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An Analysis of the State of the Project Management Maturity in Automotive Industry

Relatore

prof. Alberto De Marco

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Candidato

Michele Malamisura

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Sommario

Extended Abstract

The objective of this research is to identify, and evaluate, the level of maturity of the strategic alignment of the automotive industry with the adoption of modern Project Management practices. This has been rapidly spread in the last few decades, thanks to its versatility in fact it is applied to all organizations that have to manage their projects. In the current competitive context, it is therefore necessary to be able to innovate, manage to manage change, the constant pressures that involve the world of car manufacturers. Innovating through Project Management allows to improve business performance, the way in which projects are managed and market competitiveness. Numerous industry studies show that companies with poorly defined project management, without acceptable implementation and standardization of best practices and control methods, face greater difficulties than their competitors. The aim of this research is to investigate, not only, the level of implementation of Project Management practices within companies, but also extrapolate, through data analysis, the current trend of the sector outlining the current role from Project Management as a tool for strategic alignment and value creation. For the purposes of our research we started from an analysis of the existing literature, in particular from the paper "Projectification of the firm, Renault Case study", by Midler, which deals with the relationship between project management models and the permanent organization and processes of the firm. Subsequently, a data collection was carried out using a survey, an exploratory research, directed and compiled by the companies in the sector, also thanks to the collaboration with "Associate Mechatronic Mechanical Companies" (AMMA). The objectives of the survey are:

- Identify the best Project Management practices from the literature review;

- Measure, from the point of view of the employee and size of company, the maturity and current implementation of Project Management practices;

- Measure the strategic alignment;

- Measure the effectiveness of implementation of Project Management practices and their effects on product quality, management of the production line and human resources.

The aggregated responses of the various sections were presented through pie charts and histograms, from the data it emerged that 76.1% of respondents work in a company with less than 200 employees and is a manager in 70.4% of cases, followed as a technician and designer. Let's put the focus on the main results obtained by the various sections. Starting from section 1, concerning the current adoption level of Project Management, it emerges that almost all the companies involved started to implement project management practices to demonstrate the growing diffusion of the latter among the companies of the sector, only the 11.3% of companies do not show any implementation. The Project Management Office, on the other hand, seems to have not reached yet a good level of diffusion since only 32.4% of those interviewed present a PMO specialized in their company with a size that remains predominantly small or very small. For the moment there seems to be no particular attention from companies towards project management certifications, with a relatively low number of qualified personnel. Section 3 deals with the effectiveness of implementing project management practices and perceived improvements on the company performance. Among the best implemented practices, we find ISO / TS16949, the international standard that defines the quality management system for the automotive product, the World Class Manufacturing the methods that help the company measure performance to verify improvements, and Simultaneous Engineering, also called Concurrent Engineering, which considers all the processes to build up the car in parallel rather than one by one. Moreover, the impact of project management practices is improving business performance, in particular Time to Market, Budgeting Performance and Product Quality. Most of the organizations agree to say that a good implementation of Project Management practices helps the organizations to better perform the work, with lower time and waste of resource, and also to improve the reputation of the firm, to gain competitive edge and a better utilization of human and material resource. The last section of the survey, Section 4, is about future plan of the organizations. All the respondents agree to the will to increase the implementation of project Management practices and Lean Project Management in the future. A more in-depth analysis was carried out later using the statistical software Minitab. In particular, the data collected, were analysed through the use of the Kruskal-Wallis Test, we divided the respondents in the groups, called Factor Level, based on his business role, years of experience and the size of the company in which they works , each group is in turn composed of three independent subjects, in order to analyse if the difference between the

value of medians, of the respondent's answer, is statistically significant, in relation to the issues dealt with in the survey, i.e. if the answer is more correlate with the business role, years of experience or size of the company. We have conducted the tests first, on the whole sample (71) and then on the purified sample (52), i.e. composed only of companies in which Automotive is the company core.

