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Investigate PLM Presence - Case study of Kosovo and Albania

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Abstract: Recently there has been an approach to adopt Product Lifecycle Management (PLM) in different industries. While companies in production sector struggle to maintain their presence in the marketplace, the need for new methodologies and tools has become critical. Adopting PLM varies from business to business and the downside has been determined to be the cost and longevity. Many authors have stated that PLM helps companies regarding innovation and faster product delivery to the market, however, such studies require more time and effort to scientifically provide strong evidence. The overall aim of the study is to investigate the PLM presence in Kosovo and Albania. The research base relies on literature review in reference to PLM relevant importance to the industry, definition, and questioner interviews with companies. The study provides the current self-evaluation of the current state of PLM drivers through statistical means.

Keywords: Product, lifecycle, approach, adoption, development, management, implementation, innovation, methods

1. INTRODUCTION

Nowadays companies are focusing utilizing best available proven managerial skills and latest trend of 21st-century technological means to maintain continuous growth. The rapid change in supply-demand cycle companies needs to be up to date with technology and know-how. The need for an innovative product that solves costumer's needs are becoming critical as well as access to quickly modify existing products to meet the new demands to maintain the client base and attract new clients is growing due to local and global competition. Even though there are technological means available it is not an easy task to manage and adopt new technologies due to many facts such as costs, organization culture, process change, standardization, training, clients, etc. Today many businesses before utilizing new techniques for their products or services tend to adopt proven technologies and means that will connect their operations with their suppliers and clients so can be stated that stakeholders play an important role in choosing new systems. Being innovative in today's marketplace means you must have a set of features and to be very adaptive and fluid to the market change by identifying client needs and company reaction to meet those needs.

With the globalization of the markets, it is becoming increasingly important to understand a broader client base not only a local or a regional but a world aspect. A similar concept is applicable for foreign companies that may take over your customer base due to the overwhelming competitive advantage companies may utilize for their benefit. The need to innovate new efficient and effective processes has become more critical than ever before. The need for speed for new product development and fast return to client feedback is almost present in all companies. Companies after they design and develop a particular product they will focus by having a maintenance plan for their products in a long term. The integration of idea, planning, development, testing, launching the product, maintenance, modification requires a significant organization effort to involve all departments and levels of management for a successful outcome to the client. In today's dynamic environments clients don't only expect functionality but also maintenance and stylish to satisfy their needs (Stark, 2011).

2. LITERATURE REVIEW

The emergence of PLM has many reasons however one of them is an increase of globalization requires global reaction to different product requirements for upgrades, modifications, innovations, new opportunities targeting various markets, etc. therefore PLM appeared in the 21st century as a solution to product management across entire life cycle. In the manufacturing area in the last few decades different technologies, management techniques and styles have changed and re-shaped how products are created and managed (Wiesner et al., 2015). Companies have always maintained the products somehow or to some extent but at the time products were developed were not viewed as strategic as they are today. Businesses want to produce goods and still control their assets, modify them, keep the current clients and potentially add new customer base as the strategic approach was not part of the companies planning, and often

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anyone could explain how the company had any plan for product management across lifecycle (Stark, 2011).

New systems such as PLM that respond collectively to the needs is the answer to the fast-growing competition to the complex products. Optimizing PLM processes has gained an important objective in manufacturing enterprises to overall improve the sustainability as well as creating competitive advantage (Zhang et al., 2017). Previous models such as ERP models have only addressed organisation needs partially such as administrative and financial matters. Also, Product Data Management (PDM) systems have mainly addressed the ICT portion focusing on CAD/CAE therefore didn't offer complete product lifecycle management from "cradle to grave".

Product Lifecycle Management approach associated with a new set of components that regarding strategy & vision, process, collaboration, organizational knowledge management, ICT based systems, data management and extended network with the aim of delivering innovation through an innovative approach that would deliver the product faster and with fewer less costs (Garetti et al., 2005).

