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CONTENT

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MANAGEMENT CONTROL SYSTEM DESIGN

THE EFFECT OF TOOLS IN USE ON THE INFORMATION PROVIDED

Today's organizations have a wide variety of tools at hand to provide relevant information to management that can be used later on for various purposes, including performance evaluation and decision making. This paper investigates the range of management control (MC) tools in use and its relationship to the scope and frequency of information made available to management. As the work of controllers in the 21st century is intensively supported by diverse IT solutions, the tools under analysis are not limited to MC instruments. IT systems as enablers of well-designed MCSs are also considered. Multivariate analysis of the 2013 questionnaire from the "Competing the world" Research Program revealed a significant positive correlation between the use of MC tools and diverse informational features of MC systems. However, only a limited effect for IT intensity on information provision was proved for the 181 Hungarian, mainly mid-size companies in the sample. The results of discussions with senior controllers about some unexpected findings are also reported.

Keywords: **management control system, management information, IT systems**

Fundamental changes in the external environment provoke changes in the organizations as well. The economic crisis after 2008 and its consequences have accelerated many changes in the management control routines of business corporations (Weber – Zubler – Rehring, 2010). Some authors claim that this was the biggest concussion ever that altered both management control systems (MCS) and the nature of controllers' work in the organizations (Tirnitz, 2010).

As a consequence of increased environmental uncertainty, companies have been forced to be more forward-looking and to focus not only on internal events in the life of the company but to monitor the external environment more intensively. Therefore, one feature of MCS has become a special focus of interest: the changing information requirements of management and the ability of MCS to fulfil these new requirements.

When providing diverse sets of information to managers, controllers use diverse tools to support these activities (Ahrens – Chapman, 2000). How are the tools that are in use linked to the information provided by the MCS? This paper investigates this link between the tools and the nature of the information that is provided: are companies adopting a wider range of advanced MC practices which are able to provide a broader scope of information to management?

When discussing modern MCS one must be aware that they are embedded in IT systems and cannot be operated without intensive IT support. Acknowledging this important factor, not only formal MC tools are hereby considered, but the intensity of the use of innovative IT tools as well.

There are numerous contingencies that influence companies' management control systems. The main drivers of MCS are both external (changing business market conditions and new managerial philosophies) and internal (organisational re-design, corporate culture, the implementation of management technique innovations, and human resource developments) (Burns – Baldvinsdottir, 2005). These contextual factors of MCS have been intensively researched since the 1980s. While recognizing the importance of the wider context, this paper does not explicitly discuss the environmental context and other influencing factors; the focus is more on the relationship between the tools and the information used in MCS.

In the remainder of this paper, prior research findings about applied tools are reviewed. Subsequently, a discussion about the nature of the information that is generated is provided. At the end of the literature review section, IT systems as an enabler of MCS are introduced. Finally, research gaps are identified. Derived from understanding of these gaps, a research question with four sub-hypotheses is formulated, which are then tested on the most recently available database from the "Competing the World" research program. The results of the statistical analysis and results of the focus group discussions with 20 senior controllers are presented with conclusions.

Literature review

A management control system is conceptualized in this paper as a formalized control subsystem designed to provide information to managers (Otley, 1980; Bouwens – Abernethy, 2000). Objectivist research characterizes formal management control in two ways: through its tools (also referred to as instruments, techniques or practices) and the information provided by the tools.

Prior literature of *MC tools* either concerns what can be considered an MC tool, and/or it investigates how MC tools can be classified. Typologies based on the tasks served by the tool (budgeting, costing, etc.), by time horizon (strategic and or operative) or by level of innovation (traditional vs. new/innovative/advanced) are widely employed. The current paper focuses more on examining the innovativeness of the tools.

Traditional MC practices (such as the techniques of cost variance analysis, overhead allocation or financial KPIs) create the foundation for the discipline. These traditional techniques focus on company-internal events, are monetary-oriented and are less capable of providing non-financial information or taking a strategic focus.

Scholars have claimed that traditional tools are no longer suitable for use in the organisations of the 21th century (Chenhall – Langfield-Smith, 1998; Joshi, 2001). Firms operate in a more intensive, globally competitive environment, technology changes rapidly and new management approaches are continually emerging. The needs of managers facing these new challenges cannot be met by using traditional MC tools. New, advanced practices are required in order to maintain the relevance of formal MC (Johnson – Kaplan, 1987).

Whether traditional or advanced, the range of applied management control practices can differ among countries. Some difference between the tools that are applied is evident in the transition countries of Central and Eastern Europe (CEE). CEE countries could have been characterized by their special institutional, legislative, and cultural contexts (considerably different from the USA and Western European countries) over the first decade after the transition (Dobák, 2006; Dobák – Steger, 2003). Around the millennium, researchers claimed that MCSs in CEE were still at the initial stage of development, and much more emphasis was given to the development of financial accounting (Haldma – Lääts, 2002).

In post-socialist Hungary, the first MCS were largely built on inherited systems, but their managers wanted them to be suitable for meeting new requirements such as reporting to foreign owners (Bodnár, 1997; Lázár, 2002). Using the case of a formerly government-owned and production-oriented Hungarian company, it has been proved that some tools (such as calculation practices) were being used before the transition that followed almost the same procedures as after it. The novelty was thus not related to the technology, but to the purpose of use. Changing from a command to a market economy altered fundamentally the purpose of management control (Vámosi, 2000, 2003).

New MC tools, not formerly used during the socialist era, were slowly adopted by companies. As stated in 1997, the management control practices of Hungarian companies was similar in many ways to that of US companies 10-15 years before (Dobák – Bodnár – Lázár, 1997). How the management control toolkit of Hungarian organizations changed between 1996 and 2004 was detailed by Bodnár et al. (2005). These authors concluded that a slight shift towards more innovative practices can be identified, but the dominance of traditional MC tools still prevailed.

Using survey data from 301 organizations from the "Competing the world" research program, (data refer to 2004), three clusters of companies were identified based on their choice of MC tools. The "Planners" cluster could be characterized by their intensive use of strategic planning and budgeting tools and generally high adoption rates of MC tools. This cluster accounted for 34.5% of all companies. "Reporters" differentiated themselves through employing well-used and sophisticated feedback mechanisms. "Lagging companies" were characterized through their low adoption of MC tools in all fields. This cluster was the largest, involving 42% of all companies (Dankó – Kiss, 2006).

Zárda (2009) claimed that the main reason for the lagging behind of Hungarian companies was the old-fashioned attitudes of corporate executives. Forty years of socialism is still affecting ways of thinking and retarding the internalization of new approaches. Attitudes and the orientation of executives need to be changed in order to further develop MA and MC systems in Hungarian enterprises.

Meanwhile, Wimmer (2000) reported that the internationally adopted approach of field performance measurement had already spread throughout Hungarian enterprises, although the use of the relevant tools is lagging. The focus of performance measurement is still on the past. Management reports dominantly involve data obtained through financial accounting practices. Non-financial aspects of performance, such as quality or customer satisfaction, are neglected. External data is only partially provided to management.

In a later piece of research by the same author, improvements in many areas are reported. For example, Wimmer and Csesznák (2012) investigated some formal MC tools (referred to as 'methods') which are intensively used in Hungarian companies. These authors report on the frequency of usage of tools that focus on performance measurement and operational analysis. The adoption rates of traditional tools remained nearly unchanged over this time period. New, innovative practices such as target costing (39.3% adoption rate), economic-valued added (28.0%) and Balanced Scorecard (22.1%) are now known and used in many of today's Hungarian companies, but the use of traditional tools still dominates.

Variation in the use of the tools applied at the different companies is often explained by both external environmental and internal organisational characteristics. As referred to in the introduction, there is an extensive body of literature about contingencies that influence management control practices. Chenhall (2003) provides a detailed review of contingency studies about MCS; for some later developments, see Abdel-Kader and Luther (2008).

Multiple lines of evidence suggest that foreign ownership is one of the most important external factors when it comes to what influences the MCS of Hungarian companies (Bodnár, 1999; Lázár, 2002; Dankó – Kiss, 2006). Besides external factors, firm size (an internal contingency) is one of the most important variables as concerns the adoption of MC tools. Put simply, larger organisations are more likely to use more tools. This fact can be explained by organizational theory. Larger organisations typically undertake tasks of higher complexity that require the division of labour and specialization of tasks. Specialization leads to the differentiation of organizational function that in turn requires coordination and integration of diverse activities. Coordination and integration are supported, among other ways, by formal MC practices (Chenhall – Langfield-Smith, 1998). Another often mentioned reason is that large firms have more resources and are therefore more willing to experiment with new innovations, such as contemporary MC tools.

Based on a sample of Hungarian profit-oriented organisations, Bodnár (1999) identified a significant positive relationship between the use of 'controlling' tools and company size, and, respectively, the use of tools and the level of diversification. Companies with a limited range of activity and companies of smaller size tend to apply less advanced MCS (Bodnár, 1997). Larger companies more intensively use budgeting and planning tools than smaller firms. Differences in the adoption rates of costing tools between firms of different size prove to be less significant (Dankó – Kiss, 2006).

When describing the MCS of an organisation, the tools that are used are often listed. However, the mere provision of a list of practices that are in use does not provide much information about the appropriateness of the MCS. Accordingly, MCSs are usually characterized using other terms as well: particularly by the *scope of information provided* (Chong, 1996; Gordon – Narayanan, 1984). The scope of information can be described using three main characteristics:

- the focus of information: external vs. internal information,
- the level of quantification: non-financial vs. financial information,
- the time horizon: ex ante vs. ex post (past-oriented) information.

Information of an internal nature focuses on events within the organisation, while external information relates to the organisation's environment. Financial information is expressed in monetary terms, while non-financial information cannot be this way expressed. Ex-ante information is future-oriented and deals with future events, while ex-post information is past-oriented and relates to historical data.

Traditional MCS with a narrow scope of information mainly generate internal, financial, ex post information. In contrast, broad-scope MCS include information related to the external environment, estimates about the future, and measures that are not exclusively limited to monetary terms (Chenhall – Morris, 1986). These types of information are provided by broad scope MCSs not instead of but in addition to internal, financial and ex post information (Gordon – Narayanan, 1984).

Providing additional information might increase the length of the reports and can be even contra productive: if executives lose the focus, providing more information cannot lead to better informed management decisions. As Weber and his colleagues (2010) also stated, keeping the focus is vital: companies strongly affected by the economic crisis succeeded in decreasing the size of their management reports.

Whether traditional or broad scope, MCS cannot be operated without the intensive support of *information technology* (IT). Information systems enable the efficient use of MC tools and the user-friendly provision of information to management. The first MC-related task supported by IT systems was data-processing, while nowadays (almost) the whole spectrum of a controller's tasks is facilitated by diverse IT applications (Drótos, 2010). MC systems are increasingly embedded in IT systems. Therefore, while describing the MCS design of a firm, IT characteristics must be recognized, in addition to the specific MC tools that are being used, and the information they provide.

Research that focused on the relationship of information systems to MC became popular after the widespread adoption of enterprise resource planning (ERP) systems in the 1990s. The effects of ERP on diverse aspects of management accounting (MA) and control systems have been investigated, but the first studies indicated only a very moderate impact of ERP implementation on MC/ MA.

In their cross-sectional field study, Granlund and Malmi (2002) analysed the impact of ERP on management accounting and control procedures. In contrast with prior expectations, they found that ERP had a modest impact. MC techniques (not only advanced techniques but traditional ones too) were not integrated into the implemented ERP. Consequently, the implementation of SAP systems had not fundamentally changed the MC information that was being provided (Scapens – Jazayeri, 2003).

Ten years later, researchers still report to finding the similarly moderate effect of ERP on MC tools and information. Based on a case study in an SME context, ERP was found to be able to support the "standardized financial accounting transparency, no more" (Teittinen – Pellinen – Järvenpää, 2013, p. 294.). The lack of impact was rationalized by studies using the theoretical lens of institutionalism which referred to resistance to change: the old MA system was simply built into the new IT infrastructure without changing the content (T. Hyvönen – Järvinen – Pellinen – Rahko, 2009).

MA and MC-related activities are more often supported by processes outside of ERP such as data warehouses, executive portals or software packages specialized in the support of BSC techniques (Rom – Rohde, 2007). Therefore, a higher impact for MC techniques and information is expected in this field. Despite this, research that has investigated the interface between non-ERP IT solutions and MC is very scarce. One early exception is the investigation of Strategic Enterprise Management (SEM) as an add-on to ERP, although the focus was placed more on the success of the implementation phase than on the MC-related consequences (Brignall – Ballantine, 2004).

Most recently, first studies into the innovative use of internet-based technologies such as cloud computing services have been published in international academic journals. However, the link to management control is again missing from these publications. They either still have a financial accounting focus and report (for example) about the benefits and risks from the auditor's perspective (Yigitbasioglu, 2015) or they try to establish a direct link to business performance (Prasad – Green, 2015).

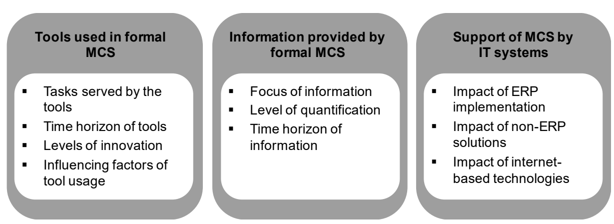
Importance of the IT background was emphasized by Tirnitz (2010) from an another point of view. He claimed that due to the turbulent environment an increasing time pressure is put on reporting. Shorter time available for preparing the month-end reports requires the better utilization of the capabilities of the underlying IT systems.

Is there a uni- or a bidirectional relationship between IT and MC? Information systems and management control systems coexist in organisations and evolve simultaneously. This situation assumes a more bidirectional relationship. However, most of the research that has focused on the interplay of IT and MC implies a unidirectional relationship (i.e. that IT impacts and enables MA and MC). While researchers acknowledge the existence of bi-directionality, they emphasize that information systems are more likely to have an effect on MC simply because, once implemented, IT systems are not so easy to change (Rom – Rohde, 2007). For example, in an ERP environment the configuration process defines what can and cannot be done later on with the system.

In line with this observation, my research model focuses on IT more as an independent construct that impacts management control. The logic is that innovative IT solutions can enable the efficient use of management control techniques and together become able to support the process of providing information to management. Some research into this subject already exists, but it tends to involve single case studies which have been used to investigate the effect of a concrete software package (e.g. how an ERP-linked ABC system was able to mediate management accounting knowledge (T. Hyvönen – Järvinen – Pellinen, 2006)). There is scarce evidence in the literature about whether and how modern, innovative IT solutions are able to influence the nature of MC information, which is provided. Similarly, there is a lack of evidence about the link be-

Figure 1

Three lines of literature under review



tween MC tools and the nature of information that is provided, when not mediated through a specific tool such as ABC or BSC.

Research model and results

Derived from the identified research gaps, the following main research question was identified: Is the intensive use of MC and IT tools linked to the ability to provide relevant MC information to management? In order to answer this question, both quantitative and qualitative techniques were used, thereby drawing on the idea of method triangulation. Firstly, data from a 2013 questionnaire survey was analysed using multivariate statistical methods that are widely employed for theory testing in MC research (Van der Stede – Young – Chen, 2005). Secondly, findings from quantitative analyses were presented and interpreted with the help of practitioners during focus group sessions in February and March 2016. In three sessions, each of which lasted 120 minutes, a total of 20 senior controllers from various industries with MC-related work experience of 7-25 years participated and facilitated the better and deeper understanding of the research findings.

Hypotheses

Management control systems are characterized by the tools they use and the information they provide. Meeting the information requirements of managers forces controllers to apply a range of MC tools. It is argued in the literature that innovative tools are required to meet the newly-emerging information requirements of managers. I characterise MC tools on the basis of whether they were originally designed to provide broad scope information or not. An advanced MC tool is designed to provide external and/or non-financial and/or future-oriented information that goes beyond internal financial data. However, tools that are labelled new and innovative (such as BSC or target costing) are already 20-40 years old. Recent innovations in information systems that enable efficient MC are increasingly prevalent.

This research investigates whether the IT and MC toolkit of companies can be associated with the scope and frequency of information that is provided. Reflecting on the above-described research question, it is hypothesised that the more intensive utilization of advanced MC practices and innovative IT applications will support the frequent provision of broad-scope information. The research question sub-hypotheses are thus the following:

H1a: Applying advanced MC tools supports the provision of a wide range of information to management.

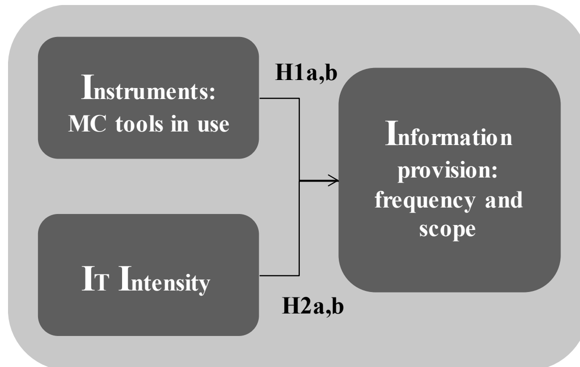
H1b: Applying advanced MC tools supports the frequent provision of information.

H2a: High IT intensity supports the provision of a wide range of information to management.

H2b: High IT intensity supports the frequent provision of information.

Figure 2

Research construct



Database and sample characteristics

The cross-sectional survey was conducted as part of a larger project named 'Competing the world'. This research program was launched by the Institute of Business Economics at the Corvinus University of Budapest with the aim of researching the competitiveness of Hungarian enterprises. The first survey in 1996 (Chikán – Czakó – Demeter, 1996) was followed by further surveys in 1999 (Czakó – Wimmer – Zoltayné Paprika, 1999), 2004 (Lesi, 2004), 2009 (Chikán – Czakó – Zoltayné Paprika, 2010) and 2013 (Chikán – Czakó – Wimmer, 2014).

The current research uses a database generated by the 2013 survey and focuses on a limited set of variables and a reduced sample size. The final restricted sample involves 181 companies. The original sample of 300 organisations was reduced in size as a number of them did not contribute to the analysis. Although MC-like activities can be found even at micro-size and small companies, the application of formal management control practices is characteristic of mid-size, and more typically, large companies. Firstly, the sample was reduced using a size variable (number of employees). Secondly, organisations for which there were many missing values were removed from the sample to increase the validity of the analysis.

As for some relevant parameters data was lacking, and non-responses decreased the effective sample size, the danger of non-response errors arose. Failing to complete the questionnaire indicates that respondents might have had no opinion because they felt the questions to be irrelevant to their organisation. Respondents with insignificant management control activities omitted answering certain questions. Additionally, non-response errors occurred when companies refused to take part in the survey. As the reasons that companies refused to participate (and the characteristics of such companies) are unknown, concerns about validity were addressed through a process of method triangulation.

The research thus focuses on examining mid-size companies from traditional industries. The majority of companies (85.1%) in the restricted sample are mid-sized; 27 (14.9%) of them are large companies with respect to their number of employees. 78.5% of the organisations in the sample are under Hungarian ownership, of which 7.7% are state-owned. 21.5% of the firms are foreign-owned. In terms of the industrial distribution of the companies, processing industries are significantly overrepresented (45.9%; cf. 7.59% of the total population).

To operationalize the research construct, a diverse set of variables was employed. Assessment of both the MC instruments and MC information is based on the responses of CFOs. Questions related to IT Intensity were answered by COOs.

Results of the statistical analysis

Increasing numbers of MC tools are reportedly being used; researchers may be interested in the number and/or type of tools, which are really being used in practice. This research focuses on a limited list of MC instruments, which proved to be applicable and relevant to the Hungarian companies in the former surveys.

From the 17 tools listed in the questionnaire, six tools can be seen as more innovative, focusing on broad-scope information. All the other tools may be categorized as traditional, focusing on internal, financial data. Companies in the sample use an average of 8.5 tools out of the potential 17, and 2 out of 6 advanced tools. Table 1 ranks the MC tools by their rates of use. Modified usage rates have been calculated based on the total (as a percentage), meaning that zero values have been interpreted as non-use. Advanced tools are indicated in grey.

Table 1

Ranking of MC tools by rate of use

	Formal management control tools	Usage rate (%)	Modified usage rate (%)
1	n) analysis of financial indicators	82,6	78,5
2	a) cash-flow analysis	78,6	75,1
3	b) fix/variable cost differentiation	71,5	68,0
4	h) analysis of inventory turnover ratio	67,8	64,1
5	i) analysis of customer turnover ratio	60,5	57,5
6	j) analysis of supplier turnover ratio	55,6	51,9
7	c) breakeven analysis	55,5	53,0
8	p) analysis of cash-flow based indicators	54,8	50,8
9	m) capital cost analysis of investments	54,4	50,8
10	e) activity-based costing	53,0	49,2
11	d) cost sensitivity analysis	48,8	45,9
12	f) target costing	39,3	36,5
13	q) analysis of market value indicators	39,1	36,5
14	g) cost based supplier evaluation (e.g. TCO)	32,7	30,4
15	o) EVA or other residual indicators	30,4	28,2
16	k) cash conversion cycle	22,3	20,4
17	l) Balanced Scorecard	16,9	15,5

Table 1 clearly verifies the dominant presence of traditional techniques in the daily practice of firms, and indicates that traditional techniques are not being replaced but expanded by the newer tools. This concept of expanding (instead of replacing) assumes that there is a certain structure in the reported values: significant association is likely between the number of traditional tools in use and the number of 'broad scope' tools that are in use.

Two variables were calculated from the original variables. The number of traditional tools (No_TRADtoolsinuse) is the sum of variables related to traditional techniques (with the values 0=non-use and 1=in use). Similarly, the number of advanced, broad scope tools (No_BROADtoolsinuse) is the sum of variables related to advanced techniques. Based on a Chi-square test, independence between the variables can be rejected (p=0.000), and Kendall's tau-b measure association indicates a moderate strength of relationship (0.521, p-value=0.000).

Table 2

Crosstabulation of MC tools in use

Count

		No_BROADtoolsinuse							
		,00	1,00	2,00	3,00	4,00	5,00	6,00	Total
No_TRADtoolsinuse	,00	5	0	0	0	0	0	0	5
	1,00	3	2	0	0	0	0	0	5
	2,00	3	1	0	0	0	0	0	4
	3,00	4	5	3	1	0	0	0	13
	4,00	1	8	4	3	0	0	0	16
	5,00	1	6	4	1	0	0	0	12
	6,00	9	2	5	3	1	0	0	20
	7,00	2	4	4	8	1	0	0	19
	8,00	2	0	8	4	2	0	0	16
	9,00	1	3	2	3	0	0	2	11
	10,00	0	2	4	3	4	1	0	14
	11,00	0	1	0	1	2	2	11	17
Total		31	34	34	27	10	3	13	152

The concept of expanding means that broad-scope tools are more likely to be used at companies in which traditional tools were already being used. This phenomenon is reflected in Table 2. The upper triangle of the data matrix is filled with zero and close-to-zero values. This means that only those companies who are very actively using numerous traditional tools report to also using more broad-scope tools. The lower triangle indicates a more heterogeneous picture. Companies who are extensively using traditional tools are not necessarily adopting (more) newer techniques. Consequently, the use of broad-scope tools is linked to the extensive usage of traditional tools, but the extensive usage of traditional tools does not necessarily lead to the adoption of newer techniques.

The application and integration of all available tools into MCS is not expected and does not necessarily lead to a 'better' MCS per se; however, the appropriate number of tools is also not easy to determine. Based on the database, companies which use at least 3 different advanced tools are designated 'intensive users' of advanced tools (35% of total sample). Companies reporting to using 1 or 2 advanced tools are specified as 'beginners' (43.9%), and others 'non-users' (21%).

A new categorical variable (CAT_BROADtoolsinuse) was calculated to represent the above-described groups of companies. The new variable has a value of 0 in the case that no advanced tools are used. Firms using 1-2 tools are awarded a variable value of 0.5 and intensive users with at least 3 tools in use have a variable value of 1.

Similarly, a categorical variable was calculated to represent the three types of companies with respect to the use of 14 diverse categories of IT applications listed in the questionnaire: non-users (0), beginners (0.5) and intensive users (1).

While the independent variables in the model are measured using categorical variables, dependents are measured using continuous intensity variables. Dependents include frequency of reporting and the three components of broad-scope information: external focus, non-financial information, and future orientation. Each of the dependent constructs represents a latent category that was measured through several underlying observable variables:

Intensity of frequent information provision was calculated using a composite of 8 variables that measure the frequency of issue of diverse reports to management. *Intensity of external focus* in data provision was calculated by combining five observable variables. Information is externally focused if it relates to data obtained from external analysis, reports from external sources, information based on customers' opinions, information from suppliers or information based on the opinions of other stakeholders (e.g. local communities).

