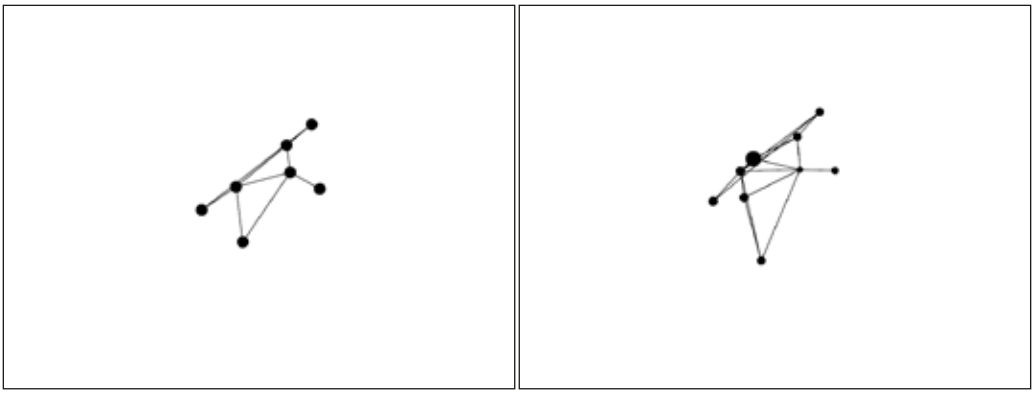
Source: own calculations.

Figure 4. Clustering process, stage 3. Variants: 2D (left graph) and 3D (right graph)



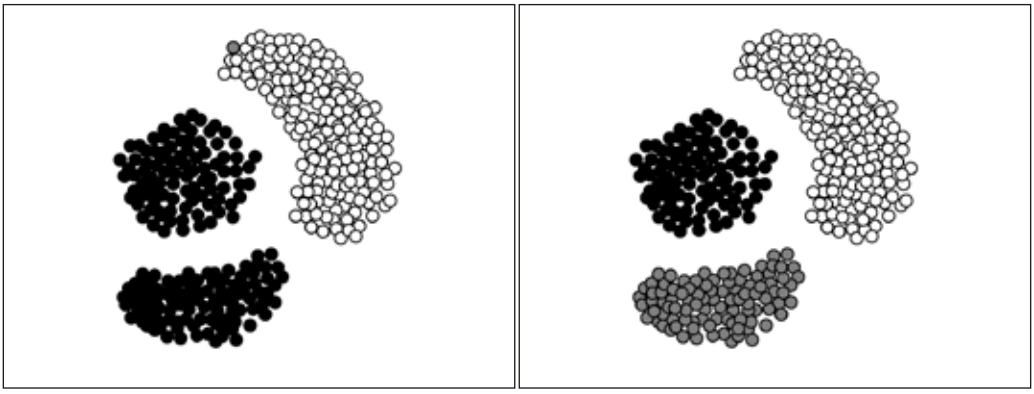
Source: own calculations.

Figure 5. Clustering process, stage 4. Variants: 2D (left graph) and 3D (right graph)



Source: own calculations.

Figure 6. Clustering process, final results. Ultimate clusters are presented with different colours: white, grey and black. Variants: 2D (left graph) and 3D (right graph)



Source: own calculations.

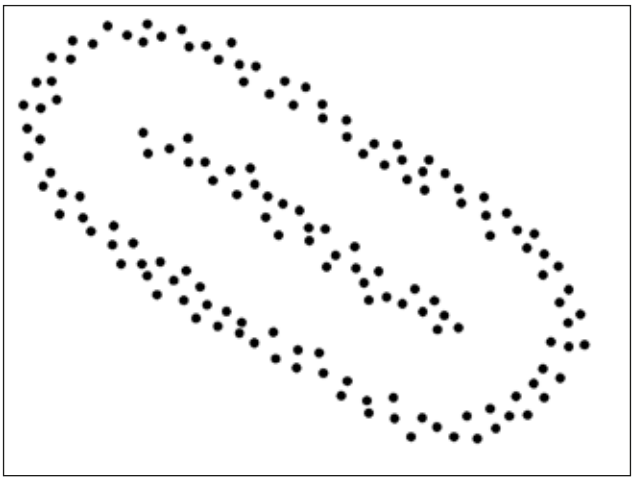
Let us note that in subsequent stages of the 3D variant, increasing dispersion of nodes along the 3rd dimension occurs over time. This effect shows real utilisation of additional degree of freedom during iterative diagram reduction, when distances between many nodes should be preserved and consequently the triangulation net must undergo deformation.

The final result of clustering process, assuming existence of three clusters, is excellent in case of the 3D variant of algorithm, while in 2D process the two groups containing black circles (linked during a previous phase) constitute one cluster, and there exists a cluster including only one node (grey circle) inside another "white" class.

3.2. Experiment 2 – "A ring surrounding central group"

Let us consider next (artificially generated) set presented in Figure 7, where objects on a plane are shown by small circles and create a ring that surrounds an internal group.

Figure 7. A graphical representation of the dataset "A ring surrounding central group"

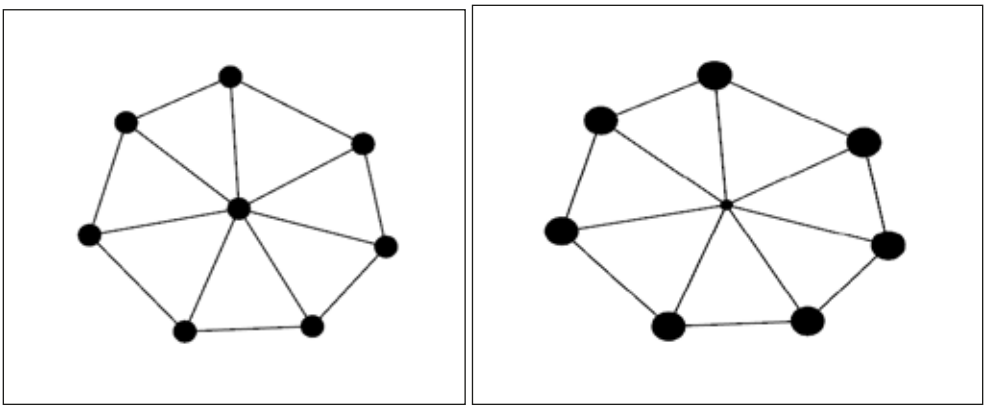


Source: own elaboration.

A process of clustering with the use of the considered algorithm has been performed similarly to the experiment 1 (Section 3.1). Also 2D and 3D variants of the procedure have been applied.

Let us analyse one of final stages of the simulation (for 2D and 3D variants), shown graphically in Figure 8 (the meaning of symbols is the same as in Section 3.1).

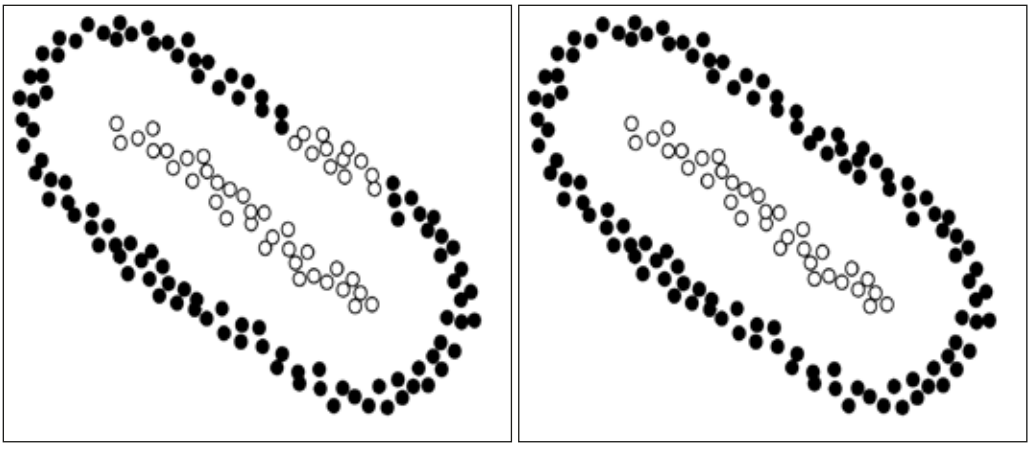
Figure 8. Clustering process, one of the final stages with 8 nodes remaining after the series of aggregations. Variants: 2D (left graph) and 3D (right graph)



Source: own calculations.

