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Evaluation of Project Management Practices in the Automotive Original Equipment Manufacturers

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Abstract

This paper aims at understanding the current perceptions related to the Project Management (PM) practices in the automotive sector. To this end, a questionnaire is administrated to professionals and data are analyzed via the Kruskal-Wallis test. Results show that the ICT function is poorly oriented to PM, especially for professionals with longer experience. On the contrary, the logistics function might exploit the benefits of PM tools. PM is also considered a lever for increasing the firm's reputation. This work demonstrates that PM is a challenge for future developments of organizations and it shows its importance in the automotive industry that involves increasingly complex projects.

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Keywords: Project Management; Automotive Sector; Empirical Analysis; Survey

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1. Introduction

Several industries such as aerospace, construction, engineering, and information and communications technology (ICT) have been able to enhance the value of their processes and products with the application of formalized PM methods and implementation of PM practices [1].. These organizations have also witnessed improved business success, few business disruptions, value enhancement, and better usage of material and human resources and thus providing them with the time to concentrate on primary strategic objectives [2]. A PM practice is a set of processes with clearly defined activities and resources, carried out in a structural manner. It involves the application of knowledge, skills, information, techniques, and experience to achieve a set of predetermined objectives using human and material resources in relation with time, cost and quality constraints [3]. Recently, those industry sectors that historically have not shared the PM traditions are also questioning whether PM practices can improve their projects' success, influenced by the positive results obtained in terms of better usage of resources and scheduling by PM-oriented sectors [4].

As per the automobile industry, the implementation of PM practices has been an effective factor to bring radical change in origination structures and processes [5] Though PM has been adopted very late as compared to other industries, a lot of progress has already been done in the Japanese, North American and European car industries. Toyota, Chrysler and Renault have defined history in creating specialized PM knowledge and traditions [6]. Car makers of today have learned more than the famous concepts of Just in Time inventory and Total Quality Management [5]. However, not much work has been observed in the lower tier echelons of the automotive supply chain and Original Equipment Manufacturers (OEMs), consisting mostly of small and medium sized companies acting as contractors and suppliers of the main car producer, appear to still lag behind schedule in the adoption of PM practices that could enable value and benefits for the leading car manufacturer and their entire supply chains. In this context, it looks important to track the level and direction of adoption of PM practices in the automotive OEMs sector.

This paper aims at getting insights into the current state of diffusion of PM practices in the automotive OEM industry, with focus to the Italian context. For this purpose, a survey methodology is used and a questionnaire is developed. Its main issues are identified through the analysis of literature and then validated with the help of industry professionals and a PM standardization body. The survey questionnaire is then sent out to automotive OEMs and responses analyzed to get insights and draw conclusions.

2. Literature Review

Industry reports have sized the current automotive industry as selling 97 million vehicles in 2017, with a 33% compound annual growth rate from 2005 to 2017. Also, in 2017 the gross turnover is valued in € 2 trillion, with € 85 billion investments, generating € 433 billion in public revenues. This economics correspond to a global workforce greater than 8 million employees, spread all over 39 countries [7].

Global competition has been causing crucial changes in the competitive environment of the automotive industry, wherein companies would like to quickly respond to customers' needs, providing high quality with competitive prices [8]. These aspects are recently acquiring a crucial importance considering the new electrification paradigm [9]. As a matter of fact, heavy industry's efforts are focusing on overcoming electric vehicles weaknesses (i.e distances to be covered). Thus, projects without clearly defined goals, low project transparency, lack of control methods, communication deficiencies and insufficient risk management are some of the most common difficulties that project members in the automotive industry have to face [10].

In this context, the implementation of PM models, methods, and frameworks for collaborative project development, data exchange, and quality standards are crucial. Owing to the growing competition, the number of automotive suppliers contributing to the value creation has been highly increasing [11]. Therefore, cross-company and supply chain projects have become essential to the success of a car manufacturer [12].

Different PM practices could be adopted for dealing with this increasing complexity of automotive projects at the various echelons of the supply chain including OEM companies. This is likely to be helped by integrating the PM practice into three main areas of general management practices, namely: implementing a project-oriented approach at

the functional departments of the OEM company, supporting quality management approaches with PM, and introducing the Project Management Office (PMO).

2.1. Structure Company's function exploiting PM practices

Usually, PM has a different level of adoption in the various functions of a company, namely: ICT, logistics, procurement, human resources, process management, sales, quality, engineering and design, and research and development. Following is an analysis of the state-of-the-art about the PM practices for each one of these functions.

ICT initiatives are often poorly defined, with a consequent increased complexity and lower project performance [13]. It is also been highlighted that that 45% of ICT projects overrun their budgets and 7% experience time delays [14]. Also Logistics projects do not typically reach benefits by using PM practices (Hadjinicolaou and Dumrak, 2017) [15]. However, PM can provide the tools for robust baseline schedule in logistics wherein the related uncertainty is gaining more and more attention [16]. In Procurement functions, PM techniques are commonly considered as very useful, since nowadays more and more resources can be supplied from a larger number of suppliers [17]. Thus, the organization and the scheduling of procurement activities become crucial [18]. Furthermore, the Project Manager, a key role to lead to project success, is often responsible not only for time and cost, but also for procurement and human resources management [19]. Therefore, Human Resources (HR) practitioners should be involved in the activities of the projects in terms of management of level careers, employees' participation and employees' relationship [20]. Anyhow, this issue is still one of the most critical in project-oriented companies [21]. Another area of increasing interest for PM is the Production function, since its strategies need control of their implementation, and companies are always looking for methods to improve production performance [22]. In this context, PM can positively and effectively interact with production processes and can contribute to the assertiveness of production management action [23]. Furthermore, there is still limited awareness and knowledge about the integration of PM with the Marketing and Sales functions, even if there is a set of marketing practices implemented in most of single projects [24]. In this context, the expression Project Marketing has been defined as a broader term of PM [25]. In addition, Quality Management and its related aspects that are broadly considered crucial by PM [26] can be significantly enhanced by PM practices [27]. The Engineering and Design departments are typically involved in the initial phase of development of a product or project [28]. Thus, the support of PM tools plays a crucial role especially when there is high substantial complexity [29]. Finally, in the current business environment, firms need to develop new products and implement new processes faster. This puts a large amount of pressure on Research and Development departments that are often called to fulfil these requests [30]. Therefore, PM techniques can significantly improve their activities by making their processes more effective and efficient [31].