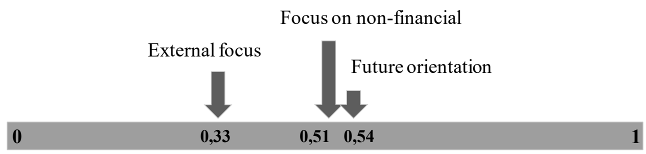
The non-financial nature of information was measured using a set of six variables. Information is of a non-financial nature if it relates to number/quantity of sales, service/product quality, service time, timeliness of order deliveries, resource utilization or customer satisfaction. *Future orientation* was expressed in terms of the extent of planning activity and in terms of extent of the preparation of pre-calculations. The extent of planning activity is measured by the number of different plans/budgets prepared out of nine plans that are generally used, while the extent of pre-calculations is measured by the number of different pre-calculations prepared out of the four listed pre-calculation types.

Intensity measures were calculated for each of the four dependent constructs as the weighted average of the underlying observable variables. Weights were derived from a Principal Component Analysis (PCA). The factor loadings of the PCA output are the correlation measures between the original variables and the latent components. Consequently, these loadings were used as weights to represent the relative importance of the observable variables that influence the overall intensity measures.

Figure 3 illustrates the central tendencies of these information-related intensity measures on a continuum from 0 to 1. Having an external focus lags far behind having a focus on provision of non-financial and future-oriented information.

Figure 3

Evaluation of MC information provided with respect to scope



The mean value of reporting frequency indicates that companies in the sample prepare reports on a quarterly basis, on average. It is important to note that the overall frequency includes both the frequency of issuing top management reports (more frequent) and functional reports (like IT, marketing etc., issued more rarely).

Hypotheses were tested by comparing the variances of the dependent variables in k independent groups. 'k' equals 3, representing the three groups of companies developed earlier with respect to the intensity of use of MC tools and IT applications. Distributions of the dependent intensity measures are non-normal across companies. As the normality assumption of parametric tests is violated, a non-parametric Kruskal-Wallis test was first employed. As regards the intensity of use of MC tools, the test suggested rejecting the null hypothesis of independence for all of the four intensity measures (p=0.002 for external focus, p=0.000 for non-financial information, p=0.000 for future orientation, and p=0.001 for reporting frequency). In terms of IT intensity, the Kruskal-Wallis test suggested rejecting the null hypothesis for reporting frequency and future orientation but retaining it for external focus and non-financial information, meaning that IT intensity is not related to these variables.

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While the rejected H0 of the Kruskal-Wallis test rules out the lack of a relationship between the variables, it is not able to measure the strength of any relationship. Eta-squared, the effect index of ANOVA, can indicate effect size. MANOVA procedures, so as the univariate ANOVA assumes the existence of a normal distribution but they are fairly robust to departures from normality (Rencher, 2002). Therefore, eta-squared (η2) may be used in the case of a non-normal distribution of data to measure strength of association. Table 3 shows the eta-squared measures calculated as the ratio of between-groups sum of squares and the total sum of squares.

ables, but it might be used to interpret the directional relationship between the independent variable and the dependent variable.

The effect sizes listed in Table 3 can be interpreted as follows: the intensive use of advanced MC tools supports reporting frequency (η2=0.0975) and all aspects of broad-scope information provision (η2=0.1040; 0.1064; 0.1851). H1a and H1b are thus supported. Intensive use of MC tools has the largest effect on future orientation among all components of MCS design (η2=0.1851). H2b is also supported by the data: IT intensity increases reporting frequency (η2=0.0978). Intensive use of IT has a positive effect (of a medium size) on future orientation (η2=0.1257), but does not affect the provision of non-financial and externally focused information. Accordingly, H2a must be rejected.

Table 3

Mean values by company group and strength of association calculated between independent and dependent variables

MC tools in use									
	Mean values by groups			Sum of squares				Eta-squared	Effect size
	Non-users	Beginners	Intensive users	Between Groups	Within Groups	Total	Sig of F-test statistics		
Reporting frequency	1,4157	1,8217	2,3116	11,1966	103,6448	114,8414	0,0004	**0,0975**	Medium
External focus	0,1667	0,2760	0,4417	1,1441	9,8612	11,0053	0,0024	**0,1040**	Medium
Non-financial info	0,4222	0,4367	0,6326	1,0992	9,2320	10,3312	0,0021	**0,1064**	Medium
Future orientation	0,3965	0,5687	0,7019	1,9223	8,4615	10,3838	0,0000	**0,1851**	Large-medium

IT Intensity									
	Mean values by groups			Sum of squares				Eta-squared	Effect size
	Non-users	Beginners	Intensive users	Between Groups	Within Groups	Total	Sig of F-test statistics		
Reporting frequency	1,4946	1,8738	2,3660	7,7455	71,4542	79,1997	0,0055	**0,0978**	Medium
External focus	0,4454	0,2605	0,3426	0,4412	7,5523	7,9935	0,1672	-	No sig. effect
Non-financial info	0,6724	0,4479	0,4626	0,2272	6,4483	6,6755	0,3359	-	No sig. effect
Future orientation	0,3989	0,6068	0,6312	0,7947	5,5293	6,3240	0,0031	**0,1257**	Medium

lthough intensively critized, Cohen's interpretive framework is very helpful for evaluating the values of eta-squared (Vacha-Haase – Thompson, 2004). Invoking Cohen's d benchmarks recalculated for eta-squared (small ~ 0.01; medium ~ 0.1; large ~ 0.25) indicates that all significant relationships are at least of medium strength.

The above reported eta-squared calculations follow the logic of R^2 (measuring model fit in regression models). Unlike R^2, eta-squared is sensitive not only to linear relationships, but also to nonlinear ones (Vacha-Haase – Thompson, 2004). It indicates the proportion of variation in the dependent variable that is attributable to differences among the means of the groups; i.e., the effect of independent variables. Consequently, a significant value for eta-squared indicates not only that there is a significant association between the variables, but it might be used to interpret the directional relationship between the independent variable and the dependent variable.

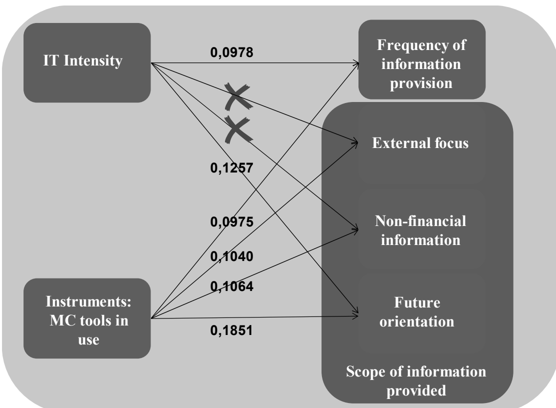
Figure 4 visualizes the rejected and verified relationships for items of management control system design and IT intensity.

Are the relationships between these variables valid? Or are they influenced by other factors not considered in the research model? Analysing relationships – whether correlational or causal – requires addressing a very important issue: the third variable problem. A third variable (often called a control variable, test variable, confounding variable or hidden factor) causes a spurious relationship that is merely statistical and may not actually be observed.

Previous studies have shown that the management control systems of Hungarian companies are significantly affected by company size and by foreign ownership. In order to avoid explaining spurious relationships, *company size* (expressed as number of employees) *and ownership variables were used as control variables.*

Figure 4

Rejected and verified relationships among items of MCS design and IT intensity



Three groups of companies of different size were established (1=50-99 FTEs, 2=100-249 FTEs and 3>=250 FTEs) and a chi-square test was performed to crosstabulate the categorical independent and categorical control variables. At a significance level of 5%, company size and IT intensity are not significantly related to each other (p=0.078). Although companies with over 250 FTEs (group 3) clearly use IT tools more intensively, this tendency is not reflected in the mean values of group 1 and 2. Similarly, company size and intensity of use of advanced MC tools are not significantly correlated to each other (p=0.187). It is worth noting that company size influences the total number of MC tools in use, but the effect is not significant for advanced tools. The same test for ownership categories (1= Hungarian state, 2= Hungarian private, 3=Foreign owner) found no significant correlations between ownership and independent variables.

Controlling for the dependent variables, the distribution of the information-related variables was studied by company size and ownership form. Two significant relationships were found for which eta-squared was calculated. Bigger companies issue reports more frequently (0.0653, p=0.002) and tend to be more future-oriented (0.0422, p=0.035). Company size and other aspects of MCS design are unrelated; ownership is not significantly correlated with any of the dependent variables.

As control variables are not systematically related to the variables in question, the confounding effect of control variables on the analysed relationships can be excluded.

Discussion of results in focus group sessions

Following the statistical analysis, results were presented to senior controllers in group discussions which focused on addressing two main questions. Why is having a future orientation more strongly correlated to intensity of tool use than other aspects of MCS, and why does increased IT intensity not support the provision of non-financial and externally focused information?

While ERP is able to support the provision of internal financial information, later developments in IT may enable companies to process a broader scope of data. This development is more typical of bigger companies, while the mid-size companies under analysis remain more engaged in establishing or developing their basic transactional systems. Add-on systems are rarely employed, a fact which is reflected in the low IT intensity of the sample firms. One application (out of the 14 listed) is used on average by only 22.8% of companies.

Mid-size companies still do not have IT systems that systematically collect and process non-financial and externally focused information. This type of information is typically manually collected and analysed in an ad-hoc way through campaigns. The other reason for manual processing is that the required non-financial and external information is much more company-specific than financial information. Automatic processing of this information would require (in many cases) customized developments; ‘off the shelf’ systems are less able to fulfil these needs.

Surprisingly, the association between IT intensity and reporting frequency is the weakest among all significant relationships. Assuming that IT automates data processing and enables easy data access, a much stronger effect on reporting frequency was predicted.

The variable in the model measured IT intensity by the weighted average of IT applications in use. With respect to reporting frequency and quality, another feature of IT systems also appears to be relevant: the level of integration between the implemented IT solutions. As one of the participants of the focus group session stated: *“The most substantial value in our company is found in data correspondence. ... One of the business units gives a number to our CEO that is derived from their own system. Of course, the systems do not communicate with each other... Controllers have their own numbers and if the numbers do not match, then the number of the controllers is wrong.”*

The ‘one number policy’ requires the integration of the underlying systems, which not only relates to the question of how effective reporting is, but more importantly, significantly affects data quality, and consequently, use of the MC information.

Among the three characteristics of broad scope information, future orientation is most supported by the intensive use of tools. Future orientation was operationalized by a variable that measured how extensively firms use pre-calculations and prepare plans and budgets for different areas of corporate functioning. This variable better measures the technical process (the existence of budgeted numbers) than the quality of forward looking. However, as IT solutions enable better planning and budgeting processes, extensive budget preparations are likely to be supported.

The effect of MC instruments on the provision of non-financial and externally oriented information is weaker than its effect on future orientation. This can be rationalized by pointing to the fact that it is still more common for business units to collect and maintain these types of information than controllers. Even if this information finally appears in MC reports, customer satisfaction (for example) is often measured, collected and monitored by the sales department, information about price fluctuations in raw materials by procurement, and analyses of competitors' activities by the production department, etc.

Conclusions

Several studies have investigated the adoption rates of management control practices. Researchers have concluded that firms use a mix of traditional and new tools, and the results of this research have also verified the fact that traditional tools have not disappeared. Classical tools that rely on financial measures (such as product profitability analyses) are likely to remain important in the future as well. As the CIMA report (based on input from over 400 respondents) states: *"It suggests that the discipline has a solid foundation, and principles which endure yet are refined so that the body of knowledge is continually expanding"* (CIMA, 2009, p. 28.).

Researchers are willingly reporting that increasing emphasis is being placed on the use of newer tools alongside traditional ones (J. Hyvönen, 2005), because older, simpler techniques might not be satisfactory any more (Tirnitz, 2010). Interestingly, our data does not support this claim. Compared to the previous survey (conducted in 2009), the rates of use of MC tools are very similar both for traditional and advanced practices. Use of the file-closer Balanced Scorecard has even dropped in popularity (from 22.1% to 16.9%). The similar decline in adoption rates at the end of the 1990s was rationalized by Dankó and Kiss (2006) as the learning effect of Hungarian companies.

Both MC and IT tools were applied as independent factors to explain the frequency and nature of the information provided. In line with the previous studies on the interplay between IT and MCS, the strength of association was found to be limited. The main rationale behind this is that the research had its focus on midsize companies, which are still wrestling with effective processing and providing internal financial information to managers.

Intensive use of advanced MC tools has a moderate effect on all information-related aspects of MCS: companies well equipped with advanced tools are more likely to be better at providing broad scope information. One might well ask, why was only a moderate level of association proved? The author believes that it is nearly impossible to incorporate all the potential sources of influence into such a study, even if they might have an effect on the dependent construct. Besides the external contingencies often investigated, I would like to stress one very important internal factor of influence: the managers themselves. What do they want to be reported and how often do they want it reported? If no need emerges to frequently report externally focused, non-financial information, controllers will not report it, even if they have a toolkit at hand.

Chenhall (2003), the author of numerous contingency studies on MC, drew attention to the problematic of researching outcome-related variables related to the characteristics of MCS such as information provided, or tools in use. Organisational members, and even entire organisations such as subsidiaries, may be forced to use certain MC tools and to provide certain information, even though they find it of little use.

Besides measuring the frequency of tool use, actual utility (i.e. the benefits that are derived from the adoption of specific tools) could be the subject of further analysis. Reported benefits may comment on future emphasis being placed on a certain MC tool / information. High adoption rates and low ranking of benefits may indicate that a tool is becoming outdated, or was not able to meet the expectations of users (Joshi, 2001; CIMA, 2009).

However, research only into the adoption rates of tools and the information they provide is not useless. As Gerdin (2005) has stated: *"It is logical to describe the MASs (Management Accounting Systems) in terms of what is actually supplied to managers. After all, only information that is available can help managers to achieve organizational goals"* (Gerdin, 2005, p. 113.).

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THE ROLE OF ECONOMIC AND PSYCHOLOGICAL COSTS IN SERVICE ELIMINATION

Service elimination (SE) requires systematic planning and execution to retain customers. However, service providers struggle with finding the best way to minimize customer churn following SE. This paper investigates the impact of economic and psychological costs on consumer reactions following SE with a scenario-based experimental design. The findings suggest that economic cost is positively related to churn and negatively related to satisfaction and commitment. Psychological cost decreases satisfaction and commitment, but does not affect churn. Interactions between costs show that psychological cost refines the impact of economic cost on customer reaction. This research contributes to the understanding of how SE impacts consumer behavior.

Keywords: **service elimination, economic cost, psychological cost, customer retention, telecommunication services**

Service elimination is a potential tool of portfolio renewal, as it enables to unlock resources of service firms and thus, accelerate the launch of new portfolios. Due to the short life-cycles of services, services might get accumulated in the system of firms very quickly that requires the management of a relatively big service portfolio. In today's fast- paced economy service elimination is seen as a requirement for business competitiveness, because through the simplification of business portfolio, both customer and firm value could be increased.

Service elimination requires systematic planning and execution to retain customers. However, service providers struggle with finding the best way to minimize customer churn following SE, due to both strategic issues and limited information about this process. Understanding customer reactions to service eliminations could contribute to a more efficient implementation of service elimination decisions.

Service elimination is particularly is relevant in the telecommunications industry, due to the short life-cycles of services, however most studies tend to focus on financial services (Argouslidis – McLean, 2003; Argouslidis – Baltas, 2007).

This paper aims to contribute to a better understanding of consumer reaction following SE in the telecommunications context.

Section 2 introduces the theoretical background of the study comprising theory of both economic and psychological costs and service elimination. Section 3 develops the study's hypotheses. Section 4 presents the sampling, level of analysis, and measures. Section 5 describes the results. Section 6 presents the conclusions, including limitations and suggestions for further research.

Theoretical background

In the literature review, the main concepts are introduced in three areas: service elimination, service elimination-related theories and customer reaction to service elimination. Satisfaction and affective commitment are used to describe consumer reactions following SE. Churn is considered as the operative key performance indicator of customer retention.

Service elimination

Based on Gounaris et al. (2006), service elimination (SE) is considered an action by service firms that involves both the closing and the elimination of existing service(s). Elimination requires existing customers to migrate to new packages, which can result in forced migration. In the case of closing, the package remains available for existing customers but is not open to new ones. The importance of SE is underlined from two main aspects:

1. There are gaps in academic research in many subfields: this literature review clearly shows possible research directions, such as the outcome of SE and customer-perspective studies.
2. There is a need for companies to build a proper SE strategy, instead of the currently adopted ad-hoc basis.

SE can be enhanced if brought to strategic level (Harness – Harness, 2012), and from the corporate portfolio management (CPM) perspective there is no adequate method in strategic management research for effectively organizing and managing multi-business portfolios (Nippa – Pidun – Rubner, 2011). SE combined with CPM could be an adequate tool for successful service innovation.

We found a link between service innovation and SE, as service maintenance is part of new service development (Gustafsson – Johnson, 2003). Furthermore, existing frameworks do not support service innovation in on-going customer relationships, where alternative service innovation methods could be a solution (Gremyra – Witell, 2013). SE could be one of these alternative solutions, if managed correctly by the firm.

Avlonitis and Argouslidis (2012) provide an overview of the field, from which we focus on the outcome of SE (Table 1). From the SE literature review, it is clear that the pre-elimination decision-making phase and the product/SE decision-making process are covered; what remains relatively unstudied is the post-elimination phase. This research is positioned as post-elimination consumer research, a significant gap in the extant literature, as it is seen on Table 1.: the authors list all the areas ever studied within SE based on two perspectives: firm and customer perspective. There are three phases of the SE process itself: 1. the pre-elimination phase deals with the causes; 2. the PEDM process determines the attributes of the elimination process; 3. and the post-elimination phase focuses on the result of the SE. Performance outcomes are only studied in manufacturing sectors and success factors in financial service sector and multi-sector studies. Surprisingly there is no customer perspective analysis in the service area combined with post-elimination phase, especially success-factors. In the literature, product elimination (PE) and service elimination (SE) are often studied together, however there are differences between the two concepts which we explain later.

Service elimination-related theories

In order to understand SE more, we review a few SE-related theories that are relevant in for our research objectives. First, product elimination (PE) is described, because although SE and PE are different concepts, they have some common attributes that can be used in our research. Second, justice theory- a widely used theory in services marketing- is used to assess customer reaction to SE. Third, economic and psychological costs are introduced, which are primarily rooted in social exchange theory.

Table 1.

Summary of product elimination literature on post-elimination phase – adapted from Avlonitis – Argouslidis (2012)

Author(s)	Broad topics investigated	Sample	Key independent variables	Key dependent variables	Main findings
Avlonitis (1987)	Post-elimination phase	166 UK industrial and consumer goods firms	Circumstances triggering PEs, nature of the elimination decision	Outcome indicators for PE decisions	Decisions guided by strategic considerations yielded higher outcomes.
Harness – Marr (2004)	Post-elimination phase	45 UK financial firms	Company type	Relative importance of financial PE success factors	Company type accounted for differences in the relative importance of success factors.
(Gounaris et al., 2006)	Post-elimination phase	164 Greek service firms	Characteristics of service elimination case histories	Indicators of elimination decision's success	Successful service elimination decisions were related to treating elimination as a strategic decision, adopting systematic elimination behavior and forming multi-departmental teams.

Product elimination – removing products that no longer add to an organization's objectives – has long been considered a negative activity (Kotler, 1965; Avlonitis, 1986; Hart, 1991), but it has also the potential to alter the relationship between the organization and its customers. Harness and Harness (2012, p. 56.) consider product elimination as a process that "can generate outcome benefits for the organization in four areas: simplification/concentration of management and sales effort; improved product portfolio performance; customer management related; improved physical and financial resource management."

Product elimination is a rather neglected area, both in practice and in marketing literature. Companies usually focus on product or service development, tending to neglect elimination. This particularly applies to service elimination (SE) where the company re-directs its clientele to purchase a different product (replacing an existing product or one dropped) (Gounaris et al., 2006).

Justice theory is a relevant service marketing concept in our research, which was mostly applied in the case of service recovery (Andreassen, 2001; Wirtz – Mattila, 2004), which is seen as a tool for customer loyalty. Boshoff et al. (2000) define service recovery as follows: *"Efforts made by the firm to return aggrieved customers to a state of satisfaction following a service failure"* (2000, p. 63.). Although SE is not a service failure, but very similarly, it can involve a negative customer attitude and complaints that might lead to customer churn, if SE is not handled adequately.

To assess the effect of SE, the three types of fairness in justice theory are relevant: distributive, procedural and interactional fairness. Distributive justice refers to the outcome, while procedural justice is the sum of processes, policies and rules (Smith – Bolton – Wagner, 1999). Interactional fairness includes apology, perceived helpfulness, courtesy and empathy of the service staff (Wirtz – Mattila, 2004).

In the following part we summarize the main findings about the application of justice theory in the field of service failures and then highlight their relevance in terms of SE.

One relevant research issue concerns the combination of service recovery tools. Based on Wirtz and Mattila's results (2004), compensation is not always required due to procedural and interactional justice: in case of service failures an immediate recovery and apology makes the compensation unnecessary, however compensation has no impact, when customer perceives procedural and interactional injustice during the process.

Compensation only had an influence on customer satisfaction, when either an immediate recovery happened without apology or a delayed reaction with apology. This means that an immediate recovery with an apology without compensation might be the most satisfying and cost effective solution for companies.

The use of service recovery tools and the underlying justice theory contribute to the understanding of customers' complaining behaviour, which is also a potential consequence in the case of SE and might affect churn. Overall we can conclude that the understanding of service recovery and justice theory helps us to get a better insight into the way (fairness) SE elimination is implemented and the reasons why it may have a positive or negative attitudes on customers.

Homans defines *social exchange* (1958) as *"an exchange of goods, material goods but also non-material ones, such as the symbols of approval or prestige"* (Homans, 1958, p. 606.). Blau (1964) adds that it *"involves favors that create diffuse future obligations (...) and the nature of the return cannot be bargained"* and *"only social exchange tends to engender feelings of personal obligations, gratitude, and trust; purely economic exchange as such does not"* (Blau, 1964, p. 93-94.).

This means that in social exchange psychological costs are also present besides economic costs, and they affect customer retention. Social exchange might also help to understand, how psychological cost captured by procedural and interactional fairness influences customer reaction (Masterson – Lewis – Goldman – Taylor, 2000). In case of SE social exchange refers to the relationship between the service provider and customer.

According to Homburg et al. (2010, p. 531.), "eliminating a product may result in severe economic and psychological costs to customers, thereby seriously decreasing customer satisfaction and loyalty." Foa and Foa (1974; 1980) describe the difference between *economic* and *psychological costs* as follows: economic costs and benefits are the 'hard factors' of an exchange, psychological costs and benefits represent the 'soft factors', such as reliability, flexibility, and cooperativeness. Further, the relationship between product elimination and customer satisfaction also affects customer retention: "psychological costs of the elimination reflect the degree to which the customer becomes uncertain about the eliminating company owing to the product elimination, as the elimination can raise customer doubts about the wisdom of engaging in a business relationship with this company" (Homburg et al., 2010).

Economic and psychological costs are related to the concept of switching costs which include not only those costs that can be measured in monetary terms, but also the psychological effect of becoming a customer of a new firm, and the time and effort involved in buying a new brand (Klemperer, 1995; Kim et al., 2003).

Switching cost is the sum of economic, psychological, and physical costs (Jackson, 1985). The economic or financial switching cost is a sunk cost which appears when the customer changes their brand, for example the costs of closing an account with an operator and opening another with a competitor (Klemperer, 1987).

Psychological cost is perceived as the cost stemming from social bonds (e.g. staff-customer relations) that appears over the course of time and the uncertainty/risk of the unused brand. The customer perceives high risk regarding a brand they have never used (Sharma – Patterson, 2000). Risk exists especially in services where customers prefer a rival service provider, because service quality cannot be evaluated before purchasing (Sharma et al., 1997).

Customer reaction to service elimination

Customer reaction involves many concepts that primarily affect the outcome of SE and thus are relevant in our research. These concepts include satisfaction and commitment. The importance of those constructs for our study can be underlined by the fact that they have an impact on customer retention. In the following section first we discuss churn as a measurement of customer retention. It is followed by the description of satisfaction and commitment with a special focus on their relation to customer retention.

Churn is an operational measurement of customer retention (Gustafsson et al., 2005). In the wireless telecommunications service industry, *customer churn* is used to denote the customer movement from one provider to another; *churn management* describes an operator's process to retain profitable customers (Berson et al., 2000). Churn studies can be categorized as cause of churn, retention, and type of churn (Braun – Schweidel, 2011). This study focuses on retention. SE can be viewed as a situational factor that impacts customer retention strategy. Thus the models determining normal customer churn rate (Rust et al., 1995; Ho – Zheng, 2003; Kamakura et al., 2005; Prince – Greenstein, 2011; Kumar – Peterson, 2012) need to be modified in order to assess the effect of SE.

Customer satisfaction is defined as a customer's overall evaluation of the performance of an offer to date (Johnson – Fornell, 1991). It is often researched in relation to customer loyalty across a wide range of product and service categories, including telecommunications services (Fornell, 1992; Fornell et al., 1996). Affective commitment is forward looking, while satisfaction is a retrospective evaluation (Verhoef, 2003).

