INNOVATION. AN INSTRUMENT FOR DEVELOPMENT OF COMPANIES

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Please cite this article as:
Nica, A.M., Stancu, I. and Stancu, D., 2016. Innovation. An Instrument for Development of Companies. *Amfiteatru Economic*, 19(45), pp. 509-527.

Article History
Received: 12 December 2016
Revised: 11 March 2017
Accepted: 3 April 2017

Abstract
Innovation is seen in numerous specialized studies as an efficient method for improving the performance of a company based on the sector in which that company operates. Based on this idea, the article aims to determine the nature of inter-correlation between the innovation activity of companies and the level of performance of these, which are the main types of innovation and how they can influence companies` position and how the sector of activity can influence the dimension of the impact of innovation.
For achieve these objectives have been analysed empirical studies in various sectors, studies which have highlighted a positive inter-correlation between innovation activity and the performance of companies with significant differences depending on the type of innovation and industry use.
The article is completed by an empirical analysis which aims to determine the extent to which performance of companies in the construction sector is sensitive to innovation activity. For the analysis were collected data from 14 companies which developed the specific activities in the construction sector of Europe, were achieve a total of 112 observations. The results obtained by applying a multiple regression model shows a positive correlation relationship between indicators of innovation (R&D expenditures and the value of patents/patents) on the one side and performance indicators (equity, labour productivity and number of employees) on the other side. Another direction of research analysed in this paper is to determine the impact of labour indicators on the level of innovation, in this situation was achieve a positive but insignificant inter-correlation between those indicators.

Keywords: Innovation, development, construction sector, performance

JEL Classification: C31; D24; L25

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Introduction

Business development present a particular importance for stakeholders of a company, regardless of its area of activity, because it can provide them additional benefits. To ensure the growth of these benefits is essential to identify those directions and methods of development needed to achieve the defined objectives. Thereby, the innovation capacity to determine the economic growth of companies is complex and intensively analysed over time.

The goal of the research is to determine how can the innovation activity to influence the performance level of a company. For this purpose, will be analyse the main types of innovation and their capacity to contribute to the development of companies, and the impact of innovation activity by size of company and its activity sector.

The empirical analysis of this paper provides an overview on the capacity of the innovation process to be used as a tool for the development of companies in the construction sector. The paper will analyse the impact of the innovation activity measured by the value of patents and R & D expenditures, on the main performance indicators of companies in the construction sector (gross profit, total income). Also, another research direction is to identify the impact of labour productivity and the number of employees on the innovation for determine whether innovation activity is conditioned by such variables.

1. Literature review

1.1. Innovation and companies' performance

In one of the most important works, Schumpeter (1934) defines innovation as "commercial or industrial application of something new – new product, process, or method of production; a new market or source of supply; a new form of commercial, business, or financial organization", a definition which represent a standard for the financial markets (OEDC, 2005). Drucker (2002) gave to innovation a definition which can clearly underline its role, he considers innovation a specific instrument of an entrepreneurial manager, a means by which he exploits change as an opportunity for various business and various services.To these definition awarded to innovation can be added the definition proposed by Damapour and Goplakrishnan (2001), they consider that innovation represent "regarding any idea, practice, or product that is new to the user organization as innovation".

Based on these definitions, we can understand that the purpose of innovation is to improve organizational performance at the level that is used (Camisón-Zornoza et al., 2004). Depending on the issues faced by organization and the development strategy used by company, we can choose a development method who can answer to our needs. In his paper, Dobrotă (2004) describes innovation as a possible form of business development that can occur at any stage of its life cycle.

Because of the influence that innovation may have on the level of performance in an organization, it was analysed over the years in many aspects. At Romania legislation level is talking about product innovation and process innovation, with different influences on the entire organization. Product innovation represent the introduction of a good or service that is new or significantly improve regarding their characteristics or intended uses. This includes significant improvements in technical specifications, components and materials or

other functional characteristics. A process innovation represents the implementation of a new manufacturing method or significantly improved or using a new methods of delivery. This includes significant changes in techniques, technological equipment and / or changes of software. (OEDC, 2005)

Another classification of innovation is proposed by Christensen (2004): sustaining innovation, with effects on existing market, enabling the development of better products, to be sold later at higher prices, evolutionary innovation that ensures the improvement of a product from an existing market in order to increase the quantity required for a specific product and disruptive innovation, that allows creating and marketing a simple product by using advanced technologies, capable to provide lower production costs compared with traditional technologies, ensuring the lower sales prices. Christensen (2004) shows in his work how disruptive innovation could contribute to development of existing companies. Thus, if company policy is to ensure the increase of performance by entering on new markets, and does not take into account the improvement of existing products, disruptive innovation can be the solution.

The profitability of innovative companies is higher than for non-innovative companies, and this difference is even more pronounced for companies with persistent innovations than non-innovative (Cefis and Ciccarelli, 2005). In support of this conclusion comes Huergo and Jaumandreu's study (2004) which considers the effect of innovation on the company's profitability is positive and can be maintained over time.