PLM business models may apply to industries such as manufacturing, engineering, and other services sectors. PLM can be applied even in curriculum design (Walsh, 2015). According to Garetti et al. "PLM is being considered a major technological and organizational challenge of this decade to face the shortening of product lifecycles (Garetti et al., 2005). The trend toward collaboration in product design and product manufacturing and, in general, to deal with a large amount of product-related data amongst business actors in inter-enterprise contexts". The product stages are closely tied to the client needs where today manufacturing is being re-shaped by shift from a in massive paradigm into a new cycle based on demand (Ferreira et al., 2017).

According to Camba et al. new approaches model-based enterprise involves by ripping the benefits of different existing systems such as CAD and by combining them with PLM where additional data can be centralized to further create a faster response to the product development activities (Camba et al., 2017).

According to Wire, PLM market is estimated to be around $40.26 billion (Wire, 2015). The growing market trend was predicted to be growing annually around 8.1% from 2015 to 2022 (Wire, 2015).

The research in PLM is still in its early phase and can be considered of high importance to provide a clear pathway for future businesses looking to implement PLM (Silventoinen, Papinniemi, and Lampela, 2009). According to Daniels et al. the expected changes in the area of PLM are to have a faster product and production taking place in efficient use or the re-use of knowledge management in the different product lifecycle activities that has previously lacked (Daniels et al., 2013). The manufacturing industry is changing from 2D to 3D therefore changes from traditional methods are evident thus a need for rapid information sharing and shortening of cycles of product creating and improving is becoming critical to maintain competitiveness (Zhu et al., 2016).

According to Deuter and Rizzo, one of the main drivers of industrial smart products is Internet of Things and new smart products are on the rise thus increasing overall functionality of smart products by combination of various lifecycle models (Deuter and Rizzo, 2016). On the other hand, new and smart technologies are thought to increase on all aspects of life by 2020 therefore IoT and PLM are no exception (Sodhro, Pirbhulal and Sangaiah, 2018).

Changes taking place in the global level are affecting companies regardless of their location therefore maintaining product information during entire lifecycles remains a challenge for SME's competing in global contest (Soto-Acosta, Placer-Maruri and Perez-Gonzalez, 2015)

3. METHODOLOGICAL APPROACH

The study is based on a literature review and by collecting the data through questioner observation at companies. The target industry were sectors involved in manufacturing areas such as Industrial manufacturers of different products such as wood commodities, metal industry, plastics, IT software, drinks and food industry, telecommunications, etc. to analyse their current operations and if they are moving toward PLM implementation. As a general guidance, a questioner has been tailored to examine the existing situation with crucial PLM drivers' implementations with questions that will answer the set questions based on current PLM frameworks for the following critical dimensions described in the figure below that includes five business domains explained by (Scheper, 2002). The table has been further modified based on (Batenburg, Helms and Versendaal, 2005) as well as other literature support on critical components of each PLM dimension.

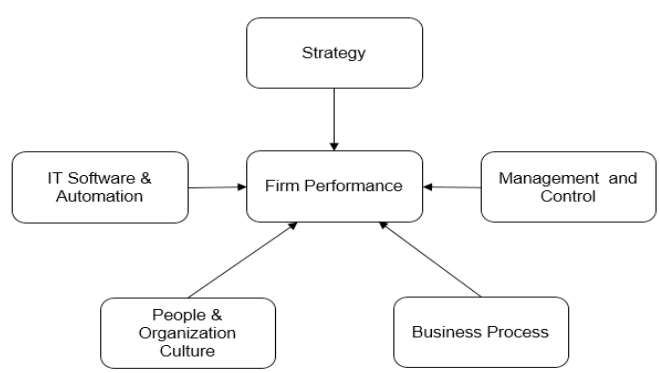

Fig. 1. PLM Model based on five (5) key dimensions (Scheper, 2002).

The overall aim of the study is to investigate the PLM presence in Kosovo and Albania.