Commitment is usually defined as the extent to which an exchange partner wants to continue a valued relationship (Morgan – Hunt, 1994). Gustafsson et al. (2005) define the main factors of retention: overall customer satisfaction and affective commitment. *Affective commitment* is created through personal interaction, reciprocity, and trust.

Hypotheses development

The objective of this study is to get a better understanding of consumer reaction following SE in a telecommunications context. It investigates the impact of economic and psychological costs on consumer reaction. As existing literature has not yet linked economic and psychological costs with SE in a business-to-consumer context, this study fills a significant gap in the literature.

The economic costs of elimination reflect the financial loss or expenditure the customer faces following SE (Homburg et al., 2010). With the increased financial burden, the customer is more likely to churn, be less satisfied with the service provider, and find less value in maintaining a relationship with them.

On the theoretical bases of economic cost, customer retention, satisfaction, and commitment literature, the following is expected:

H1: Economic cost increases churn and decreases satisfaction and commitment.

Psychological cost refers to the reliability, flexibility, and cooperativeness of the company during SE (Foa – Foa, 1974; Foa – Foa, 1980) and reflects the degree to which the customer becomes uncertain about the eliminating company and has doubts about the wisdom of staying with them (Homburg et al., 2010). Psychological costs represent an unpleasant inner state, which in turn may lead to a decrease in trust. Thus psychological cost is expected to increase intention to churn, and decrease satisfaction and commitment.

On the theoretical bases of psychological cost, customer retention, satisfaction, and commitment literature, the following is expected:

H2: Psychological cost increases churn and decreases satisfaction and commitment.

Customer perception of economic cost could also be altered by psychological costs. "Hard factors" could be modified by the service provider with the use of appropriate "soft factors" (Foa – Foa, 1974; Foa – Foa, 1980), through psychological cost effects.

In order to explain the interactions between economic and psychological costs, we rely on the concepts of cognition and affect, which are the focus of several research studies (Oliver, 1980; LaBarbera – Mazursky, 1983; Oliver – DeSarbo, 1988; Westbrook – Oliver, 1991; Mano – Oliver, 1993; Homburg – Koschate – Hoyer, 2006).

Kempf (1999) suggests that for functional (vs. hedonic) products, cognitions are more important drivers of product evaluations than affect. We consider telecommunication as a functional service. We also assume that economic costs correspond to the cognitive approach, while psychological costs are rather related to affect. When economic cost is involved, cognition is likely to dominate affect, while in the absence of economic cost, affect will have a stronger impact.

It is therefore expected that:

H3: There will be interaction effects for economic and psychological costs. In the absence of economic costs, the impact of psychological costs on customer reaction will be stronger than in the presence of economic costs.

Methodology

Experimental design

Based on the literature review and the exploratory research results, a 2x2 between-subject experiment design based on scenarios was carried out. The choice regarding experimental design instead of a consumer survey is due to limited access to customer data. Only a small number of customers involved in service package simplification agree to be contacted for marketing purposes, which results in a small sample size. Further, SE is usually not organized systematically and there are limited numbers of such projects available. SE researchers usually combine telecommunications with financial services to obtain a higher number of cases required for quantitative analysis.

The following variables and scenarios are used in this experiment:

- *independent variables:* economic cost and psychological cost,
- *dependent variables:* churn, satisfaction, affective commitment.

Economic and psychological costs are used to measure the effect of SE on customers. *Psychological cost* refers to whether the customer had received prior notice and was contacted by phone before elimination, that is, the SE was not unexpected, thus representing a lower level of psychological cost.

Economic cost is incorporated into the scenarios as the cost of the service package for the customer, which is defined as a dummy variable that takes the value of 1 if the cost of the offered service package is high (worse offer), and 0 if the cost is low (better offer).

Bearing in mind that sending a letter notifying the customer of the change in service package is a legal requirement, the four scenarios are as follows:

1. Better service package after elimination; customer receives notification by phone before elimination.
2. Worse service package after elimination; customer receives notification by phone before elimination.

Table 2.

Description of scenarios

Scenario	Description of scenario
1	Your telecommunications service provider eliminates your service package. Before the elimination, they call to inform you about this and to help you to choose a new subscription. You tell the call center operator that you don't want a new subscription, as the current one is perfect for you. The operator can offer you a new service package with lower monthly fee, more internet and lower PPM. One week after the call you receive a letter notification as well about the change.
2	Your telecommunications service provider eliminates your service package. Before the elimination, they call to inform you about this and to help you to choose a new subscription. You tell the call center operator that you don't want a new subscription, as the current one is perfect for you. The operator can offer you a new service package with higher monthly fee, less internet and higher PPM. One week after the call you receive a letter notification as well about the change.
3	Your telecommunications service provider eliminates your service package. Before the elimination, they call to inform you about this and to help you to choose a new subscription. You tell the call center operator that you don't want a new subscription, as the current one is perfect for you. The operator can offer you a new service package with lower monthly fee, more internet and lower PPM.
4	Your telecommunications service provider eliminates your service package. Before the elimination, they call to inform you about this and to help you to choose a new subscription. You tell the call center operator that you don't want a new subscription, as the current one is perfect for you. The operator can offer you a new service package with higher monthly fee, less internet and higher PPM.

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3. Better service package after elimination; customer does not receive notification by phone before elimination.
4. Worse service package after elimination; customer does not receive notification by phone before elimination.

Detailed descriptions of the scenarios are presented in Table 2.

Sample
Data were collected through an online questionnaire between November 2014 and January 2015. Participants for the experiment were recruited using social media, including LinkedIn and university student mailing lists. There was no screening for participation.

Scenarios described a telecommunications SE situation, where respondents had to answer questions about the process and evaluate the whole experience.

The sample contains 163 respondents (a 16% response rate). The male-female ratio is quite balanced (59% and 41%, respectively) and the average age of respondents is 31. Respondents were randomly assigned scenarios. The number of subjects for the different conditions varied between 37 and 44.

Measures
The following scales are used in the experiment:

- Churn is measured by the following items: "I would accept the operator's offer" and "I would leave my current operator after this case" (based on Aksoy et al*.,* 2013). Both items were averaged with a reversed second item to create the final churn intention scale.
- Satisfaction and commitment: Gustafsson's scales for measuring satisfaction and commitment are used (Gustafsson et al*.,* 2005). Affective commitment was measured by the following statements: "I take pleasure in being a customer of the company" and "I have feelings of trust toward the company." Satisfaction was measured with four items: "I am satisfied with the operator's offer," "The operator exceeds my expectations," "In my opinion the operator is close to the best operator." In addition to these three items, which were based on the work by Gustafsson (2005), the authors added a fourth "I consider the operator's reaction appropriate."

For the measurement scales, Cronbach's alphas vary between 0.794 and 0.934 (SAT: 0,794, CHURN: 0,934, AFFCOMM: 0,834).

Manipulation checks
Four expert judges (faculty members in services marketing) reviewed and commented on the scenarios and the questionnaire. Slight modifications in wording were made to improve ecological validity. Next, in accordance with the recommendations of Perdue and Summers (1986), manipulations were checked in a quantitative pilot study, independent of the main experiment indicating that the manipulations were effective, with a significant difference between test and control groups for all conditions.

When developing the manipulation checks, the study relied on the definitions provided by Homburg et al. (2010: p. 533.) who described economic costs as perceived economic burden and expenditures, while psychological costs were conceptualized as a feeling of uncertainty, doubt, an unpleasant inner state of tension, and dissonant cognitions.

The manipulation check for the two independent variable was as follows: based on Cannon and Homburg (2001) and Montgomery et al. (2005), economic cost used: "I will have to face financial losses," where *M (economic cost)*=4.,48 vs. *M (no economic cost)*=1.56, *F*(1.51)=118,73, *p*<0.000. A one-item measure was used for psychological cost (Dwyer et al., 1987; Noordweier et al., 1990; Arend, 2006): "Following the event I will have doubts about the reliability of the company," *M (psychological cost)* =3.73 vs. *M (no psychological cost)* =3.13, *F*(1.50)=3.117, p<0.01. Scenarios for realism were also checked: a telecommunications company manager commented on the scenarios and judged them to be realistic and fitting with their everyday practice. Then, a further qualitative research was conducted in order to validate the scenarios with consumers, one consumer for each scenario.

The results show that all interviewees found the scenarios realistic; they could imagine that their operator would call them informing about a situation like this. Further, two interviewees added that they already were involved in a service elimination, and the process was quite similar as described in the scenarios.

Results

A General Linear Model (GLM) was used to assess the effect of economic and psychological costs on churn, satisfaction, and commitment (Table 3.).

In case of the economic cost, all dependent variables behave as expected based on the hypothesis: economic cost decreases satisfaction and affective commitment, and increases churn. Psychological cost leads to a lower degree of satisfaction and affective commitment but does not affect churn. These results provide support for *H1* and partial support for *H2.*

These main effects, however, are qualified by significant two-way interactions. The interaction effects are visualized in Figure 1**.**

The plots show that economic cost leads to a lower level of satisfaction and commitment independent of psychological cost. But if there is no economic cost involved, psychological cost leads to a lower level of satisfaction and affective commitment. The plot for churn displays a different pattern. In the case of economic cost, the presence of psychological cost decreases churn while if no economic cost is involved, psychological cost increases churn.

Table 3.

Descriptive statistics and analysis of variance results

		Dependent variables		
Independent variables		**Satisfaction**	**Churn**	**Affective commitment**
Economic cost		F=335.97 sig. 0.000	F=241.85 sig. 0.000	F=136.98 sig. 0.000
	Yes	**1.62**	**3.88**	**1.66**
	No	**3.68**	**1.81**	**3.19**
Psychological cost		F=6.14 sig. 0.014	F=0.39 sig. 0.533	F=5.38 sig. 0.022
	Yes	**2.45**	2.87	**2.23**
	No	**2.69**	2.99	**2.49**
Economic cost	**Psychological cost**	F=9.83 sig. 0.002	F=11.38 sig. 0.001	F=9.09 sig. 0.003
Yes	**Yes**	**1.66**	**3.63**	**1.70**
	No	**1.59**	**4.14**	**1.61**
No	**Yes**	**3.37**	**1.99**	**2.84**
	No	**4.00**	**1.64**	**3.54**

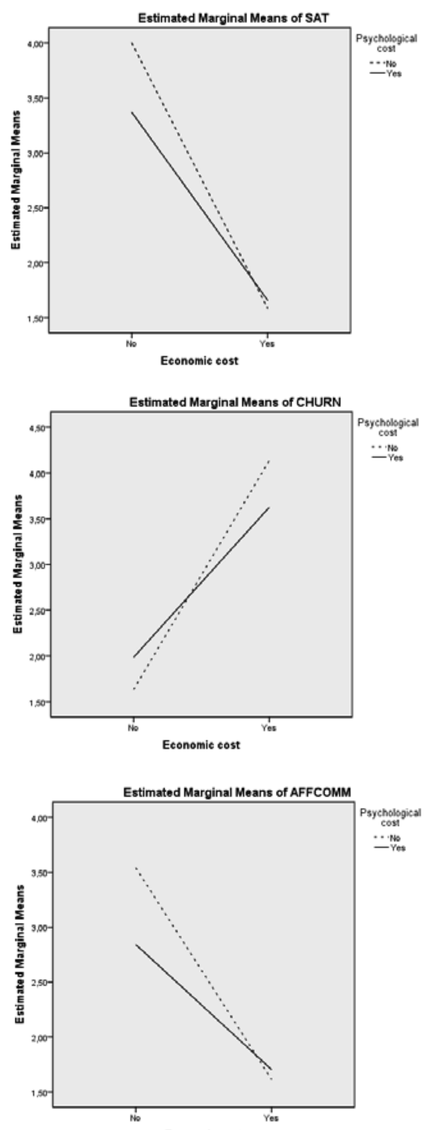
Conclusion

The study sheds light on how SE shapes customer retention. Experimental design is used to determine the effects between SE and its main success factors, churn, and other variables related to customer reaction (satisfaction and commitment). All hypotheses relating to satisfaction and commitment are supported; only interactions between economic and psychological costs gave surprising results. Regardless of economic cost, psychological cost seems to have an attention-raising role for customers. The missing contact from the operator determines the level of satisfaction, loyalty, commitment, and churn. Even if the offer was better, but the customer did not receive a phone call before elimination, they might leave the company. In a worse offer scenario, the call might worsen the situation and result in higher churn rates. Following the operator's explanation, the customer might realize that they are facing economic loss or gain.

The results indicate that the offers themselves are probably not clear for customers; direct contact with the operator before elimination is more crucial. This might change the focus on "hard factors" in terms of customer retention, and emphasize the role of "soft factors."

Figure 1.

Interaction effects between economic cost and psychological cost



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Contribution

The expected contribution of the research consists of three main parts. First, the focus on telecommunications extends the area of SE research from financial services to a broader sample. Second, SE gives a special circumstance to the normal churn modeling that might help to increase the understanding of churn. Third, SE is a key element both in academic theory and in practice in terms of service portfolio management. The research gives insights for practitioners as well, on how to incorporate this knowledge of customer reactions when formulating an SE strategy.

Managerial implications

Practitioners need to be aware that psychological cost might have a more significant role than expected: the form of contact with the customer has a stronger effect on retention than the quality of the offer itself. Perhaps offers only in written form are not clear for the customer, and as such, verbal notification raises their attention. As a result, the customer is more likely to switch operators.

The role of psychological cost is emphasized here: with worse offers it might lead to lower customer churn, and with better offers to higher customer churn. It is not just the quality of the offer that determines customer retention.

Further research and limitations

Several limitations exist regarding this research. First, partly students served as the sample pool for this investigation. Although the choice of including students somewhat limits the generalizability of the results, the behavior of students and other market segments are expected to be rather similar in a telecommunications context. Second, the scenarios employed were constructed by the researchers and do not describe real situations. With a short description of an imagined situation, it is not possible to capture all important customer details, particularly the emotional content of operator/customer interaction.

There are three possible areas for future research. First, psychological cost measures could be refined. Second, compensation is a churn-reducing technique in practice that could be incorporated into the scenarios. Third, future studies may investigate whether the relationship between the service provider and the customer determines the success of SE,

Although the results may be generalized to other fields, mobile telecom services represent a specific field within SE. Future trends of business models might influence customer reaction to SE, as new types of services emerge. For example, the elimination of contractless services with no subsidy conditions would require an entirely different approach to SE.

Further, both voice and data services are becoming unlimited, which on one hand reduces the power of operators, and on the other fosters customer co-creation (Prahalad – Ramaswamy, 2004).

SE is likely to become increasingly important in the near future, as service trends, and more specifically, telecommunications trends, have started to change dramatically. New types of services, service bundles across industries (e.g. fixed line and wireless services combined with mobile television), and the evolving role of contractless mobile service packages require the reshaping of current portfolios. As a preliminary requirement, a well-structured SE might accelerate this process, while maintaining customer value.

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Julianna FALUDI

A SHOWROOM TURNED FAB LAB:

OPEN COLLABORATIVE INNOVATION IN OPEN KITCHEN DESIGN – A CASE STUDY

This paper presents an open table design project introduced by a high-end kitchen producing company in collaboration with maker communities, independent designers and the wider public. The case illustrates a hybrid open/collaborative innovation strategy, strategically adapted by a firm for raising awareness, engaging the public, to raise its design options, and enriching its core design concepts.

Keywords: **modularity, open innovation, design table, open collaborative innovation, kitchen production, design-driven industries, digital fabrication**

Engaging with the debate on innovation openness this paper illustrates a case of a hybrid form, tempting to go beyond what is measured by studies on a larger scale. The scrutiny given to the case of *Kitchen Becomes Open* project opens a new perspective for further research where innovation is design-driven, open and experimental. A rising interest in open, user and collaborative innovation is witnessed in scholarship during the past decades, where firstly considerable focus was given to technology-intensive industries. The buzz on open innovation has created many and various meanings, and usage of the notion. What actual openness means has two fundamental approaches in innovation scholarship: one focusing on the (producer) firm, and the other on the outcome of innovation: being a public good or not (scholarship on innovation openness can be grouped into 4 main strands: Faludi, 2014). First, the notion of 'open innovation' derives from Chesbrough's frame (2006): where innovation is interpreted based on the Schumpeterian understanding of 1) producer-driven innovation, thus the firm strategically puts use to its resources and capabilities to innovate. Chesbrough focuses on how firms (can and might and do) draw in external resources to innovate, and also on how the outcome of innovation, and the spillovers of the process (patents, etc.) are being commercialized on. Thus, raising the capacities of the firm for open innovation implies rendering impermeability to it (2). Moreover, investigations on networks and ties over firms benefiting from knowledge-share (Brusoni, 2001; Luo et al., 2012; Malerba, 2005; Simard – West, 2006) are linked to the producer-driven model (3). Shifting the locus of innovation from the producer, one will find at the other end the user (4), who happens to develop solutions not met by firms, and then taken up by the producer at a given stage (benefiting from it). This strand was first theorized by Von Hippel (1976, 1988, 2005). Digital technology and platforms (often created by firms) called for a further strand investigating the outcome of innovation: where the locus of innovation might be a community of people and the outcome is a public good (4).

By bringing in a systematic approach Baldwin and Von Hippel have drawn on the different possible ways firms might follow (Baldwin – von Hippel, 2011), suggesting the frame of open collaborative innovation to study cases labeled as user-producer co-creation, collaborative innovation. This latter type, innovation driven by collaboration was studied in open source software development (Lee – Cole, 2003; Baldwin – Clark, 2006; Dahlander et al., 2008; Harison – Koski, 2010), online games development (Potts et al., 2008), branding cultural projects (Dell'Era, 2010) in fashion and music industry (Huage – Hracs, 2010), or in crowd science (Franzoni – Sauermann, 2014). However, little is known about open collaborative innovation projects resulting in a public good in fields outside open source software development.

To put it bluntly (following Baldwin and Von Hippel's (2011) suggestion), openness refers to the *permeability* of a firm: thus how external sources are used for innovation, where spillovers and outcomes can be commercialized on (producer-driven), or the *public good* nature of the outcome of innovation, where collaboration is driven rather by collective action. We also know, that companies might create platforms, where modules are set free for contributions where users, collaborators can innovate on (Schilling, 2009; Greenstein, 2009).

Design might take the role of the problem-solver in innovation (Alexander, 1964; Simon, 1969), or the driver contributing to the value creation process of firms (D'Ippolito, 2014), as well as, a mean to coordinate and improve product design development (Ravasi – Stigliani, 2012).

Looking from the angle of design-driven industries, we know that firms often innovate in various collaboration forms (Pisano – Verganti, 2008). For conveying meanings companies might work with a portfolio of designers carefully curated to overarch cultures (Dell'Era – Verganti, 2010), where brands as social constructs are valued by the public based on shared meanings (Arvidsson, 2005). Innovation as value creation in the stylistic, aesthetic or semantic realm is prevalent in the creative industries (Caves, 2000; Cappetta et al., 2006; Cillo – Verona, 2008; Potts et al., 2008; Ravasi – Rindova, 2008, in the fashion industry: Tran, 2010).

Firms in the design-driven industries are pushed to launch novelties on the market framed by events (on the role of awards: Gemser – Wijnberg, 2002). Enterprises are prone to shape the discourse on design through various channels, where the festivalization as e.g. Design Week in Milan plays an important role. Opening up the design process thus invites a larger public to engage in the process itself as well as to enter the wider discourse.

Open Design

Open design (van Abel et al., 2011) and collaboration makes possible for a community to develop ideas, and products in an additive manner. Once a design is created it is launched open for access and use, where the iteration process is taken by the community either improving it, or developing further solutions, and adaptation to other fields. Furthermore, making things together channels in knowledge and resources, where the value generation process might restructure the production process itself (Benkler, 2006). One important aspect here is that no design, or idea is lost (at least the possibility of being lost is lower) if it enters a community where anyone can take and run with it. The other is that it brings alternatives to the traditional model, where designers present their work to the producer who decides on prototyping, developing and manufacturing of the product. Due to the lowering costs of prototyping with desktop technology (3-D printers, laser-cutters, software) designers can elaborate their projects at a different level. Fab Labs unite communities fabricating and experimenting on a range of solutions to meet their everyday needs or pursue defined goals based on accumulated and shared knowledge, contributing to the advancement of technologies in robotics, electronics, 3-D printing. Makers might share goals (as the The RepRap[1] movement started from the UK in 2005 developing a 3-D printer to print its own components (de Bruijn, 2011)), and community-driven experimentation fosters overall technological advancement. The philosophy of DIY (do-it-yourself) of experimentation and open iteration at the core of their activity swiftly turns entrepreneurial (Faludi, 2017a).

In sum, open design lies in the realm of open collaborative innovation creating a public good. Again, Schumpeterian understanding considers innovation as that of initiated by the producer, benefiting from the value created. In contrast, open collaborative innovation is driven by innovators rendering their achievements into the public domain, where participants are not rivals, and they do not plan to sell the outcome or related property rights (Baldwin – von Hippel, 2011, p. 1403.). If we consider an enterprise commercializing on the value created by its innovation activity, we are bound to think that openness might imply here the producer-driven legacies, and the Chesbrough (2006) type of permeability of the firm. Specifically, generating solutions by sourcing in external knowledge, commercializing on spillovers, and mining out partnerships in development for entering new markets.

Openness is extensively researched as remaining within the (usual) structures of the net of suppliers or partnerships based on similarity, or close complementarity as seen above. This case in contrast exemplifies that a wilder approach toward reaching out to contributors can bring about connections that wouldn't have been thought of before. Open collaborative innovation where the outcome is a public good, gives floor for experimentation creating a playground for divergent ideas. Reaching out to unusual patterns of open collaborative forms is a challenge for high-end design-driven enterprises.

Method and Research Question

The *Kitchen Becomes Open* project was unique in framing the event of Fuori Salone with an open design table project overarching the worlds of digital fabrication, makers and that of post-industrial design of a high-end design-driven firm relying on a supplier network both in terms of production and innovation. This made it a valuable illustration to scrutinize an atypical case, taken from the field (being part of a broader research conducted by the author on open innovation patterns in the design-driven industries, backed by fieldwork in Milan, Italy). The case is demonstrated to reveal a process (Siggelkow, 2007), and the analysis strives to look behind the "hows" (Yin, 2003), as atypical cases offer opportunity to learn (Stake, 2003, p. 152.). I chose a single-case approach not for it being representative but to explore a hybrid model to bring evidence in the intersection of theories on open innovation.

The case study relies on data collected during field visits to the factory of Valcucine in Pordenone, the showroom in Milan, and the Fab Lab of DotDotDot, and a set of semi-structured interviews on the project 'Kitchen Becomes Open' with representatives of Valcucine, DotDotDot, and Arduino. Secondary data (available on the web) adds validity to the case (Arksey – Knight, 1999). I used theory-building approach in viewing the data from the scholarly angles of innovation openness. The interviews of the key informants were recorded, while observations noted. As this research focused rather on understanding of viable forms tapped in the field, there was no contrast drawn to this very case for generalizability of results.

The text of the interviews was coded, and systemized. First, I modelled the evolution of design of Valcucine, along the core-design concepts, since the establishment of the company, with a focus on innovation. For interpreting this given case I relied on the theoretic framework developed on understanding innovation openness thus, along the main differences of the two main strands or ends of how openness is interpreted in innovation literature: 1. from the perspective of *permeability of the firm*, and 2. how collaboration in an experimental *set-up_ends with a public good*, or a *hybrid public good*. The analysis thus focuses on the main features of the two models: the outcome of the innovation (if it is a public good, or not), and the benefits and spillovers. For this I focused on the incentives behind the experimentation (R&D phase): as a mere open-ended project, or a well-defined set of activities aiming at developing a product, and on the competition within the project (among the participants: depending on if they are rivals). Transaction costs add to the argument on benefits and costs of innovation at stake. The analysis and data collection, interpretation was structured around the *research question* of:

What are the benefits and costs of an open design table project for high-end design-driven company applying a hybrid form of open collaborative innovation?

Discussion

Toward Open Design

Open innovation serves for advancing technology, a practice adopted by Valcucine over the years was to mine its network of suppliers. Suppliers, however also follow the realm of producer-driven innovation for raising the value of their products and to gain profits. The need for new solutions and advanced technologies, for example to introduce robotics in an unusual manner into the world of food design, or to improve ergonomics in an unprecedented manner was there, along with the need for innovative brand communication.