Sources of innovation are unexpected events, inconsistencies, needs of processes, industry and market changes, demographic changes, perception changes, new knowledge (Druker, 2002). In this context, of circumstances in which innovation can be considered an effective solution for corporate development, Milic (2013) highlights the need for supporting innovation as a solution to the economic crisis. During the global economic crisis in 2007, most managers have identified as the main solution for keeping the company on the market, cost reductions, without taking into account the beneficial effects that can be bring by innovation in the long term.T hus, after the adoption of solutions that are enable maintain an acceptable position on the market in the short term, the second step would be to invest in innovation (Ilic and Milicevic, 2009), to ensure a suitable in the long term positions. The type of innovation considered efficient for pass over the economic crisis is radical innovation more than the incremental innovation (Milic, 2013).

1.2. Innovation and performance of companies by size

Characteristics of innovation and its effects on the performance of companies can be different depending on the size class of companies. Thus, small firms recorded significant benefits when they used radical product innovations, while large firms can secure strengthen the market position using incremental or process innovations (Klepper, 1996).

The study of Demirel and Mazzucato (2012) in the pharmaceutical sector of United States underlines the differential impact that innovation can have on companies depending on their size. Thus, the innovation determines growth of performance only for small firms while large companies recorded a lower level of profitability as a result of their innovation activities.

Christensen (2004) considers that disruptive innovation is an important solution which can be adopted regardless of firm size if the strategy used is selected taking into account all the implications of this process. The use of Disruptive innovation for existing businesses involves creating a completely separate company with a new business model that may or may not be related to the core business of the organization "mother". Because the innovation involves a large amounts of resources, the use of this development strategy is recommended for large companies with a high level of economic and financial performance.

In disruptive circumstances, it is desired to achieve a simple low-priced product aimed at new categories of customers, the companies' newcomers have every chance to win big companies. The author identifies three critical levels for the disruptive innovation, which can be seen in Figure no. 1.

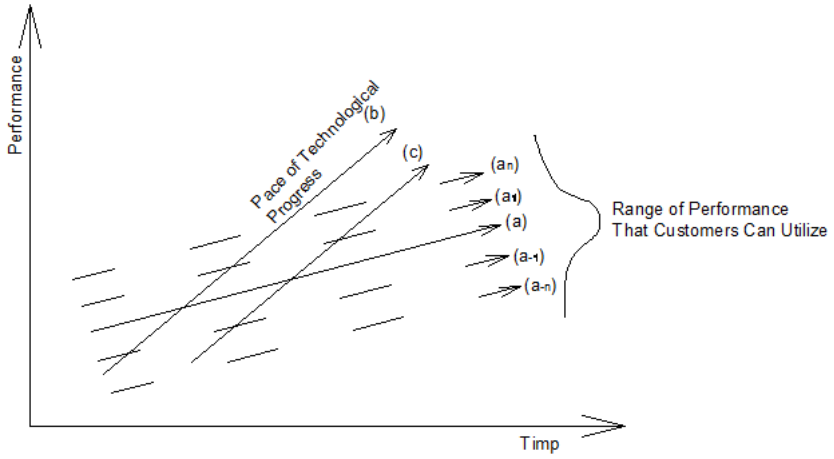

Figure no. 1: Disruptive innovation and the influence of over the companies by size
Source: Christensen, 2004, p.33

(a) – performance that customers can utilize or absorb

(b) – sustaining innovation

(c) – disruptive innovation

Level (a) – It is specific for the situation when products are improved to a limit to which this development can be used / absorbed by clients. Line (a) shows an average distribution customers opportunities that can oscillate inside the curve which represents the Range of performance that customers can utilize.

Customers of the lower levels have a capacity to absorb lower performance due to limited needs in this respect. This category of customers is very important for the newcomers and less for consolidated companies that have a high level of quality of products. On the other hand, customers from the higher levels have difficult needs to satisfy of new firms that choose disruptive innovations in this case sustaining innovation is an efficient strategy for the development of society and for attraction of this market segment.

Level (b) – Specific for innovative companies exceeds the capacity of absorption of customers being in accord with the pace of technological progress which is often faster compared to performance changes requested by customers. Because often the sustaining innovation involves incremental improvements to the product, the company that chooses this development method must be very familiar with its competitive environment and with improvements chosen by the other competitors over time.

Because of their difficulties to provide the necessary resources, the newcomers have not the ability to enter in the battle of sustaining innovations with consolidated companies. However, there are efficient ways by which start-ups can use sustaining innovations as a strategy for penetrating and consolidation of market position. Thus, they can choose the design and the development of superior products that can be sell later to a leader found behind them. This strategy ensures fast profits and cancels risks likely to arise in the fight for supremacy. Although effective and with immediate benefits, sustaining innovation strategy is risky because it is difficult for newcomers to penetrate with a superior product on a consolidated market. If, in the case of disruptive innovation firms they can move to superior levels, and make place to newcomers, in the case of powerful companies they have nowhere to go and had to stay and fight.