2.2. Management approaches supported by PM

There are several central practices in the automotive sector that can call for the help of PM as broadly discussed in the literature. As an attempt to bridge the gap between production and PM, in this section the various production. Management approaches and their relations with PM practices are described, namely: Collaborative Project Scorecard (CPS), continuous improvement and lean manufacturing, the Matrix Organization, and Concurrent Engineering. The CPS is a modified Balanced Scorecard that is more focused on projects and it aims at aligning the project goals with the business strategies of each relationship among the stakeholders [11]. In particular, CSP supports the system integration management via a common vision and set of processes [32]. It is structured into three elements: levels, cause and effect relationships and indicators. The scorecard should be built on communications, compliance, continuous improvement and cooperation [33]. It can be observed a the positive application of the Collaborative Project Scorecard in automotive projects, as it helps to identify dynamically relevant KPIs and project objectives relevant to cross-organizations set of strategies.

The concept of continuous improvement is a pillar of the World Class Manufacturing (WCM). This approach is based on a new method of performance measurement to continuously check the improvement [34]. Through this continuous improvement, the aim is to climb to the best competitors [35]. The achievement of WCM requires constant interaction with both customers and suppliers, by addressing its ten tools namely Total Productive Maintenance, Lean Manufacturing, Six Sigma, Benchmarking, Total Quality Management (TQM), Integrated Information Systems, Agile

Manufacturing, Manufacturing Strategy, Supplier Relationship Management, and Cellular Flow Manufacturing. The final goal is to produce better, faster, cheaper, being at the same time more agile. The improvement can be achieved by going far beyond the products and the services and by examining their intrinsic basic processes [36]. In particular, TQM has been applied over the last few decades, in manufacturing and service industries proving its benefits for quality and corporate performance [37]. This approach is based on the idea of guiding the organization management to make the decisions required in a strategical management process [38] with the goal of improving the customer satisfaction [39]. In this context, the Advanced Product Quality Planning (APQP) can be cited. Its objective is to facilitate communication with everyone involved in the process by adopting several steps starting from a proper team organization through the involvement of customers and suppliers [40]. This method is largely used in the automotive industry as a tool for enhancing the quality management procedures, in particular, in the phases of product development, realization and product launch [41]. An effective APQP implementation needs to be accomplished by a clear quality planning business process [42]. In addition, lean manufacturing has been widely considered as a vital factor for the business [43]. Its main objectives are aimed at eliminating waste as non-value-added components in any process. Thus less human effort, less space, less financial resources and less materials for producing the same product can be used [44]. Since all business processes are interrelated, lean manufacturing cannot operate in isolation to realize its potential [45], but its principles have to be applied across the entire organization [46].

In terms of structural organization, the Matrix one is very common as a PM practice. Under a Matrix organizational structure, employees with similar skills are pooled together for work assignment and report to several managers [47]. Project Managers have primary control over resources and project's direction, while functional managers serve in a support or advisory role. In order to obtain benefits from a matrix organization, the identification of the key people and of the mechanisms connection the whole structure, are required [48]. Furthermore, with a collaboration platform it is ensured that all stakeholders work with the same well-structure folders and files [49]. In this way, project participants, are able to quickly locate the relevant information needed to understand and process a project document [50]. In order to make a collaboration platform more effective, the work plan creation/modification should be automated as much as possible [51]. Also, a framework developed for managing the project progress has proved to earlier known mistakes (that can be in turn avoided) and increase the competence of the organization [52].

In the automotive industry literature poses a lot of emphasis on Concurrent Engineering, also called Simultaneous Engineering (SE) in project development [53]. This is why Simultaneous Engineering represents the definition of the process to be followed in order to develop a project [54]. SE approach is based on the idea of developing various sets of solutions in parallel, rather than working with one scenario at the time. Also, the development of product has to be conducted in parallel to the development of the functions within other departments, such as production systems or logistics networks [55]. Typically, SE is made up of five different phases, namely Define Value, Map Design Space, Develop Concept Sets, Converge on System and Detailed Design [53]. During each step, the set of possible solutions is reduced in order to converge to a shared and unique configuration. SE enables organizations to be more innovative in terms of improving design quality, shortening development time and reducing development and manufacturing costs.

Moreover, by taking into account the quality issue, in the automotive industry, a crucial role is also played by the ISO/TS 1649 that fixes quality standards at a worldwide level in terms of quality planning, approval processes, failure modes and effect analysis, statistical process control and measurement systems [56]. It can be used for process design/development, and if necessary for installation and services [57]. Its goal is to support organizations supplying products or service to meet customer requirements and the same time reduce variation and waste in the supply chain [58]. Table 1 summarizes the discussed management techniques with the associated sources identified in the literature analysis.

Table 1. Management techniques in the automotive industry supported by PM practices

Quality Management Approach	References
Collaborative Scorecard	[11]; [32];[33]
World Class Manufacturing	[34];[35];[36]
Total Quality Management (TQM)	[37]; [38]; [39]
Advanced Product Quality Management (APQP)	[40]; [41]; [42]
Lean Manufacturing	[43];[44]; [45];[46]
Matrix Organization	[47]; [48];[49]; [51]
Simultaneous Engineering	[53]; [54]; [55]
ISO-Technical Standard	[56] ; [57]; [58]

2.3. Introduction of the Project Management Office (PMO)

Another important approach that has contributed to the introduction of PM practices in the automotive industry is the establishment of structured PMOs as a leading factor to drive organizational transformation The concept of "Projectification" can be considered as an amalgam of project and organizational transformation [59]. Focus is on the relations between PM models and the permanent organization and processes of the firm. Projectification is more than just a formalization of PM. It refers to a major organizational transformation that organizations still struggle with at the project and organizational levels. In this context, [60] report on the findings from a survey conducted on a small sample of automotive, aerospace and rail transport companies to evaluate the current adoption of the PM practice.

For the automotive industry they reckon the institutionalization of the PMO, with a high degree of institutionalization at tier-1 suppliers and just a supporting role at the OEMs, the relation of process and PM in new product development with a focus on process management due to the high number of customers and lot sizes, and the project management-related culture as PM is acknowledged to be of high relevance.

In addition in order to create value there must be an efficient two-way relay from strategy requirements to project outcomes [61]. Project governance and enterprise PM practices must have an efficient interplay. This means that the PMO is essential to providing oversight and strategic reporting capabilities and assuring strategic alignment. PMO can be defined as the layer of control between PM and top management [62]. Thus, it has the responsibilities related to the centralized and coordinated projects carried out by the companies [19]. As a dynamic organization entity, it is crucial in reaching the strategic achievements of companies [63].