DotDotDot and Valcucine had run together several projects before, and the experience gained from the world of makers, Fab Labs and open design was at the disposal of DotDotDot, a company merging art, architecture, exhibition design and design, with a decade of experience and a substantial network of partners elaborating multidisciplinary projects with open and participative working methods. The shopping list of the ingredients for *Kitchen Becomes Open* thus was:

- a modular product as a platform to innovate on, that is a modular kitchen of easy design providing with flexibility and a range of solutions to elaborate on, adaptable to different functions and spaces (*Meccanica* is a modular kitchen engineered by Valcucine for flexible needs: it is of relatively lower cost to be accessible for larger targets, manufactured in the product line under the brand DeMoDe (stands for Democratic Modern Design). Meccanica exploring the philosophy of degrowth features radical solutions for reducing materials used, being 100% recyclable and 80% reusable, featuring no glue (thus no formaldehyde emission), furthermore it can be personalized (featuring wood, metal and textile). Meccanica can be self-constructed, disassembled and then reassembled, modules can be added, or eliminated, and stretched toward living spaces. Due to its mobile construction and modularity Meccanica was already open-ended for user-creation, thus it served as a perfect starting point, a platform for the designer team to innovate on.),
- knowledge and capabilities of makers and Fab Labs,
- discourse on furniture and kitchen design hyped by the event open to the public (Fuori Salone, Milano),
- partnership providing with specialized knowledge, capabilities and visibility, and of course
- openness of the firm toward experimentation with new solutions in both design development, and communication.

Kitchen Becomes Open

The one-week event of *Kitchen Becomes Open* was organized during Fuori Salone, the ultimate event tackling experimental design in response to and running during Milan Design Week (6-11 April, 2014). Fuori Salone is “a collection of fringe events”, an “intellectual life of enterprises” devoting themselves to “research and innovation, rather than sales” (Malossi, 2009). It is a response to the institutionalized Salone del Mobile, the event presenting novelties in furniture design focusing ultimately on interior design, with a spring of discussions and presentations. Salone del Mobile is reserved for the establishment, with pre-booked places for the high-quality producers in the realm of the ‘classics of design’. In contrast or in addition *Outside the Salon* (Fuori Salone) is reserved for experimentation outside the “conventional system of communication”. In this spirit *Kitchen Becomes Open* turned the elegant showroom with cutting-edge technology of Valcucine in the posh Brera (Brera Design District) into a Fab Lab for a weeks’ time.

> *“...é stato anche interessante trasformare quello che é il showroom dal Valcucine. Valcucine ha un target abbastanza alto, elegante, abbiamo fatto un Fab Lab dentro al showroom, quindi gente che lavorava, che tagliava, faceva polvere, é stato molto bello...”*
> *“it was interesting to transform the showroom of Valcucine. Valcucine has a high target, it is elegant, while we made a Fab Lab inside the showroom, where people were working, cutting, making dust, it was beautiful...”*
> *(Dotdotdot, curator, 2014)*

Electronics, robotics, laser-cutters, 3-D printers, and mechanical tools have entered the showroom along with a curious and wandering public, who could freely contribute to the engineering work of a team of professionals. Open discussions and research moderated by invited academics, architects, professionals[2] invited to add comments, ideas, views, arguments to the process by all:

> *“sono stati invitati una serie di mentor professionisti di alto livello nel ambito del design strategico che venivano a parlare con il gruppo di lavoro e apportavano anche loro contributo...”*
> *“A range of high level professional mentors were invited from the field of strategic design, who were talking to the working group, and contributed to their work...” (curator)*

The team consisted of 12 designers, makers, planners[3] selected from 110 applications[4] featuring applicants with a diverse background (designer, architect, engineer/ developer, student). The members of the designer team were hired for this project, thus their contribution was paid. The outcome of their work licensed open access for gaining visibility in the long term.

Partnership with Arduino was not less important, being a forerunner in digital fabrication and innovation platform for makers in the digital world. Coming from the nest of Ivrea (former Interaction Design Institute in the traditional place of the famous factory of Olivetti, sponsored by Olivetti and Telecom) Arduino is a tool “designed for makers and companies wanting to make their products easily recognizable” (http://www.arduino.cc/), operating with a global community built around it, representing a valuable source of user innovators in the long run, and a potential customer of the Meccanica, that provides with an interface to work on.

The project was open to the public allowing for participation in the design process for all:

> *“ovviamente da stare in salone era molto faticoso e le porte erano aperte ai tutti quindi la gente veniva dalla strada.”*
> *“it is obvious, that it was very tiring to be in the showroom, the doors were open for all, people were coming in from the streets.” (curator)*

Figure 1

Partnership of the Project

DotDotDot Developer/ curator of the project	Collaboration in the implementation of the project, joint selection of the team
Designers’ team 12 professionals contracted for development of the design	Selected through an open call, and contracted for the week of developing the design of the new kitchen
Invited professionals Moderating the design process, discussions	Contracted for providing with expertise.
Arduino Digital fabrication, robotics	Collaboration where Arduino provided with expertise, and robotics/ tools as a sponsor
Valcucine (DeMode) Meccanica Providing expertise in construction, mechanics	DeMode is a brand of kitchens designed and engineered by Valcucine.
Spotti Srl. Vendors of Valcucine	Vendors of Valcucine, the showroom in corso Garibaldi, Milano which provided with location is maintained in collaboration with Valcucine
Mechanical equipment suppliers Sponsors (Bosch, DWS system, Gravotech)	Collaboration with sponsors providing the equipment for the kitchen

The initiator of the project was a third party, DotDotDot, a firm providing with its expertise in participative and open design methodology. DotDotDot curated the project in close cooperation with Valcucine. Remarkably, DotDotDot was able to answer an internal need of Valcucine "to channel in new resources for innovation for creation of new markets, and to enhance in-house technology" (Chesbrough, 2006) by delivering an open design project ready to implement. Valcucine financed the project as an investment in communication, and a range of sponsors contributed. In this respect it is in the realm of the producer as driver of innovation, however the initiator was a third party, as pointed out above.

The outcomes, thus designs and prototypes of the project were not patented, but rendered open access and licensed under Creative Commons[5] CC by-nc-sa 4.0 with the permission to distribute, modify and create projects based on the original, except for business purposes, recognizing the author's paternity. The outcome of the project thus, was a public good, where participants were not rivals as did not plan to sell or commercialize the innovation or the related property rights (Baldwin – von Hippel, 2011, p. 1403.). Participants had the same scheme and terms of contract, suppling their individual expertise and knowledge as a team forming a project-based organization in the frame of *Kitchen Becomes Open*. Since participants delivered their labor to the contractor along with related intellectual property rights the project can be considered a hybrid model of open collaborative innovation. (Figure 1)

From Open Innovation Toward an Open Collaborative Project

Valcucine is open to incorporate solutions developed by its supplier net (new materials, technology) operating in a just-in-time production system. Suppliers demonstrate their competitiveness obtaining and constantly updating their technology and capabilities, with

Figure 2

Hybrid Model of Open (Collaborative) Innovation

Hybrid Model of Open (Collaborative) Innovation			
Kitchen Becomes Open	***Open Collaborative Innovation (Baldwin, von Hippel 2011)***	***Producer-driven (Chesbrough 2006)***	***Features***
Yes: licensed under CC 0.4	The outcome is a public good	The producer benefits from the innovation, by profiting or by selling the related Property Rights	Benefits of innovation
Experimentation with no specific product constraint	Collaborators contribute for free to experiment (no constraint) and create innovation	The producer invests in innovation to create value, and targets results (some experimentation exists however)	Incentives
Designers were rivals when applied to the team. No rivalry in co-creation of design table.	Designers are not rivals	Designers of innovation are rivals	Competition
Designers experimented in the frame of a design table, and arrived to tangible results. No specified push, however monetary incentives to produce results.	Innovation to 1. experiment, 2. to create a specific utility/software, etc.	Innovation to create value	Value creation
Costs related to experimentation, transaction costs of collaboration	Transaction costs related to experimentation Design costs divided among collaborators, and all benefit the value	Costs related to innovation and experimentation conforming quality and technical standards Design costs born by the producer, whom benefits of the value	Costs
For opening up the design table to source in knowledge and expand the market.	Partnerships are based on collaboration based on a variety of capabilities	Partnerships are based on sourcing in knowledge and technology, raise capabilities, and expand the market, and outsourcing spillovers of R&D	Partnerships

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a specialized knowledge in production that is external to the enterprise. In developing and engineering its new products Valcucine follows a semi-open strategy on the palette of open/ semi-open and closed innovation schemes of Barge-Gil' (2010, p. 586-587.): thus "having cooperated or bought external R&D", where most important external knowledge was as important as its internal knowledge. Internal knowledge of the technical and designer staff of Valcucine served the co-creative experiment to back with technical knowledge on feasibility of suggested solutions, and represented the core design concepts (beauty, functionality, sustainability, ergonomics). While the overall innovation story of Valcucine fits into the Chesbrough-type permeability of the firm (nested into the network of suppliers), this project witnessed a shift toward participative and collaborative forms of experimentation. The *Kitchen Becomes Open* project (Figure 2) is a hybrid model of open collaborative innovation as the problem is posed by the producer, solutions are solicited from third parties, despite that selected solutions are not closed by the producer to make profit from, but revealed open (as opposed to closed collaborative innovation: coined by Baldwin and von Hippel 2011, and identified by others and termed 'crowd-sourcing'). At the same time the clear intention of the project was to pick from the 'goulash' of good and bad ideas:

> *"molti di questi progetti avevano l'intenzione di portargli avanti, svilupargli ed eventualmente commercializzare."*
> *"many of these projects were considered to be developed on, and finally commercialized on." (curator)*

Costs and Benefits of Kitchen Becomes Open

Transaction costs of innovation include costs of research and development (iteration, testing). Experimentation and lab conditions of opening up innovation on one hand raise design options channeling in knowledge not available in-house (or within the established supplier-network and partnerships), and raises costs related to coordination of the pool of different expertise and new partnerships, and enforcement of the core-design concepts on the other hand. Open collaboration and the activity of makers is structured around experimentation free in choice of approach, selected tools and methods, while constrained by budget, which is relaxed by downloadable design and open access data.

In the frame of more restrictive rules, and well-defined procedures of in-house or innovation over networks, experimentation ends with the establishment of a dominant design (Henderson – Clark, 1990). Quality standards and technological requirements need to be met, and experimentation is coordinated via well-defined targets, for example to improve the characteristics of materials used, or finding solutions in the realm of ergonomics based on studies. Enterprises spend on innovation, and protect their solutions and prototypes with licenses, augmenting their transaction costs by enabling and protecting property rights and maintaining trade secrets. For innovation projects facing a less-tight means-end approach in respect of the outcome, where the aim is experimentation itself: open design table is a viable strategy. However, this implies transaction costs of aligning concepts and managing communication. In this given case those, introducing the open design table method raised coordination costs:

> *"non tutti questi progettisti sono abituati a questo tipo di progettazione, alla condivisone di proprio file, per cui molti, sono stati ancora lenti a preparare il materiale, cioe il lavoro dopo e molto lungo (...) collaborare con persone esterne in questo modo rallenta le cose, pero e stato interessante, persone sono state approciate in maniera nuova." (communication manager)*
> *"not all the designers are accustomed to this type of work of sharing their own files, for that reason, many were slow in preparing their materials, so, the work took long. (...) Collaboration with outsiders in this manner slows down things, however it was interesting, people were approached in a new way." (communication manager, 2015)*

Open design table unifies experts not companies, working on ideas not pre-defined technology-intensive solutions, and as the outcome is not expected to be a final product, and launching the ideas for prototyping and licensing does not imply any obligation for the company, it provides a favorable climate for experimentation. To reduce transaction costs, the purposive division of intellectual labor among the collaborators, with a centralized coordination role played by the invited moderators and experts of Valcucine created a project close to what is described as open hierarchical mode of collaboration, as openness shall not suggest flat decision-making per se (Pisano – Verganti, 2008). Lab conditions for experimentation without the strict result-constraint relieved rigorous hierarchy. The next level of decision-making was taken by the management in its ordinary manner, that of considering the produced menu of solutions ready to be prototyped or developed.

Architecture of Meanings

Modularization defines innovation (radical, incremental, modular, architectural) by how components relate to the structure. To explore that relationship, Henderson and Clark (1990) rely on the architecture of a product based on core design concepts. In their definition (p. 2.) the architecture of a product along with its components make up a system that makes it function. Furthermore, a component embodies a core design concept, and performs function. They point out two different types of knowledge that is required here: 1. the knowledge of the component and the way it is implemented, 2. architectural knowledge: how components are linked together to make up a whole. Henderson and Clark illustrate that with the motor of a fan being a component of the design, with a function to deliver power to the fan. Design concepts might vary for delivering power, where one is chosen, and that is the core design concept. In this case the component (the motor) becomes the physical implementation of the given concept. Valcucine communicates a set of values that are represented in each of their product or set of products. These values can be understood as core design concepts, as they define the direction of technological and ergonomic improvements carried out through the evolution of kitchen design. Furthermore, if we consider the product as architecture of meanings, then core design concepts (referred to as values) encapsulate meanings of the product (here: beauty, functionality, ergonomics, and sustainability).

Figure 3

Architectural and Component Knowledge

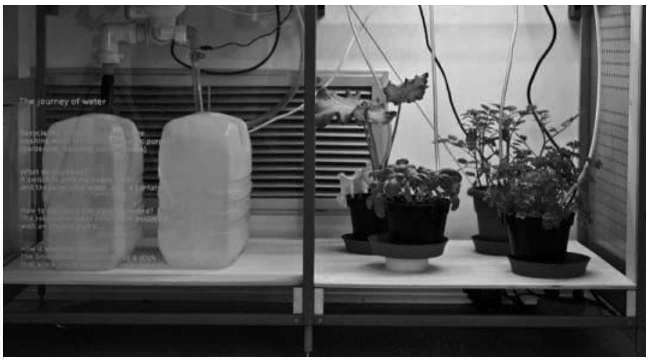
Knowledge of Valcucine	*Contributors' Knowledge*	*Product as a System*
Accumulated knowledge on the evolution of the core design concepts featuring the components both in physical embodiment, function and as meanings	possible components, knowledge related to the core design concepts of Valcucine	Component and how it is implemented
Accumulated knowledge on the architecture of previous designs learned	obtained within this project on the architecture of a specific design	Architecture
Repository knowledge (technology) at the suppliers net Accumulated knowledge on design and technology	Accumulated knowledge gained in collaborative innovation projects on experimentation and related design methodology	Technology

Modeling the interaction of knowledge within the collaboration illustrates architectural innovation. The team of Valcucine obtains the knowledge of the core design concepts that feature the components, the accumulated knowledge on the evolution of these core design concepts, the way they have been implemented, and the accumulated knowledge on the architecture of previous designs learned. What the collaborating designer team added was their knowledge related to the core design concepts of Valcucine, accumulated knowledge gained in collaborative innovation projects on experimentation with related design methodology, and technological knowledge outside the scope of Valcucine's designer team (for e.g. on digital fabrication, graphic design, etc). What is learned through interaction within the project is a jointly shared and developed knowledge that targets both core concepts and architecture. (Figure 3)

Innovation in the Kitchen Becomes Open project, thus stems here rather in the sphere of stretching the meanings created, than fine-cut technological or quality improvements. Solutions developed are in the domain of exploring the core design concept of sustainable design deriving from Latouche's frames adapted by Gabriele Centazzo, without the presence of rigorous control of the usual engineering practice (Montalti, 2014). Valcucine introduced radical innovation in exploring ergonomics and sustainability in kitchen engineering during its evolution of design. The concept of sustainability for example is a core concept bridging all products and product lines of Valcucine over time, where constant improvements in design are the actual implementation of this concept, at the same time refining its meanings. Sustainability, which gains special importance in this project, unfolds as dematerialization, recycling, reduction of toxic emissions, long-lasting aesthetics and technology. The basis, the Meccanica model, served as a tentative to produce a kitchen exploring in-depth the philosophy of degrowth (products of DeMoDe brand) by the 8Rs[6] inspired by Serge Latouche. Valcucine's core design concepts rhyme with those of makers' on reusability, recycling and search for sustainable solutions. Entering the world of makers the core design concepts of Valcucine gain a new shade, exploring solutions along shared values but from new approaches. The widespread argument on the movement of makers gaining power as an answer to economic crisis suggests that the driver of innovation in the case of makers is to find solutions based on achievable raw material (reused and thrifted spare parts, tools, old machinery, etc.) with low costs. This approach serves a democratic way to find solutions to needs, and reuse of available resources, and reducing resources consumed, like water, energy, gas. The solutions developed during the project reflect this approach. In real-life conditions engineering of a new product takes years within the company, as constant testing and fine-tuning to meet the above-mentioned requirements is a rigorous part of the project. The solutions developed as a result of 'Kitchen Becomes Open' were guided by Valcucine's designers and experts, without going through the validation channel.(Figure 4)

Figure 4.

Grey Water



Source: www.demode/openkitchen

A solution[7] explored how grey water can be reused, for e.g. that of vega-originated cooking for gardening, and cleaning. Another converted the fabric used for the cupboards of Meccanica, into shopping bags. Marina Cinciripi and Vittorio Cuculo designed an infographic with reactive and conductive LEDs tracking kitchen tools and cupboards. (Figure 5 and 6)

Figure 5.

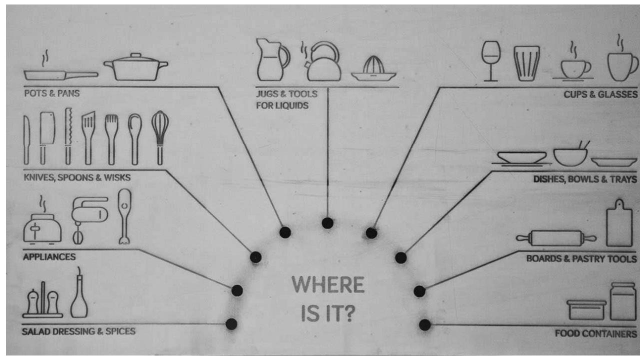
Open Design Table

Source: http://www.domusweb.it/it/notizie/2014/04/19/cucina_open_source.html

Valcucine created a platform for entry for innovators: open access solutions are to be developed. Meccanica is a platform for makers and for food design conscious consumers willing to add modules developed by communities of digital fabrication. In sum, complementary elements are now open to other producers (for e.g. food-capable 3-D printers, laser cutters), and for single-user and collaborative innovators.

Figure 6.

Tracking tools and cupboards



Source: http://www.domusweb.it/it/notizie/2014/04/19/cucina_open_source.html

The outcomes of the project are reusable and open for anybody to innovate on. This frees from property rights protection, and benefits the enterprise with the role of being a forerunner as paternity of the design shall be indicated. The value of innovation benefits those who will build upon the CC licensed prototypes, and solutions considered to be elaborated as a product under Valcucine in the future.

No matter how powerful 'Kitchen Becomes Open' was as an experiment toward opening a platform inviting single-user and collaborative innovators to contribute, the project added to the immaterial value of the brand. The project served for raising awareness of the public with media coverage about the values of Valcucine, providing a first-hand experience on how these values (sustainability, responsibility, social awareness) transform into design, backed by debates and discussions moderated by professionals.

Publicity was reached by the partners involved. Previous events organized by Valcucine during Fuori Salone also involved direct public engagement: people could bring their own laundry to be washed, dried and ironed in the showroom while launching Lavanderia (laundry) of Valcucine. Kitchen Becomes Open expanded the horizon toward sourcing in maker communities. Since, Meccanica entered the Casa Jasmina of Arduino, a lab, gallery and open space for experimentation developing a connected home.

Conclusions

Kitchen design needs to relate to current trends in food consumption and cooking patterns, where the household's kitchen has turned into a lab, and where cooking became the field for communities and service-providers to experiment in the intersection of food and design seasoned with easy-to-consume narratives of slow-food. Sustainability, eco-consciousness and originality became keywords just as beauty or ergonomics, or how to design one's customized nutrients. Digital fabrication has entered the playground of cooking vigorously experimenting with laser-cutters and edible 3-D prints (Faludi, 2017b). Producers relying on their innovation network might find themselves in lock-in, where experimental approach both to product development and communication strategy might open up new paths to follow and new audience to engage. The *Kitchen Becomes Open* project illustrated that hybrid forms of open collaborative innovation are viable outside open-source development. To understand and channel in the needs outside the innovation network of the firm into product design, Valcucine launched an experimental open design project. The findings of this analysis revealed that: just-in-time production creates an innovation network that is backed by modularization however, the firm might search for alternative sources of innovation outside its net. This approach allowed for modular innovation, along with refinement of the architecture of a modular product, Meccanica. 'Kitchen Becomes Open' was an important communication tool for engaging online communities, communities of makers and digital fabrication as well as the audience, the flaneur of the Fuori Salone. Rendering the outcomes as a public good contributes to a longer-term visibility of the brand, and creates a platform for innovation for other contributors.

In sum, the benefits of opening up the design and revealing the results of the innovation project contributed

Figure 7.

Stages of the 'Kitchen Becomes Open' Project

2014		stages		Actor
January-	The research and strategy behind the concept with the possible risks and results if implemented, was delivered by DotDotDot. Based on their previous experience 'Kitchen Becomes Open' was designed specifically to adapt the design table approach by an enterprise. The aim was to use the already existing tools of open design in a setting where engineering was internal to the firm.	Elaboration (research, strategy)	1.	DotDotDot
January-	The concept of 'Kitchen Becomes Open' had to find its partners. It was appealing due to its branding value, and as a communication tool for large enterprises. Valcucine and DotDotDot look back to a history of collaboration in the field of communication. Thus contacts were established with marketing, technical, and design teams. The management board of Valcucine has accepted the project after a series of negotiations and presentations based on preliminary research on the impacts of the project. It was rather the communication value that was appealing to the management board. 'Kitchen Becomes Open' fit the line of communication strategy and the philosophy of innovativeness and sustainability of Valcucine.	Selling (finding a company to implement)	2.	DotDotDot
March-	Close cooperation of DotDotDot and Valcucine in recruitment of partnerships, suppliers, media coverage, and the team of designers.	Finetuning, partners call	3.	DotDotDot Valcucine
April Fuori Salone di Milano	The literal implementation of the seven days of engineering at the design table during the design week 'Fuori Salone' in Milan, implied very detailed and precise organizational work from catering and technical supply to moderating the process of design, and welcoming the interested participants.	implementation	4.	Valcucine Dotdotdot Arduino
April-	The developed projects are open to all. The prototypes are licensed under the Creative Commons, parts and ideas of the elaborated projects can be freely downloaded and used by third parties, given Valcucine is indicated as a source. In this respect there is no direct commercialization. However raising visibility of the outcomes, and the value of the brand being a path-breaker in its approach, Valcucine indirectly benefits from the results.	Licensing open source	5.	Valcucine

largely to visibility and engagement. However, it seems that this project remained in the realm of experimentation with communication tools. Kitchen Becomes Open brought together the concepts and approach of digital fabrication, design for all and participation, stretching the limits of classic model of in-house design and development. Knowledge and approach of digital fabrication is an important experience within the technical realm of finding solutions, and furthermore it provides with a further path for understanding user experience in a new way: what would users like to fabricate, and what are the possible points of entry for users in creating their kitchen. (Figure 7)

Jegyzetek

[1] http://reprap.org/ http://en.wikipedia.org/wiki/RepRap_Project

[2] Giulio Iacchetti (designer), Stefano Maffei (Politecnico di Milano), Dario Buzzini (IDEO New York), Massimo Menichinelli (open design facilitator) Enrico Bassi (FabLab Torino), Zoe Romano (Arduino)

[3] Daniele Caltabiano – student, Andrea De Chirico – designer, Laurence Humier – MISS DESIGN progettista, Alexander Kashin – KINK FAB designer, Cécile Leporte – ULTRA ORDINAIRE designer, Emanuele Magini – designer, Marco Napoli – designer, Michele Novello – LABORTORIO GRAFFE designer Liviana Osti – designer, Francesco Rodighiero – SRA designer, Kodo Sam – developer, Juan Soriano Blanco- designer

[4] The applicants were ranging from 23 to 62 years old, gender ratio 39/61 women/ men, and from 16 countries.

[5] https://creativecommons.org/licenses/by-nc-sa/4.0/deed.it

[6] redistribute, reuse, recycle, reduce, relocate, renovate, re-contextualize, re-evaluate

[7] http://kbo2014.tumblr.com/

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Noémi LŐRINCZ

MAIN CHARACTERISTICS OF NOWADAYS' GLOBAL VALUE CHAINS AND THEIR RELEVANCE TO THE HUNGARIAN AUTOMOTIVE MANUFACTURING INDUSTRY

Modern-day globalization allows international fragmentation and production sharing. By connecting companies, employees and consumers, global value chains (GVCs) influence the structure of international trade with effects on countries' GDP, employment and ultimately on the global economy. Enterprises have the opportunity to enter and to upgrade their position within GVCs leading to higher integration in global trade. However, participating in GVCs also has a complex set of prerequisites, including the need to invest in infrastructure, institutions, services, labor force, and in general trade and business environment. We can also name specific characteristics, which enable economies to reinforce their activity within GVCs, like cheap labor force, proximity to end markets or signed trade agreements. For many developing countries this integration process is a major lever of intensive development.