The central node in both diagrams (2D and 3D) in Figure 8 represents all objects belonging to the central group, and the remaining seven nodes around it correspond to aggregated parts of the surrounding ring. However, as the 2D process is performed on the plane, during the aggregation of subsequent pairs of active nodes (neighbouring objects), the remaining (passive) nodes, which try to keep distances to surrounding elements but have no possibility to move along 3rd dimension, cannot preserve intervals between them and undesirable distortion of location of these nodes happens. It can lead to a wrong objects allocation to particular clusters. On the other hand, in the 3D variant, which allows "bending" the whole structure in the 3rd dimension, the distances between passive nodes, that currently do not create pairs and do not aggregate themselves, can remain constant or undergo only slight changes. Such a phenomenon is visible in Figure 8 (right graph), where the central node (representing the central cluster), shown by a circle with a significantly smaller diameter, is actually moved far backward along the 3rd dimension (perpendicular to the figure plane that is an X-Y plane constituting the feature space), whilst other nodes are moved in opposite direction (towards the observer). Such a possibility allowed to preserve much longer distances between the central node (central group) and other surrounding points (representing subsequent parts of the ring). This quality of the clustering algorithm significantly impact on its effectiveness (see Fig. 9).

Figure 9. Clustering process, final results. Ultimate clusters are presented with different colours: white and black. Variants: 2D (left graph) and 3D (right graph)



Source: own calculations.

Figure 9 shows ultimate results of both clustering experiments (2D and 3D), assuming that two clusters are expected. During the 2D process, a part of the ring has been wrongly assigned to the central cluster. It is an effect of previous improper aggregation between the central node and one of surrounding nodes representing this part of the ring (see Fig. 8), which in turn is a result of impossibility to keep sufficient distances between non-aggregating nodes on the plane. Such a problem did not occur in the 3D case, which ended up generating proper division into clusters.

4. Conclusion

The paper introduces significant enhancements for the FCA clustering algorithm, previously proposed by us in (Morajda & Wołoszyn, 2015) and then modified in (Wołoszyn & Morajda, 2016). The alterations concern mainly: 1) changing the method of objects (nodes) processing (instead of a firefly-like behaviour during objects pairing and linking, we use strict mathematical description (based on Voronoi diagrams) of nodes, their movements and aggregation); 2) utilisation of an additional (3rd) dimension as the next degree of freedom for processed objects. The presented, enhanced algorithm performs better than its 2-dimensional version.

However, further experiments performed for other datasets are necessary to obtain stronger confirmation of the submitted results. Next, a generalisation of the algorithm to any number of feature space dimensions should be indicated as an important direction of further researches. The advancement degree of the method will also rise if a visualisation of the clustering process in a dendrogram-like form is elaborated.

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Chapter 13

Comparison of Mclust and EMMIXuskew R Packages Implementing Gaussian and Skewed t-Student Mixture Models

Elena Lenchenko

1. Introduction

Mixture Models are parametric tools for cluster analysis of grouped data. They can be used among others to jointly model data including ratios and financials for non-homogenous groups of companies, returns of financial market instruments under different regimes, and multivariate measures of the development among heterogenous administrative units.

In our study we focus on the estimation quality assessment for the location and scale parameters and capabilities for outlier separation of Gaussian and skewed t-Student mixture models implemented in R packages `mclust` (Scrucca et al., 2016) and `EMMIXuskew` (Lee & McLachlan, 2013), based on the simulated data. In the subsequent part of the paper we briefly discuss basics of mentioned mixture model structures. In the third paragraph we firstly make data simulation from the skewed t-Student mixture contaminated by uniformly distributed outlier. Then we assess capability of selected mixture models implemented in the `mclust` and `EMMIXuskew`, to capture properties of this simulated data. Lastly we conclude our results obtained using considered models.

2. Basics of Mixture Models structures

Mixture models in its basic form assume that the data $\mathbf{x}_i \in \mathbb{R}^p$ is generated from the finite number of K subpopulations (components) with the same distributions type, but different parameters, and the variable representing distribution from which data was generated is unobserved. This variable is denoted by the vector

$$\mathbf{z}_i = \left[z_{ik}, k = 1, \ldots, K \right] \tag{1}$$

where

$$z_{ik} = \begin{cases} 1, & \text{when data come from the } k-\text{th component} \\ 0 & \text{elswhere} \end{cases}.$$

For the considered sample we assume that state *k* of the hidden variable follows an *iid* process with the categorical distribution.

2.1. Gaussian Mixture Models and `mclust`

The `mclust` package implements Gaussian Mixture Models with the possibility of introducing outliers into the model structure, it also allows parameter regularization.

Basic Gaussian Mixture Model with *K* components for the sample $\{\mathbf{x}_i, i = 1,\ldots,n\}$ is defined as:

$$f\left(\mathbf{x}_i \mid \Theta = [\mu_k, \Sigma_k; k = 1,\ldots,K]\right) = \sum_{k=1}^{K} \pi_k f_N\left(x_i \mid \mu_k, \Sigma_k\right), i = 1,\ldots,n, \tag{2}$$

where:

$\pi_k \geq 0, k = 1,\ldots,K$ is the prior probability of belonging to the *k*-th component, for which $\pi_k \geq 0, k = 1,\ldots,K$ and $\sum_{k=1}^{K} \pi_k = 1$, moreover f_N denotes Gaussian distribution density for each component *k*, with μ_k and Σ_k as the location and scale parameters, and Θ groups all of the model parameters.

There are some propositions to include outliers in the Gaussian Mixture Model structure, one of them presented below, is implemented in the `mclust` package:

$$f^o\left(\mathbf{x}_i \mid \Theta = [\mu_k, \Sigma_k; k = 1,\ldots,K]\right) = \pi_0 I\left(\mathbf{x}_i \in \mathcal{R}_0\right) + \sum_{k=1}^{K} \pi_k f_N\left(\mathbf{x}_i \mid \mu_k, \Sigma_k\right), \tag{3}$$

where:

$\mathcal{R}_0$ is the set of outliers,

I is an indicator function, $\pi_0 \geq 0, \sum_{k=0}^{K} \pi_k = 1,$ and other notation remain unchanged.

In this construction we assume that some of the observations weren't generated from any of the recognized *K* mixture components, but where generated from some unknown disturbing distribution, for which we assume prior probability π_0.

On the other hand to circumvent the problem of the degeneracy and singularity, we can introduce parameter regularization component to the likelihood function.