A survey of German automotive sector found that 80% of the surveyed companies have a PMO and this occurrence does not relate to the company size [64]. Also, their results show that PMOs are organizationally accepted by 81% of respondents, underlining the great consideration associated with PMOs. However, 62% of the respondents report PMO as not involved in strategic decision making but still relaying strategy to operations as lightweight PMOs. Also, successful PM practices of a German automotive supplier might to facilitate shared knowledge, support HR development, enable dexterity, enhance leadership style and culture, and improve competence management [65].

In this context, PM certification programs and diplomas seem a remote concern. at least in the IT industry there is no always correlation between certified PM competences and project results [66].

A six-year study by MIT's International Motor Vehicle Program [67] finds that, to dramatically improve strategic product portfolios, Toyota and other leading companies moved beyond single-project management on which lean thinking is based. Single-project management can produce isolated hit products and "fat" designs that contain few common components and many unnecessary parts and features. As a result, automotive companies are maximizing their investment by utilizing "multi-project management", by implementing platform strategies which relied on sharing components and subsystems among different products through a global part sourcing [68].

[69] developed a theoretical framework where the platform concept is seen as an interplay between product project portfolio management and innovation life-cycle management. Therefore, platforms should not be a standardization process to gain economies of commonalities, but rather the practical application instances of a continuous flow of

incrementally innovative features. Thus, it can be stated that the exploitation of PM principles can create important benefits to an organization. As a matter of fact, PM is fundamental to develop empirical experience for structuring and planning project activities and ensuring project activities, once designed, are completed according to the established plan. The widely cited iron triangle made up of time cost and quality represents the main areas of enhancement [70]. In particular, having an explicit time for completion plays a critical role in realizing strategic objectives, and firms project based are expected to set target dates to realize project objectives in terms of on-time delivery, quality and cost budget [71]. Consequently, the firm's reputation is positively affected by using PM techniques. This is particularly important, as reputation is an intangible asset to which no value is assigned by accounting method, but that can heavily influence the market value of any company [72]. Finally, PM is likely to provide competitive advantage related to a superior performance in a specific business indicator [73], and therefore companies are encouraged to invest in PM techniques, methodologies, PMOs, and cross-functional teams and departments [74].

3. Methodology

This research is conducted through the following steps. First, the set of open issues to be surveyed are identified by reviewing the available literature, as presented in the earlier sections. Most open issues are pertinent to understanding the state of diffusion of the PM practice, its ability to support cross-functional organization, enable strategic alignment, and implement quality management standards. Based on these practices, a survey questionnaire is designed to seek the opinions of professionals on these issues. In particular, the questionnaire is aimed at collecting the perceptions of professionals with regard to the level of adoption and maturity of diffusion of the PM practice in their OEM companies. After some general questions about their professional experience, respondents have been asked to rate the importance of PM methods, techniques or tools that can be used to enhance their performance. For all statements, a Likert scale scoring system is used, where 1= Not Important, 2= Moderately Important, 3 = Important, 4 = Very Important, 5 = Extremely Important. This scale is commonly adopted in dealing with questionnaires in order to scaling the answers in survey researches. The respondents provide their level of agreement or disagreement to a list of statements developed by the researchers.

The questionnaire is then sent out via e-mail to 400 professionals working either as technical experts, managers or designers in companies that are members of AMMA, an Italian Association of Mechanical and Mechatronics businesses in the field of manufacturing, automotive, and aerospace sectors. Technical experts monitor and control the process trend and they typically cover the technical aspect of the information sharing and flow with other departments of the company and with external organizations [75]. Designers are more focused on the product and process development and on their integration with product quality [76]. Managers are in charge of supervising the activities that are carried out in their function, and coaching, empowering and adapting the team in the workplace [77]. A cover letter explains the aims of the study and provides the link to the survey. The questionnaire, as reported in the Appendix, is separated into four sections that seek to investigate the current state of PM diffusion, its strategic alignment, its ability to implement quality management standards, and future directions. As soon as respondents complete the questionnaire, the results are collected and sent to the authors of this paper for statistical analysis.

The survey results give insights about the perceptions of surveyed professionals. For this purpose, it is necessary to statistically check if the variables converge to measure the same construct, in the sense that the aim is to identify differences among the responses of the different groups of respondents. This could be done using an analysis of variances. However, two problems are posed here: on the one hand, data are not normally distributed; on the other, the Likert scale used to collect the answers is merely ordinal in that it is not guaranteed that the distance between 1 and 2 is actually the same as between 4 and 5 scores [78]. Thus, it is inappropriate to analyze data using arithmetic mean and standard deviations [79]. To overcome these problems, the non-parametric Kruskal-Wallis test is used to support the statistical analysis. Its goal is to find out if the samples under analysis come from the same population [80]. In case of significant results, at least one of the samples is different from the other ones [81]. This test is as follows:

$$H = (N-1)\frac{\sum_{i=1}^{g} n_i(\bar{r}_{i\cdot} - \bar{r})^2}{\sum_{i=1}^{g}\sum_{j=1}^{n_i}(r_{ij} - \bar{r})^2}$$

where:

- H: is the value of the test
- n_i: is the number of observations in group *i*;
- r_{ij}: is the rank (among all observations) of observation *j* from group *i*;N: is the total number of observations across all groups.
- $\bar{r}_i = \frac{\sum_{j=1}^{n_i} r_{ij}}{n_i}$ median value
-

The number of the groups under study is G.

The Kruskal-Wallis statistics test the null hypothesis that the populations have identical medians. If the test shows p-value lower than the significance level (usually 5%), the null hypothesis can be rejected meaning that there is at least one difference among the groups under study. This statistics has been selected thanks to its unique ability to provide a test of homogeneity in case of not normality of data [82].

In this research, the Kruskal-Wallis test is then used to measure whether different perceptions are expressed by different groups of respondents, clustered according to their characteristics.

4. Findings

Out of 400 questionnaires, the survey totals 71 respondents, yielding a response rate of 17.75%.

Table 2 summarizes the results of the survey. Columns report the median scores obtained for each question. PM practices appear to be poorly adopted to perform the ICT management tasks. On the contrary, Engineering and Design result as the most PM oriented functions. Also, PM is generally considered as a support for different activities. In fact, all the mean scores related to the effectiveness of PM implementation are higher than 3. Another important result is that most of the companies are willing to head to future PM implementation as the mean equal to 3.79 shows. The next step of the analysis is to study the answers according to the characteristics of the respondents that have been grouped based on their years of experience, their role in the company, and the size of the company they work for.