This paper analyzes the role of Hungary in global value chains with a focus on the automotive manufacturing industry. It overviews global and local changes occurred in the last decades, when foreign direct investments of automotive manufacturers appeared in the country. The findings of the article could be of great assistance for policy makers to answer questions about the possible development paths and can provide some ideas about actions needed for an effective, beneficial participation in GVCs.

Key words: **global value chains, automotive manufacturing, value added, competitiveness, workforce development**

In today's global economy there is a systematic shift observable from the traditional multinational enterprise model to a more dynamic one, where ownership and control are separate. It is the result of a growing pressure for cost efficiency, organizational flexibility and agility to attain resources and to reach consumers at different markets (Beleska-Spasova, 2016).

Regarding manufacturing activities, since the 1990s there is a significant relocation tendency from the developed to the developing countries (Baldwin et al., 2014). With opening to new and higher value added markets, global value chain (GVC) participation offers – especially for developing countries – several technological innovations and the ability to add more value within industrial production, to improve labor force demand and productivity, and to raise income consequently. Governance of GVCs and upgrading within or between them can improve development and competitiveness of economies (Bamber et al., 2013). However, the improvement of own capabilities is a complex prerequisite to capture this opportunity to foster structural economic growth. The global value chain analysis comprises the effects of these new patterns of international trade and production (Gereffi, 2016).

The purpose of this paper is to reveal how the integration and the upgrading of the automotive manufacturing companies within GVCs affect the Hungarian economy. Albeit the topic of GVCs is widely discussed in the international literature, there is a gap relating the Hungarian automotive manufacturing industry. This article discusses the following subtopics based on an expansive literature review:

- role of the automotive manufacturers in Hungary's GVC participation,
- the amount of value added part in the production (export-import),

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- spillover effects of foreign multinationals on the skills of labor force, on managerial and organizational methods and on the Hungarian economy overall, including growth, infrastructure, wages, etc.

The first main part of the paper gives a comprehensive theoretical background of the GVCs, including their key characteristics, functions, different types and upgrading possibilities. After introducing the GVC framework, the paper describes the development of the foreign direct investment (FDI) inflow into Hungary from the 1990s, focusing on the automotive manufacturing industry and its connection to the GVCs. It also presents the main features and the key players of the automotive manufacturing sector in the country. The final, concluding part is a summary of the literature research including some predictions about the future trends of the automotive manufacturing industry in general and its relations to Hungary.

Global value chains (GVCs)

Recent years' trade liberalization and investment arrangements have facilitated the growth of GVCs, which served as a key pillar for the interconnectedness of economies. The roots of the GVC concept can be derived from the global commodity chain approach from Gary Gereffi et al. (1994). It refers to an international character of value flows, where multiple nations bring their goods or services through the different phases of production and deliver them to final consumers and final disposal after use (Gereffi, 2005). It is described as an interorganizational network around one product, which connects households, enterprises and states. The network is embedded in the world-economy (Gereffi et al., 1994). Due to advanced information technologies, transport, trade and business innovation of the 21st century, GVCs attained a central role in today's global economy.

A final product's global value chain comprises the value added of all activities that are directly and indirectly necessary for its production (Timmer et al., 2014). A value chain is a collection of business activities at the firm level, like actual manufacturing of products or creation of services, delivery, marketing, after sales services, etc. To ensure competitive advantage after the aggregation of all of the above-mentioned discrete activities, firms either have relative lower cost structure compared to their competitors or differentiate their products. According to Porter, because of the high relevance of international competition, companies need to adopt their global strategies by expanding activities in the value chain among countries (Gereffi, 2005). Global value chains take various forms: they are either short or long, with limited or numerous discrete stages in production, consumption and trade. To perform its tasks, the lead firm can opt for in-house solutions or outsourcing (Low, 2016). In case of outsourcing, when a product is completed in a particular country, it does not mean that the domestic companies lead and govern the value chain, e.g. Apple governs the production network of its products and they are completed in Asia (Timmer et al., 2014).

There are three major characteristics of the current stage of globalization: larger share of intermediate inputs in total trade, development of global production networks and presence of production processes around the world (Gereffi, 2005). There is a strong correlation between FDI stocks and the GVC participation index of both the developed and developing countries (OECD, 2014). Developing countries with their low cost labor force and raw materials and developed countries with their R&D and design capabilities affect each other even in widely separated locations (Gereffi – Fernandez-Stark, 2016).

Stages of manufacturing are dispersed over the world and they are often owned or controlled by independent suppliers. A significant amount of these international supply chains is regional and not global (Baldwin, 2009). (GVCs are still in majority, but regional chains are having growing importance nowadays in value chains research (Staritz et al., 2011).) Generally, a tendency of growing specialization is observable, where specific activities and stages in value chains are in focus rather than entire industries. In GVCs not all firms and countries are equally involved. The connectedness of economies is influenced by many different factors, some with fix considerations (e.g. location, resources, etc.) and some by public policy-shaped ones (e.g. infrastructure, investment climate, human capital, etc.). Policy makers of various countries can influence the extent of the involvement of the firms in GVCs significantly, e.g. with attracting investments or with influencing competitiveness (OECD, 2014). Today's GVCs are still dominated by the multinational enterprises of advanced economies, like companies from the USA, Japan or Germany (Alvstam et al., 2016).

Organizations have to face constantly accelerating changes in the macro-, industrial- and micro environment, which requires them to become more dynamic and to adapt faster to the turbulent and complex environment (Balaton et al., 2014; Balaton – Tari, 2014). Quality and efficiency of developed logistics services and international regulatory cooperation are essential in GVC participation, e.g. in the case of trade it is important to avoid unnecessary delays, to cut costs and to reduce uncertainty. Successful integration into GVCs has numerous positive effects on the trade, growth, labor market and general economic development of countries (OECD, 2014), because participating companies have access to new technologies and know-how, which results in improved productivity. Furthermore, GVCs can provide access to global markets and to acquisition possibilities of technological and managerial knowledge. At the same time, they may affect the operations of other companies negatively by limiting their participation or excluding them from GVCs (Contreras et al., 2010). Realizing the gains mentioned are not automatic and participation in GVCs does not guarantee stimulated growth: governance frameworks, effective social and environmental policies are essential to maximize the benefits of GVC participation. Structural policies and macroeconomic measures should also facilitate the growth process, where the local conditions of each country are different. Minimizing risks in countries is also important, especially in developing countries (OECD, 2014). Developing countries have to deal with a higher competitive pressure during their integration into global markets, where producers have two choices: either to increase the skills and competence of their activities and those of their workers or to move to other niche markets, where entry barriers reduce the intensity of competition (Humphrey – Schmitz, 2002).

GVCs require skilled labor force, thereby affecting also the structure and quality of the labor market in the involved countries. Nowadays, there is a strong international competition between workers, which formerly used to be on the level of companies and industries in different nations. Individual tasks are able to be offshored, which is very helpful for some workers, but can be harmful for others (Baldwin, 2006).

GVCs mostly consist of differently developed private firms from small and medium enterprises (SMEs) to multinational enterprises (MNEs), with different places in the GVC hierarchy, usually with different industry background and organizational characteristics. Value chains are coordinated by large MNEs in general, who cover the highest-value activities and they define the participating conditions for other firms, including the upgrading opportunities for them (OECD, 2014). Typical GVC entry for SMEs is selling goods and services to larger MNEs. According to OECD, 80-90% of the total employment in developing countries is employed by companies in GVCs, therefore, it is reasonable to stimulate the participation of such firms in GVCs. SME development policies, supplier-development programs can directly contribute to the cooperation with foreign firms. However, SMEs also face certain barriers set by the governments or by foreign firms; furthermore, they have to be able to comply with different international standards. Several less developed countries and SMEs failed to meet the requirements of high-income markets (Staritz et al., 2011). Barriers for domestic companies are usually caused by defects or weaknesses in the financial market, infrastructure, human capital or in the local industry. It is important to emphasize that the potential advantages realizable from participating in GVCs depend not only on the chains where SMEs operate, but also on the local circumstances of a country. Business environment and institutions influence local firms' ability to increase their productivity and to upgrade to a higher value added activity within GVCs (OECD, 2014). Then again, governments play a crucial role in the regulation of firm capabilities with a huge impact on competitiveness and on general investment attractiveness. Educational institutions are important as well, because they are responsible for the human capital development. Investment- and development encouraging policies – focusing on local suppliers – are also crucial in accessing the GVCs and in the upgrading of developing economies. According to a questionnaire conducted by the OECD and the WTO in 2013, developing economies point out three main obstacles their firms have to deal with by connecting value chains: *infrastructure problems*, *financial market accessibility problems* and *standard compliance problems* (OECD, 2014).

GVC participation of the economies are determined mostly by geographical factors and by the countries' policy in the medium term. In general, the most important factors are *size of the domestic market, income per capita*, *share of manufacturing sector, and the country's distance to manufacturing hubs* (OECD, 2014). According to Bamber et al. (2013), in the case of developing countries there are five factors, which influence the competitiveness of the GVC participating countries: *productive capacity, infrastructure and services, business environment, trade and investment policy* and *industry institutionalization*. They significantly differ among specific industry contexts (Bamber et al., 2013).

Types of GVCs

The literature distinguishes between *goods* and *services value chains*. There are certain differences in the way they function, but globalization affects both similarly, e.g. service-related tasks are also increasingly outsourced. The development of value chains in goods also needs services (e.g. IT, telecommunication, logistics, R&D, etc.) (WEF, 2012). In case of a services value chain, the activity of a company can be a core- or an outsourced competence (mostly back-office activities). The aim of these services is to be higher value added through innovation, design, R&D or branding development. Banking, tourism, health and IT services are the most typical among services value chains (WEF, 2012). Based on the governance, we also distinguish between *buyer-* and *producer-driven* chains. In the case of a buyer-driven chain, large retailers and merchandisers have powerful roles (e.g. Tesco, Nike). In producer-driven chains technological and scale advantages are in the focus and vertically integration is typical to the segments of the supply chain (Gereffi – Fernandez-Stark, 2016).

Types of upgrading within and between GVCs

Global competition force enterprises to upgrade their activities and to bring higher value added products and services constantly to the market (Gereffi, 2005). Changes of the last decades occurred in the global business organizations have had significant impact also on the upgrading possibilities of developing countries (Gereffi, 2005). According to Humphrey and Schmitz (2002), upgrading process of the activities of firms can materialize in four different ways:

- *Functional upgrading*: moving to higher value functions. A company acquires new capabilities, which are higher value added and therefore competitive products and services can be offered in new segments of a GVC (Humphrey – Schmitz, 2002; OECD, 2014; Fernandez-Stark et al., 2011). According to the range of its new functions, the position of the firm also increases (Staritz et al., 2011).
- *Process upgrading:* using more sophisticated technologies and methods in the production. A company acquires new capabilities, which are more efficient than the one of its rivals. Capital investment and better skills of workers are needed to use the new technologies, but costs can be reduced and flexibility can be improved. It can result in more complex services and lower defect rate (Humphrey – Schmitz, 2002; OECD, 2014; Fernandez-Stark et al., 2011). Process upgrading can also occur by re-organization of the production system and not only by the introduction of new technologies (Staritz et al., 2011).
- *Product upgrading:* producing higher-value products. A company acquires capabilities resulting in better end-product quality, more value added and sophisticated product lines and faster new product releasing capabilities. By getting experienced in the industry, a company can move to higher value added commodities with higher returns (Humphrey – Schmitz, 2002; OECD, 2014; Fernandez-Stark et al., 2011). Upgraded products also have a higher unit value and price (Staritz et al., 2011).
- *Chain upgrading*: a company acquires capabilities to be able to participate in a new global value chain and to produce higher value added products or services (Humphrey – Schmitz, 2002; OECD, 2014; Fernandez-Stark et al., 2011). One chain's acquired capabilities can lead to competitive advantage in other chains (Staritz et al., 2011).

Further upgrading possibilities by Gereffi and Fernandez-Stark:

- *Backward linkages upgrading:* a local company supplies products or services to foreign companies, which are located in the country and are already members of a separate GVC (Gereffi – Fernandez-Stark, 2016).
- *End-market upgrading:* a company moves into larger or more sophisticated markets, which require production on larger scale and stability of prices or standardization (Gereffi – Fernandez-Stark, 2016).

It is important to emphasize that product and process upgrading can encourage growth in industries (Fernandez-Stark et al., 2011), and the way of upgrading is influenced by different types of industries and business environments (e.g. input-output structure of value chains, institutional context, etc.) (Gereffi – Fernandez-Stark, 2016). The possibilities of upgrading differ in each type of chains as well, because of the varying core competences of lead firms. Lead firms' strategies can support or enable the upgrading process, but in general they are supportive in the product and process upgrading (Staritz et al., 2011). The structure of a value chain is also influenced by the lead firm, who governs the whole chain. The allocation of resources and the relationships among the different participants within the value chain are determined by the governance structure (Staritz et al., 2011).

In developing countries the upgrading process can often fail because of qualified workforce shortages, including lack of sufficient management and supervisor quality. Differences in culture and languages can also limit the transfer of capabilities (Fernandez-Stark et al., 2011). In the production sector the private sector has a highlighted role in labor force development, e.g. some companies have internal trainings for their employees at entry. International institutions can support the upgrading process, e.g. the cooperation between ILO and the World Bank helps raising the labor standards of global supply chains ("Better Work program") and also global buyers have influence on improving working conditions and workforce development practices (Fernandez-Stark et al., 2011).

Stakeholders of the value chains are companies, employees, educational institutions, government agencies, etc. Their relationships and roles influence the operation of value chains significantly. The upgrading process and the growth strategy of industries depend greatly on the stakeholders, therefore key players of the value chain should be identified first and foremost (Gereffi, 2016). In order to be able to enter GVCs or to upgrade within them, policies can help companies in the innovation and cost lowering processes in two different ways: in the case of a horizontal policy the different effects are economy-wide e.g. stable political and economic environment, developed labor market and infrastructure, etc. (WEF, 2012). The other case, the sector-specific policy can be harmful for the international competition. Beside policies and governmental measures, also innovative firms can help in supporting the upgrading process (OECD, 2014).

As Figure 1. the so called "Smile curve" shows, developed countries concentrate on high value added activities like R&D, design, marketing and services, while developing countries focus on the lower value added ones, like production (Gereffi – Fernandez-Stark, 2016). The curve describes that the value added activities in manufacturing are in the pre- and post-fabrication services. The pre-fabrication services cover R&D and design activities, while marketing and other services count as post-fabric activities. Both pre- and post-fabrication are carried out by developed countries, while the production activities mostly by the developing countries. The curve is introduced originally by founder and CEO of Acer, Stan Shih in the 1990s in the information technology-related manufacturing industry (Baldwin et al, 2014).

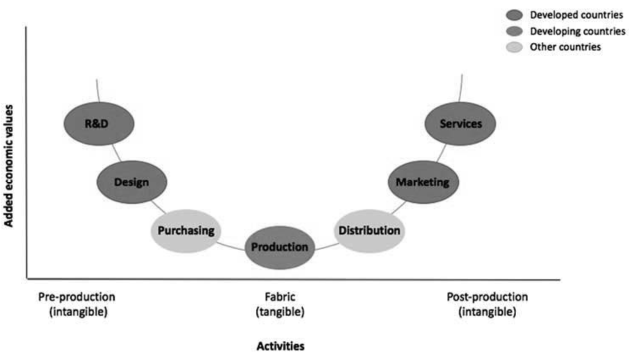
Also Francois and Wörz (2007) analyzed the linkages between services and manufacturing, and made some observations in this regard, including the following:

- with the level of development, also the importance of services in production is rising,
- linkages of services to manufacturing have become important in the 1990s.

As mentioned, countries which would like to participate in GVCs have to invest in R&D, innovation, organizational know-how and branding. As a consequence, GVC-participating countries have higher skill levels. It is characteristic to most of the OECD countries that the share of high-skilled workers in manufacturing increased faster than that of low-skilled workers. For developing countries moving up into mid-value segment means focusing on technical education, while moving further into high-value segment requires development of managerial tasks (OECD, 2014). Beside the economic dimensions of upgrading, the social upgrading is also very important, which makes the whole upgrading process more complex. An upgrading in social conditions means better working conditions with skilled workforce and improved salaries. Both types of upgrading are usual, they often happen parallel (Staritz et al., 2011).

Figure 1

Smile curve



Source: Based on Baldwin et al. (2014, p. 14.)

Types of jobs relating to GVCs

Changes in production locations have resulted in re-structurings also in specialization patterns. Gereffi and Fernandez-Stark (2016) differentiate five types of work in GVCs:

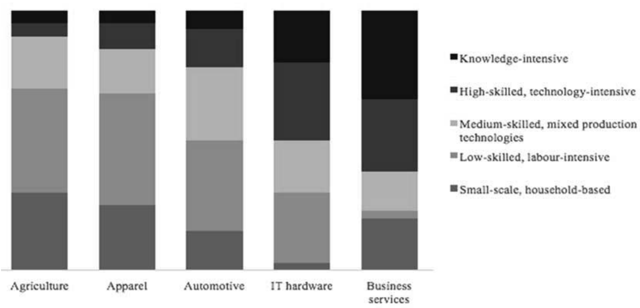
a) *Informal small-, micro-enterprise and household work:* these types are usual primarily for developing countries and for industries like agriculture or apparel industry. In general, they are low-paid jobs with low level of education. The production utilizes both the paid and unpaid family labor with long working hours (Gereffi – Fernandez-Stark, 2016).
b) *Low-skilled, labor-intensive work*: the working relationship between the employer and the worker can be temporary or permanent. Workers' education is low, maximized in six years in general. In global value chains the access to such low-cost and labor-intensive workforce was the main driver of offshoring activities (Gereffi – Fernandez-Stark, 2016).
c) *Moderate-skilled work:* in this stage of employment, specific technical knowledge is required and the level of education is higher. It is characteristic of the technology-intensive supply chains (Gereffi – Fernandez-Stark, 2016).
d) *High-skilled, technology-intensive work*: off-shoring of this type of work was especially

typical in the 1980s and 1990s, in capital- and technology-intensive industries (e.g. automobile, electronics). However, it presents only a small share of GVC employment. Education level (technical) and wages are relative high (Gereffi – Fernandez-Stark, 2016).

e) *Knowledge-intensive work:* businesses activities like IT, medical, finance and engineering services count as knowledge-intensive services. Due to the knowledge spillover into developing countries, these kind of business activities have significant growth potentials. High level of education and income are characteristic of workers in this category and their share in GVC employment is rather small (Gereffi – Fernandez-Stark, 2016)

Figure 2

Workforce allocation within different industries



Source: Based on Gereffi – Fernandez-Stark (2016, p. 24.)

As Figure 2 shows, there is a general observation that to high-wage service jobs belong activities like R&D and marketing, while low-wage jobs are typical in production services (e.g. iPhones are designed in California and produced in China) (Baldwin et al., 2014).

FDI as a driver of growth

FDI is considered as the most important channel of international technological diffusion between countries. Multinational companies with advanced managerial techniques invest heavily in R&D and transfer their technologies and practices through FDI to foreign economies, which can spread later on over the entire economy (ECB, 2009). According to OECD studies, the GDP per capita growth rates of developing countries taking part in GVCs are 2% above average. These benefits are attainable mainly for countries with large domestic markets and local knowledge capacities, while economies with lower income or far from the international markets are less likely to benefit (OECD, 2014). The applied technologies and technical know-how of multinational companies spread into local economies through suppliers' connection or movement of workers from multinational to national companies. Spillover from the applied know-how does not happen automatically, it depends significantly on the "sender" affiliates and on the "receiver" parties as well (OECD/WTO, 2011; Contreras et al., 2010). Local companies not always have the accurate capabilities to take over the advanced technologies or techniques from foreign firms (Blomström – Kokko, 2003). Technology transfer between countries requires the receiving ability of the host country, due to the specificity of the technological knowledge. Human capital and productivity are not the only factors of knowledge absorptive capacity, the innovation effort of companies is also very important to establish the appropriate business environment (ECB, 2009). Technologies are getting more complex and it becomes more difficult to adopt them (Aghion et al., 2005). The spillover effect is influenced by the country, the sector, the type of the firms paired with the nature of the FDI and the domestic companies' absorptive capacities. Spillovers are more likely, when foreign affiliates and local companies are in direct competition with each other (ECB, 2009). The increased competition caused by foreigners' entry can stimulate locals to invest in new technologies and to work more effectively, which can be attractive for further foreign investors (Blomström – Kokko, 2003). Technology imports by MNCs are larger where educational level is higher, local competition is tougher and operational requirements are fewer (Blomström – Kokko, 2003). Even without any knowledge spillovers, the pure presence of MNCs can be beneficial for recipient countries, because MNCs are among the technologically most advanced enterprises (ECB, 2009).

GVC participation of the Visegrad 4 countries

In case of the Visegrad 4 countries (Czech Republic, Hungary, Poland and Slovakia) we can observe an increasing GVC participation and integration since 1995. Not just the import volume of component parts of manufacturing industries, but also their production contribution to GVCs has increased steadily. Even though countries showed up some common features, differences were observable, e.g. the integration level into GVCs varied. In terms of imports and exports Hungary is the more dependent on GVC participation, while Poland is to a lesser extent. Czech Republic, Hungary and Slovakia have relative comparative advantage in capital-intensive and high-tech industries, while Poland has resource-based industries predominantly (Grodzicky, 2014). The index of the economic openness (sum of exports and imports in % of GDP) shows that Hungary and Slovakia had the most significant international trade since 1990, but there is an observable increase in Poland and in the Czech Republic as well (Grodzicky, 2014). A further sign of the economic integration is the increasing presence of multinational companies within these countries' production structures. In 2008 MNCs employed nearly a quarter of all labor force and produced 30-50% of the domestic products of the countries involved. Because of capital accumulation, structural transformation and knowledge diffusion the presence of multinationals and the international trade have positive effects on the development of these countries. The role of the EU was also important in the region's integration process within the global economy (Grodzicky, 2014). Based on different case-studies, an ongoing industrial upgrading process is observable in the Visegrad countries: besides of assembly operations at the early stages of the involvement, more and more complex tasks are being performed in the region. Recently, Hungary and the Czech Republic have the highest share of manufacturing in GVC income (ca. 60%) (Grodzicky, 2014).

Table 1

EU countries with highest industrial growth index, 2011-15 (2010=100%)

EU countries	2011	2012	2013	2014	2015
Slovakia	105.2	113.6	117.9	128.1	137.0
Ireland	99.6	98.1	95.9	116.0	136.4
Romania	109.1	111.9	120.2	127.8	131.6
Estonia	119.4	121.2	126.3	131.7	128.6
Hungary	**105.6**	**104.2**	**105.7**	**113.3**	**121.5**
Lithuania	106.6	110.6	114.2	114.5	119.7
Poland	106.8	108.1	110.9	114.5	119.6
Latvia	108.9	115.8	115.0	114.0	118.1
Czech Republic	105.7	104.8	105.0	110.2	115.2
Austria	106.8	106.5	107.4	108.4	110.4
Bulgaria	105.9	105.5	105.3	107.2	110.3

Source: KSH (2016b)

Based on the Hungarian Central Statistical Office (KSH) data, in 2015 the Hungarian industrial growth was 21.5% compared to the basis year of 2010 (Table 1). (There was a slowdown observable in 2012 and 2013.) Among the Visegrad 4 countries only Slovakia had a better growth performance in this period with 37%. In the case of Hungary the automotive industry has a presumably outstanding role in this achievement (KSH, 2016b).

The automotive industry and its connections to GVCs

The automotive industry belongs to those sectors where large suppliers manage complex global production activities and have a significant impact on logistics, finance, design and product development processes (Staritz et al., 2011). It is a very concentrated sector with a small number of large assembly firms with worldwide recognition and globalized suppliers (Humphrey – Memedovic, 2003; Contreras et al., 2010). For local suppliers of the sector the increased globalization meant a great opportunity to join global value chains. Relocation of manufacturers resulted in connections with local suppliers who could gain from the potential spillover effects, e.g. improving quality and speed of production processes. Furthermore, in case suppliers prepare themselves for the potential spillover effects, it is more likely that knowledge will be transferred by the satisfied value chain leaders to such companies (Contreras et al., 2010).

Globally, there are only a few large design centers (e.g. Detroit, Stuttgart, Tokyo) of automotive development, which implies that automotive industry's local, national and regional value chains are embedded within global organizational structures (Cattaneo et al., 2010). Due to a set of unique circumstances (technologies, governance policies, etc.), upgrading in the automotive industry is different from other upgrading processes. The most important factors are the engineer- and designer skills, the costs and workforce availability (Contreras et al., 2010). The upgrading is connected to public commitments, which support the FDI and innovation among companies (Bamber et al., 2013). In general, with the spread of different automation technologies a *functional upgrading* process is observable from labor-intensive to capital-intensive processes within the industry (Contreras et al., 2010).