Let's consider joint density of $\left(\mathbf{x}_i, \mathbf{z}_i\right)$ for the basic Gaussian Mixture Model:

$$f_c\left(\mathbf{x}_i, \mathbf{z}_i \mid \Theta = [\mu_k, \Sigma_k; k = 1,\ldots,K]\right) = \prod_{k=1}^{K} \left[\pi_k f_N\left(\mathbf{x}_i \mid \mu_k, \Sigma_k\right)\right]^{z_{ik}}, i = 1,\ldots,n, \tag{4}$$

Associated with the joint density is the complete-data likelihood, which is sum of its logarithms for all sample observations:

$$l_c\left(\mathbf{x}, \mathbf{z} \mid \Theta = [\mu_k, \Sigma_k; k = 1,\ldots,K]\right) = \sum_{i=1}^{n}\sum_{k=1}^{K} z_{ik} \log \pi_k + \sum_{i=1}^{n}\sum_{k=1}^{K} z_{ik} \log f_N\left(\mathbf{x}_i \mid \mu_k, \Sigma_k\right), \tag{5}$$

In practice z_{ik} values are unknown and the maximum likelihood estimation of the parameters is considered as the incomplete data problem.

To find the maximum likelihood parameters estimator value for the considered mixture model, we employ iterative EM (Expectation-Maximization) method, for which in each iteration in the E-step we calculate the expected value (conditional on sample data values $\mathbf{x}_i$) of complete-data loglikelihood, under model parameters value from previous iteration. Then in the subsequent M-step we maximize expression from the E-step according to the model parameters values. In the E-step in the complete-data loglikelihood expectations of z_{ik}, conditional on $\mathbf{x}_i$, take the form of the posterior probabilities that *i*-th observation belongs to the *k*-th mixture component, under model parameters values taken from the previous iteration. In the Gaussian Mixture Model for the M-step we have closed-form solution. Such an iterative steps are continued until difference between parameters values from the consecutive iterations drops below given threshold. Procedure is presented in details in (McLachlan & Peel, 2004).

In the regularization case we assume some prior distribution for the mixture model parameters. It can take the form of the conjugate prior, which for the Gaussian Mixture Models is Normal-Inverse Wishart for the location and scale parameters of the each component.

This results in the so called MAP (Maximum a posteriori) estimator of the mixture model parameters, because value of this estimator equals posterior mode for the Bayesian Gaussian Mixture Model (with assumed parameter prior).

For the mixture models with the parameters regularization we modify EM method, such that in the M-step we maximize penalized complete-data likelihood:

$$\begin{aligned} l_{c,r}\left(\mathbf{x},\mathbf{z}\mid\Theta^{(r)}=[\mu_k,\Sigma_k;k=1,\ldots,K]\right)&=\sum_{i=1}^{n}\sum_{k=1}^{K}\tau_{ik}^{(r-1)}\log\pi_k{}^{(r)}+\\ +\sum_{i=1}^{n}\sum_{k=1}^{K}\tau_{ik}^{(r-1)}\log f_N\left(\mathbf{x}_i\mid\mu_k,\Sigma_k\right)&+\sum_{k=1}^{K}f_N\left(\mu_k\mid\Sigma_k;\eta_\mu\right)+\sum_{k=1}^{K}f_{IW}\left(\Sigma_k;\eta_\Sigma\right), \end{aligned} \tag{6}$$

where:

$\tau_{ik}^{(r-1)}=E\left(z_{ik}\mid\mathbf{x}_i;\Theta^{(r-1)}\right)$ are posterior probability, conditional on the $\mathbf{x}_i$, for the *i*-th observation belonging to the *k*-th component, under the mixture model parameters values $\Theta^{(r)}$ from the previous iteration, moreover f_N and f_{IW} are respectively Normal and Inverse Wishart prior densities for the location and scale parameters of the mixture components, for which η_μ and η_Σ are respective distributions hyperparameters.

2.2. Skewed t-Student Mixture Models and `EMMIXuskew`

Skewed t-Student Mixture Models from the `EMMIXuskew` package can capture fatter tails and skewness of components distributions, but the package don't give the opportunity to structure outliers and to include parameter regularization.

For $\mathbf{x}_i\in\mathbb{R}^p$ we define skewed t-Student Mixture Model as:

$$f\left(\mathbf{x}_i\mid\Theta=[\mu_k,\Sigma_k,\delta_k,\nu_k;k=1,\ldots,K]\right)=\sum_{k=1}^{K}\pi_k f_{skT}\left(\mathbf{x}_i\mid\mu_k,\Sigma_k,\delta_k,\nu_k\right),\ i=1,\ldots,n, \tag{7}$$

where:

f_{skT} is the density of the skewed t-Student distribution for each k-th ($k = 1,\ldots,K$) component of the mixture, which distribution is parametrized by the location vector μ_k, scale matrix Σ_k, skewness vector δ_k and (scalar) degrees of freedom ν_k.

The p-dimensional skewed t-Student variable $\mathbf{X} \sim skT(\mu, \Sigma, \delta, \nu)$ can be defined using the following stochastic representation:

$$\mathbf{X} = \mu + \frac{1}{\sqrt{w}} \Delta |\mathbf{U}_1| + \frac{1}{\sqrt{w}} \mathbf{U}_0, \tag{8}$$

where:

$\mathbf{U}_0 \sim N(\mathbf{0}, \Sigma)$ is p-dimensional variable with normal distribution having $\mathbf{0}$ vector mean and Σ covariance matrix, $\mathbf{U}_1 \sim N(\mathbf{0}, \mathbf{I})$ is standardized p-dimensional normal distribution variable, and $w \sim Gamma\left(\frac{\nu}{2}, \frac{\nu}{2}\right)$ scalar variable with Gamma distribution with the location and scale parameters equal $\frac{\nu}{2}$.

Using this kind of distribution for the mixture model components enables us to model deviations of the empirical distribution from the elliptic distribution. Skewed t-Student distribution in the case when $\delta = \mathbf{0}$ reduces to the symmetric t-Student, and when $\nu \to +\infty$ it becomes skewed normal distribution. Under both mentioned here conditions it reduces to the symmetric normal distribution. In other words skewed t-Student distributions can encompass elliptic distribution under specific values of parameters.

To get the maximum likelihood estimates of skewed t-Student mixture model, based on its complete-data likelihood, we employ EM procedure, for which the M-step has closed-form solution. Procedure is presented in details by (Lee & McLachlan, 2013).

2.3. Number of mixture components selection methods

We can have two scenarios considering number K of mixture components. In one we have prior information about K, and we will call it known number of components scenario. In the other case component number is unknown and it should be estimated from the data.

In the latter case, if we focus on the descriptive aspects of the mixture model, in the component number selection procedure we should use BIC (Bayesian Information Criterion), which is the asymptotic approximation of the posterior probability that the model generated observed data.

If we concentrate on the goodness of the observations' component membership posterior probability prediction (class membership prediction) we should use ICL (Integrated Classification Likelihood) criterion, which is based on the complete-data likelihood.

We select the mixture model number of components, for which selected criterion value is maximized.

3. Simulation comparative study for Mixture Models

3.1. Simulation setting

In our simulation study 900 observations are simulated from the three-component two-dimensional skewed t-Student Mixture Model, each component generated 300 observations.

We established convex hulls for 95% highest density regions (HDR) for each of the mixture components.

The mixture components parameters was selected such to approximately obtain assumed separation level for the components. It is measured by the percentage of the observations generated by the considered component, which belong to the 95% HDR of another component. In other words it measures level of the components HDR overlapping.