Level (c) – particular for disruptive innovations it involves the introduction of new products, inferior to those existing on the market.

If in the first phase newcomers that have choose disruptive innovations, are not important competitors for consolidated companies, the rhythm of technological progress may lead to the improvement of poor product and disruptors can entering into a fair conflict with large firms. Photovoltaic Glass, for example, can be considered a disruptive innovation for a construction company if you choose to use resource for providing electricity to areas where conventional power may be supplied.

2. The study of empirical research

The link between innovation and the level of performance of a company has been extensively analysed over time to identify the causal relationship between the level of R&D, innovation and productivity. The study made on 1494 companies in Ireland highlights a higher level of profit in innovative companies compared to the non-innovative, with significant differences in terms of labour productivity (Love, Roper and Du, 2009).

The profitability of companies is influenced by the whole activity of innovation, with different effects depending on the type of innovation chosen. Thus, by separating the product innovation of process innovation, can be noticed a decrease in profitability level of a company in case of using the product innovation. On the other side, process innovation has positive and stable effect on the profitability of a company (Leiponen, 2000).

Leiponen (2000) consider the reduction of profitability of the company a disruptive effect generated by the discontinuity in the technological process. Analysing this hypothesis at the US services sector, Mansury and Love (2008) considers that the disruption effect is not strong enough to reduce productivity. Moreover, the authors of the study suggest that the productivity of companies in the service sector is not affected by the process of innovation, be it radical or incremental innovation.

Researching the impact of innovation on labour productivity, Mairesse and Robin (2008) showed that the product innovation generated a high level of labour productivity in France in 1998-2000 and 2002-2004.On the other hand, the process innovation does not influence the labor productivity level. This idea is supported by the authors Brown and Guzman (2014), after a research on 2078 companies of Mexico, indicating that labor productivity at innovative companies' level is with 1.3 times higher than in the case of companies with a low innovation level.

In a recent study made on 16,623 companies of Italy, Bartoloni and Baussola (2015) come to contradict the conclusion above, relating to incapacity of product innovation to improve the profitability level of the company. The authors consider that this type of innovation can have significant benefits on the performance of a company as long as the innovation process is used on a longer time horizon. Otherwise, the results recorded will be positive but insignificant in the case of occasional innovations. To provide a positive effect is necessary to complete the innovation activities with efficient marketing activities.

The research findings of Bartoloni and Baussola (2015) are supported by the analysis of Deschryvere (2014) performed on companies in Finland. The results of this study shows the positive impact that can have both the product and process innovation on profitability of companies. But the innovation effects are different depending on class size of companies engaged in innovation activities. Thus, the use of occasional product innovation generates negative effects both at the small companies level and large companies level. In the case of occasional process innovation, the results recorded are positive but insignificant for the two size classes.

Both process and product innovation, whether occasional or continuous, causes positive effects on performance for medium sized businesses. But, continuous process innovation generates the greatest benefits to the large companies but it gives less significant positive benefits for small and medium businesses.

Analysing the capacity of the radical and incremental innovation to improve the performance of the companies has been established that the positive effects coming from the radical innovation, even if is occasional or persistent in time. The effect of radical innovation on firm profitability can be increased by combining it with efficient marketing activities, these two generates the increase of profitability level of around 2.2 percentage points (Bartoloni and Baussola, 2015).

3. Empirical analysis

In order to achieve the analysis was constructed a panel of data from 14 European companies operating in construction sector such as: production and distribution of building materials, design and engineering, execution of residential and non-residential constructions. The motivation for choosing this sector as a basis for analysis, resides in the limited number of empirical studies highlighting the impact of the innovation process over the level of performance of construction companies.

The database used is Thomson Reuters Eikon. Within this sample are included enterprises which registered innovation activity since their establishment until today. The data collected were recorded annually in the period 2007-2014, were obtained a total number of 112 observations. The frequency of the annual data used is caused by the lack of monthly, quarterly or semestrial records relating to analysed indicators.

The importance of the construction sector in the national economic development in conjunction with decreased performance in the recent period (2007-2014), determines the need to find solutions for the economic recovery of this sector. If innovation, seen as a solution for developing companies may bring benefits to certain sectors under certain conditions (according to the information previously submitted), still remains the question of whether this process can be beneficial for the development of companies in the construction sector.

At basis of the research stand the main performance indicators of a company: Pb (gross profit) and Vt (total income), and basic indicators of the innovation: CD (Research and development expenses), Br (the value of patents held by the firm, obtained as a result of research and development or purchased). Also was analysed the relationships of these indicators W (labor productivity), Nr (number of employees) and Cp (equity). These seven indicators were chosen having regard to their ability to determine the level of performance of a company and the level of development of innovation activity but also the level of other factors of production (labor force and capital).