Table 2. Results of the survey

Issue Under Study	Median scores	Mean Scores
1. Current state of PM		
PMs implementation	3	3.01
ICT Management Task	2	2.32
Logistics tasks	3	2.69
Purchasing Procedure	3	2.70
HR Management Tasks	2	2.45
Process Management Tasks	3	3.04
Sales Functions	3	2.82
Quality tasks	3	2.94
Engineering & Design functions	3	2.94
Research & Development functions	3	2.86
2. Strategic Alignment		
PM current certifications	2	2.04

3. Effectiveness of Implementation of PM Practices		
PM for CPS	3	3.14
PM for WCM	3	3.37
PM for Platform Management	3	3.35
PM for SE	3	3.32
PM for ISO/TS16949	3	3.52
PM for TQM/QFD	3	3.24
Time to Market	4	3.58
Budgeting Performance	4	3.54
Product Quality	4	3.63
Firm's Reputation	4	3.62
Competitive edge	4	3.51
Human & Material Resource	4	3.66
4. Future Plan		
PM Future Implementation	4	3.79
Lean Future Implementation	3	3.51
Future Certifications	3	3.24
Sharing information	4	3.68

Figure 1 shows that most of the respondents have more than 20 years of experience, meaning that the sample is made up of skilled professionals, and the answers can be considered as reliable.

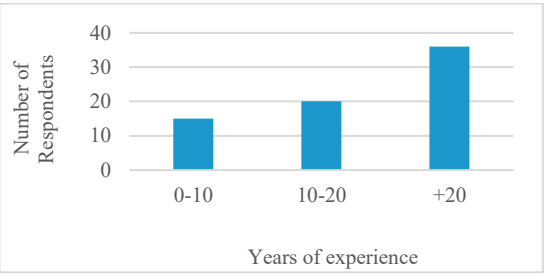

Figure 1. Number of years of experience of respondents

Most of the respondents are managers (70%) or technical experts (24%) with few designers (less than 6%). PM activities are often carried out by managers, and involve technical experts. Thus, it is not surprising to see only a few designers among the respondents.

According to Figure 2, the majority of the companies are small or medium sized and less than 10% of the sample have more than 500 employees. This result is coherent with the structure of the local production system mostly made up of small and medium enterprises.

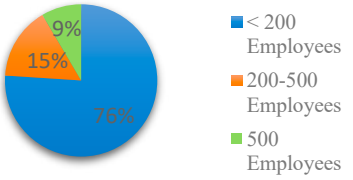

Figure 2. Number of employees

Table 3. Results of statistical analysis by company role

Role	Designer		Technician		Manager		Kruskal
Issue Under Study	Median scores	Mean Scores	Median scores	Mean Scores	Median scores	Mean Scores	P-Value
1. Current state of Project Management							
PMs implementation	2.5	2.25	3	3.18	3	3.02	0.300
ICT Management Task	2	2.00	2	2.24	2	2.38	0.821
Logistics tasks	3.5	3.50	3	2.76	3	2.60	0.178
Purchasing Procedure	3	3.00	3	3.00	3	2.58	0.291
HR Management Tasks	2.5	2.50	3	2.71	2	2.36	0.452
Process Management Tasks	3	3.25	3	3.00	3	3.04	0.865
Sales Functions	3	3.25	3	2.76	3	2.80	0.736
Quality tasks	3	3.25	3	2.88	3	2.94	0.892
Engineering & Design functions	3	2.75	3	2.94	4	2.96	0.875
Research & Development functions	3	2.75	3	2.88	3	2.86	0.984
2. Strategic Alignment							
PM current certifications	2.5	2.25	2	2.06	2	2.02	0.846
3. Effectiveness of Implementation of Project Management Practices							
PM for CPS	3	3.00	3	3.41	3	3.06	0.263
PM for WCM	3	3.00	3	3.35	3	3.40	0.318
PM for Platform Management	3	3.00	3	3.47	3	3.34	0.437
PM for SE	3	3.00	3	3.41	3	3.32	0.443
PM for ISO/TS16949	3	3.00	4	3.59	3.5	3.54	0.212
PM for TQM/QFD	3	3.00	3	3.35	3	3.22	0.545
Time to Market	3	3.00	4	3.71	4	3.58	0.145
Budgeting Performance	3	3.00	3	3.53	4	3.58	0.172
Product Quality	3	3.25	4	3.71	4	3.64	0.428
Firm's Reputation	3	3.00	4	3.88	4	3.58	**0.049**
Competitive edge	3	3.00	4	3.71	4	3.48	0.095
Human & Material Resource	3	3.00	4	3.94	4	3.62	**0.012**
4. Future Plan							
PM Future Implementation	3	3.25	4	3.94	4	3.78	0.246
Lean Future Implementation	3	3.00	3	3.59	4	3.52	0.265
Future Certifications	3	3.25	3	3.29	3	3.22	0.993
Sharing information	3.5	3.50	4	3.82	4	3.64	0.745

Table 3 shows the results of the Kruskal-Wallis test performed by the various respondents. The results highlight that the three roles have the same perception about the current implementation of the PM practice in the different functions of the companies. It is important to underline that among the departments taken into account, the ICT is the less PM oriented, while the logistics tasks are often carried out through a PM approach. The significant level of the p-value highlights that the reputation and exploitation of resources are differently considered. In particular, according to technicians and managers, a PM organizational maturity can substantially enhance the firm's reputation. The lower importance given from the Managers to the Firm's reputation and to the management of the resources might be due

to the fact that for the industry at issue the projectification is relatively new and the processes' approach is the most adopted one. Thus, those professionals are managers in a field wherein the PM concepts are still not fully established.

Also, the resources (both human and material) are more effectively used when PM practices are implemented. The Designers seems to be less sensitive to this issue probabily in the light of their lower level of involvement in resource management.

