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THE MODEL APPROACH TO LINKING INNOVATION ANNOUNCEMENTS AND MARKET VALUE OF EQUITY IN SERVICE SECTOR

WPŁYW OGŁOSZEŃ O INNOWACJACH NA WARTOŚĆ DLA AKCJONARIUSZY PRZEDSIĘBIORSTW SEKTORA USŁUG RYNKOWYCH. UJĘCIE MODELOWE

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Summary: Despite the research conducted in this field of innovation the attempt to model the effects of communicating innovation through announcements on market value changes has not been undertaken yet. Thus the purpose of the present research was to model the relationship between communicating innovation and market value of service companies. Summary of the existing evidence relied on such methods of systematic literature studies as SALSA, one step forward and backward snowballing, meta-synthesis and mapping review procedure. In order to represent the relationship between innovation and market value in services a conceptual model is proposed. It encompasses seven innovation-level and seven firm-level predictors. It covers also interaction and second-order effects.The research was burdened with several limitations. Namely it was limited to papers published in English and included scientific articles and conference proceedings only. Further quantitative research aiming at testing the model empirically seems beneficial from the point of view of model development.

Keywords: innovation, market value, service sector, service companies.

Streszczenie: Celem niniejszego badania było stworzenie modelu opisującego relację pomiędzy komunikowaniem innowacji a wartością dla akcjonariuszy tych przedsiębiosrtw. Syntezy dotychczasowych dociekań naukowych dokonano na podstawie systematycznych studiów literaturowych z wykorzystaniu metod: Salsa, *forward* i *backward snowballing,* meta-syntezy oraz mapowania (ang. *mapping review*). Zależności pomiędzy innowacjami a wartością dla akcjonariuszy przedsiębiorstw usługowych przedstawiono za pomocą modelu koncepcyjnego. Model obejmuje siedem zmiennych na poziomie innowacji oraz siedem zmiennych na poziomie przedsiębiorstwa. Model zawiera również efekty interakcyjne i efekty wyższego rzędu. Przeprowadzone badanie nie było wolne od ograniczeń. Zostało ograniczone do prac opublikowanych w języku angielskim oraz uwzględniło wyłącznie artykuły naukowe i materiały konferencyjne. Z punktu widzenia dalszego rozwoju modelu, wydaje się uzasadnione przeprowadzenie badań ilościowych umożliwiających jego weryfikację empiryczną.

Słowa kluczowe: innowacje, wartość rynkowa, sektor usługowy, przedsiębiorstwa usługowe.

1. Introduction

Companies operating in highly competitive environment set numerous goals. It seems, however, that their primary purpose is to increase value [Koller et al. 2015]. Value incorporates all aspects vital for company functioning [Bodie, Merton 2000]. The comprehensiveness of the measure in line with its conceptual simplicity determines its high applicability in business practice and high usage in academic research. Increasing value entails a series of benefits, not only for the company but also for the local communities and society as a whole − increased employment, better working conditions, growing consumer satisfaction and responding to environmental issues to name just a few [Rappaport 1999].

Among the numerous ways to increase value innovation occupies a central position. It provides companies with competitive advantage by delivering to the market new and significantly improved products and optimizing company internal processes [Tirole 1995]. Moreover, it stimulates the increase in knowledge [Lam 2006], entails cost minimization, facilitates achieving the most efficient organisational structures [Trott 2008] and permits linking supply and demand more efficiently [Perreault, McCarthy 2005].

In this light it seems of vital importance for both theory and practice to model the relationship between innovation and the value of service sector company. There are numerous approaches to value but it seems that the one based on market estimate surpasses others [Szutowski 2016]. Also following the neo-Schumpeterian approach, the issue under investigation is especially vital in the case of large, public companies. The value of such companies undergoes constant evaluation. Selecting the approach based on the market valuation entails several assumptions.

In order to observe the relationship between an event and company market value the market has to demonstrate a sufficient level of efficiency which depends on its size, depth and liquidity amongst others [Kristoufek, Vosvrda 2012; Baciu 2014]. Yet in order to detect market reaction, the market must be able to react accordingly. The low liquidity of the market prevents its accurate reaction due to the insufficient funds possessed by investors. Such a situation results in sharp market value changes that do not correspond to the new information. Thus, a necessary condition for any research on the impact of events on company market value is the sufficient number and size of transactions on company stock. This condition may be referred to as volume, which covers demand for the stock reflected in "buy" and "sell" offers [Sloan 2012].