3.1 Field Survey

Selecting the proper method ensures unbiased results, and it is considered critical element in every study. The research was organized by first defining the research goals and objectives followed by most relevant literature review in the combination of creating questionnaire and previous frameworks and adopting most relevant information after a thorough review of pertaining literature. The research included 161 companies in Kosovo and Albania in the manufacturing industry. The data collected was examined through SPSS. In this case study, a five Likert type scale based on five opinions expression for the model utilized (Likert, 1932). The questions were designed that an average survey would take about 20 minutes. The study targeted various management levels at the companies (CEOs, Executive Level, Managerial, Engineers, Economists, etc.). The study was conducted during July 2017 through Oct 2017.

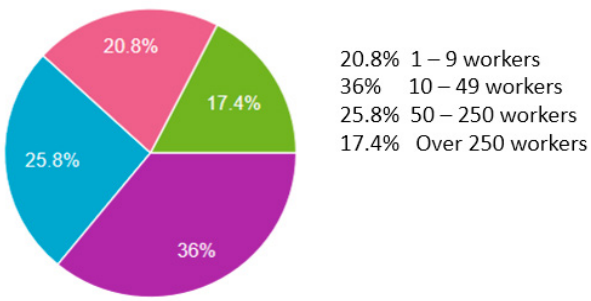

Fig. 2. Number of workers for selected companies.

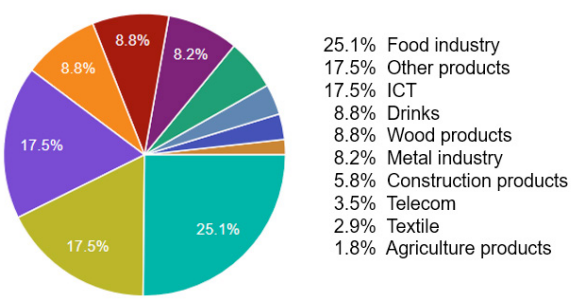

Fig. 3. Type of company sector.

The Companies structure overall in Kosovo and Albania are micro and small enterprises that make over 96%. The focus was to include different company sizes and measure their effectiveness in implementing PLM drivers. According to Stark size of the company, even small they can still apply technological tools that are part of the PLM even in some cases may take advantage of it (Stark, 2011).

4. RESULTS ANALYSIS

In our case, it was necessary to perform a linear regression to come to a determination about the effects of independent variables (Business Strategy, Management & Control, Business Process, Organization Culture, and People & Information Technology) and the dependent variable Performance. Statistical Package for the Social Sciences (SPSS) has been utilized to generate the analyses results.

Table 1 shows regression model summary in the multiple correlation coefficients that measures the strength of the linear relationship in response to variable and set of variables explanation. In a case of multivariable like in our case, this allows us to measure the correlation that involves the response variable and more than one explanatory variable. The typical values of R square are in the range between 0 to 1; the smaller the value shows that the model doesn't fit well. In our case table, 7 shows R square that it indicates that the adjusted R square is 0.74 meaning/ referring that the independent variables explain the 74% percent of the total effect on performance which is the dependent variable.

Table 1. Regression model summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.865[a]	.749	.740	.29326	.749	92.275	5	155	.000	2.177

a. Predictors: (Constant), IT, strategy, Process, OC, MC

b. Dependent Variable: Performance

Coeffcient Table 2 indicates that Business Strategy, Management & Control, Business Process, Organization Culture /People & Information Technology have acceptable significance levels at the 99 percent confidence level. So the regression function is: Performance = -.130 + 0.170 Business Strategy +.200 Management & Control +.230 Business Process +.170 Organisation Culture& People +.246 Information Technology & Automation.

Table 2. Coefficient

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Correlations Zero-order	Partial	Part	Collinearity Statistics Tolerance	VIF
1	(Constant)	-.130	.215		-.604	.547					
	strategy	.170	.067	.155	2.647	0.01	.658	.208	.107	.473	2.114
	MC	.200	.068	.201	3.024	0.00	.733	.236	.122	.368	2.718
	Process	.230	.065	.242	3.638	0.00	.760	.280	.147	.368	2.717
	OC	.170	.062	.170	2.711	0.01	.725	.213	.109	.414	2.415
	IT	.246	.048	.277	5.159	0.00	.697	.383	.208	.562	1.778

a. Dependent Variable: Performance

The one-way analysis of variance ANOVA is mainly used to check whether there are any significant differences

statistically between the means of three or more independent groups where in our case we have five different independent variables and one dependent variable. Table-3 from the Anova results it indicates that the significance of the model, in general, is .000 which is acceptable at the 99 percent confidence level.