Table 4. Results of Statistical Analysis for years of experience

Years of Experience	0-10 years		10-20 years		20+ years		Kruskal
Issue Under Study	Median scores	Mean Scores	Median scores	Mean Scores	Median scores	Mean Scores	P-Value
1. Current state of Project Management							
PMs implementation	3	3.40	3	3.00	3	2.86	0.316
ICT Management Task	3	3.27	2	2.45	2	1.86	**0.001**
Logistics tasks	3	3.13	3	2.70	3	2.50	0.129
Purchasing Procedure	3	3.00	3	2.60	3	2.64	0.576
HR Management Tasks	3	3.20	2	2.30	2	2.22	**0.013**
Process Management Tasks	3	3.07	3	3.20	3	2.94	0.817
Sales Functions	3	3.07	3	2.70	3	2.78	0.705
Quality tasks	3	3.07	2.5	2.75	3	3.00	0.847
Engineering & Design functions	3	3.47	2.5	2.75	3	2.83	0.243
Research & Development functions	3	3.33	2.5	2.70	3	2.75	0.320
2. Strategic Alignment							
PM current certifications	2	2.33	2	1.9	2	2	0.280
3. Effectiveness of Implementation of Project Management Practices							
PM for CPS	3	3.13	3	3.45	3	2.97	0.061
PM for WCM	3	3.27	3	3.50	3	3.33	0.659
PM for Platform Management	3	3.40	3	3.35	3	3.33	0.964
PM for SE	3	3.33	3	3.30	3	3.33	0.857
PM for ISO/TS16949	4	3.73	3	3.45	3.5	3.47	0.579
PM for TQM/QFD	3	3.20	3	3.35	3	3.19	0.804
Time to Market	4	3.53	4	3.65	4	3.56	0.876
Budgeting Performance	4	3.53	3	3.35	4	3.64	0.483
Product Quality	4	3.73	4	3.55	4	3.64	0.932
Firm's Reputation	4	3.67	4	3.60	4	3.61	0.968
Competitive edge	4	3.60	3.5	3.50	4	3.47	0.786
Human & Material Resource	4	3.73	4	3.75	4	3.58	0.656
4. Future Plan							
PM Future Implementation	4	3.67	4	3.70	4	3.89	0.448
Lean Future Implementation	4	3.60	3	3.45	4	3.50	0.708
Future Certifications	3	3.27	3	3.10	3	3.31	0.846
Sharing information	3	3.40	4	3.90	4	3.67	0.217

The years of experience (Table 4) show significant differences in the current level of implementation of PM at the various company departments. In particular, the ICT function is considered poorly project oriented for respondents with medium and higher level of experience. Younger professionals state that the projectification in ICT is rather medium. This result may indicate that the ICT functions should be more related to those PM processes that are carried out by junior resources. Similarly, the HR functions for younger respondents are more project based in that the culture of PM is more diffused among the new generations. PM is generally considered more crucial for time to market, definition of budget, and quality. Also, it is considered as a lever of competitive advantage and as an important aspect related to the company reputation. Finally, respondents agree to evaluate PM as crucial for enhancing the use of resources. Coherently, most of the respondents appear to be interested in implementing PM initiatives in the future.

Table 5. Results of Statistical Analysis for company size

Size of Company	< 200 employees		200-500 employees		>500 employees		Kruskal
Issue Under Study	Median scores	Mean Scores	Median scores	Mean Scores	Median scores	Mean Scores	P-Value
1. Current state of Project Management							
PMs implementation	3	2.98	3	3.18	4	3.01	0.409
ICT Management Task	2	2.28	3	2.55	2	2.32	0.717
Logistics tasks	3	2.65	3	2.91	3	2.69	0.766
Purchasing Procedure	3	2.68	3	2.82	3	2.70	0.688
HR Management Tasks	2	2.47	2	2.36	2	2.45	0.850
Process Management Tasks	3	3.00	3	3.27	3.5	3.04	0.548
Sales Functions	3	2.80	3	2.91	3.5	2.82	0.539
Quality tasks	3	2.87	3	3.36	3	2.94	0.441
Engineering & Design functions	3	2.93	3	3.00	4	2.94	0.124
Research & Development functions	3	2.83	3	3.00	4	2.86	0.294
2. Strategic Alignment							
PM current certifications	2	1.95	2	2.55	2.5	2.04	**0.007**
3. Effectiveness of Implementation of Project Management Practices							
PM for CPS	3	3.15	3	3.09	3	3.14	0.841
PM for WCM	3	3.30	4	3.73	3	3.37	0.281
PM for Platform Management	3	3.35	3	3.36	4	3.35	**0.021**
PM for SE	3	3.32	3	3.36	4	3.32	0.266
PM for ISO/TS16949	3	3.47	4	3.82	4	3.52	0.312
PM for TQM/QFD	3	3.22	3	3.36	4	3.24	0.302
Time to Market	4	3.55	4	3.73	4	3.58	0.270
Budgeting Performance	3	3.50	4	3.73	4	3.54	0.067
Product Quality	4	3.60	4	3.82	4	3.63	0.606
Firm's Reputation	4	3.58	4	3.82	4	3.62	0.327
Competitive edge	4	3.48	4	3.64	4	3.51	0.383
Human & Material Resource	4	3.65	4	3.73	4	3.66	0.345
4. Future Plan							
PM Future Implementation	4	3.78	4	3.82	4.5	3.79	0.066
Lean Future Implementation	3	3.47	4	3.73	4	3.51	0.349
Future Certifications	3	3.18	4	3.55	4	3.24	**0.005**
Sharing information	4	3.67	4	3.73	4.5	3.68	**0.029**

Table 5 shows the results carried out according to the size of the company. There are no significant differences with regard to the current application of PM in the company.It is interesting to underline that HR is generally poorly considered in relation with the current development of PM principle. Higher scores can be observed in the Engineering and in the R&D function. PM is considered more useful when dealing with the Platform Management for big companies. This finding may indicate the greater need for larger organizations to run their processes by using PM techniques. Also, bigger companies express higher interest in future PM certifications, meaning that more skilled employees are required. On the contrary, for small and medium organization there is not a full interest related to the Certifications of their employees. Probably this aspect might be also related to financial constraints that make more difficult the development of master education programs. Finally, the information sharing process along the whole supply chain is viewed as an important aspect especially for large companies. This result is not surprising, since the larger the organization, the higher the amount of information that has to be processed. On the contrary, the perception of the benefit realization is similar with regard to the size of the company. Thus, both small and big companies consider the PM practice as effective for their strategic execution.

5. Interpretation and discussion of results

This study is an attempt to structure the main key PM practices that are currently adopted by OEM companies operating in the automotive sector. These key practices are integrated and elaborated through a survey for exploring the perceptions of professionals about the importance of PM practices in performing the various company functions. Responses are analyzed using the Kruskal-Wallis test that is used to detect differences between control groups. The survey results suggest that managers consider PM as an effective approach to increase corporate reputation and use of human resources. This finding may depend on the greater confidence that managers typically have with PM practices than technical experts and designers. Also, among the various roles, the manager is usually dedicated to PM support. Finally, managers often encourage the adoption of PM in the companies. Also, professionals with fewer years of experience consider PM more implemented in ICT and HR tasks. This result confirms that the acknowledgment of PM as a valuable managerial practice is rather recent and the willingness to work with PM tools is higher among junior professionals. This is likely due to the fact that recent educational programs more often include PM courses. In the long term it is expected that the considerations associated with these issues will even more increase. Finally, larger companies are more interested in certifying their employees in that big organizations pay more attention to PM skills that are considered as crucial in carrying out companies' processes. Coherently, larger companies express more attention to future PM certifications for their employees. This result could be due to the fact that larger companies may be able to afford more training and consultancy programs. In fact, there are companies running their own internal PM academies and centers of excellence. Furthermore, the sharing of information is considered crucial for larger organizations, meaning that the greater the company, the higher the need for control of production and service processes. In addition, smaller organizations typically operate with lower margins and consequently they are not able to generate those economies of scale that support a more complex project governance system such as a PMO or portfolio management system. So far, the path towards projectification is mostly pulled by semi-rational expectations without real associated resources. This jeopardizes the ability to withstand this misalignment typical of any business change and innovation. Also, this makes a weaker case for the attainment of a "plateau of enlightment", which is the condition where continuous improvement can actually take place [83]. Finally, the platform management is expected to get more benefits from implementing appropriate PM practices in large organizations that have typical platform management processes [49].