Furthermore, there is a conceptual difference between studying the impact of the actual changes implemented and the impact of the new information referring to them. Thus, the crucial role of the way of communication emerges. It is especially important if after releasing the initial information a company updates it [Sorescu et al. 2007]. The usual small informative value of the update discourages market reaction. Despite releasing information it will not have any impact on the stock

prices as the whole information is already discounted. Moreover, there is a fundamental distinction between the information on the plans and works under development and the information on actual implementations [Kelm et al. 1995]. The substantial value of the two releases is different. The first one is treated as a promise and requires a considerable amount of trust as it carries much uncertainty. The second one signals that the project reached a successful outcome and thus it may be judged based on the facts. Such a distinction may be referred to as stage.

Despite the above considerations numerous factors need to be accounted for in order to model the relationship between innovation and company market value. However, the comprehensive study attempting to summarize the previous research in services in the form of a model is still missing. Thus, the purpose of the research was to model the relationship between innovation and market value of service companies. In order to achieve it, a systematic review was performed. It aimed at precisely selecting and synthesizing the previous research on the relationship studied in order to create a comprehensive representation. It relied on numerous tools such as: *salsa method, one step forward and backward snowballing, meta-synthesis*, and *mapping review procedure*. The model created included seven innovation-level predictors, two company-level innovation-related predictors, interaction and second order effects, and five control variables. It is accompanied by a descriptive component.

The paper is structured as follows. First the systematic literature studies summarizing the research on the relationship between innovation and market value is provided. Second the research results are delivered. Third the author's model is developed. The paper terminates with conclusions.

2. Methods of systematic literature studies

The purpose of the systematic review was to create a conceptual model representing the relationship between innovation and market value of service companies. The advantage of the method employed is that it provides an exhaustive and timely summary of the literature relevant to the subject. By dint of the methodical approach it allows a precise selection and a critical analysis of multiple papers and research studies. Here the scoping research, which consisted of search terms and database selection, was followed by a four-step SALSA (Search, AppraisaL, Synthesis and Analysis) approach [Booth et al. 2012].

Substantial coverage of the research resulted in search terms specification in three domains: innovation (innovation, improvement, modernization), market value ("market value", "firm value", "stock price") and services ("service industry"). Due to their wide usage five databases were selected: Web of Science, JSTOR, Ebsco, Scopus and Scholar. Each combination of the three search terms was researched in articles' titles, abstracts and keywords (Scopus), abstracts and titles (Ebsco, JSTOR), titles and topics (Web of Science) and titles (Scholar). Both American and English spellings were covered. Time restriction was set between January 2000 and December

Table 1. The papers referring to the impact of innovation on market value in services

No	Author (s)	Year	Relation	Sample	Time	Country
1	Chuang and Lin	2015	Positive, indirect relationship through co-creation	396 financial service firms	03.2013--10.2013	Taiwan
2	Nicolau and Santa-Maria	2013b	Positive relation moderated by growth, experience and service character	30 announcements of innovation awards	1994-2008	Spain
3	Son, Lee, Lee & Chang	2011	Positive relation moderated by size and service character	183 firm-level announcements regarding cloud computing	2005-2010	US
4	Khansa and Liginlal	2009	Positive relationship driven by R&D intensity and patents	33 security software companies	1998-2008	US
5	Filson	2002	Positive relationship moderated by the source of innovation (alliances and acquisitions)	328 events for Amazon.com, BarnesandNoble.com, CDNOW, N2K	1997-2001	US
6	Ho, Fang and Hsieh	2011	Positive relationship moderated by high-tech/low-tech industry	2 companies: HTC (high tech) and 7-eleven Taiwan (low tech)	1997-2011; 1979-2011	Taiwan
7	Ehie and Olibe	2010	Positive relationship driven non-linearly by R&D investment and moderated by firm size and industry concentration	26.429 firms-years	1990-2007	US
8	Meng, Zhang and Wei	2015	Positive relationship moderated by debt to assets ratio, sales, asset turnover, degree of total leverage, assets to sales ratio, tradable shares and ratio of shares from top ten controlling shareholders	1.455 firms	2003-2013	China
9	Ho, Keh and Ong	2005	No significant relationship	15.039 firms-years	1962-2001	US
10	Cho and Pucik	2005	Positive relationship mediated by increase in quality	Companies from the Fortune database	1999-2001	US
11	Dotzel, Shankar and Berry	2013	Positive relationship moderated by customer satisfaction, firm age, market size, market growth, operating margin and competitor innovation activities	90 firms/9industries/1.049 innovations	2000-2004	US
12	Hall, Jaffe and Trajtenberg	2005	Positive relationship moderated by R&D intensity, patent yield of R&D, and citations received by the patent	4.864 firms, 3 million patents, 16 million citations	1963-1999 (P), 1975-1999 (C)	US
13	Nicolau and Santa--Maria	2013a	Positive, moderated by type	2 hotel companies listed in Spain - NH and Sol Melia, 24 announcements	1996-2008	Spain
14	Zach, Krizaj and McTier	2015	Negative in the case of new property openings	2 hotel companies listed in US, 131 announcements	2011-2013	US
15	Hull & Rothenberg	2008	Positive relation moderated by corporate social performance	69 firms	1998-2001	US