According to Thomson Reuters Eikon, definitions of the indicators that make up the panel are the following (Reuters, 2009):

- *Gross profit (Pb)* is a measure of the operating performance of the company and is calculated as the difference between total revenue and total expenditure.

- *Total revenues (Vt)* is income from all operating activities of the company after deducting any sales adjustments and their equivalents.

- *Total Equity (Cp)* is the equities of majority and minority shareholders of the company.

- *Research and development (CD)* is expenditure on research and development of new products and services registered in a company.

- *Value of Patents (Br)* is the value of patents for products and manufacturing processes recorded in the company.

- *Labour productivity (W)* represents the labor time used to achieve a unit of product.

- *Number of employees (Nr)* represents the total number of people reported to be committed at the end of each year.

Because the value of these indicators are expressed in different scales sizes (thousands, tens of thousands, hundreds of thousands of Lei or number of employees), the analysis was performed by expressing the indicators as percentage of annual growth rate (annual percentage change). Moreover, using the winsorize process (cutting) to reduce the effect of the observations with extreme values (outliers). Including outliers in regression has a drastic effect on the terms with statistical significance: R^2, t-stat, the value or sign of beta coefficient of the independent variables.

The winsorize process replaces extreme observations, larger or smaller than a particular level (e.g. 90% and 10%). For example: the pace of variation of the series of research and development spending (R_CD) record, for some observations, growth rates (R_CD) over 1200%, which is totally excessive and with an exaggerate influence over a regression. We chose a winsorize process 90% – 10% because it is proportional with the total number of

observations (less than 100) for each series. The new series of research and development (WR_CD) has annual rates of variation which lies between 20% and 60%, much more sensitive (Figure no. 2).

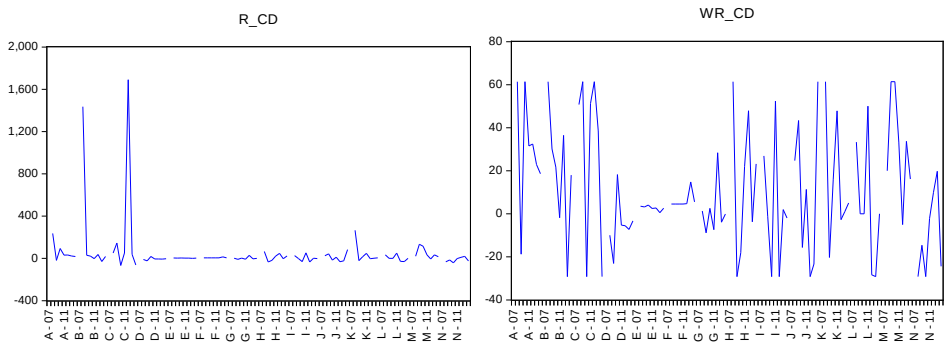

Figure no. 2: The graphic evolution of annual percentage variation of research and development spending, compared with the values obtained after winsorize process (cutting the extremes)

Our empirical analysis was performed by using a multiple regression model that highlights the cross-correlation of the main indicators of the performance of an enterprise (gross profit and total revenue) and innovation indicators (patents, research and development expenses) but also the indicators for obtaining this performance (equity, labour productivity and employment). For analysing the level of cross-correlation between the indicators defined above have been formulated the following working hypothesis:

- *Hypothesis 1.* Gross profit is positively influenced by the evolution of the innovation activity.

- *Hypothesis 2.* Total income is in positive cross-correlation with the innovation activity.

- *Hypothesis 3.* Innovation activity is in direct cross-correlation with labor productivity and with the number of employees.

- *Hypothesis 4.* Gross profit is positively influenced by the evolution of total equity, labor productivity and the number of employees.

- *Hypothesis 5.* Total income is positively influenced by the evolution of the total equity, labor productivity and the number of employees.

Research and development expenditures do not always equate with successful innovations, at products and/or improved processes (European Commission, 2013). Therefore, it is necessary to analyze the impact of value of patents on the company performance. To determine if there is an interdependence between research and development expenditures and value of patents was proposed for analysis the next hypothesis.

- *Hypothesis 6.* The evolution of value of patents is positively influenced by evolution of research and development expenditures recorded at the company level.

An overview on the confirmation of the assumptions made above is provided by the correlation matrix between the independent variables and the dependent variables mentioned above. The analysis of the correlation matrix between the percentage variation of gross profit and the value of patents and research and development expenditures as well as the annual percentage variation between gross profit compared to the total equity, labor productivity and the number of employees gives a first clue over the positive/negative correlations of these variables. The result obtained is shown in Table no. 1.