6. Implications and Conclusions

In this paper a study aimed at understanding the perceptions related to the PM practices most largely adopted by companies, operating in the automotive industry is proposed. In the last years, this topic is becoming particularly crucial, especially considering the growing level of complexity associated

with the projects that the organizations are developing. To this end, a questionnaire has been administrated to professionals playing as designers, managers or technical experts. The data gathered, have been coherently analyzed using a Kruskal-Wallis test according to the years of professional experience and the company role of the respondent, as well as the size of the company. The obtained results show that the ICT functions are scarcely focused on PM processes, in particular according to professionals with longer experience, while the logistics departments are able to better unlock the benefits of PM tools. Also, PM is considered as an important lever for increasing the firm reputation

and further exploiting the usage of corporate resources. Finally, most of the respondents state that PM initiatives are going to be carried out in the future. This work originates some theoretical and practical implications. From a theoretical perspective, theproposed study can stimulate the research related to the alignment between PM and the other functions of a company. As a matter of fact, this topic is going to acquire more and more importance

in the next future, especially in the automotive sector that is facing new challenges related to the production of new low impact vehicles transition [84]. Also, the proposed analysis highlights the importance of the PM for the whole automotive industry and it emphasizes the importance of academic contributions to enlarge the body of knowledge in this research area. From a practical perspective this study might provide a roadmap with companies, in order to identify the weakest areas wherein concentrate more efforts. As well as, the growing interest in the PM arena demonstrate the need of acquiring PM competencies by professionals. Also, the positive effects related to the adoption of PM on the performance of a company and on its reputation it is here fully confirmed. Finally, it is underlined the importance of

PM that is a challenge for future developments of organizations [85]. In particular, it shows its crucial role played in the automotive sector that involves increasingly complex processes and has adopted PM tools only more recently compared with other industries. However, this work suffers from some limitations. In particular, the survey investigates the professional's perception of PM practice adoption only within the Italian automotive OEM sector. Also, it should be interesting to add to the proposed semi-quantitative approach, some qualitative and reflective methods such as focus groups or individual structured interviews and case studies. These additional research tasks could help investigate more in-depth the underlined picture which causes and at the same time it is caused by the opportunities the industry is exploiting. Current research is under way to investigate professionals' points of view in Europe and to understand how the future is seen in this field.

References

[1]Mullaly, J., and Thomas, M. (2008). Researching the Value of Project Management. *PMI*.
[2] Lila Lenoria Carden, T. M. E. (2008), "Human Resource Development and Project Management: Key Connections", *Human Resource Development Review*, 7 (3): 309-338.
[3] Thielmann, R., and Silva, C. (2014), "Evaluation of Project Management maturity: case study of automotive project", *Revista Gestão Da Produção, Operações e Sistemas*, 9 (2): 34–50.
[4] Carden, L., and Egan, T. (2008), "Does Our Literature Support Sectors Newer to Project Management? The Search for Quality Publications Relevant to Nontraditional Industries", *Project Management Journal*, 39(3): 6–27.
[5] Morris, P. W. G., and Pinto, J. K. (2004), "*The Wiley guide to managing projects"*, John Wiley and Sons.
[6] Schonberger, R. J. (2007), "Japanese production management: An evolution-With mixed success", *Journal of Operations Management*, 25: 403–419.
[7] OICA" from http://www.oica.net/category/economic-contributions/facts-and-figures/[Accessed July 16, 2019].
[8] Morris, D., and Donnelly, T. (2006). "Are there market limits to modularisation?", *International Journal of Automotive Technology and Management*, 6(3): 262-275.
[9] Muniz, S. T. G., and Belzowski, B. M. (2017). "Platforms to enhance electric vehicles' competitiveness", *International Journal of Automotive Technology and Management*, 17(2): 151-168.
[10] Niebecker, K., Eager, D. and Moulton. B. (2010), "Collaborative and cross-company project management within the automotive industry using the Balanced Scorecard", *International Journal of Managing Project in Business*, 3(2): 328-337.
[11] Niebecker, K., Eager, D. and Kubitza, K. (2008), "Improving cross- company project management in performance with a collaborative project scorecard", *International Journal of Managing Projects in Business*, 1(3):356-386.
[12] Hab, G. and Wagner, R. (2006), "Projektmanagement in der Automobilindustrie Effizientes Management von Fahrzeugprojekten entlang der Wertschoepfungskette", 2nd ed., Gabler, Wiesbaden.
[13] Rivera, A., and Kashiwagi, J. (2016), "Identifying the State of the Project Management Profession", *Procedia Engineering*, 145: 1386-1393.
[14] Kashiwagi, D., and Kashiwagi, I. (2014), "The Best Value IT Industry. CIB: International Council for Research and Innovation in Building and Construction", *The Journal for the Advancement of Performance Information and Value*, 6(1):81-122.
[15] Hadjinicolaou, N., and Dumrak, J. (2017), "Investigating association of benefits and barriers in project portfolio management to project success", *Procedia Engineering*,182: 274-281.
[16] Ke, H., Wang, L., and Huang, H. (2015), "An uncertain model for RCPSP with solution robustness focusing on logistics project schedule", *International Journal of e-Navigation and Maritime Economy*, 3: 71-83.
[17] Tabrizi, B. H., and Ghaderi, S. F. (2016), "A robust bi-objective model for concurrent planning of project scheduling and material procurement", *Computers & Industrial Engineering*, 98:1-29.
[18] De Araújo, M. C. B., Alencar, L. H., and de Miranda Mota, C. M. (2017), "Project procurement management: A structured literature review", *International Journal of Project Management*, 35(3): 353-377.
[19] Project Management Institute, Project Management Body of Knowledge (PMBOK) Guide, 5
Th edition, Project Management Institute, 2013.
[20] Keegan, A., Ringhofer, C., and Huemann, M. (2018), "Human resource management and project based organizing: Fertile ground, missed opportunities and prospects for closer connections", *International Journal of Project Management*, 36(1): 121-133
[21] Shariatmadari, M., Nahavandi, N., Zegordi, S. H., and Sobhiyah, M. H. (2017), "Integrated resource management for simultaneous project selection and scheduling", *Computers & Industrial Engineering*, 109: 39-47.
[22] Guimarães, J.C.F., Severo, E.A., Rocha, J.M., and Olea, P.M., (2013), "Decision criteria for the implementation of cleaner production: the case of five leading companies in southern Brazil", Espac. (Caracas) 34, 1e12.
[23] Guimarães, J. C. F., Severo, E. A., and Vieira, P. S. (2017), "Cleaner production, PM and strategic drivers: an empirical study", *Journal of cleaner production*, 141:881-890.
[24] Obradović, V., Kostić, S. C., and Mitrović, Z. (2016), "Rethinking project management–Did we miss marketing management?", *Procedia-Social and Behavioral Sciences*, 226: 390-397.