Source: own work.

2016 (inclusive). Thus defined search resulted in selecting 369 publications. The publications were sifted to maintain the focus of the study. First works published in popular science (n=65), duplicates (n=148), and non-English works (n=6) were eliminated. Second the papers referring to the subject superficially were excluded based on their titles (n=101), abstracts (n=15), and full texts (n=23). Next to assure the comprehensiveness of the study the selected 11 publications were complemented in one step forward (with the use of a Scholar database) and backward snowballing [Jalali, Wohin 2012]. The final set of 15 papers was synthesized in a tabular form in Table 1.

3. Research results

In order to create the model based on the above set of papers a mapping review procedure was applied [Graham-Matheson et al. 2006]. It consists of the attribution of codes to the publications studied. The codes referred to the variables employed in the models proposed in particular studies. They were defined as: TYPE – innovation type, CSR – corporate social responsibility, PAT – patent, GWTH – growth, EXP – experience, IND – industry, SIZE – firm size, INT – strategic intention to increase operational efficiency, R&D – R&D intensity, SRC – source, DNI – degree of novelty involved, TM – target market, D/A – debt to asset ratio, AT – asset turnover, DTL – degree of total leverage, A/S – assets to sales ratio, CSH − ratio of shares from top ten controlling shareholders, TS – tradable shares, INN – innovativeness, Q – quality of products and services, CS – customer satisfaction, MRG – operating margin, CIA – competitor innovation activity, MG*U – market growth*utility, CAP – cooperation capability, Ø − empty set, no common parts. Despite attributing the same code different authors may have operationalized the variables differently; e.g. R&D

Table 2. Commonalities and differences between the studies covering the innovation-level

Publications		Nicolau and Santa--Maria [2013a]	Zach, Krizaj and McTier [2015]	Khansa and Liginlal [2009]	Hall, Jaffe and Trajtenberg [2005]
	Variables	TYPE, CSR	TYPE, DNI	PAT	PAT
Nicolau and Santa--Maria [2013a]	TYPE, CSR	–			
Zach, Krizaj and McTier [2015]	TYPE, DNI	TYPE	–		
Khansa and Liginlal [2009]	PAT	∅	∅	–	
Hall, Jaffe and Trajtenberg [2005]	PAT	∅	∅	PAT	–

Source: own work.

Table 3. Commonalities and differences between the studies covering the company-level