Table no. 1: The correlation matrix between the dependent variables from the hypothesis of our study and independent variables (winsorize sizes)

	WR_PB	**WR_VT**	**WR_BR**	**WR_CD**	**WR_CP**	**WR_W**	**WR_NR**
WR_PB							
WR_VT	64%						
WR_BR	26%	34%					
WR_CD	37%	55%	18%				
WR_CP	52%	44%	48%	26%			
WR_W	22%	48%	2%	14%	-6%		
WR_NR	46%	63%	39%	43%	51%	-28%	

Analyzing the correlation matrix between variables it can be seen that:

- For hypothesis 1 and 2, the percentage evolution of gross profit (WR_PB) and of total revenues (WR_VT) are in positive correlation with the evolution of the value of patents (WR_BR, ρ = 26%, respectively, ρ = 34%) and the R & D expenditures (WR_CD, ρ= 37%; respectively, ρ = 55%);

- For hypothesis 3, the percentage evolution of the value of patents (WR_BR) and R & D expenses (WR_CD) are in positive correlation with productivity gains (WR_W, ρ = 2%; respectively, ρ = 39%) and with the number of employees (WR_NR, ρ = 39%; respectively, ρ = 43%). Among all correlations, the evolution of the value of patents and labor productivity has a very low intensity (2%);

- For hypothesis 4 and 5, the evolution of the gross profit (WR_PB) and total income (WR_VT) is positively correlated with the evolution of equity (WR_CP, ρ = 52%; respectively, ρ = 44%), with labor productivity (WR_W, ρ = 22%; respectively, ρ = 48%) and with the number of employees (WR_NR, ρ = 46%; respectively, ρ = 63%);

- For hypothesis 6, the percentual evolution of the value of patents (WR_BR) is in positive correlation with the evolution of R & D expenditures (WR_CD, ρ = 18%).

Multiple regression analysis will indicate to what extent these relationships are valid and from statistical point of view.

Hypothesis 1: WR_PB ~ WR_BR and WR_CD

The initial model: WR_PB = C(1) + C(2)*WR_BR + C(3)*WR_CD

- The model with fixed effects[1] on companies (cross section):

$$WR\_PB = C(1) + C(2)*WR\_BR + C(3)*WR\_CD + [CX=F] \quad (1)$$

- The model with fixed effects per years (period):

$$WR\_PB = C(1) + C(2)*WR\_BR + C(3)*WR\_CD + [PER=F] \quad (2)$$

- The model with fixed effects on companies (cross section) and per years (period):

$$WR\_PB = C(1) + C(2)*WR\_BR + C(3)*WR\_CD + [CX=F, PER=F] \quad (3)$$

where:

WR_PB - the annual evolution of the gross profit;

WR_BR - the annual percentual evolution of the value of patents;

WR_CD - the annual percentual evolution of R&D expenditures;

[CX=F] - the model with fixed effects on companies.

[PER=F] - fixed effects per years;

[CX=F, PER=F] - fixed effects on companies per years.

The adjustment of coefficients errors was done by changing the matrix of variance-covariance of the model (White cross-section). In this way, the errors of coefficients estimated are more robust against the induced effect of heteroscedasticity. To determine the validity of the hypothesis 1 has analysed the impact of the value of patents and of the R&D expenditures on gross profit. Results obtained are shown in Table no.2.

Table no.2: Comparative analysis of regression models between the variation of gross profit (WR_PB) and the value of patents (WR_BR) and the research and development expenditures (WR_CD), winsorize sizes

WR_PB ~	Initially	Fixed effects		
		On companies	On years	On companies and on years
	1	1.1	1.2	1.3
WR_BR	0.142**	0.093 -	0.184**	0.135*
WR_CD	0.231***	0.177**	0.191**	0.129 -
Adj R[1]	15.7%	13%	18.9%	16.7%
Schwarz criterion	8.62	9.15	8.84	9.32
Prob(F-statistic)	0.00	0.03	0.00	0.02
Periods	7	7	7	7
Cross section	14	14	14	14
N	98	98	98	98

*Note: ***Significant at 1%;**Significant at 5%; *Significant at 10%; - Non-significant*

Note: We chose for the fixed effects on companies and on periods because the regression series contained annual data for a relatively short time. Therefore, using random effects is not justified.

From the analysis results can be appreciated that the best evaluation of the relationship between the gross profit and the indicators of innovation can be realized by fixed effects model on years (PER = F) and with an adjusted R^2 coefficient of about 19%. This result explains the significant positive impact that the activity innovation can have on the gross profit, and represent a base to accept the hypothesis one. Yet, the adjusted R^2 coefficient is reduced, which indicates that there are other independent variables that determine the evolution of gross profit. To emphasize a more comprehensive determination of the evolution of gross profit, was selected WR_PB model with all six independent factors (WR_VT, WR_CP, WR_BR, WR_CD, WR_W and WR_NR). The analysis of the implications of the innovation indicators on the gross profit made by the model with fixed effects on companies, fixed effects on periods and fixed effects on companies and periods is presented in Appendix 1. The impact of the two indicators of innovation on the evolution of gross profit also highlighted in Appendix 1. Analysing the evolution of potential profit it can be seen that this is determined of the six independent variables in proportion of 43% but innovation indicators (WR_BR and (WR_CD) and the two indicators of performance (WR_W and WR_NR) have coefficients with high probability coefficients (between 38% and 87%) to be statistically insignificant. Finally, the variation of gross profit is determined, as was expected, by the variation of total revenues and the variation of total equity. The obtained results are presented in table no. 3.