The results in general show how the larger companies have a greater awareness of the importance and benefits deriving from a good implementation of Project management practices compared to small businesses, which do not yet seem to be interested in implementing such practices within the organization. In particular, for large companies, the use of project management best practices gives added value to products, processes and organizational models, making it possible to align company strategies with those of the project, as well as helping the implementation of industry best practices. All this is confirmed by the last Kruskal-Wallis test carried out with only two subgroups for the "size of company" Factor Level as we had a number of observations for the "> 500 employees" subgroup not sufficiently large to validate the test results. In conclusion, the application of Project Management standards and practices improves crucial factors within the company such as cost, time and quality. The benefits are not limited solely to project objectives but also to the management of relationships with suppliers, the company's reputation and the best management of human capital. Large companies have therefore started a Projectification process and are particularly ahead of small businesses in the implementation of Project Management within the organizational structure, small businesses do not seem interested for the moment in carrying out this process for project management.

1 Project Management Issue

In an increasingly competitive context marked in the last twenty years of economic history, by social, economic, and environmental challenges, companies must try to respond to the growing needs of innovation. Standards, knowledge and methodologies have a central role in this direction and become part of competitive strategies elements such as, compliance with environmental and social regulations, the differentiation or customization of products and the pursuit of quality.

To better respond to the problems and opportunities of the modern business environment, companies are forced to leave traditional management control processes and adopt more suitable techniques. In recent decades, this need for a new approach has led to the growth of Project Management, innovation with the Project Management expresses a sign of maturity for the company structure and organizational culture, in a project-oriented logic. The new trends therefore require a profound change in the production system to achieve rapid response, operational efficiency and flexibility; this means that it is necessary to move from traditional production to production systems that are strongly synchronized with market demand and characterized by a strong focus on reducing waste in the process. In an increasing number of industries, project-based systems are complementing or even replacing traditional structures. Standardization with the Project Management have an high economic value, the sharing of all the best practices allow the organizations to share projects with their partner with a low transaction cost. [1]. Owing of this fact, there is an increasing interest in using practices in project management (PM) and certifying professionals in this field, supported by bodies of knowledge proposed by the institute (PMI, Project Management Institute, 2013) and associations (IPMA, 2013).

1.1   Definitions

The basic project management terms are defined not only by the project management theory, but also by the international project management standards.

The basic project management standards include the standard of the Project Management Institute (PMI), the standard of the Association for Project Management called PRojects IN Controlled Environments 2 (PRINCE 2), and the standard of the International Project Management Association (IPMA).

The Project Management Institute (2004) states, in its standard, that "Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements. It is accomplished through the application and integration of the project management processes of initiating, planning, executing, monitoring and controlling, and closing" and a project as "a temporary endeavour undertaken to create a unique product, service, or result".

The Association for Project Management (APM, 2012) defines, in its PRINCE 2 standard, project management as "the process by which projects are defined, planned, monitored, controlled and delivered such that the agreed benefits are realised" and a project as "a unique, transient endeavour undertaken to achieve a desired outcome".

So, both standards explicitly remark that the main functions of Project Management are define, plan, organize, execution, check and closure. Through these phases, organization's project can reach certain objectives of time, cost and quality.

Let's briefly analyse the functions just mentioned:

- Define: determine the main characteristics of the new project, the global vision, make market analysis, define customer requests and results to be achieved.
- Plan: determine the steps to follow for the subsequent execution of the project, the main project's activity, identifying a start and end date, subdividing the work and responsibilities, carrying out activity such as risk analysis.
- Organize: organizing means managing resources effectively for the correct execution of the project. Organizing the project team, going to select the members and the resources that will go to set it up, calculate the costs and schedule the main activities of the project defined during the planning.

- Execution: this is the main function and concern the evolution and correct realization of the project. This function is influenced by the specific technic of the organization's sector.

- Check: check that in every phase the execution of the project is in line with the objectives to be reached in terms of costs and quality, addressing potential problems by undertaking corrective actions.

- Closure: closure of project in terms of contracts, compilation of statistics and documents, ensuring that the project has been completed efficiently.