Publications		Nicolau and Santa-Maria [2013b]	Son, Lee, Lee and Chang [2011]	Khansa and Liginlal [2009]	Filson [2002]	Ho, Fang and Hsieh [2011]	Ehie and Olibe [2010]	Meng, Zhang and Wei [2015]	Cho and Pucik (2005)	Dotzel, Shankar and Berry [2013]	Hall, Jaffe and Trajtenberg [2005]	Chuang and Lin [2015]	Ho, Keh and Ong [2005]	Hull and Rothenberg [2008]
	Variables	GWTH, EXP, IND	SIZE, IND, INT	R&D	SRC	DNI, TM	R&D, SIZE	D/A, SIZE, AT, DTL, A/S, CSH, TS, IND	INN, Q, GWTH	CS, INN, SIZE, EXP, GWTH, SRC, MRG, CIA, GWTH*U	R&D, PAT	CAP, SRC	R&D, R&D^2, SIZE	CSR, INN, IND, CSR*INN, CSR*IND
Nicolau and Santa-Maria [2013b]	GWTH, EXP, IND	–												
Son , Lee, Lee and Chang [2011]	SIZE, IND, INT	IND	–											
Khansa and Liginlal [2009]	R&D	∅	∅	–										
Filson [2002]	SRC	∅	∅	∅	–									
Ho, Fang and Hsieh [2011]	DNI, TM	∅	∅	∅	∅	–								
Ehie and Olibe [2010]	R&D, SIZE	∅	SIZ	R&D	∅	∅	–							
Meng, Zhang and Wei [2015]	D/A, SIZE, AT, DTL, A/S, CSH, TS, IND	IND	IND, SIZE	∅	∅	∅	SIZE	–						
Cho and Pucik [2005]	INN, Q, GWTH	GWTH	∅	∅	∅	∅	∅	∅	–					
Dotzel, Shankarand Berry [2013]	CS, INN, SIZE, EXP, GWTH, SRC, MRG, CIA, GWTH*U	EXP	SIZE	∅	SRC	∅	SIZE	∅	INN, GWTH	–				
Hall, Jaffe and Trajtenberg [2005]	R&D, PAT	∅	∅	R&D	∅	∅	R&D	∅	∅	∅	–			
Chuang and Lin [2015]	CAP, SRC	∅	∅	∅	SRC	∅	∅	∅	∅	SRC	∅	–		
Ho, Keh and Ong [2005]	R&D, R&D^2, SIZE	∅	SIZE	R&D	∅	∅	R&D, SIZ	∅	∅	SIZ	R&D	∅	–	
Hull and Rothenberg [2008]	CSR, INN, IND, CSR*INN, CSR*IND	IND	IND	∅	∅	∅	∅	∅	INN	∅	∅	∅	∅	–

Source: own work.

variable was operationalized as R&D intensity by Khansa and Liginlal [2009] and as R&D investment by Ehie and Olibe [2010] and size variable referred either to sales [Meng et al. 2015] or natural logarithm of market capitalization [Ho et al. 2005].

The key aspects of the studies were mapped using keywords and the meta-synthesis method was used [Siau, Long 2005]. All the analyzed articles were compared and merged with one another. In the context of the relation studied two distinctive groups of variables were used: **innovation-level** and **company-level**. Depending on the study the focus was placed either on the first one or the second one or both. The outcomes of the meta-synthesis are delivered in tabular form. Tables 2 and 3 provide the similarities and differences between studies.

The creation of the conceptual model relied on the similarities reported in previous research. It was based on the firm evidence supported in several studies. Although the above meta-synthesis offered a clear indication of the variables to be included in the conceptual model, several comments need to be delivered. Despite the fact that the degree of novelty and CSR variables were used in the studies whose main focus was set on the different levels, both were firmly proven important. Zach, Krizaj and McTier [2015] as well as Ho, Fang & Hsieh [2011] confirmed the importance of the degree of novelty involved, and Nicolau and Santa-Maria [2013a] as well as Hull and Rothenberg [2008] indicated the usefulness of CRS. Such support achieved by the variables in different contexts maintains their high rank in these theoretical considerations.

Furthermore R&D variable was proven significant in a lot of research. In this context further attention is required to the conclusions of Ho, Keh and Ong [2005] stating the statistical significance of its squared transformation. Such a result on one hand supports other research by pointing the significance of R&D, on the other hand it differs from them by indicating the curvilinear relationship. Based on the significance of the R&D variable in the context of its impact on the market value and the higher statistical significance of its squared transformation than its basic form reported by Ho, Keh and Ong [2005], it is concluded that the inclusion of squared R&D ($R\&D^2$) in further theoretical considerations is justifiable.

Moreover, both CSR and innovativeness variables were indicated important in the studied set of papers. In this light the essential consideration is delivered by Hull and Rothenberg [2008] who proved the significant interaction effect between them. The authors demonstrated that CSR more positively impacts the financial performance of companies low on innovation. So the confirmed moderation effect between the two significant variables justifies the inclusion of the interaction effect in further theoretical considerations.

4. The model

The outcomes of the performed studies took a form of comprehensive model representing the relation between communicating innovation and company market value of equity. The model is accompanied by a descriptive component. Initially it

was ascertained that the necessary condition for the impact to occur is the sufficient trading volume. Moreover, it was ascertained that the way of communication and development stage constitute the conceptual basis for the evaluation of innovation announcements. Furthermore, meta-synthesis allowed indicating and attributing five variables to the level of innovation itself. Besides, it indicated a group of six variables describing the innovating company, two of which connected to innovation and four of which did not. Finally based on the study the second order effect of R&D intensity and the interaction term of corporate social responsibility and innovativeness were introduced. The model took a graphic form. It is presented in Figure 1.