Table no. 3: The correlation between gross profit and the main innovation and performance indicators

Dependent Variable: **WR_PB**				
Method: Panel Least Squares				
Periods included: 7				
Cross-sections included: 14				
Total panel (balanced) observations: 98				
White diagonal standard errors & covariance (d.f. corrected)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.28	2.09	1.57	0.12
WR_VT	0.97	0.36	2.68	**0.01**
WR_BR	-0.07	0.08	-0.89	**0.38**
WR_CD	-0.05	0.08	-0.69	**0.49**
WR_CP	0.29	0.17	1.67	**0.10**
WR_W	-0.05	0.33	-0.16	**0.87**
WR_NR	-0.15	0.37	-0.39	**0.69**
	Effects Specification			
Cross-section fixed (dummy variables)				
Period fixed (dummy variables)				
R-squared	0.58	Mean dependent var		10.45
Adjusted R-squared	**0.43**	S.D. dependent var		18.97
F-statistic	3.98	Schwarz criterion		9.06
Prob(F-statistic)	**0.00**	**Durbin-Watson stat**		**2.36**

Hypothesis 2: WR_VT ~ WR_BR and WR_CD

Models for hypothesis 2 are relatively similar with models for hypothesis 1 (as can be seen in Table no. 4). From the results it is observed that the variation of value of patents an mostly the variation of R&D expenditures have a significant impact on the evolution of total revenues, both in terms of size volatility coefficients (between 0.130 and 0.259) and in terms of statistical significance of these coefficients for the value of patents (1%) and R&D expenditures (1%).

Table no.4: The comparative analysis of regression models between the variation of total revenues (WR_VT) and the variation of value of patents (WR_BR) and research and development expenditures (WR_CD) winsorize sizes

WR_VT ~	Initially	Fixed effects		
		On companies	On years	On companies and on years
	1	1.1	1.2	1.3
WR_BR	0.130***	0.122***	0.151***	0.137***
WR_CD	0.259***	0.256***	0.208***	0.194***
Adj R^2	34.8%	41.3%	42.3%	50.8%
Schwarz criterion	7.80	8.16	7.89	8.18
Prob(F-statistic)	0.00	0.00	0.00	0.00
Periods	7	7	7	7
Cross section	14	14	14	14
N	98	98	98	98

*Note: *** Significant at 1%; ** Significant at 5%; * Significant at 10%*

Total revenue (WR_VT) have a complex determination which can be highlighted by four of the five independent variables (WR_CD, WR_CP, WR_W and WR_NR). Was selected the model without fixed effects, as the best model (as can be seen in table no.5).

Table no. 5: The correlation between the total income and the main innovation and performance indicators

Dependent Variable: WR_VT				
Method: Panel Least Squares				
Periods included: 7				
Cross-sections included: 14				
Total panel (balanced) observations: 98				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.12	0.58	0.21	0.83
WR_BR	-0.01	0.02	-0.57	0.57
WR_CD	0.06	0.02	2.83	0.01
WR_CP	0.06	0.03	2.00	0.05
WR_W	0.93	0.05	17.22	0.00
WR_NR	0.79	0.05	15.07	0.00
R-squared	0.88	Mean dependent var		6.80
Adjusted R-squared	0.88	S.D. dependent var		14.01
F-statistic	140.82	Schwarz criterion		6.23
Prob(F-statistic)	0.00	Durbin-Watson stat		1.75

Thus, the variation of total revenue is significantly determined by factors of production (capital and labor), a very important influence being given by labor indicators (WR_W = 0.93 and WR_NR = 0.79). A low determination comes from R&D expenditure (WR_CD = 0.06) and the value of patents have not a significant coefficient of volatility, in size (- 0,01) or statistically (probability of being zero is 57%).

Hypothesis 3.1 WR_BR ~ WR_W and WR_NR

From the analysis of regression models was selected the model with fixed effects on years (periods) as the most significantly statistic. The obtained results are presented in table no. 6.

Table no. 6: The correlation between the number of patents and the main performance indicators

Dependent Variable: WR_BR				
Method: Panel Least Squares				
Periods included: 7				
Cross-sections included: 14				
Total panel (balanced) observations: 98				
White period standard errors & covariance (d.f. corrected)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	4.84	1.83	2.64	0.01
WR_W	0.53	0.25	2.15	0.03
WR_NR	1.06	0.16	6.53	0.00
	Effects Specification			
Period fixed (dummy variables)				
R-squared	0.26	Mean dependent var		11.55
Adjusted R-squared	0.19	S.D. dependent var		26.79
F-statistic	3.83	Schwarz criterion		9.53
Prob(F-statistic)	0.00	Durbin-Watson stat		1.85

Hypothesis 3.2 WR_CD ~ WR_W and WR_NR

From the analysis of regression models was identified the model without fixed effects as the most statistically significant model. Both innovation indicators (WR_BR and WR_CD) have a reduced determination of the labor indicators. Thus, the evolution of WR_BR and WR_CD is determined of WR_W and WR_NR in proportion of 19% respectively 25% (as can be seen in table no.7).