Table 3. ANOVA results

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	39.679	5	7.936	92.275	.000[b]
	Residual	13.330	155	.086		
	Total	53.009	160			

a. Dependent Variable: Performance

b. Predictors: (Constant), IT, strategy, Process, OC, MC

Table 4 below shows the descriptive statistics.

Table 4. Descriptive statistics

Descriptive Statistics

	Mean	Std. Deviation	N
Performance	4.2245	.57559	161
strategy	4.2573	.50528	161
MC	4.2697	.56582	161
Process	4.1597	.58758	161
OC	4.2298	.57746	161
IT	4.1819	.64740	161

a. Dependent Variable: Performance

b. All requested variables entered.

The table 5 shows residuals statistics summarises the predicted values and residuals. Considering the standardized residuals due to their ease of interpretation it is standard practice to start with therefore from the observations we don't see any outliers going beyond values of 3.3 or less than 3.3. From the observations, we can consider that we are within limits.

Table 5. Residuals statistics

Residuals Statistics

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	2.4799	5.0355	4.2245	.49799	161
Residual	-.90416	.94225	.00000	.28864	161
Std. Predicted Value	-3.503	1.629	.000	1.000	161
Std. Residual	-3.083	3.213	.000	.984	161

Cronbach's Alpha is used to calculate the reliability coefficients surveys for the PLM implementation based on Likert scale sets. The values of the Cronbach's alpha range from 0 to 1.0 and higher values denoting increased reliability. In this case, the criteria to be acceptable Cronbach's alpha coefficient is widely debated throughout the literature, but once the coefficient values are below .70 or above .95 there is a cause for concerns (Nunnally 1994, Bland 1997, DeVilis. 2003, Cohen R, Swerdlik. 2010). The data analysis shall use summated scales or subscales and not on an individual basis as Cronbach's alpha does not provide estimates for reliability for single items (Makhoul, 1975). According to (Darren and Mallery, 2011) provides the following techniques:

Table 6. Cronbach's scale for data analysis

Higher than > 0.90	=	Excellent
0.80 And between 0.89	=	Good
0.70 And between 0.79	=	Acceptable
0.60 And between 0.69	=	Questionable
0.50 And between 0.59	=	Poor
Lower than < 0.50	=	Unacceptable

Findings: The Cronbach's Alfa for the PLM maturity indicates an excellent internal consistency of the items in the scale.

Table 7. Cronbach's Alfa PLM results

Item-Total Statistics	
Strategy	.908
Management and Control	.896
Process	.892
OC	.896
IT	.914
Performance	.883

Multicollinearity does not seem to be a problem because the VIF figures are 1,233 (less than 10).

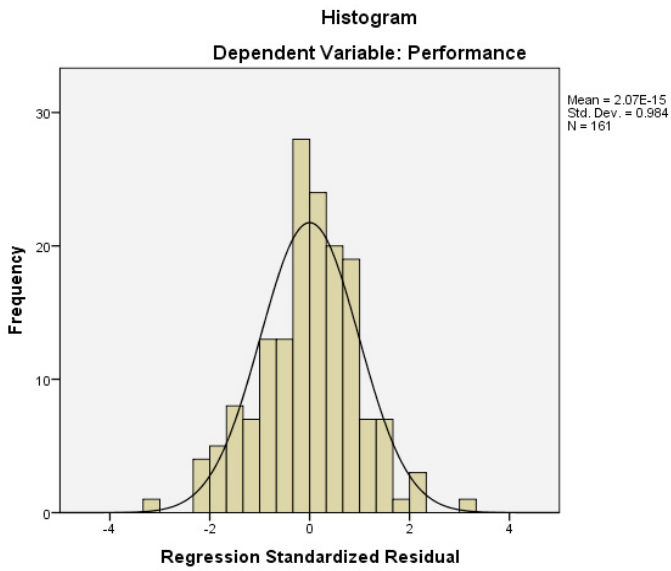

Fig. 4. Histogram chart Multicollinearity

Based on the figure 5 below the residuals are normally distributed.