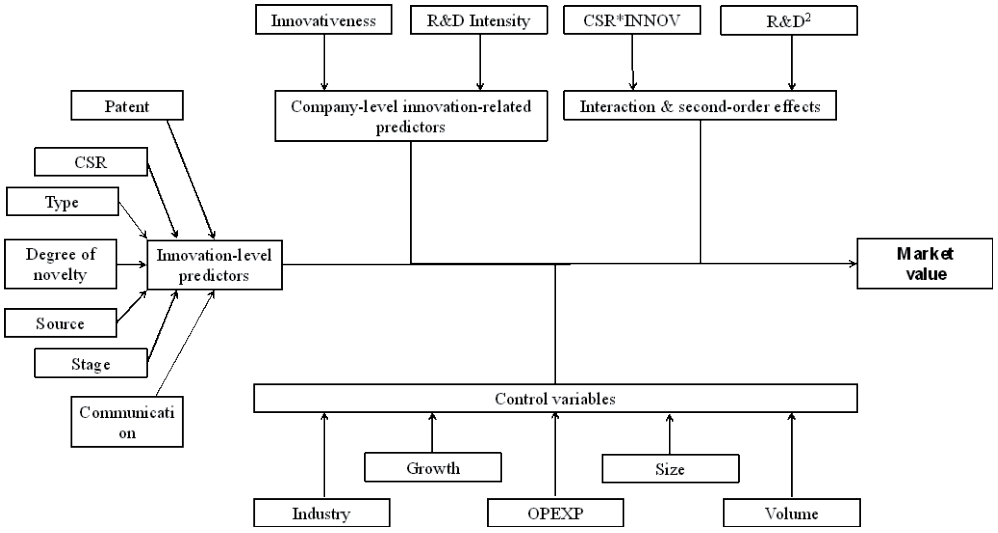

Fig. 1. The model representing the relation between innovation and company market value

Source: own work.

The analytical form comprising one equation with the company market value of equity as a dependent variable and selected variables as independent ones complements the graphical representation. The model is as follows:

$$MV = \beta_0 + \beta_1 PAT + \beta_2 CSR + \beta_3 TYPE + \beta_4 DNI + \beta_5 SRC + \beta_6 STG + \beta_7 COM + \beta_8 INN + \beta_9 R\&D + \beta_{10} IND + \beta_{11} GWTH + \beta_{12} EXP + \beta_{13} SIZE + \beta_{14} VOL + \beta_{15} CSR * INN + \beta_{16} R\&D^2 + \varepsilon ,$$

where: *PAT* – patent, *CSR* – *CSR*, *TYPE* – type of innovation, *DNI* – degree of novelty involved, *SRC* – source of innovation, *STG* – stage, *COM* – communication, *INN* – firm innovativeness, *R&D* − firm R&D intensity, *IND* – industry, *GWTH* – firm growth, *EXP* – firm operational experience, *SIZE* – firm size, *VOL* – volume, *CSR*INN* – interaction effect between CSR and innovativeness, $R\&D^2$ – second-order effect of R&D intensity, ε – error term.

The impact of each of the variables contained in the model differs depending on the conditions. Based on their substantial value the company-level variables were divided into innovation-related and control. Such a distinction is necessary to account for the effect of the variables substantially disconnected from innovation. The distinction and inclusion of the control variables is necessary for the correct estimation of parameters related to innovation. It allows predicting the changes in the market value above and beyond the effect of the controls. Despite the fact that the control variables do not refer to innovation they may not be eliminated from the model. Such omission results in transferring their effect on the variables actually included and may cause a significant bias in their estimation. The inclusion of control variables is a well-founded requirement.

5. Conclusions

Innovation is one of the primary drivers of company market value increase. It seems, however, that in the case of the effects of communicating innovation the research gap prevails. In this light the purpose of the present research was to model the relationship between innovation announcements and market value of equity of service companies. In order to achieve the purpose the method of systematic review was selected. The result took a form of conceptual model including seven innovation--level and seven firm-level predictors. It covered also interaction and second-order effects. The firm-level predictors were divided further into innovation-related and control variables. One of the limitations was that the research was limited to papers published in English, which narrowed the search area. Second, due to the search possibilities offered by the databases used it focused on scientific papers and conference proceedings and omitted the books. Further studies could expand the criteria of literature research. Additionally, the promising direction for further research seems to be a quantitative study aiming at the empirical verification of the author's model. It is necessary to confirm the significance of the selected predictors and determine their actual impact on the changes in market value.

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