Table no. 7: The correlation between R & D expenditure and the main performance indicators

Dependent Variable: WR_CD				
Method: Panel Least Squares				
Periods included: 7				
Cross-sections included: 14				
Total panel (balanced) observations: 98				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.86	2.68	1.44	0.15
WR_W	0.76	0.25	3.09	0.00
WR_NR	1.08	0.19	5.61	0.00
R-squared	0.26	Mean dependent var		10.93
Adjusted R-squared	0.25	S.D. dependent var		27.27
Log likelihood	-447.56	Akaike info criterion		9.20
F-statistic	16.96	Schwarz criterion		9.27
Prob(F-statistic)	0.00	Durbin-Watson stat		2.13

Hypothesis 4: WR_PB ~ WR_CP, WR_W and WR_NR
From the analysis of regression models was selected the model with fixed effects on years (periods) as the most significantly statistic. The obtained results are presented in table no. 8.

Table no. 8: The correlation between gross profit and factors of production

Dependent Variable: WR_PB				
Method: Panel Least Squares				
Periods included: 7				
Cross-sections included: 14				
Total panel (balanced) observations: 98				
White period standard errors & covariance (d.f. corrected)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.18	1.33	2.40	0.02
WR_CP	0.29	0.17	1.75	0.08
WR_W	0.73	0.15	4.94	0.00
WR_NR	0.62	0.22	2.81	0.01
	Effects Specification			
Period fixed (dummy variables)				
R-squared	0.50	Mean dependent var		10.45
Adjusted R-squared	0.45	S.D. dependent var		18.97
F-statistic	9.70	Schwarz criterion		8.49
Prob(F-statistic)	0.00	Durbin-Watson stat		2.13

The evolution of gross profit in the construction sector has a significant determination (R^2 adj = 45%) of the factors of production (capital and labor), both in size of volatility coefficients (between 0.29 and 0.73) as well as statistical significance.

Hypothesis 5: WR_VT ~ WR_CP, WR_W and WR_NR
From the analysis of regression models was selected the model with fixed effects on companies (cross section) as the most significantly statistic. The obtained results are presented in table no. 9.

Table no. 9: The correlation between the total income and factors of production

Dependent Variable: WR_VT				
Method: Panel Least Squares				
Periods included: 7				
Cross-sections included: 14				
Total panel (balanced) observations: 98				
White cross-section standard errors & covariance (d.f. corrected)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.22	0.30	0.73	0.47
WR_CP	0.07	0.02	2.98	0.00
WR_W	0.96	0.03	27.42	0.00
WR_NR	0.85	0.06	15.04	0.00
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0.90	Mean dependent var		6.80
Adjusted R-squared	0.89	S.D. dependent var		14.01
F-statistic	47.95	Schwarz criterion		6.55
Prob(F-statistic)	0.00	Durbin-Watson stat		2.16

The evolution of total revenues in the analyzed construction sector has the strongest determination (R^2 adj = 89%) from labor factors (labor productivity and number of employments) with volatility coefficients of 0.96 for WR_W and 0.89 for WR_NR. Although statistically significant, the coefficient of equity volatility is low (only 0.07).

Hypothesis 6: WR_BR ~ WR_CD

Analyzing the validity of the hypothesis is found a negative inter-correlation between the evolution of patents value and the evolution of R&D expenditure. Both the model without fixed effects and the model with fixed-effects, the adjusted R^2 takes values from 0.02 to 0.07 which are able to invalidate the hypothesis 6.

Conclusions

Analyzing the impact of innovation on company performance in the construction sector it is found a direct positive correlation between the indicators of innovation and indicators of performance. Thus, the level of performance of companies in the construction sector, expressed by gross profit and total income is influenced in proportion of 18.9% and 34.8% by the evolution of indicators of innovation (R&D expenditures and the value of patents).

Analyzing the impact of capital and labor on performance of companies in the construction sector resulted a positive correlation between the factors of production (capital, labor productivity and number of employees) and performance indicators used. Thus, the evolution of gross profit is influenced by production factors with almost 45%, which influence with almost 89% the evolution of total revenue recorded by companies in the construction sector.

According to Christensen (2004) the innovation capacity to determine the improve of company's market position and strengthen or create a competitive advantage is generated by a number of factors such as firm size, type innovation, marketing activities, the specific of the sector of activity and the market from which the company take part. Based on study results made on companies in the construction sector there is an insignificant interdependent relationship between company size and innovation activity, a situation which contradicts the above statement.