1.2 Trend

PMI's 2017 Pulse of the Profession reported that Project management maturity is rising in the last 10 years, organizations with a PMO increased by 16%, up from 61% in 2007 to 71% in 2017.
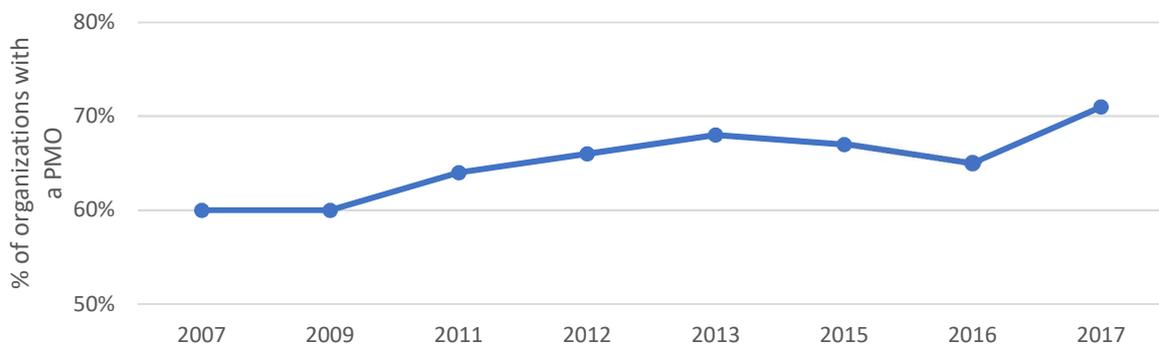
Figure 1 PMO maturity

Increasing project management maturity reflects a clear trend. Organizations are applying process approaches in their operations, increasingly standardizing their project management practices across all or most of their activity.

This trend is driven by the business environment and the markets, which demand that organizations need to be increasingly responsive and dynamic.

We are also seeing a rise in enterprise-wide project management offices (EPMOs). The recognition for PMOs and EPMOs increases each year. Managers now see the value of

standardizing the way they run projects. PMI reports these benefits for companies who align their EPMO with company strategy:

- 38% more projects meet their original goals and business intent
- 33% fewer projects are deemed failures

This year (2017), for the first time since 2011, we can see an upward trend: more projects are meeting their original goals and business intent and being completed within budget. Compared to last year, fewer projects are deemed failures. [2]
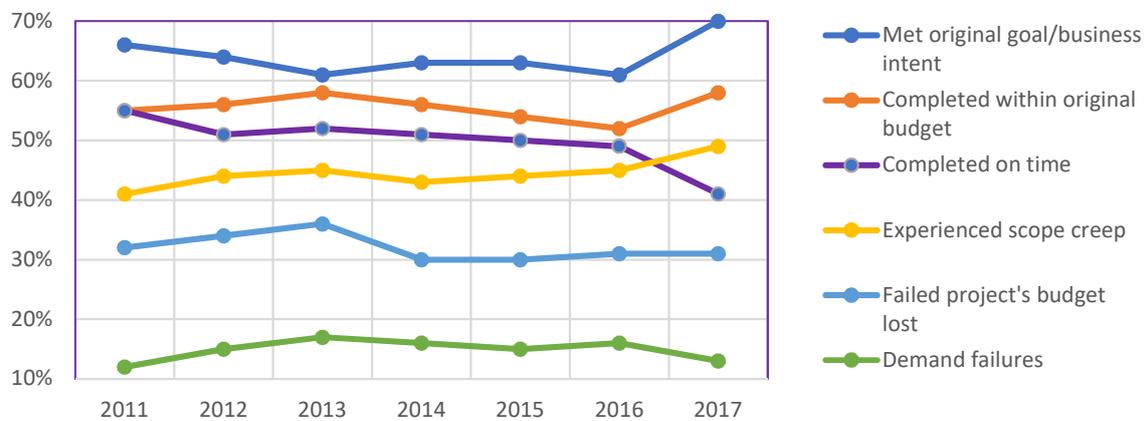
2 The Concept of Project

2.1 Definition

Before analysing in detail different tools and various techniques made available by the Project Management, it is appropriate to give a definition of the project.

There are many design definitions presented in the literature. Taking into consideration the definition of the Project Management Institute (2013), a project is "*a temporary initiative undertaken to create a product, a service or a result with characteristics of uniqueness*"[3].

A similar definition is given by Turner (2009), i.e. a project represents "*a temporary organization in which the resources are assigned to carry out the work, so as to obtain a beneficial change*" [4].