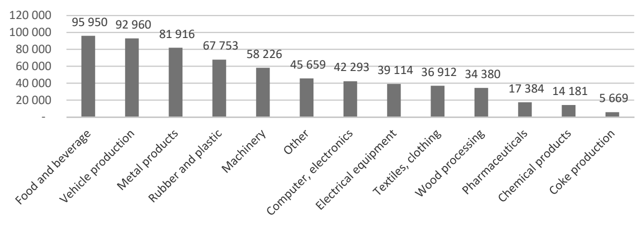
Value upgrading in the Hungarian automotive manufacturing sector

During an industrial upgrading process, economic actors (countries, companies, workers) in global production networks move from low-value to high-value activities. In economic performance, the role of institutions, governments, corporate strategies, technologies and skills of workers are also determinative (Gereffi, 2005).

CEE countries went through a systematic transformation process during the 1990s (Balaton, 2005). In the first half of the '90s relatively a large volume of FDI arrived in Hungary. Privatization was applied by the Hungarian government and as a result foreign investors attained a significant role in the ownership structure of enterprises by the end of the century (Balaton, 2011). Economic conditions became similar to Western European countries and firms were able to compete with firms in developed markets (Balaton, 2005). In these years foreign investors also appeared from the automotive industry in Hungary. Coupled with them, high-technology, modern business management and organization methods have come into the region, which have contributed to the successful change of industrial structure (KSH, 2011).

Figure 3

Number of employees in the processing industry, 2015



Source: KSH (2016b)

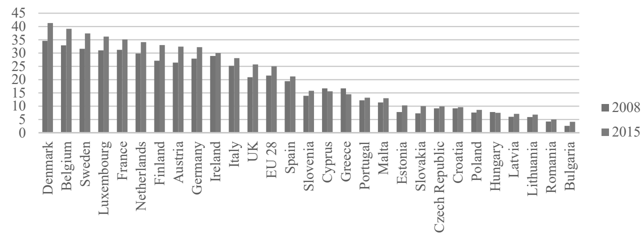
Nowadays, a significant amount of the Hungarian manufacturing resources is concentrated in the automotive industry (in Figure 3 the vehicle production has the second highest share of employment in the processing industry) (KSH, 2016b), which counts as one of the fastest growing sectors (PWC, 2014a) and plays a significant role in the country's economy. The Hungarian automotive industry is based on the presence of the OEMs (Original Equipment Manufacturers). They have originally appeared in the country as major greenfield investments, like Audi Hungaria Motor Kft. in Győr, Mercedes Benz Manufacturing Ltd. in Kecskemét, Opel Szentgotthárd Automotive Ltd. in Szentgotthárd and Magyar Suzuki Corporation in Esztergom (PWC, 2014a). The presence of the four major corporations have encouraged a significant number of suppliers to establish production capacities in the country, which resulted in an automotive industry which today consists of more than 700 companies. Many of the top TIER 1 suppliers have opened their operation in the country, like Bosch, Bridgestone, Continental, Delphi, Hankook Tires, Michelin, etc. (PWC, 2014a).

And why do car manufacturers like Hungary? First of all, the territorial proximity to investors' current major markets (Western Europe) and the relatively cheap and skilled labor force are necessary for global manufacturers to assemble vehicles in the CEE region (Havas, 1997). Furthermore, in investment decisions tax incentives also play a crucial role and CEE countries have offered favorable grants and tax holidays for foreign investors (Havas, 1997).

Because of constant demand for products with high technological solutions, the innovation potential of the automotive business is high. It requires high capital investment, since the production of components and the final assembly works are built on high-tech machinery and equipment paired with skilled workforce (KSH, 2011). Nowadays, ca. 65% of cars and car parts produced in CEE plants are exported to Western Europe, and 17% of car production in Greater Europe comes from CEE factories (grew from a low level of 7% in 2000) (McKinsey Global Institute, 2013). As Figure 4 shows, labor costs in CEE are far below the Western and Southern European levels and this significant difference has increased since the crisis (Eurostat, 2017). Within CEE, Hungary is among the countries with the cheapest labor costs.

Figure 4

Labor costs in the EU-28 countries (EUR)



Source: KSH (2016b)

In Slovakia and the Czech Republic automotive sales constitute a significant proportion of exports and the industry has similar effects on the whole economy (EY, 2013a; EY, 2013b). Slovakia has the highest per capita car production in the world and it is the third-largest car producer among the new EU members after the Czech Republic and Poland (EY, 2013b).

In Hungary, due to the advanced level of technologies, wide range of automation, high level of work organization and product range, the automotive sector has the highest production value per employee within the machinery industry and plays a key role in the employment. With company establishments, production capacity expenditures and widening supplier networks, the industry has generated a growing demand for labor and has contributed to the declining unemployment rate of the region. These large, export-oriented com-

Table 2

Changes in employment rates (within population between 15-64 ages)

	Employment rate			Unemployment rate		
Region	**2010**	**2014**	**2015**	**2010**	**2014**	**2015**
Central Hungary	60.0	66.0	67.6	9.0	6.2	5.3
Central Transdanubia	57.0	64.3	67.9	10.1	5.6	4.5
Western Transdanubia	58.6	65.8	67.5	9.3	4.6	3.8
Southern Transdanubia	52.4	58.6	60.2	12.5	7.9	8.2
Northern Hungary	48.3	55.7	59.0	16.3	10.5	8.7
Northern Great Plain	49.0	57.3	58.9	14.5	11.9	10.9
Southern Great Plain	54.1	59.7	62.2	10.5	9.0	8.0
Hungary (total)	**54.9**	**61.8**	**63.9**	**11.3**	**7.8**	**6.8**

Source: KSH (2016a)

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panies have significant impact on the improvement of the trade balance (KSH, 2011). Local companies with successful transformation of the production structure together with newly-settled foreign firms have enabled the automotive industry to have outstanding value generating capabilities, first of all in the Western regions of Hungary (KSH, 2011).

In 2015, disparities in employment levels of the different Hungarian regions decreased slightly, employment rates increased and unemployment rates declined in all regions compared to the previous year (with the exception of the Southern Transdanubia region). While in Central Hungary and Central- and Western Transdanubia regions the labor indicators were favorable, in Southern Transdanubia, Northern Hungary, Northern- and Southern Great Plain they were far below the national average. The highest employment rates were in Central and Western Transdanubia (Table 2) (KSH, 2016a).

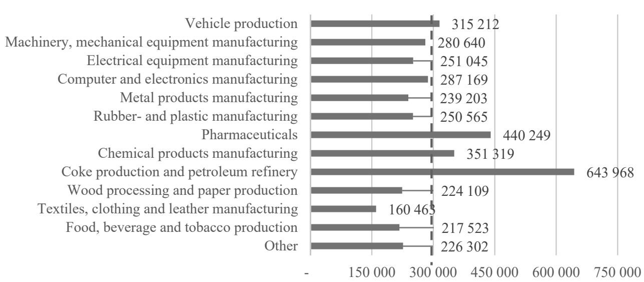
Beside the sufficient pool of high-skill talent and cheap workforce, the North-West Hungarian region also has several research universities, e.g. Széchenyi István University in Győr, where a wide range of automotive training and education take place. The institution has developed strong and active cooperation with automotive enterprises of the region, like Audi (KSH, 2011).

Among the Hungarian processing industry, the weight of the vehicle production was more than 28.6% in 2015, increased from a level of 18.5% in 2011. In 2015, 10.8% of processing industry's output came from computer, electronics and optical products manufacturing, which counts as the second largest industry in the country, followed by food, beverage and tobacco production with 10.3%. The shares of the other sectors are insignificant (KSH, 2016b).

Automotive industry's average wages are high compared to the national economy average or to the industry average.

Figure 5

Monthly gross average wages in the processing industry, 2015



Source: KSH (2016b)

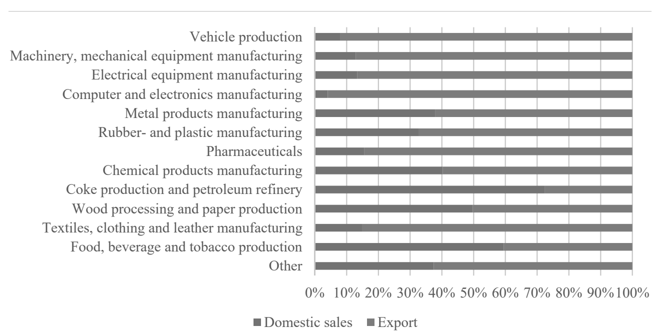
As Figure 5 presents, gross average wages were above the industrial average (299,000 Forint) in four subsectors of the processing industry (vehicle production, pharmaceuticals, chemical products manufacturing and mining) with a range of 315,000 and 644,000 Forint. Since the proportion of graduated engineers is lower in the automotive industry, its average wages do not reach the level of the above-mentioned subsector. In other subsectors average wages were far below the industry average (between 160,000 and 287,000 Forint) (KSH, 2016b). According to KSH, the average wage in Hungary was net 159,000 Forint in June 2015. Average salary in the automotive industry is net 196,000, which is above the national average, but far below the German salaries in the same positions (KSH, 2016b).

For the Hungarian employers it was difficult to compete for engineers against the Western European companies, but according to a recent study conducted by the German Institutes for Economy (Institut der deutschen Wirtschaft Köln, IW), Germany's economy will need 100,000 electric engineers over the next ten years, thus the Hungarian brain drain is expected to increase (Institut der deutschen Wirtschaft Köln, 2016).

Several existing studies about electric devices show a similar pattern of specialization, when advanced economies are responsible for the contribution of skilled labor and capital while emerging economies deliver the low-skilled activities with little added value (Timmer et al., 2014). It is the case in the automotive industry in Hungary, as well. A significant share of intermediate production processes of German cars is performed outside of the country, typically in Europe and a huge part of German cars' value is produced abroad. In this regard, the question often arises: to what extent are these cars really German? (Gurgul – Lach, 2016).

Figure 6

Domestic and export sales distribution in the processing industry, 2015



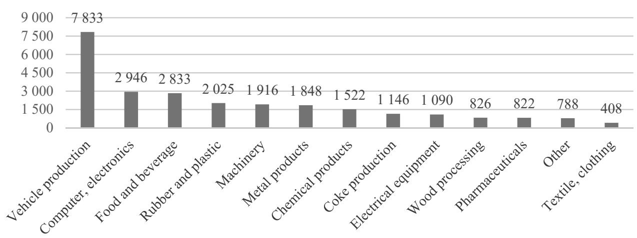
KSH (2016b)

The significant weight of physical working activities can hinder the upgrading process to the more value added segments of the supply chain (as higher value added activities like design, sales or R&D are carried only to a limited extent in the country). According to Stocker (2014) an increase in the GVC participation of the local suppliers could have a positive effect on the value added per revenue. As Figure 6 shows, more than 90% of the automotive industry's production is exported to countries abroad. However, a large amount of raw materials and production lines are imports, therefore the value added in Hungary is relatively small (KSH, 2016b).

Despite having a positive influence in general (see Figure 7 for the dominant role of the subsector), the national economy's exposure to the automotive industry and to its key players' decision making is dangerously high. In Hungary's GDP the automotive role is not extreme high, it has around 4.5% share, but the industry has a domestic value added of 39% (KSH, 2016b). Even though the number of small and medium enterprises in Hungary is large, they realize only a fairly limited part of the industrial production. It is especially characteristic of the automotive industry, where there are ca. 900 companies, that only about 70 companies have more than 250 employees to produce the 90% of the sector's output. Small players are stronger in the domestic sales, not in export activities (KSH, 2016b).

Figure 7

Annual production values in the processing industry (billion HUF), 2015



Source: KSH (2016b)

As Table 3 in the appendix shows, 17 foreign-owned automotive industry players are among the top 50 biggest exporter companies in Hungary. Aggregate production value of the three major car manufacturers (Audi, Mercedes and Suzuki) is greater than the rest of the automotive industry (components manufacturers) (HVG, 2016).

Future of the automotive industry in Hungary and some threats

Electrical cars are spreading globally with new technological basis and they are expected to account for a significant share of the global car sales within the next ten years (PWC, 2014b). This process could be further fueled by political ambitions, which would relegate diesel vehicles from bigger cities until 2030. The replacement of the internal combustion engines by electro motors can result in a situation where large automotive manufacturers lose their competitive advantage within a short time. As the car industry has a dominant role in Hungary, the electric car revolution in the next decades can particularly affect the country. The domestic motor and automotive manufacturers and a significant part of the suppliers produce internal combustion vehicles and parts. They should be prepared to be able to serve markets in the future as well, otherwise the demand for their products – which counts today as the 18-20% of the total export (KSH, 2017) – will be significantly diminished. According to the KSH, not just complete vehicles but bodyworks, motors and their components are also sold abroad in a significant amount. It is a very important aspect, because there is a huge difference between the electro cars and the traditional cars, namely the electro cars have a way less and totally different components compared to the traditional ones. With the penetration of the electro car manufacturing, the domestic manufacturers should change their production processes, otherwise their output will be obsolete in the future. It will be a long process, and there are signs from the automotive manufacturers in Hungary, especially from Audi and Mercedes that they aware of the challenges they face. As an example Mercedes' newest factory in Kecskemét, planned to start operating at the end of the decade, will also produce alternative-powered models. We can assume that Mercedes will produce complete electro cars in Hungary in the near future (Mercedes-Benz, 2016). In case of Audi, the company plans the serial production of electro cars and electro motors in the Hungarian plant starting from the years 2018-2019, stated Peter Kössler, President of Audi Hungaria Motor Ltd. (Audi Hungaria Kft., 2016). In case of Suzuki, the hybrid version of the new Baleno and Ignis models are planned to be produced in Esztergom (Magyar Suzuki Zrt., 2016).

Conclusion

Companies from advanced economies have chosen other countries with lower wages for their unskilled-labor-intensive production activities and have left the high value added functions and strategic operations at home, where the necessary skilled workers have been available (Timmer et al., 2014). "GVCs today are complex networks of pre-production, production, trade and consumption." (Law, 2016). The embeddedness in GVCs are determined by the local economic, social and institutional conditions. The availability of inputs like labor, infrastructure, capital and other resources are important economic factors; the accessibility of skilled labor and education are main social elements, while tax policies, labor regulations, subsidies are relevant institutional features. According to Gereffi and Fernandez-Stark (2016), economic upgrading means that companies, countries or regions move to activities with higher values in GVCs to increase their benefits. These benefits of the global participation can be higher value added, security, profit or capabilities. To be able to move up the value chain in knowledge-intensive manufacturing and services, CEE economies need to invest in R&D and innovation. Local workforce should be qualified enough to be able to enter GVCs. The education system allows countries to have a well-educated population, which is able to serve knowledge-intensive industries, but building up clusters and collaboration between companies, research institutions and universities is required. Furthermore, a modern and effective infrastructure is also a key element of growth and GVC participation of companies (OECD, 2014).

These GVC requirements are also valid in the case of Hungary: from 2011 the vehicle and vehicle parts production became the number one engine of the industrial production. With a share of 20% it counts as one of the largest sub-sectors in the processing manufacturing ahead of computer, electronic and optical products. The sector's share reached 30% in 2015 (KSH, 2016b). Beside the large motor and vehicle manufacturers, there is a strong network of automotive suppliers operating in the country. More than 700 companies are present in the sector as a supplier (PWC, 2014a). The presence of the multinational automotive manufacturers improves the quality and skills of the workforce and education in the country. Moreover, it has economic prospering effects (GDP growth, increasing wages, etc.) and improving effects on the general company culture due to partnerships with local suppliers (managerial skills, organizational methods, etc.). However, the extent of the value added part in the export volume is relatively small, because the share of imported parts for the production is large. Furthermore, foreign companies are influenced strongly by the Western European headquarters and some car brands' success may have too much influence on the performance of the whole economy.

In general, with the spread of different automation technologies, the *functional upgrading* process is observable from the labor-intensive to capital-intensive processes (Contreras et al., 2010). Nowadays' electric car revolution can particularly affect Hungary. Electrical cars are expected to account for a significant share of the global car sales within the next ten years, while all the Hungarian motorcycle and car manufacturers and a significant portion of the suppliers produce internal combustion vehicles and components. The large manufacturers in Hungary, especially Audi and Mercedes have shown some evidence of development in this direction, which can result in the production of electric cars, motors, batteries and other components in Hungary in future. To ensure growth, the country needs to invest in education and training of workers and so to raise labor productivity. If CEE governments would like to prevent their economies from being locked into a low-wage, low-tech, low value added development stage, they need to provide funds for education and training and invest in R&D (Havas, 1997). Moreover, high-level cooperation is required between companies, universities and research institutes to establish an attractive atmosphere (PWC, 2014a). Last years' investments show some good initiatives in R&D activities in Hungary, but there is still room to be more attractive to high value added activities.

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Appendix

Table 3

The 50 largest export-revenue companies operating in Hungary, 2015

Rank	Company name	Sector	Foreign sales rev. (mHUF)
1	GE Infrastructure CEE Holding Ltd.	property management	4 483 809
2	MOL PLC.	energy industry	2 998 282
3	Audi Hungaria Motor Ltd.	car manufacturing	2 599 054
4	Mercedes-Benz Manufacturing Hungary Ltd.	car manufacturing	1 062 038
5	Samsung Electronics Hungarian PLC.	electronic industry	627 977
6	Hungarian Suzuki PLC.	car manufacturing	580 646
7	Wizz Air Hungary Ltd.	transportation	493 292
8	Felxtronics International Ltd.	electronic industry	469 051
9	MVM Hungarian Electrical Works PLC.	property management	463 962
10	Robert Bosch Electronics Ltd.	car parts manufacturing	458 569
11	Bimbo Hungria PLC.	wholesale trade	451 934
12	Richter Gedeon Chemical Factory PLC.	pharmaceutical industry	330 244
13	PCE Paragon Solutions Ltd.	electronic industry	284 648
14	BorsodChem PLC.	chemical industry	284 470
15	GDF Suez Natural Gas Trading Ltd.	energy trade	257 787
16	Robert Bosch Energy and Body System Ltd.	car parts manufacturing	275 455
17	Sanofi-aventis/Chinoin	pharmaceutical industry	261 486
18	Harman Becker Ltd.	car parts manufacturing	260 113
19	Jabil Circuit Hungary Ltd.	electronic industry	232 337
20	Electrolux Lehel Refrigerator Factory Ltd.	machine manufactures	230 081
21	MOL Petrolchemical PLC.	chemical industry	225 028
22	LuK Savaria Kuplunggyártó Ltd.	car parts manufacturing	222 382
23	ContinentalAutomotive Hungary Ltd.	car parts manufacturing	219 915
24	Michelin Hungary Ltd.	rubber manufacturing	218 975
25	Hankook Tire Hungary Ltd.	rubber manufacturing	211 968
26	Alcoa-Köfém Ltd.	metal processing	204 798
27	Delphi Hungary Ltd.	car parts manufacturing	193 434
28	Teva Pharmaceutical Works PLC.	pharmaceutical industry	185 192
29	Lear Corporation Hungary Ltd.	car parts manufacturing	180 317
30	Denso Manufacturer Hungary Ltd.	car parts manufacturing	178 704
31	NI Hungary Ltd.	electronic industry	168 643
32	SE-CEE Schneider Electric Ltd.	wholesale trade	162 986
33	Opel Southeast Europe Ltd.	car trade	148 990
34	BorgWagner Oroszlány Ltd.	car parts manufacturing	139 253
35	Synopsys Global Ltd.	business services	113 653
36	Glencore Grain Hungary Ltd.	wholesale trade	108 444
37	Valeo Auto-Electric Hungary Ltd.	car parts manufacturing	107 571
38	Johnson Controls Mór LP.	car parts manufacturing	107 046
39	Porsche Hungaria Ltd.	car trade	102 147
40	SMR Automotive Mirror Technology LP.	car parts manufacturing	100 054
41	Robert Bosch Automotive Steering Ltd.	car parts manufacturing	97 382
42	Ibiden Hungary Ltd.	car parts manufacturing	97 259
43	Egis Pharmaceutical Works PLC.	pharmaceutical industry	97 150
44	Videoton Holding PLC.	electronic industry	97 120
45	Hungarian Telecom Telecommunicatio PLC.	telecommunication	89 758
46	Apcom CE Ltd.	wholesale trade	89 215
47	Coloplast Hungary Ltd.	plastic industry	85 417
48	Grundfos Hungary Ltd.	machine manufactures	83 242
49	Bunge Vegetable Oil Industry PLC.	food industry	83 205
50	Zollner Ltd.	electronic industry	81 678

Source: HVG (2016)

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Bence KOVÁCS – Judit SIMON

THE IMPACT OF SCIENTIFIC EVIDENCE AND PRICE LEVEL OF HYPERTENSION DRUG THERAPIES ON THEIR MARKET PERFORMANCE

– A EUROPE BASED ANALYSIS

This study aims to investigate how much the market performance of drug therapies is influenced by their scientific evidence and price level. Compared to the seemingly simple objective, performing the analysis in the pharmaceutical industry makes the evaluation very complex. Examining the purchase decision process in the prescription drug market, besides the patient as the final consumer, the prescribing physician has the largest decision potential. In addition, the authors cannot ignore the healthcare system financing the therapy either, not to mention the interlacements of regulations, manufacturer interests, their marketing potential and marketing activities. This complexity makes it impossible to describe the pharmaceutical industry in uniform terms. The literature search also confirms that the mentioned complexity makes it hard to draw unambiguous conclusions. In spite of that –with a positivistic approach- the authors live with the assumption that scientific evidence (better efficacy and safety profile) should be awarded on the market on the aggregate level. It is inevitable to clarify at the very beginning that the authors investigate *active pharmaceutical ingredients* (APIs) and not brands in the recent study. With all this in mind, their intention is to introduce a novel approach for the evaluation of the relationship between the product characteristics (clinical evidence of APIs) and their market performance. In order to examine the relationship the authors involved APIs that belong to the same indication group, having the same mechanism of action and which have been in the generic competition for years after their patent have expired. As a model they perform the analysis with *antihypertensive* drug therapies. The authors consider that it is possible to *rank* the active ingredients of drug therapies on the basis of their efficacy and safety, based on relevant clinical literature. The result of ranking serves as the starting point of the analysis. Unequivocally, the authors do not forget about the additional factors that significantly influence the market performance of APIs, but deliberately do not involve these factors in the recent analysis. These factors are the different reimbursement and funding policies, marketing activity of the manufacturers, country-of-origin effect, the impact of clinical guidelines and clinical literature, and their effect on each other. There is one exception, since the article partially deals with the influence of price level on the market performance. In contrast with the majority of the available literature, this study aims to explore the identifiable patterns by investigating the European pharmaceutical market on system-level.

Key words: **pharmaceutical therapies, scientific evidence, price level, market performance**

Generating far over 1 trillion USD of revenue (Deloitte, 2015), the pharmaceutical industry should only have one realistic aim beyond the provision of corporate profit: treating diseases. This aim can be reached by *efficient* drugs with appropriate side effect profile, namely *safe* active ingredients. By drug efficacy we mean its ability to promote a quantifiable biological response. In case of drug safety, the question is: what secondary (and usually negative) effect does the drug have on the human body? The clinical evidence (also referred to as scientific evidence) is determined by the drug's efficacy and safety profile. As a marketing-oriented analysis we would like to investigate the effect of scientific evidence on market performance. The fundamental assumption of our research is that the various drug therapies can be ranked based on these two factors. In order to define the ranks, we use the basic principles of evidence based medicine in the analysis (Sacket, 1997; Friedland, 1998; Botz – Szűcs, 2014; Hamer – Collinson, 2014). Evidence based medicine is the explicit and judicious use of current best evidence in making decisions about the care of patients based on the best available external clinical evidence from systematic research. Following the principles, the recent article assumes that clinical ranks can be defined for APIs that have instead of have the same method of action, by the evaluation of the relevant clinical literature on efficacy and safety. We must also mention that there are authors who question the general acceptability of evidence based medicine (Greenhalgh et al., 2014; Spence, 2014). This skeptical approach, however, is not attributable to the unacceptability of the principles, but rather to the hardly processable amount of literature serving as the basis of analysis and the strong influence of the pharmaceutical industry on the studies. Concerning the influence of the industry, Sismondo suggests that as many as 40% of published articles focusing on specific drugs are ghost managed, i.e. directly influenced by pharmaceutical manufacturers. Even independent of detailers, responsible physicians and medical researchers search the literature to gather evidence about the best treatments. Published scientific articles are the sources of medical information with the highest authority. Systematic reviews and meta-analyses almost all start with the published literature, so even fully independent reviews are influenced by ghostly activities (Sismondo, 2007).