We below present the skewed t-Student mixture components parameters values assumed in the simulation:

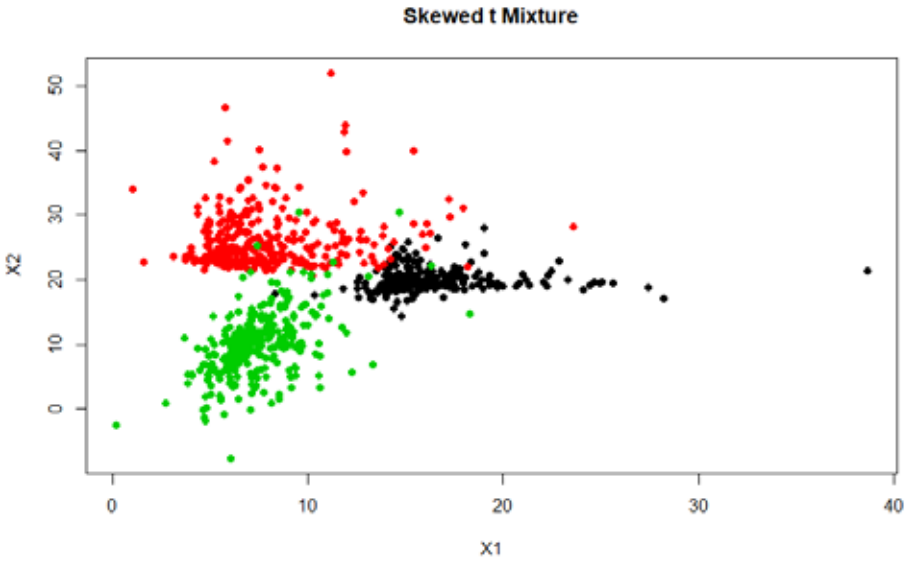
- location parameters vectors: $\mu_1 = [14.0, 19.0]', \mu_2 = [5.0, 22.0]', \mu_3 = [6.0, 10.0]'$,
- scale parameters matrices: $\Sigma_1 = \begin{bmatrix} 2.0 & 1.5 \\ 1.5 & 2.0 \end{bmatrix}, \Sigma_2 = \begin{bmatrix} 2.0 & 0.0 \\ 0.0 & 1.0 \end{bmatrix}, \Sigma_3 = \begin{bmatrix} 3.0 & 7.0 \\ 7.0 & 24.0 \end{bmatrix}$,
- skewness parameters vectors: $\delta_1 = [3.0, 1.5]', \delta_2 = [4.0, 6.0]', \delta_3 = [2.0, 0.5]'$,
- degrees-of-freedom scalars: $\nu_1 = 1, \nu_2 = 2, \nu_3 = 3$.

It results in the observations overlap frequencies, for each components respectively at levels: $k = 1 : 0.03,\ k = 2 : 0.02,\ k = 3 : 0.04$.

In the subsequent step data was contaminated by 100 outliers, generated by the uniform distribution with the support on the rectangle $(0.9 \cdot \min_i\{x_{i1}\}, 0.9 \cdot \min_i\{x_{i1}\}) \times (1.1 \cdot \max_i\{x_{i1}\}, 1.1 \cdot \max_i\{x_{i2}\})$, with 95% HDR set for each component excluded. By $\mathbf{x}_i = [x_{i1}, x_{i2}]'$, $i = 1, \ldots, 900$, we understand data generated from the uncontaminated model.

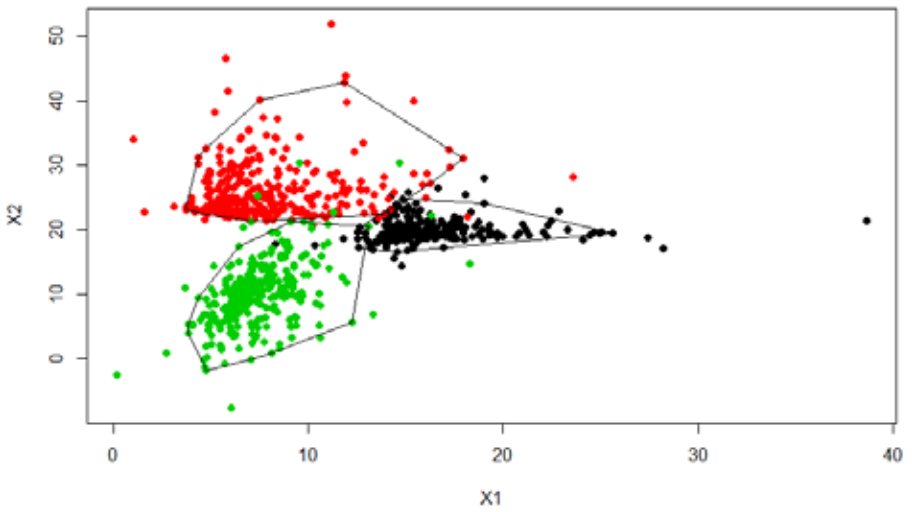
We now graphically present effects of the subsequent steps of our simulation.

Figure 1. Simulation study: data simulated from 3-component skewed t-Student Mixture Model



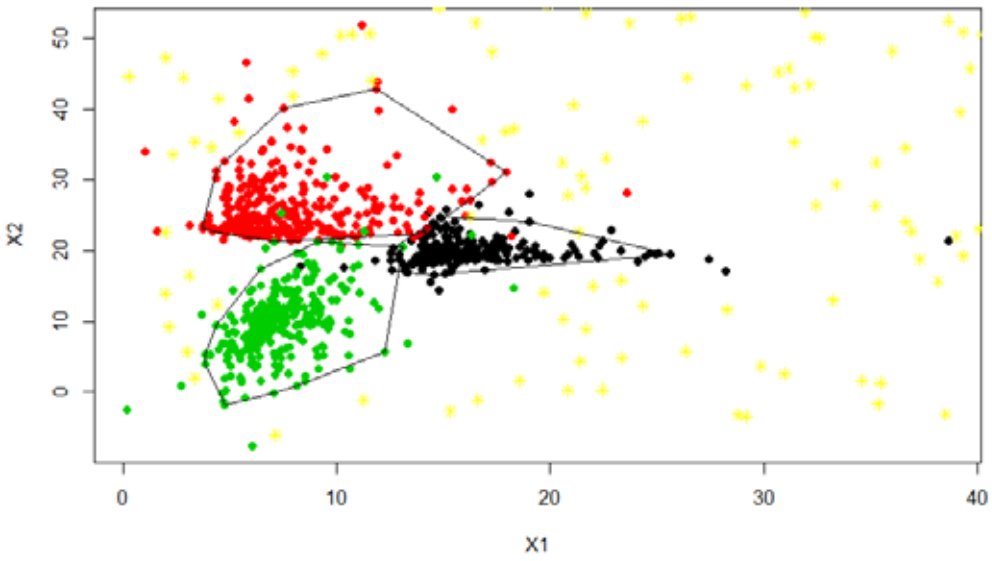
Source: own elaboration.

Figure 2. Simulation study: data without outliers, convex hulls for 95% highest density regions for clusters



Source: own elaboration.

Figure 3. Simulation study: expanded samples consist of 10% outliers (in yellow)



Source: own elaboration.

In the next paragraphs we explore capabilities of Gaussian and skewed t-Student mixture models to render simulated data characteristics, using different model configurations.

3.2. Mixture models estimation using uncontaminated data

In the uncontaminated data case (900 observations) we assume that the number of components are known and equals $K = 3$, and no longer need to be estimated.

We start from the Gaussian Mixture, which knowing structure of the skewed t-Student 3-component process which generated data, wrongly assumes elliptic distributions for mixture of components. It can be regarded as the skewed t-Student Mixture, with unnecessary constraints: $\delta_k = \mathbf{0}, \nu_k \to +\infty, k = 1,2,3.$

In the `mclust` package function `Mclust` we assume default initial values for the EM algorithm.

We assume `VVV` model type, i.e. Gaussian Mixture Model with components distributions for which all of the volume, shape and orientation is not constrained.