Whereas, the ISO 21500: 2012 standard (Guidance on project management) states that a project is "*a unique set of processes, consisting of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective.*

Achievement of the project requires deliverables conforming to specific requirements, including multiple constraints such as time, costs, resources" [5].

While Kerzner (2009), well-known project management expert, consider project "*a set of activities or tasks that have a specific objective, that have defined a start and end date and that consume human and not*"[6] .

In practice, a project represents characteristics of:
- high specialization;
- uniqueness and repetitiveness;
- significant investments in phases such as research and production;
- use of temporary resources to achieve a specific goal;
- predefined budget;
- pre-established time (the duration of the course is usually medium-long).

The non-recurrent nature of the project implies the definition of a start date, the end of the project is established by the achievement of the objective, the exhaustion of resources, the dissolution of the project group or the closure of the "window of opportunity", in fact

the temporal limitation also manifests itself in the need to carry out the activities within precise time windows not dictated by the availability of resources, but linked to the project itself. These typical characteristics of the projects and the relative difficulty in standardizing procedures and activities, require a rather complex control system. In particular, this control focuses on three dimensions:

1. the time dimension, which refers to the timing of the project;

2. the economic dimension, which concerns the costs of the project;

3. the qualitative dimension, which refers to the technical quality of the project.

These variables determine any project, regardless of the sector and the organization in which it developed and represent the constraints of the project.

If the project has to be completed for an external customer, there is a fourth constraint, that is good relations with the customer.

2.2   Features of a project

A project, according to the Project Management Institute, is a temporary effort undertaken in order to create a unique product, service or result. Its main features are:

1.   Temporality: each project has a definite beginning and end. The end is reached when:

   a. the objectives of the project have been achieved;

   b. it is evident that it will be impossible to reach the objectives;

   c. the project is no longer necessary and is closed.

   This does not mean that a project has a short duration, the projects can last even years, the important thing is to understand that the duration of a project is defined. The "temporary" term does not normally extend to the product, service or result created through the project, in fact the goal of many projects is to create lasting results.

   The temporary nature of projects can also be applied to other aspects:

   -    the opportunity or market window is generally temporary;

- as a working unit, the project group rarely survives the project, the group will implement the project and at the end of the project will be dissolved, reassigning the staff to other projects.

2. Unique products, services or results.
   Projects create:
   - a final product or a component of a product;
   - the ability to provide a service;
   - a result.
   Uniqueness is an important feature of the outputs of a project.

3. Progressive processing: this expression means incremental development in successive steps and continuation. For example, in the first phase the scope of the project is defined, this will then be explained and enriched with details and activities as the project team develops knowledge on the sector.

The progressive processing of product specifications must be carefully coordinated with an appropriate definition of the scope of the project, especially in case in which the project is developed on order. If properly defined, the work to be performed must be checked during project progress and the processing of product specifications, following the main phases exposed before.

3 Project management maturity

Knowledge of the level of maturity of organization is essential for top managers, increasingly aware of the importance of project management and the need to undertake a path of maturation to achieve excellence. However, the use of project management is not a sufficient condition to achieve excellence. In the literature we can found different definition about the concept of Maturity that are closely related way. According to Rabechini Junior, "the concern for the maturity in project management arose in organizations because the projects represent the best way to change a complex situation"[7]. Between 1986 and 1993, this concept of process maturity migrated to a

measure of ''organizational'' process maturity. Following the PM Solutions, Organizational Maturity is "the extent to which an organization has explicitly and consistently deployed processes that are documented, managed, measured, controlled, and continually improved"[8]. Nowadays organizations, even adopting Project Management practices, are still immature as they are characterized by improvisation in project management, without a real communication and connection between the various areas of knowledge. By organization we do not mean only an entire company, association or institution but also simply a sector or department or business unit. The organizational dimension depends on the depth with which the project management processes are applied and consequently on how pervasive the project management culture is in guiding people's behaviour. In order to assess the level of maturity it is necessary to take into consideration various factors, analysing them in the environment in which they develop, enhancing the characteristics of uniqueness of each situation. It is therefore necessary, for example, to understand and define how much a specific organization is aligned with the best practices of the sector of competence, if there is or not a PMO at company level or at departmental level, the skills widespread within the organization should be evaluated by analysing the role played by project managers as well as their skills and those of project teams in relation to the application of project management processes.