The positive relationship between the innovation factors (value of patents and R&D expenses) and the performance indicators (gross profit, total income) helps to reinforce the idea that innovation activity can help improve company growth. The dimension of the innovation activity impact depends on the specific of business sector and its openness towards such activities.

The importance of the study is given by the ability of innovation to raise the level of performance to a company of construction sector, a sector that is characterized by multiple particularities, which generates the need to identify effective solutions for development. The existence of other indicators of innovation and their capacity to improve the performance to a company of construction sector and the correlation between innovation indicators and performance indicators of construction sector companies from Romania will provide the premises for further research.

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Appendix 1

1. The initial model: WR_PB = C(1) + C(2)*WR_BR + C(3)*WR_CD

Dependent Variable: WR_PB				
Method: Panel Least Squares				
Date: 06/20/15 Time: 16:09				
Sample (adjusted): 2008 2014				
Periods included: 7				
Cross-sections included: 14				
Total panel (balanced) observations: 98				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.288175	2.003124	3.139184	0.0023
WR_BR	0.141888	0.067137	2.113407	0.0372
WR_CD	0.230739	0.065961	3.498122	0.0007
R-squared	0.174468	Mean dependent var		10.44866
Adjusted R-squared	0.157088	S.D. dependent var		18.97213
S.E. of regression	17.41836	Akaike info criterion		8.583060

Sum squared resid	28822.91	Schwarz criterion	8.662192
Log likelihood	-417.5699	Hannan-Quinn criter.	8.615067
F-statistic	10.03865	Durbin-Watson stat	2.340958
Prob(F-statistic)	0.000111		

1.1. The model WR_PB with fixed effects on companies (cross section):

WR_PB = C(1) + C(2)*WR_BR + C(3)*WR_CD + [CX=F]

Dependent Variable: WR_PB				
Method: Panel Least Squares				
Date: 06/20/15 Time: 15:15				
Sample (adjusted): 2008 2014				
Periods included: 7				
Cross-sections included: 14				
Total panel (balanced) observations: 98				
White cross-section standard errors & covariance (d.f. corrected)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.441075	2.890185	2.574602	0.0118
WR_BR	0.092763	0.074841	1.239465	0.2187
WR_CD	0.177165	0.091708	1.931843	0.0568
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0.264742	Mean dependent var		10.44866
Adjusted R-squared	0.130243	S.D. dependent var		18.97213
S.E. of regression	17.69355	Akaike info criterion		8.732560
Sum squared resid	25671.07	Schwarz criterion		9.154596
Log likelihood	-411.8954	Hannan-Quinn criter.		8.903265
F-statistic	1.968361	Durbin-Watson stat		2.560172
Prob(F-statistic)	0.027668			

1.2. The model WR_PB with fixed effects on years (period):

WR_PB = C(1) + C(2)*WR_BR + C(3)*WR_CD + [PER=F]

Dependent Variable: WR_PB
Method: Panel Least Squares
Date: 06/20/15 Time: 15:34
Sample (adjusted): 2008 2014
Periods included: 7
Cross-sections included: 14
Total panel (balanced) observations: 98
White period standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.235145	2.011178	3.100246	0.0026
WR_BR	0.183940	0.095054	1.935105	0.0562
WR_CD	0.191146	0.087401	2.187007	0.0314
	Effects Specification			
Period fixed (dummy variables)				
R-squared	0.256096	Mean dependent var		10.44866
Adjusted R-squared	0.189228	S.D. dependent var		18.97213
S.E. of regression	17.08305	Akaike info criterion		8.601393
Sum squared resid	25972.93	Schwarz criterion		8.838788
Log likelihood	-412.4683	Hannan-Quinn criter.		8.697415
F-statistic	3.829881	Durbin-Watson stat		2.382136
Prob(F-statistic)	0.000656			

1.3. The model WR_PB with fixed effects on companies (cross section) and on years (period):

WR_PB = C(1) + C(2)*WR_BR + C(3)*WR_CD + [CX=F, PER=F]

Dependent Variable: WR_PB				
Method: Panel Least Squares				
Date: 06/20/15 Time: 15:35				
Sample (adjusted): 2008 2014				
Periods included: 7				
Cross-sections included: 14				
Total panel (balanced) observations: 98				
White diagonal standard errors & covariance (d.f. corrected)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.471846	2.466370	3.029491	0.0033
WR_BR	0.135335	0.080775	1.675448	0.0980
WR_CD	0.129354	0.093230	1.387465	0.1694
	Effects Specification			
Cross-section fixed (dummy variables)				
Period fixed (dummy variables)				
R-squared	0.347633	Mean dependent var		10.44866
Adjusted R-squared	0.167374	S.D. dependent var		18.97213
S.E. of regression	17.31175	Akaike info criterion		8.735394
Sum squared resid	22776.96	Schwarz criterion		9.315693
Log likelihood	-406.0343	Hannan-Quinn criter.		8.970113
F-statistic	1.928518	Durbin-Watson stat		2.654025
Prob(F-statistic)	0.020303			