Initial model parameters for the EM algorithm are taken from the clusters generated by the Gaussian Hierarchical Clustering (Fraley, 1998). Model estimation results are presented in the table below.

Table 1. Estimation results for the 3-component Gaussian Mixture Model under uncontaminated data

```
----------------------------------------------------
Gaussian finite mixture model fitted by EM algorithm
----------------------------------------------------

Mclust VVV (ellipsoidal, varying volume, shape, and orienta-
tion) model with 3 components:

 log.likelihood n df  BIC  ICL
  -5284.387 900 17 -10684.41 -10793.62

Clustering table:
 1 2 3
270 273 357

$pro
[1] 0.2830976 0.2962521 0.4206503

$mean
    [,1]  [,2]  [,3]
[1,] 16.00511 7.182673 9.010061
[2,] 19.60069 9.241808 24.957635

$variance
$variance$modelName
[1] "VVV"

$variance$d
[1] 2

$variance$G
[1] 3

$variance$sigma
, , 1

    [,1]  [,2]
[1,] 9.4952029 0.5201077
[2,] 0.5201077 1.0828351

, , 2

    [,1]  [,2]
[1,] 2.529042 2.915995
[2,] 2.915995 17.290656

, , 3

    [,1]  [,2]
[1,] 14.017434 -3.005118
[2,] -3.005118 26.781592
```

Source: own elaboration.

We also estimate parameters of the unconstrained three-component skewed t-Student Mixture Model, using function `fmmst` from the package `EMMIXuskew`. The EM algorithm was initialized with the function `fmmst` default initialization procedure. Model estimation results are presented in the table below.

Table 2. Estimation results for the 3-component skewed t-Student Mixture Model under uncontaminated data

```
$loglik
[1] -5316.53

$iter
[1] 345

$eps
[1] 1.267097e-05

$aic
[1] 10685.06

$bic
[1] 10809.92

$pro
[1] 0.08994839 0.22691474 0.68313687

$mu
$mu[[1]]
     [,1]
[1,] 5.729015
[2,] 8.076856

$mu[[2]]
     [,1]
[1,] 6.221757
[2,] 8.841902

$mu[[3]]
     [,1]
[1,] 7.981611
[2,] 18.924874


$sigma
$sigma[[1]]
     [,1]     [,2]
[1,] 3.474923 4.953869
[2,] 4.953869 8.308139

$sigma[[2]]
     [,1]     [,2]
[1,] 1.302461 2.455749
[2,] 2.455749 5.272622

$sigma[[3]]
     [,1]     [,2]
[1,] 14.246035 -8.489813
[2,] -8.489813 5.142822


$delta
$delta[[1]]
     [,1]
[1,] 2.011790
[2,] -3.582742
```

```
$delta[[2]]
     [,1]
[1,] 1.352457
[2,] 3.059036

$delta[[3]]
     [,1]
[1,] 4.767773
[2,] 5.060029


$dof
[1] 23.46049 53.47396 20.08487
```

Source: own elaboration.

In the both cases, component parameter estimates was significantly biased, especially scale parameters. Surprisingly using more elastic structure of the skewed t-Student Mixture Model didn't result in the significant reduction of the bias for the location and scale parameters.

Moreover degrees-of-freedom estimates was wrongly estimated. For both model structures classes prior probabilities estimates is distorted (in data generating process equal prior probabilities was assumed).

3.3. Mixture models estimation using contaminated data

This time mixture models parameters is estimated using 1000 observations sample containing 100 outliers, other 900 observations are from used earlier uncontaminated sample.

In the first attempt we assume known number of three components in the Gaussian Mixture Model and include in its structure outlier part. We initialize the EM algorithm with default values and we make initial guess which observations are outliers, using method of the Robust Covariance Estimation via Nearest Neighbor Cleaning (Wang & Raftery, 2002). Model estimation results are presented in the table below.

In comparison to the Gaussian Mixture Model estimated using uncontaminated data, results are less biased for the Gaussian Mixture Models with outlier part in the structure. It can be explained by the fact that some 'distant' observation generated by skewed t-Student components, which distort estimates can be assumed as outliers.

In the second attempt we introduce to the three-component Gaussian Mixture Model with the outliers structure, the conjugate prior Bayesian regularization. Model estimation results are presented in the table below.

Introduction of the parameter regularizations didn't improve overall estimation results.

In the another approach to the Gaussian Mixture Model specification and estimation, we do not include outlier part in the model structure, we also assume that number of components are unknown and should be estimated. We select number of components by maximizing BIC criterion This approach is aimed to enable outliers to form additional clusters, but knowing outlier generating process it can fail to do so. Model estimation results are presented in the table below.

Table 3. Estimation results for the 3-component Gaussian Mixture Model with outlier part structure under contaminated data

```
----------------------------------------------------
Gaussian finite mixture model fitted by EM algorithm
----------------------------------------------------

Mclust VVV (ellipsoidal, varying volume, shape, and orienta-
tion) model with 3 components
and a noise term:

 log.likelihood n df  BIC  ICL
  -6206.314 1000 19 -12543.88 -12659.49

Clustering table:
 1 2 3 0
277 277 288 158

 $pro
[1] 0.2706147 0.2655590 0.2813366 0.1824897

$mean
    [,1]  [,2]  [,3]
[1,] 15.29624 7.268810 7.663791
[2,] 19.78102 9.804303 25.150120

$variance
$variance$modelName
[1] "VVV"

$variance$d
[1] 2

$variance$G
[1] 3

$variance$sigma
, , 1

    [,1]  [,2]
[1,] 2.4484186 0.3422144
[2,] 0.3422144 1.8308341

, , 2

    [,1]  [,2]
[1,] 2.313865 3.029875
[2,] 3.029875 15.928278

, , 3

    [,1]  [,2]
[1,] 6.6158093 -0.4712837
[2,] -0.4712837 10.0058871
```

Source: own elaboration.

Table 4. Estimation results for the 3-component Gaussian Mixture Model with outlier part structure and parameter regularization, under contaminated data

```
----------------------------------------------------
Gaussian finite mixture model fitted by EM algorithm
----------------------------------------------------

Mclust VVV (ellipsoidal, varying volume, shape, and orienta-
tion) model with 3 components
and a noise term:

Prior: defaultPrior()

 log.likelihood n df  BIC  ICL
  -6207.263 1000 19 -12545.77 -12657.07

Clustering table:
 1  2  3  0
279 277 282 162

$pro
[1] 0.2750143 0.2653517 0.2749221 0.1847119

$mean
    [,1]  [,2]  [,3]
[1,] 15.27768 7.271425 7.524859
[2,] 19.82977 9.812493 25.162247

$variance
$variance$modelName
[1] "VVV"

$variance$d
[1] 2

$variance$G
[1] 3

$variance$sigma
, , 1

    [,1]  [,2]
[1,] 2.4353105 0.3098628
[2,] 0.3098628 2.0847994

, , 2

    [,1]  [,2]
[1,] 2.311533 2.956076
[2,] 2.956076 15.496309

, , 3

    [,1]  [,2]
[1,] 5.6651381 -0.3555334
[2,] -0.3555334 9.7655107
```

Source: own elaboration.