The effect of the efficacy and safety on the prescription of drug therapies

In their paper, Borjádi and Juhász emphasize that 'Drugs are not the objects of desire like most consumer goods but they are real consumer needs" (Borjádi – Juhász, 2003). As mentioned previously, our article evaluates this question from the marketing point of view. Likewise, the authors summarize the corresponding marketing literature and build their analysis on the marketing principles. With respect to this, let's examine how this statement can be interpreted in the drug prescription process. The only aim of the *patient* taking the drug is to get treated by the most efficient therapy with the least possible side effects. Pursuant to the vocation, the prescribing *physician*'s primary interest cannot be different from that of the patient. The *payer*'s responsibility is more complex in this issue even theoretically, since on an economic basis the payer has to choose the recommended therapy within the given indication based on the cost-benefit ratio (Bootman – Townsend, 1991). When concerning the benefit of the therapy, efficacy and safety may be a dominant factor, and during the comparison of therapies the payer also has to consider which therapy is scientifically proven to be the best. Of course, the question is far from being this simple. On one hand, the evaluation of the scientific evidence (and accordingly the ranking that the authors introduce) is not a simple task. The complete information of the stakeholders is not present in the system. This is attributable among others to the biasing effect of actors with different levels of awareness and corporate and political interests as well as the complex nature of evaluation. On the other hand, the choice and therefore market performance of drugs (in volume) is not solely determined by their scientific evidence. The cost of the therapy and the availability of products are central questions and of course, product promotion also has a significant influencing effect. First of all, we summarize the effect of clinical evidence in the light of corporate marketing activities.

Generally investigating marketing investments, Berndt et al. had several observations concerning the market of anti-ulcer drugs. Marketing investments unequivocally have a positive influence on drug sales, which obviously effect spreads from the innovator product to the follower generic products. The authors mention that switching between therapies is faster when the manufacturer can prove an actual added value (e.g. lower dose, less side effects) (Berndt et al., 1996).

Through contact with pharmaceutical representatives and attendance on symposiums, physicians become well-informed on the drugs' clinical evidence (Gönül et al., 2001), and these activities have significant informative and persuasive effect (Narayanan et al., 2005). Clinically, the most important information of all is the efficacy and safety of drugs. In the literature, Azoulay is the first to deal with the relationship between the scientific value of a drug and sales data (Azoulay, 2002). Investigating the market of H_2 antagonists, he concludes that marketing (promotion) has a much more dominant effect on the demand of drugs than their clinical evidence. Still, we shall also consider the effect of the latter as significant both statistically and economically. Thoroughly studying the paper, one may also recognize that in his research, the author has not examined how much the effect of promotion is affected by clinical evidence (the effect of the physician being visited with a clinically more beneficial drug). However, clinical evidence may also present indirectly in drug prescribing. As a conclusion of his study, Azoulay states that on the market of H_2 antagonists, Zantac was able to overshadow Tagamet, which was ahead of it, due to its more appropriate clinical profile.

Further positive examples of a clinically more advantageous compound being able to take over the market:

- The world's largest blockbuster, the manufacturer of Lipitor (Warner-Lambert) has widely communicated that its compound is as efficient in lowering cholesterol levels as its competitors (Merck: Zocor, Bristol Myers-Squibb: Pravachol) but this effect is reached by a much lower dose (Winslow, 2000).
- In relation to our later research results, the story of Vasotec (enalapril) and Capten (captopril) is also an interesting example on the market of ACE inhibitors. Enalapril has appeared on the market after captopril and was still able to reach a much higher share on the US market. The main reason of this was Merck's appropriate marketing activity (Werth, 2013).

The example of Zoloft and Prozac may be of interest too. However the two compounds can be considered very similar clinically, Zoloft was able to overshadow Prozac from the second position. By not being able to come up with real advantages in the reasoning, Zoloft is an example for the persuasive power of marketing (Cutler – Berndt, 2007).

If we investigate the marketing effect of visits by pharmaceutical sales representatives, we will not get an unequivocal answer based on the literature. While there are authors who think there is a positive relationship between visits by pharmaceutical sales representatives and prescribing (Gönül et al., 2001), others think that the relationship is weak (Mizik – Jacobsen, 2004), and we also found literature, where the authors state that there is no relationship whatsoever between the two (Rosenthal et al., 2003). Leeflang et al. think that the conflicting results are due to the inaccuracy of research. In their study, they claim that researches do not treat brand portfolio marketing investments uniformly, therefore these can bias the results, and the physician's responsiveness may also vary during the promotion of the different therapies (Leeflang – Wieringa., 2010). Based on studies using aggregated data for the analysis, we can conclude that the marketing activity of manufacturers (e.g. visits by pharmaceutical sales representatives, symposiums) have an unequivocally positive effect on drug sales (Chintagunta – Desiraju, 2005; Narayanan et al., 2004; Narayanan et al., 2005; Neslin, 2001; Rizzo, 1999). In a meta-analysis (Kenneth et al., 2016) will be found that there are several factors which directly and indirectly affect the physician's prescription pattern. They find that the curing effect is the most important factor, but the influence of patients and advertising can be significant factors as well. The above examples show that the statement – although verified on aggregated level – is not necessarily applicable for all therapeutic groups and in each case. That is why it is essential to examine this issue in details.

Based on the foregoing, Venkataraman and Stremersch studied the relationship of clinical evidence and the number of prescriptions (sales, indirectly), just like Azaulay (Venkataraman – Stremersch, 2007). Interestingly, they consider their work as a first in the investigated issue – just like Azaulay. The study investigates how much a drug's clinical advantage (in terms of safety and efficacy) influences the effect of pharmaceutical actors' marketing activities (visits and professional symposiums and B2C activities appearing in patient requests) on prescription. In their econometric model, the authors examined the following factors:

- detailed biannual visiting activity of a US pharmaceutical company by months for 3 drug groups (statins, gastrointestinal agents, erectile dysfunction),
- the attendance of symposiums organized by the manufacturer for doctors,
- drug requests by patients at the 2774 studied physicians,
- the number of prescriptions and the amount of distributed drugs,
- efficacy (meta-analysis of clinical trials, 'Z-values' compared to placebo),
- side effect profile (FDA, drug approval database).

According to their theory, more efficient therapies decrease the uncertainty of physicians, therefore convincing physicians becomes easier via various marketing activities (as Azoulay has described it in his paper in 2002). In terms of safety, drugs with less favorable side effect profile increase the physician's uncertainty. This uncertainty can be decreased by marketing activities but because of the earlier described, physicians prefer safer therapies. Of their conclusions it is worthy to emphasize that it is important to examine the different drug groups and drug brands separately as it is hard to make a valid conclusion in general. Nevertheless, the authors claim that prescription of drugs is higher where a more efficient or safer therapy is considered. Also, physicians take their patients' requirements more into consideration in such cases. It is necessary to emphasize that the authors based their results on US data.

According to Scherer's study, switching between different drugs is made more difficult by the established prescription habits and the possible negative consequences that the doctors will face (e.g. negative professional and perhaps legal consequences of prescribing a new drug). However, this effect may be decreased if genuinely relevant and objective information is available on a competing product. In such cases, switching takes place faster (Scherer, 1990).

The role of price in decision making on drug prescription

The role of price in the decision making process may vary in the different countries; therefore literature is also not unified in the question whether marketing costs decrease price sensitivity. Ceteris Paribus, doctors should choose the cheapest therapy, which can be strongly modified by the convincing function of marketing, predominantly because the ceteris paribus principle is really difficult to evaluate among drug therapies (De Laat et al., 2002; Leffler, 1981; Hurwitz – Caves, 1988). If doctors become less price sensitive as a result of corporate marketing activity, this process is considered by De Laat et al. as 'increase of brand loyalty based on factors other than brand characteristics' (De Laat et al., 2002, p. 80.). This leads to higher prices, which finally emerges as a loss of the society (Windmeijer et al., 2005). In contrast with Windmeijer et al., Leeflang and Wieringa state that this effect is not significant (Leeflang – Wieringa, 2010). About their work, it is important to mention that it has investigated the quasi totally funded Dutch pharmaceutical market. In a Swedish study (Semark et al., 2013) the registered data of dispensed drugs were analyzed together with the sociodemographic data of the patients. For each of the diagnostic groups (chronic obstructive pulmonary disease, depression, diabetes, and osteoporosis), selected drugs were dichotomized into cost categories, lower and higher price levels. They found that individual factors such as gender, age, education, income, foreign background, and type of caregiver (public or private) influenced the prescribing of drugs of different price levels, although in some cases, the influence was relatively small. Because the average price of the cheaper drugs in each diagnostic group was between 19% and 69% versus more costly drugs, there is a risk that factors other than medical needs are influencing the choice of drug. However, medical reasons for the observed differences cannot be ruled out.

Based on the results of Cleanthous et al., the existence of health insurances and the increase of the extent of reimbursement, decrease price sensitivity and price regulation in turn increases price sensitivity on the pharmaceutical market. This statement explains why authors investigating different countries get totally different results (Cleanthous et al., 2005). For this reason it is crucial to compare the drug policy tools of the analyzed countries.

Table 1

Supply and demand side drug policies in 9 European countries in 2017

		UK	DE	NL	FR	IT	ES	HU	RO	PL
Demand side	Promotion of generic prescribing		x		x			x	x	x
	Mandatory generic prescribing	x		x			x			
	Generic substitution		x		x	x		x	x	x
	Mandatory INN prescribing	x		x	x	x	x		x	
	Officially defined retail and wholesale margins		x	x (extremely high)	x	x	x	x	x	x
	Authorized discounts and volume agreements	x	x		x	x	x	x	x	x
	Clinical guidelines	x	x	x	x	x	x	x	x	x
	Reimbursement system	x	x	x	x	x	x	x	x	x
Supply side	External reference prices		x	x	x	x	x	x	x	x
	Internal reference prices		x	x	x	x	x	x	x	x
	VAT pharmaceuticals (standard) (%)	0 (20)	19 (19)	6 (21)	2/10 (20)	10 (22)	4 (21)	5 (27)	9 (20)	8 (23)
	Generic price depends on the price of the innovator	-	-	-	50%	min 20%	-	20-50%	-	20-50%

(Author's edit, Source: Barbu, 2012; Dylst et al., 2012; Kaplan et al., 2012; Kanavos et al; 2011a,2011b; Panteli et al., 2016;Thomson-Mossialos 2010; Vogler, 2012; Vogler et al., 2015)

The effect of drug policy tools on different pharmaceutical markets

The role of authorities on the pharmaceutical market varies in the different countries of the world. Considering the healthcare financing systems three major health care models are used in industrialized nations, including: the Beveridge model, the Bismarck model, and health care systems based on private founding. Concerning the European healthcare systems, the foundations of the Beveridge and Bismarck models are the dominant. The Beveridge model provides health care for all citizens and is financed by the government through tax payments (UK, Italy, Spain). The Bismarck model uses an insurance system and is usually financed jointly by employers and employees through payroll deduction. Unlike with the US insurance industry, Bismarck-type health insurance plans do not make a profit and must include all citizens. Doctors and hospitals tend to be private in Bismarck countries (Germany, France, Netherland, Hungary, Poland) (Busse et al., 2007; Chintagunta – Desiraju, 2005; Wallace, 2013). The characteristics of the funding system and the country's drug policy largely determines what interest physicians, industrial actors and patients need to take into consideration in the process of drug purchase. For the analysis, it is necessary to review and compare the generic funding and reimbursement tools of the countries involved in our research. The analysis is helped by the Table 1, which summarizes the demand and supply side pharmaceutical market regulations of the nine countries involved in the analysis. Table 1 is a result of proprietary research activity.

We will return to the role of governmental funding and reimbursement policy during the analysis, however only on a superficial level, since the impact of the reimbursement and funding system could be the scope of an independent research. In this chapter we only bring up a few examples to illustrate trends, emerging from the difference of drug policies in purchasing decision. Investigating the Dutch pharmaceutical market, Leeflang and Wieringa concluded that in case of most drugs, the price of the drug has no effect on demand and doctors' decisions. Their results were supported by the study of Gönül et al. in 2010 (Leeflang – Wieringa, 2010). Consequently the authors declare that only clinical considerations should be present during drug prescription, both by doctors and patients. This could be strongly arguable as a general statement. However the statement is less debatable, if the almost perfectly insured Dutch pharmaceutical market is considered. Dutch doctors and patients care less about the financial considerations when choosing a medicine.

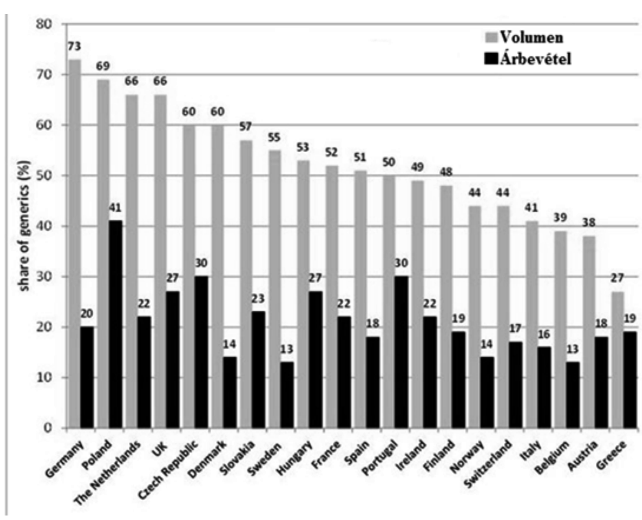
Governmental policies play a great role in the formation of price level as well. The tools for this aim may be the mandatory price reduction for generics against innovator products (e.g. in France, the first generic has to set a price at least 50% lower than the originator), tax rates, as well as external and internal reference prices.

In relation to the role of drug policy, we should not ignore to mention the high influence of *clinical guidelines* on doctors' decision. These professional guidelines represent the interest of both authorities and professional stakeholders. Their primary aim is to influence the prescribing decision (Spurling et al., 2010). However, in terms of the clinical guidelines, it is always indispensable to examine the interests in the background as well (e.g. besides professional interests, reimbursement protocols; reduction of drug costs, pharmaceutical lobby, etc., may also be present).

In our analysis, we investigate generic pharmaceutical markets where the patents of active ingredients have expired for at least 5 years. This is necessary because we strongly believe that clinical superiority can only predominate the market in a competitive landscape, after a proper amount of time. It is inevitable to mention that clinical evidence helps to launch the innovator product and has a drag on effect in genericized markets. The aforementioned clinical guidelines also promote this process. When examining governmental factors, it is therefore necessary to examine how these factors influence (stimulate) the purchase of generic drugs. The Figure 1 shows the share of generic drugs in certain countries in terms of volume and sales revenue. It is interesting to compare the regulatory drives (Support of generic prescription, Mandatory generic prescribing, Generic substitution, Mandatory INN prescribing) leading to high values in the countries with the most significant generic share (DE, PL, NL, UK).

Figure 1

Generic market share in European countries



(Source: Generics Initiative, 2014

Research Questions and Framework

Our assumption is that clinical evidence of drugs has a positive effect on their market performance. As we could see, literature is ambiguous in this question. This is due to that in most cases the authors examined a single country only and because there are many mutually interrelated variables. The purpose of our research is to analyze the relationship with a rather novel approach, through the example of several countries. Of course, it is fundamental to define the framework in which the statement is considered to be valid. For the sake of comparability, *we define the depth of our study at the level of active ingredients.* We do so because on a scientific basis this is the level where it is meaningful to make a distinction between drug therapies. (We can live with this assumption, because due to the generic concept, the rigidity of the drug approval process provides identical quality for products containing the same active ingredients.) Consequently the volume of aggregated sales associated to active ingredients may provide good comparability of the different drug therapies. Another important criterion is that our study was performed *in the market of generic drugs*. The monopolistic market of patented active ingredients deserves distinct evaluation. In the research we involved active ingredients if their *patent expired at least 5 years ago.* The post-patent period is critical, since generic market entries redefine the market. A 5-year timeframe may be sufficient for the development of a new balance as a result of regulation and free competition. For the aforementioned reason it is also a stipulation that innovative *drug therapies should not appear in the examined indication in the examined period* which could redefine the market. Our research was conducted in the market of *prescription drugs*. In the market of prescription drugs, physicians act as the agents of patients, so the consumer is well distinguishable from the decision maker in the purchasing process. Assuming a clinically responsible drug prescription, the doctor's primary motivation must be the selection of a clinically appropriate therapy. Therefore due to the unavoidable control of doctors in the market of prescription drugs, the clinical evidence (meta-analyses and guidelines) has a larger effect than in the market of OTC drugs. Another argument in favor of examining the market of prescription drugs is that due to the rigor associated with pharmaceutical advertising, the effect of advertisements targeting the final consumer is negligible (Gönül et al., 2001). According to our assumption, the clinical evidence presents in the market sales of active ingredients within the described framework in the following way: Following the expiry of patent protection, generic manufacturers prefer therapies with active pharmaceutical ingredients, which are the most appropriate for convincing the prescribing physician. In the medical persuasion, the clinical evidence of active pharmaceutical ingredients has a critical role, and this effect is further supported by the above mentioned professional guidelines. In order to avoid competitive disadvantage, generic manufacturers develop and market the clinically most appropriate therapy, and allocate the marketing investments to this territory, thereby increasing the level of knowledge in the market. Since our study was performed on the level of active pharmaceutical ingredients – and not on the level of manufacturer brands – it has to prevail in the generic competition that the clinically more beneficial active pharmaceutical ingredient can reach higher sales volumes. We have to emphasize, that the previous statement stands in theory, but this relationship is seriously affected by further factors. In spite of that we deliberately avoid the evaluation of the impact of further factors, except one: the effect of the price level.

In our analysis we could not ignore the effect of the price level of the discussed drug therapies. The countries involved in our study typically possess extended health insurance system and high (100% in several cases) reimbursement rates on the basic drugs which decreases price sensitivity among doctors and patients. On one hand, this effect may vary in the different countries (e.g. because of low income patient groups), and on the other, we should not forget that the payer's aim is to promote choice between the available therapies based on optimal cost-benefit rate. When performing the study on the level of active pharmaceutical ingredients, it is worth to analyze the influencing force of price level characteristic of the individual active pharmaceutical ingredients. The primary focus of this study is therefore to investigate the effect of clinical evidence and price level on the market performance of drugs. In addition, we will take an outlook on the further factors influencing the relation in question.

Drug therapies in the scope of research

We had to choose an indication group for the analysis that meets the requirements of the described framework. Our choice was the drug therapies of hypertension:

- several drug families are distinguished for the treatment of hypertension based on their mechanisms of action (diuretics, ACE inhibitors, ARBs, etc.),
- due to the importance and duration of this field, several therapies are known within the drug families (e.g. more than 10 ACE inhibitors and 7 ARBs),

- within these two groups, the expiry of the patent protection of active pharmaceutical ingredients is well beyond the predetermined limit,
- the active pharmaceutical ingredients has prescription status and are available in the analyzed countries.

According to the original concept, we intended to rank the anti-hypertensive therapies both by mechanism of action groups and on the level of individual active pharmaceutical ingredients (within the groups) as well. However, as a result of consultation with doctors, only two groups and their active pharmaceutical ingredients were involved in the analysis. These two groups are angiotensin-converting enzyme inhibitors (ACE inhibitors, ATC code: C9A)) and angiotensin II receptor blockers (ARB, ATC code: C9C)). The reason of such filtering is that therapies with different mechanism of action are used for the treatment of not only hypertension but other indications too. Since these appear in the aggregated sales data, the criteria of comparability would not have been met. The chosen two groups meet all the criteria as they are prescribed in the same range of indication in the vast majority of cases. There was no need for any similar exclusion on the level of active pharmaceutical ingredients. ACE inhibitors and ARB therapies are also prescribed in fixed dose combinations. After discussions with physicians we decided to perform the analysis with the mono therapies and to exclude the combinations.

Clinical ranking based on evidence based medicine principles

In order to compare active pharmaceutical ingredients, it was important to first determine their clinical order. Towards, clinical meta-analyses, scientific comparative studies, and professional guidelines were collected within this indication. The key to the comparison of therapies were obviously the results of randomized clinical studies and their higher level, systematic analyses, such as meta-analyses. The formation of the scores was a three phase procedure. First of all, the authors collected clinical literature, and based on that we defined our 'internal' ranking of the APIs. The clinical literature was classified according to the internationally accepted classification system of evidence based medicine (Botz, 2014) and the order of clinical evidence and the ranks was calculated by using the weights based on the classification system. (The list of clinical literature used for the research is attached in Annex 1.) Since the authors are not medical doctors, we validated our results with medical doctors (1 internist, 1 surgeon, and one GP). First, we asked them to perform a literature search and rank the APIs based on their literature search (evidence based medicine scoring was introduced to them). As a second round we asked them to confirm/ refine the scoring with their professional experience. We got the final ranking after discussing the results jointly. We did not initiate to gather and analyze data until the closure of the validation process, in order to ensure the independency of our judgment. *The clinical evidence of therapies on the API level was considered universal for the concerned countries.*

From medical point of view, the use of ARBs is recommended against ACE inhibitors due to their more favorable side effect profile. The clinical ranking of ACE inhibitor drug therapies is indicated on the Figure 2.

Figure 2

Summary of the relations of clinical evidence

ARB > ACE inhibitors

ACE inhibitors	Rami-pril	Enalapril	fosino-pril	Lisinop-ril	Perindo-pril	Zofeni-pril	Capto-pril	Trando-lapril	Benaze-pril	Quina-pril	Moexi-pril
Clinical Rank	1	2	2	2	2	2	3	4	5	5	5

As a limitation, of course this ranking could be refined in the future (more reviewers, more literature, and more robust methodology). However the authors rather consider this research a medical-oriented, and not a marketing-oriented goal. All in all, the authors think, the research and work and the involvement of medical doctors justifies the implication of the ranking in the recent study.

Market data and Methodology

We perform and present two types of analyses in the recent study. First, we compare the two pharmacological groups (ARB vs ACE), and then the active pharmaceutical ingredients of ACE inhibitors were compared based on sales volume (thousand tablets, moving annual total (MAT)) and sales revenue (EUR, ex factory price, moving annual total (MAT)). Information concerning market performance was gained from the IMS database made available by Gedeon Richter Plc. On the first level of query, the distribution by dosage form was examined. Since 99.9% of ACE inhibitors and almost 100% of ARBs are taken orally worldwide, only oral pharmaceutical forms were filtered during the later queries. Therapeutic group–country, active pharmaceutical ingredient–country, and active pharmaceutical ingredient–country–brand level queries were also performed for the affected markets. *In order to secure comparability*, we analyzed sales volume data in the concerned countries, more punctually we compared the sales ratio that describe each API's market performance in the concerned countries. We also took into account that the APIs differ concerning defined daily dose (DDD) and that different strengths are available. The Days of Treatment (DOT) can be given only if we know all the mentioned information about the APIs. From IMS database we got the sales volume (thousand tablets) in the following breakdown: API-strenght-country. From that data we were able to calculate if the ratio of Sales volume (please find later as CU/MAT) is linearly proportional to DOT. We can confirm that the values used for the analysis represent the ratio of DOT of the API therapies.

In order to explore interrelations, the markets were described by different indices. In addition, the method of multidimensional scaling was used for the demonstration of similarities and differences between countries. Multidimensional scaling is a method allowing the comparison of objects based on the level of similarity while taking multiple variables into consideration at the same time (Malhotra, 2010). The method is capable to explore data structure in such a way that the objects are represented as geometric relationships among points in a multidimensional space. The advantage of the method is the graphic display visualizing the magnitude of differences between the objects and showing which objects are close to each other. The statistical reliability and validity of the solution is measured by R^2 value and the stress indicator. The method does not provide a direct solution for interpreting the dimensions of the space of perception and object characteristics. The interpretation may be promoted by several ways: based on professional expertise or using different evaluation methods with qualitative nature and supplementary calculations such as regression analysis may insert characteristics vectors into the perceptual map. Thus, as a result of multidimensional scaling, it may be determined which objects are close to each other and which are more far away and it also gives an idea on which dimensions of characteristics form the basis of the objects' spatial localization (Backhaus et al., 2015). In our analysis, the countries were placed as objects in the multidimensional space, and the similarity data were derived from their characteristics.