[25] Skaates, M. A., Tikkanen, H., & Lindblom, J. (2002), "Relationships and project marketing success", *Journal of Business & Industrial Marketing*, 17(5): 389-406.
[26] Demirkesen, S., & Ozorhon, B. (2017), "Impact of integration management on construction project management performance", *International Journal of Project Management*, 35(8): 1639-1654.
[27] Ali, H. A. E. M., Al-Sulaihi, I. A., and Al-Gahtani, K. S. (2013), "Indicators for measuring performance of building construction companies in Kingdom of Saudi Arabia", *Journal of King Saud University-Engineering Sciences*, 25(2): 125-134.
[28] Hanisch, B., Lindner, F., Mueller, A., and Wald, A. (2009), "Knowledge management in project environments", *Journal of knowledge management*, Vol 13(4): 148-160.
[29] Bjorvatn, T., and Wald, A. (2018), "Project complexity and team-level absorptive capacity as drivers of project management performance", *International Journal of Project Management*, 36(6): 876-888.
[30] Vicente-Oliva, S., Martínez-Sánchez, Á., and Berges-Muro, L. (2015), "Research and development project management best practices and absorptive capacity: Empirical evidence from Spanish firms", *International Journal of Project Management*, 33(8): 1704-1716.
[31] Tatikonda, M. V., and Rosenthal, S. R. (2000), "Successful execution of product development projects: Balancing firmness and flexibility in the innovation process", *Journal of Operations Management*, Vol. 18 No.4, pp. 401-425.
[32] Norrie, J., and Walker, D. (2004), "A balanced scorecard approach to project management project management leadership", *Project Management Journal*, 35(4): 47–56.
[33] Stewart, W. E. (2001), "Balanced scorecard for projects", *Project Management Journal*, 32 (1): 28-38.
[34] Gosselin, M. (2005), "An empirical study of performance measurement in manufacturing firms", *International Journal of Productivity and Performance Management*, 54(5/6): 419-437.
[35] De Felice, F., and Petrillo, A. (2015), "Optimization of Manufacturing System through World Class Manufacturing", *IFAC-PapersOnLine*, 48(3):741-746.
[36] Digalwar, A.K., Jindal, A. and Sangawan, S. (2015), " Modeling the performance measures of world class manufacturing using interpreting structural modelling", *Journal of Modelling Management*, 10(1): 4-22.
[37] Panuwatwanich, K., and Nguyen, T. T. (2017), "Influence of Total Quality Management on Performance of Vietnamese Construction Firms", *Procedia Engineering*, 182: 548-555.
[38] Todorut, A. V. (2012), "Sustainable development of organizations through total quality management", *Procedia-Social and Behavioral Sciences*, 62: 927-931.
[39] Sahooa, S., and Yadava, S. (2018), "Total Quality Management in Indian Manufacturing SMEs", *Procedia Manufacturing*, 21:541-548.
[40] Bobrek, M., and Sokovic, M. (2005), "Implementation of APQP-concept in design of QMS", *Journal of Materials Processing Technology*, 162:718-724.
[41] Kiefer, J., Allegretti, S., and Breckle, T. (2017), "Quality-and Lifecycle-oriented Production Engineering in Automotive Industry", *Procedia CIRP*,62: 446-451.
[42] Kwon, S., Koon Lee, K., and Park, Y. H. (2007), "A Study on a Methodology of Integrating Lean DFSS and Advanced Product Quality Planning (APQP) in ISO/TS16949", *Asian Journal on Quality*, 8(3):173-187.
[43] Alefari, M., Salonitis, K., and Xu, Y. (2017), "The role of leadership in implementing lean manufacturing", *Procedia CIRP 2017*, 63: 756-761.
[44] Zargun, S., and Al-Ashaab, A. (2014), "Critical Success Factors for Lean Manufacturing: A Systematic Literature Review an International Comparison between Developing and Developed Countries", *Advanced Materials Research,* 845: 668-681.
[45] Maskell, B. H., and Kennedy, F. A. (2007), "Why do we need lean accounting and how does it work?", *Journal of Corporate Accounting & Finance*,18(3), 59-73.
[46] Fullerton, R. R., Kennedy, F. A., and Widener, S. K. (2014), "Lean manufacturing and firm performance: The incremental contribution of lean management accounting practice", *Journal of Operations Management*, 7:414-428.
[47] Sy, T. and Cote, S. (2004). "Emotional Intelligence: A key ability to succeed in the matrix organization", *Journal of Management Development*, Vol. 23 No. 5, pp. 439-445.
[48] Ryynanen, H. and Salminen, R.T. (2014). "Promoters in a matrix organization's social network during industrial project sales", *International Journal of Managing Projects in Business*, 7(4): 701-719.
[49] Forcada, N., Casals, M., Roca, X., and Gangolells, M. (2007). "Adoption of web database fror document management in SMEs of the construction sector in Spain", *Automation in Construction*,16: 411-424.
[50] Mao, W., Zhu, Y. and Ahmad, I. (2007), "Applying metadata models to unstructured content of construction documents: a view-based approach", *Automation in Construction*, 16: 242-252.
[51] Ma, Z., Zhang, D., and Li, J. (2018). "A dedicated collaboration platform for Integrated Project Delivery", *Automation in Construction*, 86: 199-209.
[52] Rolstadas, A., Tommelein, I., Schiefloe, P.M., and Ballard, G. (2014), "Understanding project success through analysis of Project Management approach", *International Journal of Managing Project in Business*, 7(4): 638-660.
[53] Khan, M.S., Al-Ashaab, A., Shehab, E., Haque, B., Ewers, P, Sorli, M., and Sopelana, A. (2013), "Towards lean product and process development", *International Journal of Integrated Manufacturing*, 26(13):1105-1116.
[54] Ikmal, M., Maulana, B.M., Al-Ashaasb, A., Flisiak, J. W., Araci, Z.C., Lasisz, P.W., Shehab, E., Beg, N., and Rehman, A. (2017), "The Set-based Concurrent Engineering application: a process of identifying the potential benefits in the Surface Jet Pump case study", *Procedia CIRP*, 60:350-355.
[55] Meis, J. F., Tüshaus, A. T., and Reinhart, G. (2016), "Engineered Hours Per Product for Simultaneous Engineering", *Procedia CIRP*, 52: 52-55.