Table 5. Estimation results for the 3-component Gaussian Mixture Model without outlier part structure and estimated number of components, under contaminated data

```
----------------------------------------------------
Gaussian finite mixture model fitted by EM algorithm
----------------------------------------------------

Mclust VVV (ellipsoidal, varying volume, shape, and orienta-
tion) model with 6 components:

 log.likelihood n df  BIC  ICL
  -5057.961 900 35 -10354.01 -10678.46

Clustering table:
 1 2 3 4 5 6
213 175 227 93 135 57

Mixing probabilities:
   1   2   3   4   5   6
0.21912180 0.23362375 0.23822240 0.10421173 0.12713264
0.07768768

Means:
   [,1]  [,2]  [,3]  [,4]  [,5]  [,6]
[1,] 14.99276 13.95998 7.23686 7.223163 6.523584 7.675220
[2,] 19.43730 23.15388 10.84935 29.808308 23.500825 5.640051

Variances:
[,,1]
   [,1]  [,2]
[1,] 1.312432 0.4097640
[2,] 0.409764 0.8090484
[,,2]
   [,1]  [,2]
[1,] 28.351761 -9.710742
[2,] -9.710742 13.268882
[,,3]
   [,1]  [,2]
[1,] 1.971069 2.995065
[2,] 2.995065 11.505212
[,,4]
   [,1]  [,2]
[1,] 4.505102 4.335609
[2,] 4.335609 35.642217
[,,5]
   [,1]  [,2]
[1,] 2.2651971 -0.2145033
[2,] -0.2145033 1.3067576
[,,6]
   [,1]  [,2]
[1,] 5.967578 6.311009
[2,] 6.311009 19.615509
```

Source: own elaboration.

Using BIC criterion Gaussian mixture model with 6 components was selected. For the estimated model first three clusters can be recognized as mixture components, other three represent

outliers clusters. Prior probabilities estimates for the mixture components are less biased than that estimated using uncontaminated sample.

Lastly we considered skewed t-Student Mixture Model. Unfortunately function `fmmst` from the package `EMMIXuskew` doesn't have possibility to include outlier part in the model structure, so we cannot explicitly model them. To select number of the components we employ the BIC criterion. Procedure selected model with six clusters, but the model completely failed to capture simulated data features, so we omit its presentation.

4. Conclusion

We have searched for the finite mixture model capable to capture properties of two-dimensional three-component t-Skewed distributions mixture data, contaminated by the uniformly distributed outliers. From the considered models the nearest to solve this task was the Gaussian Mixture Model with outlier structure implemented in the `mclust`. Surprisingly skewed t-Student Mixture Model performed below expectations. Overall estimation results for the given data can be improved by fine tuning model structure and estimation algorithm parameters implemented in the `mclust` and `EMMIXuskew` R packages.

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Chapter 14

View Tracking as a Method of Assessing the Quality of Virtual Reality Web Interface[1]

Paweł Wołoszyn, Przemysław Pływ, Małgorzata Gucwa, Mateusz Dudek

1. Introduction

The ubiquity of Internet access and web browsing tools make the WWW and related technologies the platform of choice for development of almost any kind of applications, either utilitarian, business-oriented or purely entertaining. The most common web design paradigm concentrates on 2- or 2.5-dimensional layout of information, more or less hierarchical information structure, dynamic revealing or hiding the content and clicking, pointing and scrolling as the primary means of interaction. Accordingly to this design paradigm the quality assessment of graphic interfaces should address similar features related to spatial distribution of information and its navigational structure (Johnson, 2013; Yang et al., 2005; Rodden, Hutchinson & Fu, 2010). There is however one important obstacle to objective measurement of user interaction quality in traditional graphical interface: the lack of directly observable relationship between presentation and perception.

There are two approaches for overcoming this problem: indirect methods and direct measurements. The indirect approach is based on statistical analysis of usage data easily obtainable from web interfaces with the use of specialized analytic services. The other, direct approach involves the use of specialized eye tracking technology for measuring and recording the direction of user gaze. Unfortunately eye tracking instruments are expensive and interfere with natural human-computer interaction.

Web technologies however are still evolving and currently there can be observed increasing efforts towards developing new generation of web interfaces based on virtual reality (VR). Virtual reality immersion can be experienced with the use of typical smartphone and cheap stereoscopic goggles (Butcher, Roberts & Ritsos, 2016). It seems therefore important to develop new tools and methods applicable to VR environments which could be used for assessing the quality of interfaces.

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2. The quality of VR interface

From the technical point of view Virtual Reality headset device is fundamentally different from simple stereoscopic display device. The key difference lies in bidirectionality of interaction as VR hardware acts both as input and output device since it is impossible to create convincing illusion of space without constantly tracking user's position and orientation in a tightly closed feedback loop. It should be therefore emphasized that the term "application interface" in the case of VR must gain broader meaning beyond simply communicating information (in the direction towards user) and decisions (in the opposite direction).

The concept of quality applied to VR interface consequently has several layers. On the least abstract level there is the quality of sensory illusion. At the higher level we distinguish two other layers of quality: the quality of presentation and the quality of interaction. Presentation is the aspect covering all aesthetic characteristics present in a virtual reality scene, including general composition, visual style, level of details, complexity of the design, artistic value and similar traits. On the other hand the quality of interaction covers all other characteristics – excluding aesthetics – typically associated with the concept of user experience and usability, such as utility, learnability, familiarity, efficiency, navigability, memorability or fault tolerance.

Distinguishing presentation from interaction is not present in VR usability studies reported in literature. Instead the virtual reality environment is often regarded as constituting a monolithic whole with underlying application logic (Ahn et al., 2017; Speicher, Cucerca & Krüger, 2017). In our opinion such a holistic approach can be helpful in evaluating overall quality of a particular solution, but at the same time it makes difficult to formulate general rules and design principles allowing to improve existing solutions or create a new successful ones. Virtual reality brings entirely new paradigm of presentation where metaphors can be replaced with verbatim message (Richir et al., 2015). It is therefore possible that user experience concepts in virtual reality will evolve towards entirely different characteristics and features.

3. Presentation layer and user attention

In the rest of the paper we will focus on the quality of presentation alone. We define presentation quality as the ability to attract and direct user attention towards specific desirable targets in VR environment without limiting the freedom of exploration. It seems reasonable to assume that attention attractors become necessary when the world simulated in VR interface becomes sufficiently large and detailed, giving the user enough freedom in deciding where to go, which items to look at and which objects to interact with. The user can simply miss out an important information, confuse interactive object for static scenery or look in the wrong direction unaware of some action happening behind his back.

The need for study on user behavior and system usability in VR environment was recognized quite a long time ago (Kaur, 1997) however the research was based mostly on formal theories and models (Sutcliffe & Kaur, 2000) and on subjective judgments reported in questionnaires (Kaufmann & Dünser, 2007). This approach is still used nowadays (Murtza, Monroe & Youmans, 2017) along with video analysis (Holderied, 2017) or even literature review (Ahn et al., 2017) although other researchers choose more quantitative approach by recording and analyzing numeric data during experiments (Zibrek, Kokkinara & McDonnell, 2017).

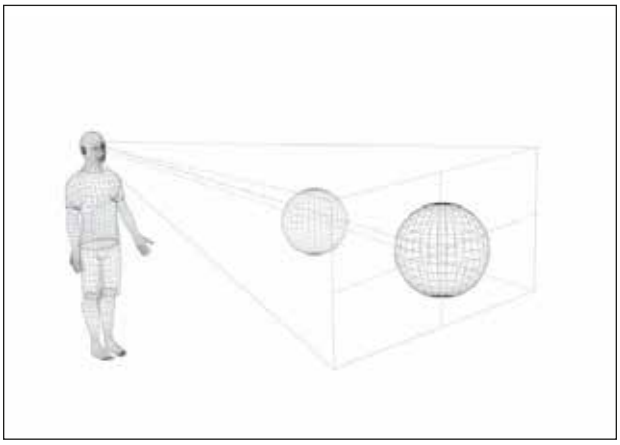
Reports on factors influencing attention focus in VR environment are nevertheless still scarce, but this situation could improve if more automated means of recording the direction of user gaze become available. One possible approach is to combine VR hardware with eye tracking equipment (Meißner et al., 2017) which is also an idea explored for a long time (Duchowski et al., 2000). Integrating eye tracker into VR headset is both technically and economically feasible (Stengel et al., 2015) although such technology is still experimental and not widely available as opposed to VR hardware alone.