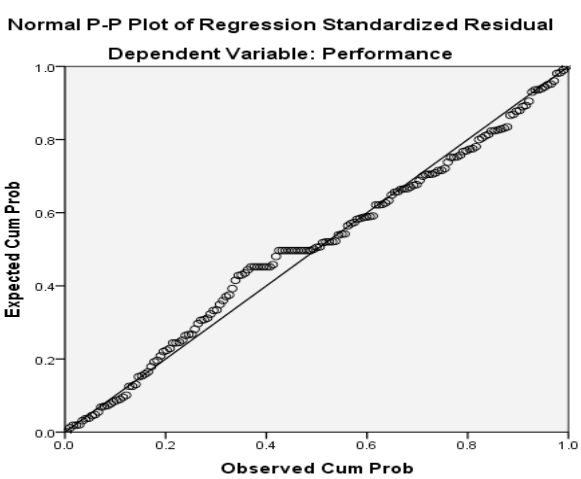

Fig. 5. Plot of Regression Standardized Residual

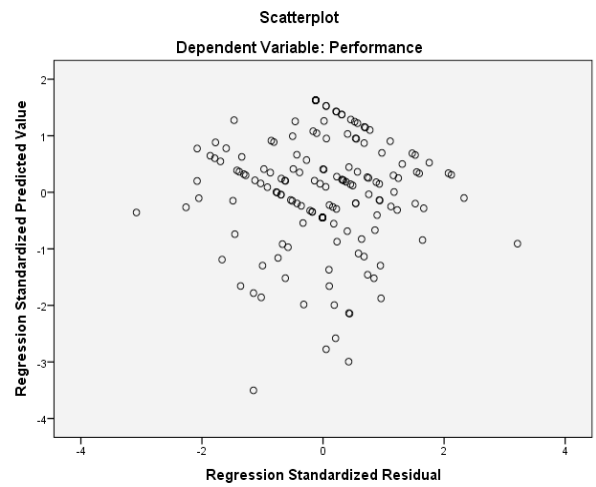

Fig. 6. Regression Standardized Residual

Based on the assumptions, there seem no problems regarding the heteroscedasticity.

6. CONCLUSIONS

Based on quantitative results obtained from the companies where multiple regression analysis was performed to test the independent variables and dependent variable in a grouped test there is a relationship between five (5) independent variables (Strategy, Management & Control, Business processes, Organization Culture, IT and Automation) and dependable variable Organization Performance.

According to the self-evaluation responses by the companies, the research shows that crucial PLM drivers are present in the surveyed companies and play significant role in their operations as per the table 1 model summary where it stands at .74. Based on analysis of the questionnaires, companies are further aiming to automate their routine processes, and IT is shaping their businesses with current trends to cut operating costs and focus on innovative approaches to develop new products and increase profitability. The business strategy and management control of the companies remain in the close watch as they are controlled mainly by the owners or managers that play both roles as it enables them to minimize control costs and have fast decision making. It has to be understood that innovation of specific new products may not take in full place. However, application of IT automation in running companies in the more efficient process can attribute to more profits, therefore, improves the process of achieving targets faster in revenues or capital growth. There remains significant work to be done to reach EU and USA standards however these are reachable as access to new technologies have become available through outsourcing (purchasing it outside the respective countries). During the analysis of descriptive statistics, it was noted that document control, data sharing, and collaborative environment needs to be further improved therefore training of employees and organization management will need to also strengthen where at some point reflects that it lacks compared with other functions. Aligning their business processes by utilization of high-end computer software may give companies further efficiency and competitive edge.

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