[56] Pop, Liviu Dorin, and Nagy Elod. (2015), "Improving Product Quality by Implementing ISO/TS 16949", *Procedia Technology,*19: 1004-1011.
[57] Oliveira, A. A. S. B. S., da Silva, M. B., and Calado, R. D. (2013), "Applying Business Diagnostic Method in Companies Certified by the Quality Management System ISO TS 16949", *IFAC Proceedings Volumes*, 46(24):235-240.
[58] Bevilacqua, M., Emanuele Ciarapica, F., Giacchetta, G., and Marchetti, B. (2011), "Implementation of a quality procedure based on Delphi method and the ISO/TS 16949: 2009 in the production of stainless steel tubes for automotive exhaust systems", *International Journal of Quality & Reliability Management*, 8: 841-866.
[59] Midler, C. (1995), "Projectification" of the firm: The Renault case", *Scandinavian Journal of Management*, 11(4):363–375.
[60] Müller, A. K., Wald, A., and Görner, A. (2012), "Comparing project management practices in new product development: a study in the automotive, aerospace and rail transport industry", *International Journal of Project Organisation and Management*, 4(3): 203-217.
[61] Too, E. G., and Weaver, P. (2014), "The management of project management: A conceptual framework for project governance", *International Journal of Project Management*, 32(8):1382–1394.
[62] Kerzner, H. (2003), "Strategic planning for a project office", *Project Management*. *Journal*, Vol. 34(2), 13-25.
[63] Szalay, I., Kovács, Á., and Sebestyén, Z. (2017). "Integrated Framework for Project Management Office Evaluation", *Procedia Engineering*, 196: 578-584.
[64] Arndt, C., Braun, L., Ribeiro, M., Rietiker, S., von Schneyder, W., and Scheurer, S. (2014), "The PMO in Practice. Dispersal – Acceptance – Performance Measurement", Empirical PMO Study 2013 / 14. GPM Deutsche Gesellschaft für Projektmanagement.
[65] Renzl, B., Rost, M., and Kaschube, J. (2013), "Facilitating ambidexterity with HR practices - a case study of an automotive supplier", *International Journal of Automotive Technology and Management*, 13(3):257.
[66] Catanio, J. T., Armstrong, G., and Tucker, J. (2013), "PM Certification and Experience: The Impact on the Triple Constraint", *Journal of Advances in Information Technology*, 4(1):8–19.
[67] Cusumano, M. A., and Nobeoka, K. (1998),"Thinking Beyond Lean: How Multi-PM is Transforming Product Development at Toyota and Other Companies".
[68] Lehnerd, A. P., & Meyer, M. H. (2011). *The power of product platforms*. Simon and Schuster.
[69] Beaume, R., Maniak, R., and Midler, C. (2009), "Crossing innovation and product projects management: A comparative analysis in the automotive industry", *International Journal of Project Management*, 27(2):166–174.
[70] Sanchez, O. P., and Terlizzi, M. A. (2017), "Cost and time project management success factors for information systems development projects", *International Journal of Project Management*, Vol. 35(8): 1608-1626.
[71] Zwikael, O., Chih, Y. Y., and Meredith, J. R. (2018), "Project benefit management: Setting effective target benefits", *International Journal of Project Management*, 36(4): 650-658.
[72] Siano, A., Kitchen, P. J., and Giovanna Confetto, M. (2010), "Financial resources and corporate reputation: Toward common management principles for managing corporate reputation", *Corporate Communications: An International Journal*, 15(1): 68-82.
[73] Areias, J. S., and Eiriz, V. (2013), "Building competitive advantage through inter-organizational projects", *Strategic Direction*, 29(9): 31-34.
[74] Mathur, G., Jugdev, K., and Shing Fung, T. (2007), "Intangible project management assets as determinants of competitive advantage", *Management Research News*, 30(7): 460-475.
[75] Fieseler, C., Lutz, C., and Meckel, M. (2015). An inquiry into the transformation of the PR roles' concept. *Corporate Communications: An International Journal*, 20 (1): 76-89.
[76] Riel, A., Tichkiewitch, S., Stolfa, J., Stolfa, S., Kreiner, C., Messnarz, R., and Rodic, M. (2016)," Industry-academia cooperation to empower automotive engineering designers", *Procedia CIRP*, 50:739-744.
[77] Monahan, K. (2018), "*How Behavioral Economics Influences Management Decision-Making: A New Paradigm*", Academic Press., pp. 119-156.
[78] Vonglao, P. (2017), "Application of fuzzy logic to improve the Likert scale to measure latent variables", *Journal of Social Sciences*, 38(3): 337-344.
[79] Clegg, C. (1998). Simple statistics. Cambridge, UK: Cambridge University Press.
[80] Guo, S., Zhong, S., and Zhang, A. (2013), "Privacy-preserving Kruskal–Wallis test. *Computer methods and programs in biomedicine*, 112(1):135-145.
[81] Kruskal, W. H., and Wallis, W. A. (1952), "Use of ranks in one-criterion variance analysis", *Journal of the American statistical Association*, 47 (260): 583-621.
[82] Ruxton, G. D., and Beauchamp, G. (2008), "Some suggestions about appropriate use of the Kruskal–Wallis test", *Animal behaviour*, 76(3): 1083-1087.
[83] Linden, A., and Fenn, J. (2003), "Understanding Gartner's hype cycles", *Strategic Analysis Report N° R-20-1971. Gartner, Inc*.
[84] Alochet, M., and Midler, C. (2019), "Reorienting electric mobility research focus on industrialisation issues, *International Journal of Automotive Technology and Management*, 19(3-4): 229-256.
[85] Margineanu, L., Prostean, G., and Popa, S. (2015), "Conceptual model of management in automotive projects", *Procedia-Social and Behavioral Sciences*: 1399-1402.