An alternative approach we propose is to develop an approximate software method for tracking user's field of view, which is described in the next section. The method could be then used for measuring effectiveness of different means of affecting user attention, and thus measuring the overall quality of VR interface presentation layer. Also the method would be suitable for yet a simpler task of identifying potential techniques which could be utilized for directing and managing user attention in VR applications.

4. The view tracking method

Our method is based on general assumption that user gaze direction coincides to some extent with direction of VR headset viewing frustum displayed to the user which in turn is directly linked to head position and orientation. The assumption is backed by several arguments. The natural reflex of turning the head towards current area of interest is not suppressed as in the case of stationary computer display. The view angle of popular VR systems is relatively small and fluctuate around 100 degrees (Sites in VR Test Lab 2017) which is rather narrow angle compared to human field of view. These factors make the VR experience slightly resembling tunnel vision condition forcing the user to align gaze direction with head orientation.

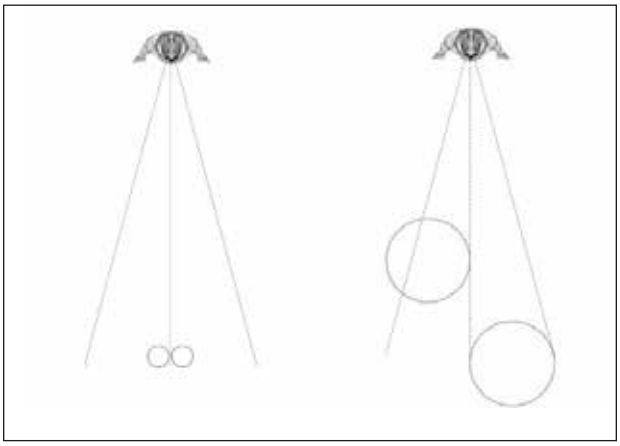
Figure 1. Illustration of the concept of view tracking. Central spot is the point in world coordinates where central ray (dotted line) intersects geometry nearest to the camera



Source: own work.

Although the method we propose is based on analogy to eye tracking, the view tracking method in virtual reality environment is absolutely transparent to the user and integrates fully with practically any kind of VR application. The primary data recorded in view tracking method consist of position and rotation of virtual camera coinciding with position and rotation of user's head in virtual world coordinate system. Temporal resolution of this data can be chosen arbitrarily within technical limits of given VR system but it is reasonable to record tracking data with frequency matching the frame rate or its aliquot. Spatial resolution on the other hand depends only on the precision of VR system.

Figure 2. Problematic layout of objects can result in confusing or missing them in view tracking

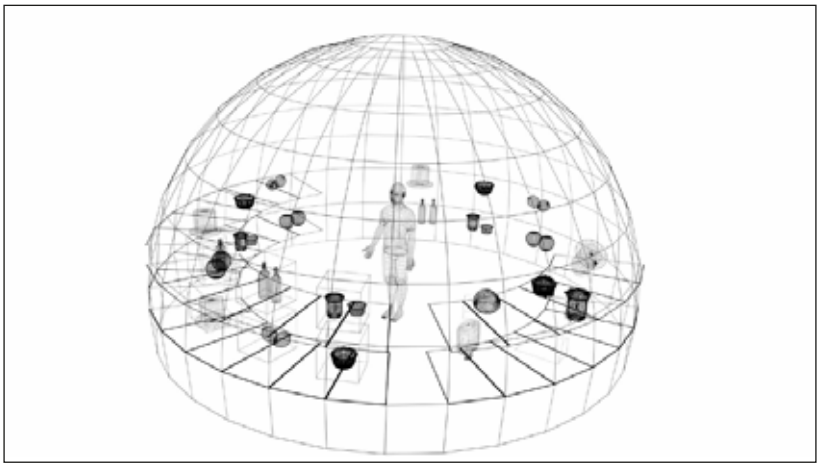


Source: own work.

Viewing direction alone does not allow to determine which objects the user is looking at and so it is necessary to confront this data with scene geometry. The most straightforward approach is to find first intersection of a ray casted from camera towards the center of viewing frustum with any of scene objects. We refer to these intersection points as central spots (Fig. 1). The trajectory of central spot movement can be visualized by drawing three-dimensional curve joining all detected central ray hit points in chronological order. This technique is applicable mainly for static scenes but offers advantageous possibility of studying how the user becomes aware of scene layout and familiarized with particular objects.

An alternative visualization of view tracking data involves transforming central spot locations to objects' texture coordinates. By accumulating these coordinates and calculating their local densities a new texture can be generated with color scale encoding of the length of time the user spent focusing on particular part of viewed object. The texture resembles a heat map obtained in traditional eye tracking survey with the exception of being three-dimensional and wrapping the entire object from each side.

Figure 3. Overall design of experimental application virtual scene



Source: own work.

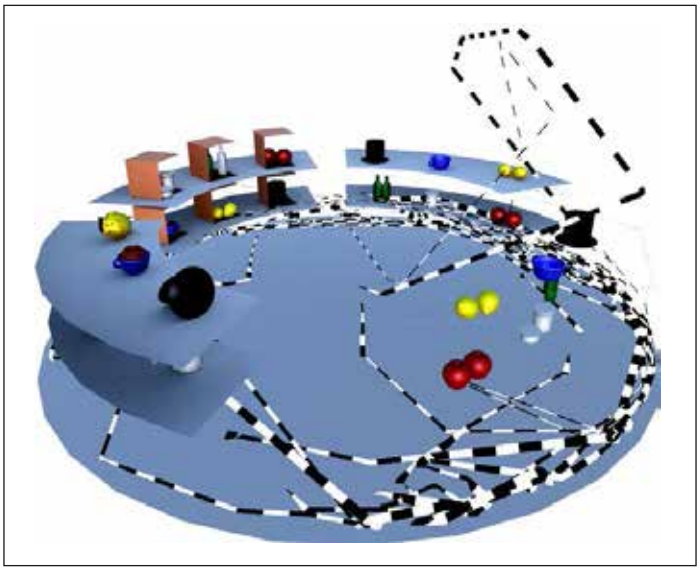
Proposed method in its current form has several limitations. To avoid ambiguity all objects which are subjects of view tracking should have their viewing angles large enough to occupy the central area in VR headset viewport. They also should have similarly sized empty space around them. Smaller objects can be missed entirely if the user is not looking exactly at the center of view, and objects spaced too closely can be confused. Moreover, there should be only a single foreground layer of objects without elaborated background, otherwise in certain perspectives objects of interest and unimportant background could overlap and also become confused (Fig. 2).

5. Experimental results

In order to study the feasibility of proposed view tracking method we developed an experimental system consisting of sample WebVR application and separate analysis and visualization module. We chose two main goals of our experiments. First, we wanted to verify whether view tracking data could be used for comparing object attractiveness and revealing patterns of attention movement between objects. Second, our goal was to find out whether view tracking could allow to measure thoroughness of scene exploration and provide some hints on potential improvements.

The overall design of virtual scene is resembling an abstract online shop in minimalist setting with simple objects put on display as products (Fig. 3). The objects have similar sizes but differ in color, shape, familiarity or presentation, and some of them have different distortions applied. The scene encircles completely the place where the user is initially located and products are placed at equal distances from the center, slightly below eyes level – an important design factor for smartphone VR adaptation which allows the user only to turn around in place excluding linear movement.