Results

In accordance with the methodology section, we examined the ranking of clinical evidence and price level of anti-hypertensive drugs and their effect on market performance in nine European countries (United Kingdom, Germany, Netherlands, France, Italy, Spain, Hungary, Romania, Poland) (Table 2). When we examined the clinical evidence of drug therapies, with the help of the medical doctors we concluded that ARB therapies are considered to be superior against ACE inhibitors. In order to analyze the relationship, therapeutic group–country level data were queried from the IMS database. Our raw data were as follows: Group-level aggre-

Table 2

Comparative table of ACE and ARB therapies

Country	ARB price level (EUR/CU)	ACE price level (EUR/CU)	ARB CU (ARB/Gros) %	ARB EUR (ARB/GROSS) %	ACE CU (ACE/GROSS) %	ACE EUR(ACE/GROSS) %	Price level difference index ARB:ACE	Volume difference index ARB:ACE	Sales Revenue difference index ARB:ACE	ARB pref. index
ES	0,322	0.064	**41.91**	78.41	58.09	21.59	5.03	0.72	**3.63**	**2.62**
DE	0.158	0.025	32.58	75.56	67.42	24.44	6.4	0.48	**3.09**	**1.49**
FR	0.196	0.14t7	**49.59**	56.81	50.41	43.19	1.34	0.98	1.32	1.29
IT	0.249	0.14	**43.2**	57.53	56.8	42.47	1.78	0.76	1.35	1.03
NL	0.067	0.036	**38.87**	54.12	61.13	45.88	1.85	0.64	1.18	0.75
UK	0.138	0.054	29.05	51.26	70.95	48.74	2.57	0.41	1.05	0.43
HU	0.113	0.067	29.22	41.12	70.78	58.88	1.69	0.41	*0.7*	*0.29*
RO	0.143	0.076	25.73	39.4	74.27	60.6	1.88	0.35	*0.65*	*0.23*
PL	0.133	0.085	24.22	33.23	75.78	66.77	1.56	0.32	*0.5*	*0.16*

gated sales volume (thousand tablets) and sales revenue (€, ex factory price) of ACE inhibitors and ARBs as the sum of hospital and pharmacy sales. (Aggregated sales volume allows appropriate comparison of defined daily dose of the individual therapies between the two groups. This was tested separately.) Derived indicators for the characterization of markets:

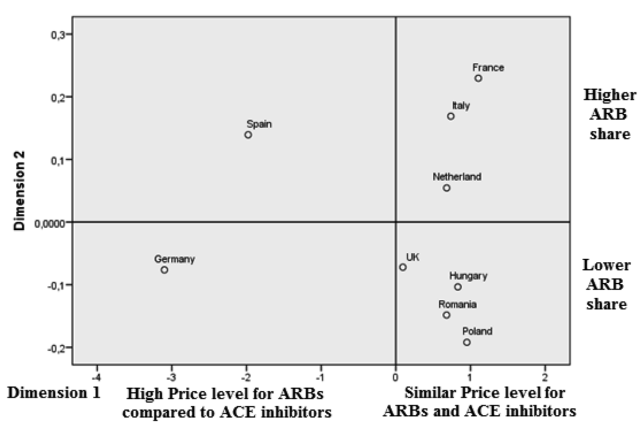
- Price level of ARBs and ACE inhibitors: Ratio of the revenue and sales volume. Price level characteristic to the individual countries by therapeutic groups.
- Price level difference index: The ratio of the mean price level of ARB and ACE inhibitor therapies show the extent to which ARB therapies are more expensive compared to ACE inhibitors in the given country.
- Volume difference index: The ratio of ARB sales volume and ACE inhibitor sales volume. Its value shows the proportion of ARB and ACE inhibitor sales characteristic to the given country.
- Sales revenue index: The quotient of sales revenues. The value determines the proportion of financial outflow (both by consumers and payers) for ARB and ACE therapies. It may be also interpreted as a product of volume and price level difference index.
- ARB preference index: Sales revenue index (where volume and price both play a role) multiplied by the volume difference index. The significance of the prescribed volume is square-weighted, and the influence of higher ARB prices is also taken into account.

Recommendation: In order to support the interpretation of the results, multidimensional scaling has been performed (after the percentages were decimalized) (Figure 3). With this method, it can be appropriately examined how similar these nine European countries may be considered in terms of the market data of ACE and ARB therapies. The two-dimensional scatter plots that present the similarity of the countries was achieved by running the ALSCAL routine of SPSS 22.0 software package with standardized variables, using Euclidean distance plot and ordinal scale. The value of the stress indicator testing the statistical fit was 0.00198 (Kruskal's stress formula), and R^2 was 0.999 indicating extremely close fit.

It is well visible that the countries localized on the stretched plain can be excellently evaluated by a 2×2 matrix. The first dimension is determined by the difference in the price levels of ARBs and ACE inhibitors, while the second dimension is determined mostly by the market share of ARBs. Of these countries, only the United Kingdom is difficult to be classified into any of the 4 groups. The reason is that the UK is characterized by relatively low ARB share (its value is almost identical with the Hungarian data), despite a higher price level. However, this higher price level is far below the German and Spanish values where there is indeed a large difference between the price levels of the two therapeutic groups. As described, the point symbolizing the United Kingdom is located very close to the pole symbolizing the countries' center of gravity. When examining the value of ARB preference index, a similar pattern emerges. The Spanish market ranked first with a high sales volume even beside an outstandingly high price level of ARBs. The trio of Germany, France, and Italy form a group with the value between 1 and 1.5 point. In the French and Italian market, high sales volume is also supported by lower price level. The German market, although lags behind the previous countries in terms of volume, however this sales volume is reached beside an outstanding price level. In spite of high price level, its sales volume exceeds that of the low share countries forming the next group. The Dutch market is considered to be average in every aspect, while the already mentioned UK market (despite its higher price level) is close to the last group in terms of ARB sales volume. The last group consists of the Hungarian, Romanian, and Polish market. These countries are characterized by low share of ARB which is accompanied by a price level almost comparable with that of the ACE inhibitors.

Figure 3

Results of the multidimensional scaling



Of the two treatment groups, ACE inhibitor therapies were analyzed on the level of active pharmaceutical ingredients too. In the following table, the first data to appear beside the name of the active pharmaceutical ingredient is the clinical rank determined by the analysis. It is followed by the sales volume data by active pharmaceutical ingredients characterizing the exam-

Table 3

Market data of ACE inhibitor therapies in Europe

API	Clinical Rank	Sales VolUK CU MAT/6/16 (%)	Sales VolDE CU MAT/6/16 (%)	Sales VolNL CU MAT/6/16 (%)	Sales VolFR CU MAT/6/16 (%)	Sales VolIT CU MAT/6/16 (%)	Sales VolES CU MAT/6/16 (%)	Sales VolHU CU MAT/6/16 (%)	Sales VolRO CU MAT/6/16 (%)	Sales VolPL CU MAT/6/16 (%)	Innov.	Country
ramipril	1	**58.8**	**72.1**	5.4	**46.1**	**60.0**	**17.6**	**33.0**	**18.5**	**54.8**	Hoechst >Sanofi	DE, FR
enalap-ril	2	5.1	**15.9**	**30.7**	5.5	**15.4**	**66.7**	**17.3**	**28.4**	**12.1**	Merck	USA (GER)
fosino-pril	2	0.1	0.2	5.9	1.3	1.1	0.5	1.9	3.5	-	Bristol-My-ers Squibb	USA
lisino-pril	2	**22,9**	9,0	**23,9**	3,3	5,3	6,1	3,3	6,5	5,9	Merck > Astra Zeneca	UK, SE
perindo-pril	2	**11.9**	0.1	**28.2**	**37.5**	6.8	0.9	**37.1**	**23.2**	**12.9**	Servier	FR
zofeni-pril	2	-	-	0.4	0.8	*8.0*		-	*5.4*	1.6	Menarini	IT
capto-pril	3	0.6	1.9	2.8	1.4	0.6	4.5	*5.7*	*7.3*	*5.2*	Squibb	USA
trando-la-pril	4	0.3	0.0	-	2.4	0.1	0.1	0.3	0.5	1.2	Abbott	USA
benaz-epril	5	-	0.4	0.0	0.9	0.9	0.3	0.2	0.2	0.4	Novartis	CH
quinapril	5	0.3	0.3	2.6	0.7	1.2	0.8	1.2	*6.4*	3.1	Pfizer	USA
moexi-pril	5	0.0	0.0	-	0.0	0.1	-		-	-		

ined markets. The results of the active pharmaceutical ingredient–country level query of the IMS database were transformed into market share for the sake of comparability. The rows of active pharmaceutical ingredients with a market share over 10% are marked by bold fonts, and the share of the most commonly applied active pharmaceutical ingredients was marked by underlining. Table 3 indicates the innovator of the given active pharmaceutical ingredients, or if the innovator (or the compound) was acquired then the name of the holder pharmaceutical company and its nationality.

Based on the results, amongst the ACE inhibitor therapies the sales of four compounds can be considered significant. Ramipril, enalapril, lisinopril, and perindopril are responsible for 76.6 to 98.8% of the sales in volume in the investigated countries. In general, it can be stated that these active pharmaceutical ingredients have high clinical ranks (1st or 2nd) within the group of ACE inhibitors however apparently the proportions are shifted in the different countries. From the aspect of patients it is considered a positive result that ramipril, which takes the first place in clinical ranking, also takes the first place based on its share expressed as volume in five of the nine countries (UK, DE, FR, IT, PL). In addition, it has significant sales share (33%) in Hungary as well. Its share is more moderate in Spain (17.6%) and Romania (18.5%), while it is lagging far behind in the Netherlands (5.4%). Ramipril was developed by the German company Hoechst which became part of the French Sanofi group by means of acquisition.

Enalapril (developed by Merck (USA) is the most popular anti-hypertensive therapy in the Netherlands

(30.7%) and Spain (66.7%) based on sales volume, and has a significant share in the other investigated countries too, with the exception of the United Kingdom and France.

Lisinopril is used for the treatment of hypertension in significant quantities in the United Kingdom (22.9%) and Netherlands (23.9%) among the investigated countries. The original developer was Merck (USA) but the distribution of the active pharmaceutical ingredient was taken by Astra Zeneca (UK, SE). Based on one of our previous researches it is interesting data that investigating the pharmaceutical market of the United States of America, lisinopril leads the sales list of ACE inhibitors with a share over 77% (IMS database, moving annual total (9/15); ratio of sales value based on thousand tablets sold).

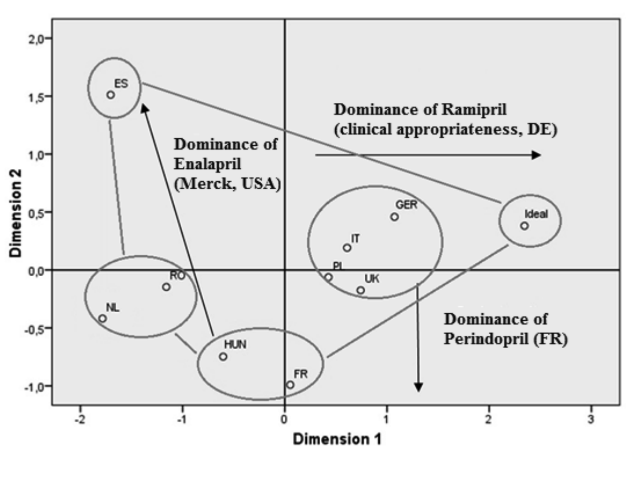
Perindopril reaches outstanding sales data in Hungary (37.1%, first rank) and France (37.5%). Significant sales volumes are characteristic to the Dutch (28.2%) and Romanian (23.2%) perindopril market, and its share is over 10% in the UK and Polish market. Perindopril was developed by the French company, Servier.

Interestingly, captopril which is noted as the first ACE inhibitor therapy but lagging behind in the clinical ranking, has a market share over 5% in the Hungarian (5.7%), Polish (5.2%), and Romanian (7.3%) market. (The average price level of captopril is the lowest among ACE inhibitors).

The sales data of the countries introduced in Table 3 were subjected to multidimensional scaling. These nine European countries can therefore be compared by the market data of the 11 different ACE inhibitors. Similarly to the previous analysis, the SPSS 22.0 software package was used. We set an 'Ideal' variant in the database symbolizing the country which can be considered as ideal in terms of clinical evidence with 100% ramipril sales. The value of the stress indicator is 0.0512 (Kruskal's stress formula), and R^2 is 0.987 indicating a very appropriate statistical fit. The first dimension is characterized by higher dispersion.

Figure 4

Results of the multidimensional scaling



The following groups of countries can be distinguished based on the results:

- DE, IT, UK, PL: Ramipril has the highest market share as the most recommended API concerning clinical evidence. Besides ramipril we can typically identify one (maybe two) ACE inhibitor with significant market performance, from the second group of the clinical rank list. Germany is the closest to the ideal state in terms of ACE inhibitor consumption.
- FR, HU: These countries are characterized by perindopril and ramipril dominance. As both active pharmaceutical ingredients are the products of French pharmaceutical companies, these two countries may be described as having strong French influence in the field of ACE inhibitors. (Based on consultation with pharmaceutical experts, in Hungary, this phenomenon may be explained by the marketing activity of EGIS acquired by Servier, the producer of perindopril). The example of the active pharmaceutical ingredient zofenipril can be mentioned in parallel with perindopril. The API, developed by Menarini (IT) reaches sales volume above 5% only in Italy (8%) and Romania (5.4%). Both examples assume some country of origin effect in the market of anti-hypertensive drugs. Consequently the country of origin effect may be an important influencing factor in the market performance of other active pharmaceutical ingredients (e.g. ramipril, lisinopril) as well. Due to the above, this effect is worth to be researched further in the future.
- RO, NL: Dominance of enalapril and perindopril. Interestingly, the literature emphasizes that in the Dutch market, doctors do not make their decisions based on price level in the process of drug prescription. However, in the case of ACE inhibitors, it can be concluded that the factor influencing prescription in the Dutch pharmaceutical market is not clinical evidence. Of the investigated countries, the Romanian market of ACE inhibitors is the most fragmented between the various active ingredients.
- ES: The Spanish ACE inhibitor market is obviously ruled by enalapril. Besides enalapril ramipril reaches considerable sales.

By evaluating the effect of the ACE inhibitors' price level on their market performance, the following conclusions can be made. The price level of captopril, the first noted ACE inhibitor is the lowest in the investigated countries. However, from the clinical point of view, captopril lags behind ramipril (first rank) and other active pharmaceutical ingredients that are listed in the second place. This may explain why it also lags behind in terms of market performance in spite of being the cheapest anti-hypertensive drug. However, in three countries (HU, RO, PL) captopril is still able to reach a share above 5%. Most probably this phenomenon can be explained by low-income consumer groups with increased price sensitivity even against cheap ACE inhibitor therapies. This phenomenon exists even though in the European healthcare systems patients sense only a small fragment of the payable price. Another explanation is that mostly elderly patients whose condition is manageable with the captopril was initiated decades ago and the doctor does not want to switch for another therapy.

By examining further sales data we can conclude that in the investigated countries, usually those therapies can reach high shares in volume which price level is lower than the average (the price pattern of the APIs differ in the involved countries). It is important to note that the tools of drug policy mentioned at the beginning of the literature summary also play an important role in the formation of the price level, so drug policy tools influence prescription patterns directly and indirectly too. (Assuming a properly working healthcare system – on an economic basis – the therapy which has the most appropriate long-term benefit-risk ratio on aggregate level has to be preferred within the healthcare system.) Comparing the drug policy tools with the sales data, we cannot draw general conclusions. It means that the demand and supply side tools have significant impact on the generic competition on the aggregate level (for instance stimulating the spread of generic share) but has less effect in the development of the proportion amongst individual drug therapies in the same indication group. A factor that is recommended to investigate in the future is the impact of clinical guidelines and clinical literature on physician decisions (including behavioral elements, i.e. awareness towards and compliance with clinical guidelines and literature).

In contrast with the above conclusions, in some cases we can detect significant market share despite higher than average price levels. In the German market, the price of ramipril, which has a 72.1% market share and is considered to be clinically the most appropriate is higher than the average price level of ACE inhibitors. The outstanding sales data of ramipril in the German market may have several reasons. From the clinical point of view, Ramipril is the preferred API in the ACE group, furthermore its price level is only slightly (2%) higher than the average price level. In German ramipril sales, country-effect may also play a role via visits by pharmaceutical representatives. A more outstanding example compared to ramipril is the high level of perindopril sales, which is characteristic to several countries. Perindopril has reached sales between 23% and 37.5% in the Romanian, Hungarian, French and Dutch markets despite its significantly high price level compared to the average (the range between +13.8 and +49.3%). Zofenipril, the most exceptional example in this respect, has an 8% market share in the Italian market in spite of its 65.5% higher price, and 5.4% share beside a 164% higher price in the Romanian market. This anomaly is attributable to the persuasive function of sales representatives. Consequently the mentioned Consequently the mentioned country-of-origin effect could have a significant impact on decreasing price sensitivity could have a significant impact on decreasing price sensitivity. This relationship should be analyzed in detail in the future.

Summary, Outlook, Limitations of the Research

As a summary, the main goal of the recent study is to introduce a novel approach for the evaluation of the relationship between the pharmaceutical products' clinical evidence (theoretically the main product feature for the patients and physicians) and their market performance. In theory, the better efficacy and safety profile should end up in higher sales in volume (DOT). Assuming that the active pharmaceutical ingredients can be ranked based upon their safety and clinical profile, the article analyzes the relationship between the clinical evidence and the market performance. The article briefly mentions further factors that have a significant impact on the analyzed relationship, but deliberately does not involve them in the analysis. There is one exception, because the article touches the impact of the price level of drug therapies.

The analysis was performed on the market of anti-hypertensive drugs in 9 European markets. It can be stated in general when comparing ARB and ACE inhibitor therapies that the clinically preferred ARB therapies were prescribed in the largest amount in France, in almost 50%. Based on the comparison of these two therapeutic groups, we cannot state that clinical evidence is the most dominant factor in the process of drug prescription. As a limitation, we must mention that ARB and ACE therapies are equivalent in terms of efficacy, ARB therapies' superiority comes from their slightly-better side effect profile. This minor clinical difference is probably overshadowed by their higher price level. Nevertheless, we conclude that the ARB market share of lower-income countries (HU, PL, RO) lags behind that of the higher-income countries. A further result is that the countries involved in the study could be categorized by a well-defined 2×2 matrix.

The group of ACE inhibitors was analyzed more in-depths in the level of individual active pharmaceutical ingredients. Of the members of a five-grade scale, typically the active pharmaceutical ingredients ranked into the first and second category as per clinical evidence reach considerable sales. Analyzing the market performance of drugs it seems that clinical evidence may therefore play an important role in the decision making process of drug purchase. When introducing the results we also point out the determinative role of price level, emphasizing the experienced anomalies. Beside the role of clinical evidence and price level, our data show country-of-origin effect-effect in the market of ACE inhibitors. In several cases this also explains the anomalies experienced by investigating the role of price level. Beyond the dominant role of product characteristics, the marketing activity of manufacturers has an obvious effect on the market performance of active pharmaceutical ingredients; however it was only mentioned in a superficial manner.

A further limitation of our research is that it only involves one therapy group and was conducted in the prescription drug market. Therefore the available data do not allow us to make a general conclusion that can be considered valid for the whole pharmaceutical industry. For general pharmaceutical investigations, we set four main research directions for the future: detailed investigation of the elements of the presented decision making pathway, the evaluation of the effect of the funding and reimbursement regulations, the effects of factors influencing the prescribing doctor's decision, emphasizing the detailed evaluation of the country-of-origin effect, as well as extending the research to further indication groups.

Concerning the managerial implications, the introduced approach and the findings of the future studies may be supportive for the better understanding of the purchase decision process. If the clinical ranking can be accepted as a general quality indicator for differentiating between the APIs, the effect of the additional significant factors can be compared between the countries more easily. This may help to design generic portfolios for pharmaceutical companies. From the patients' side an easy-to-understand tool could be also beneficial.

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CIKKEK MAGYAR NYELVŰ ÖSSZEFOGLALÓI

Szukits Ágnes

Menedzsmentkontroll-rendszerek: az eszköztár hatása az információszolgáltatásra

A mai szervezetek számára már az eszközök széles köre áll rendelkezésre ahhoz, hogy vezetőik számára releváns, a teljesítményértékelés és a döntéshozatal során felhasználható információkat tudjanak adni. Ez a tanulmány a menedzsmentkontroll (MK) eszköztárat és annak kapcsolatát vizsgálja a vezetés számára elérhető információk terjedelmével és az információszolgáltatás gyakoriságával. A XXI. század controllereinek munkáját IT-megoldások sokasága támogatja, ezért az eszköztár vizsgálata nem korlátozódik az MK-eszköztárra, hanem kiegészül a támogató IT-eszközökkel is. A Versenyképesség Kutatás 2013. évi felmérésének adataira támaszkodva a tanulmány szignifikáns összefüggést igazol az MK-eszközök és az MK-rendszerek különböző információs jellemzői között. Az IT-intenzitás információszolgáltatásra gyakorolt hatása ugyanakkor csak korlátozott a vizsgált 181, főleg közepes méretű vállalat esetében. A statisztikai elemzést tapasztalt gyakorló controllerek bevonásával készített fókuszcsoportos megbeszélések eredményei egészítik ki.

Somosi Ágnes – Kolos Krisztina

Gazdasági és pszichológiai költségek szerepe a szolgáltatáskivezetésben

A szolgáltatáskivezetés az ügyfélmegtartás érdekében szisztematikus tervezést és végrehajtást igényel. A szolgáltatók azonban nehezen tudják a szolgáltatáskivezetést követő lemorzsolódást csökkenteni. Ez a cikk a gazdasági és pszichológiai költségek fogyasztói reakciókra gyakorolt hatását vizsgálja szolgáltatáskivezetést követően, kísérleti módszertan segítségével. Az eredmények szerint a gazdasági költség a lemorzsolódásra pozitívan, míg az elégedettségre és az elköteleződésre negatívan hat. A költségek közötti interakciók azt mutatják, hogy a pszichológiai költség finomítja a fogyasztó gazdasági költségre adott reakcióját. Ez a kutatás a szolgáltatáskivezetés fogyasztói magatartásra gyakorolt hatásának megértéséhez járul hozzá.

Faludi Julianna

Egy kiállítóterem gyártási laborrá változik: Nyitott, innovatív együttműködés egy nyilvános konyhatervezésben – Esettanulmány

A nyílt innováció, a kollaboráció és az open design table módszertanából merített kísérleti projekt: egy konyhatervezési folyamat résztvevőivé emelte a milánói design week fringe eseménysorozatának széles közönségét.

A luxus és a Latouche-i értelemben vett fenntarthatóság mentén tervezett és gyártott Valcucine-konyhák történetében a maker-forradalom vett fordulatot: a konyha-hackelést független designer-ek, maker-ek, és az arduino csapata végezte el: egyben Brera elegáns szalonjából egy hétre FabLab-et varázsolt: porral, forgáccsal, és 3D nyomtatóval. A cikk e folyamatot mutatja be, egyben elhelyezi az innovációs irodalom nyílt/ felhasználói/ kollaborációs mintáinak tengelyén.

Lőrincz Noémi

Napjaink globális értékláncainak főbb jellemzői és azok befolyása a magyar autóiparra

A globalizáció lehetővé teszi a termelési folyamatok nemzetközi szinten történő megosztását. Ebben jelentős szerepük van a globális értékláncoknak (GVC-k), melyek a vállalatok, a munkavállalók és a fogyasztók összekapcsolásával hatással vannak a nemzetközi kereskedelem szerkezetére, az egyes országok GDP-jére és foglalkoztatására és így a globális gazdaság egészére is. A vállalatoknak lehetőségük van belépni az ilyen GVC-kbe, illetve javítani pozíciójukon a GVC-ken belül, ami a globális szintű kereskedelem fokozottabb integrációjához vezet. A GVC-részvételnek azonban komplex előfeltételei vannak, melyek többek között a fejlett infrastruktúra, intézményi rendszerek, munkaerőpiac, valamint a megfelelő kereskedelmi és üzleti környezet. Számos fejlődő ország számára ez az integrációs folyamat az intenzív fejlődés egyik fő mozgatója. Jelen cikk Magyarország globális értékláncokban való szerepét elemzi, hangsúlyt helyezve az autóipari szereplőkre. Az elmúlt évtizedek globális és lokális szinten bekövetkezett változásaiból indul ki, amikor a külföldi autógyártók közvetlen tőkebefektetései megjelentek az országban. Bemutatja a helyi piac sajátosságait, továbbá kitekintést nyújt a jövőbeli trendekre, beleértve az elektromos autók elterjedésének várható hatásait. A cikk egyes megállapításai támaszt nyújthatnak a GVC-részvétel hatékony és eredményes megteremtésében.

Kovács Bence – Simon Judit

A tudományos eredmények és a magas vérnyomás elleni gyógyszerek árának hatása azok piaci teljesítményére – Egy európai elemzés

A szerzők tanulmányukban egy új megközelítést mutatnak be annak vizsgálatára, hogy a gyógyszerek piacán a marketingmix elemei közül a terméket jellemző klinikai megfelelőség és az árszínvonal hogyan befolyásolja azok piaci teljesítményét. A tanulmányban azonos indikációs csoportba (magas vérnyomás betegség) sorolható, azonos hatásmechanizmussal rendelkező hatóanyagokat vizsgáltak, melyek évek óta a generikus versenyben vesznek részt szabadalmuk lejártával. A fő kérdés, hogy a generikus verseny eredményeként kialakuló, hatóanyag szintű eladási volument menynyiben határozza meg az egyes hatóanyagok klinikai bizonyítékokon alapuló értékelése, illetve a terápiák árszínvonala. Feltevésük szerint hosszú távon és megfelelő versenyhelyzetben, a klinikai rangsorban hatásosabbnak és biztonságosabbnak bizonyuló hatóanyagok pozitív tulajdonságainak azok eladásában is tükröződnie kell. Ezt torzíthatja az egyes országokra jellemző árszínvonal, a gyógyszerpolitika eszközei, a gyártók marketingtevékenysége, illetve ezek egymásra gyakorolt hatása. A vizsgálatot európai gyógyszerpiacokon végezték.

TARTALOM