Figure 4. Sample trajectory (rendered as striped ribbon) of central spot superimposed on test scene layout with original shading



Source: own work.

The application was presented to 21 test users chosen from university students not familiar with VR technology and having no prior experience in exploring virtual environments. The subjects were introduced to virtual environment in random orientation and allowed to freely examine the scene while at the same time view tracking data were recorded for offline processing. These sessions lasted from 1 to 5 minutes and the behavior of subjects – style of movements, reactions and comments – was also observed and noted. Afterwards the subjects were asked by one of researchers to describe which objects caught most of their attention. The answers were not revealed to other members of research team. Next the view tracking data recorded during VR sessions were processed and central spot trajectories were generated (Fig. 4). Then another researcher reviewed each trajectory trying to conclude which objects were given the most attention. These conclusions were confronted with original descriptions provided by subjects and their similarity was rated.

6. Results

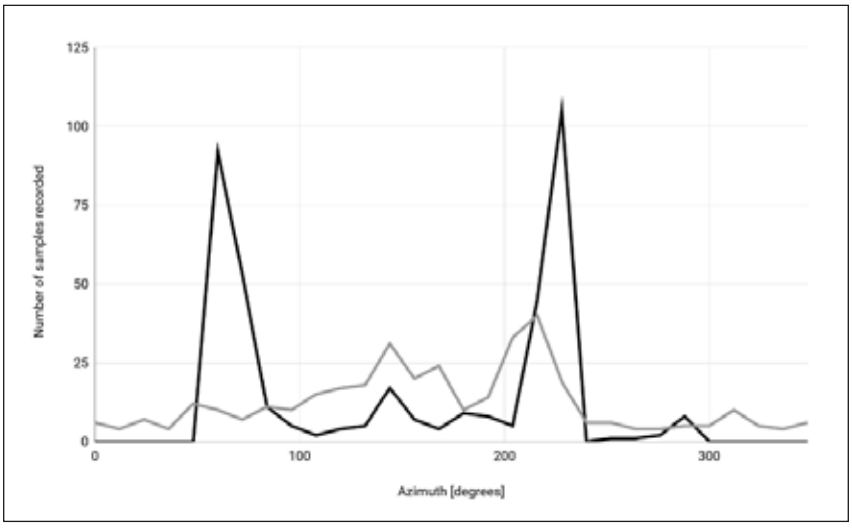
Participants explored the environment performing two general styles of movements: smooth, slower, broad swipes similar to watching a landscape, and faster, more jerky and limited turns resembling reading a poster from short distance. In about 70% of all recorded sessions the trajectory of central spot revealed enough information to allow the person who analyzed it to precisely point out the object which gained most attention according to experiment subject's account. Half of the remaining 30% were cases where the subject could not recall any particular object as the most interesting. Also in 60% of all cases the analyzing person was able to deduce the dominant style of movements matching the description recorded during VR session.

Surprisingly only about 40% participants did turn around fully exploring entire 360 degrees of surrounding scene, according to observations made during experimental sessions. Other subjects remained more or less stationary and oriented in one dominant direction which coincided with initial viewing direction at the beginning of VR session. These observations were in 85% consistent with distributions of central spot azimuths and their completeness (Fig. 5).

Less than 40% of participants were able to recall the surroundings of the object they were most interested in. Other participants frequently reported that objects displayed without convincing support – appearing as levitating – although attracting attention, were also perceived as unnatural and unfriendly. These observations were again consistent with results of analysis of central spot azimuth distribution which indicated that most subjects were attracted to familiar objects displayed on shelves without additional decoration.

In the recorded data we observed some variability of geometric relations between view direction and actual gaze direction specific to individual subjects and consistent within single recording session (Fig. 6). This variability can be caused by two independent factors: first, each participant has specific level of peripheral vision abilities and individual visual system geometry, and second, the VR head mounted device can be weared in a range of possible alignments and each time it is put on in a unique position. A calibration procedure could improve the accuracy of approximation of gaze direction, however it could also disturb normal interaction with VR environment. In our tests we did not include calibration phase and nevertheless we were able to correctly interpret recorded data.

Figure 5. Comparison of central spot azimuth distributions in two experiments of equal duration. One participant turned around fully (grey line) while the other did not (black line)



Source: own work.

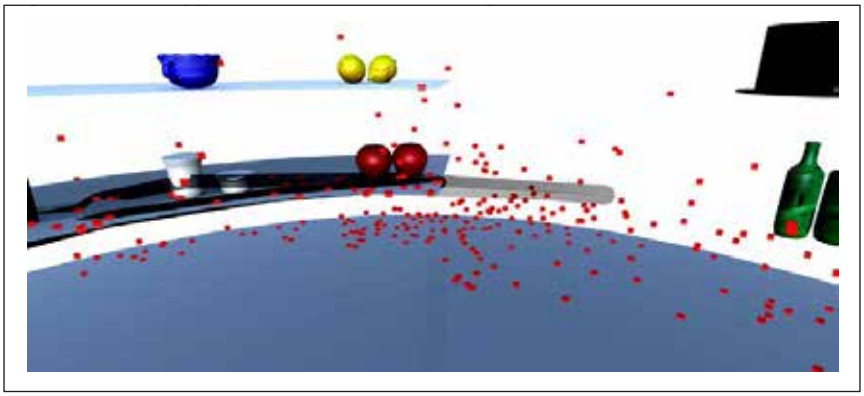
Our experiments suggest that view tracking can provide insights into patterns and rules of user behavior in virtual environments such as for example the preference for natural but simple object presentation. Participants tended to focus more attention on objects placed on shelves than on

the same objects floating in midair, and they seemed not to notice that the shelves were floating themselves. They also preferred to look at single objects instead of objects enclosed in accompanying boxes, even if both presentations revealed the same object details.

7. Conclusion

The view tracking method we propose in this paper is the method of estimating and recording gaze direction and attention focus in VR environment by using optical axis of viewing frustum and its intersection with scene geometry. The motivation for developing the method comes from the need for simple, unobtrusive and technically feasible tool for obtaining objective information which could be used to analyze user behavior in order to assess the quality of presentation layer in VR interface design, perceived as the ability of the interface to direct user attention towards specific targets.

Figure 6. Projected locations of central spots (small dots) seen from the user perspective. The user was focusing on two round objects near the center of image



Source: own work.

It is possible that at some point of future VR technology development direct eye tracking features will become ubiquitous, nevertheless in the current state one cannot assume that typical users of VR application are equipped with eye tracking device. View tracking as readily available replacement for eye tracking can be especially useful in web-based VR applications which are rapidly gaining popularity.

Experimental implementation of the method proved effective enough to provide both qualitative and quantitative insights into user behavior in VR environment. Analysis of view tracking data also helped to outline new problems requiring further empirical research, such as determining which features of object presentation play the key role in attracting user attention and what factors are influencing scene exploration behavior.

Most benefits of proposed method result from its readiness to seamlessly integrate with application interface thus yielding instant feedback on usability and user experience without any need for external software, hardware or measuring procedures. Developing this approach could open an important opportunity to depart from one-design-fits-all paradigm currently adopted in user

interface domain, as the application would be able to observe user behavior in more holistic manner, reaching beyond commands issued and data entered by the user and dynamically adapting the interface, not only the content, to user expectations.

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This work inscribes into the series of publications under the common title Knowledge – Economy – Society, which constitute one of the effects of many years' cooperation between the academic environment of the Faculty of Management at the Cracow University of Economics and employees and doctoral students of other faculties of the University, with representatives of different Polish academic circles, as well as representatives of foreign academic circles. Results of such cooperation are the following books published by the Foundation of the Cracow University of Economics:

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