Every aspect of project management has two dimensions:

- technical dimension;
- human dimension.

The technical dimension includes those groups of practices or processes that are integral to project management, while the human dimension includes not only the people who are operating these processes, but their expertise. The continuous gradual performance improvement as processes mature is in sharp contrast with the way individuals acquire skill. Taken together, these two dimensions, the human and the technical, will merge in a corporate culture that either promotes good project management practice, or that inhibits it. [9]

3.1 Main Fields of Application

Project Management is a transversal discipline because any type of organization can find itself having to manage different projects. The field of research could therefore include organizations belonging to any business sector. To delimit it, we have chosen to start our analysis by analysing two different sectors with regard to the dissemination of Project Management activities and the role of PM within them:

- **Construction**: This is the sector of national economy engaged in preparation of land and construction, alteration, and repair of buildings, structures, and other real property.

  It is one of the sectors of historical development of Project Management. It includes different organizations such as Automotive, Naval (or Marine/shipbuilding) and Building.

- **Information & Communication Technology (ICT)**: ICT sector refers to equipment and services related to broadcasting, computing and telecommunications, all of which capture and display information electronically. It is a sector in which project work is very widespread and structured and it reflects all the changes introduced by technological development.

3.1.1 Information & Communication Technology (ICT)

The Project Management in the Information Technology (IT) is the process of planning, organizing and delineating responsibility for the completion of an organizations' specific information technology (IT) goals. The complexity and importance of IT projects, which involve using software, hardware, and networks to create a product, service, or result, have evolved dramatically.

Today's governments, companies, and non-profit organizations are recognizing that to be successful, they need to use modern project management techniques, especially for IT

projects. To remain competitive in the workplace, it is a necessity develop skills to become good project team members and project managers. They also realize that many of the concepts of projects management will help them in their everyday lives as they work with people and technology on a day-to-day basis.

IT project management includes supervision projects for software development, hardware installations, network upgrades, cloud computing and virtualization rollouts, business analytics and data management projects and implementing IT services. In addition to the normal problems that can cause a project to fail, factors that can negatively affect the success of an IT project include advances in technology during the project's execution, infrastructure changes that impact security and data management and unknown dependent relationships among hardware, software, network infrastructure and data [10].

3.1.2 Construction

The management of construction project requires knowledge of modern management as well as an understanding of the design and construction process. Construction project have a specific set of objectives and constraints such as required time frame for completion. Construction sector is in general characterized by frequent deadlines delays, budget overruns and problems in maintaining proper quality. To prevent such problems, a common practice is to transfer the management methods used successfully in production industry. While the institutional arrangements, relevant technology, or processes will differ, the management of such project has much in common with the management of similar types of projects in other specialty or technology domains such as aerospace or naval. Execution of the construction project is a complex undertaking. Traditional methods of management associated with the same plan implemented throughout the construction period typically operate inefficiently because they do not involve the introduction of improvements in the process. Nowadays for example, using the methodology of Lean Management, production is understood as a network of processes and operations, which make possible not only comprehensive management of the entire construction process from the design phase, but also the implementation of improvements in facilities which are already under construction and the gradual improvement of the situation from the management point of view.

Project management in construction includes a set of objectives which may be accomplished by implementing a series of operation subject to resource constraints.

The main functions of Project Management for construction generally include:

- Specification of project objectives and plans including delineation of scope, budgeting, scheduling, setting performance requirements, and selecting project participants.
- Maximization of efficient resource utilization through procurement of labor, materials and equipment according to the prescribed schedule and plan
- Implementation of various operations through proper coordination and control of planning, design, estimating, contracting and construction in the entire process
- Development of effective communications and mechanism for resolving conflicts among the various participants [11].

3.1.3 Shipbuilding Sector

Shipbuilding, and in particular the construction of large cruise ships or transport, poses particular problems with regard to:
- average size of investments;
- oversized on-board equipment;
- management and approval of thousands of project documents;
- amount of work force required;
- quantity of suppliers involved.

The coordination of shipbuilding, subcontracting companies, the procurement of vehicles and materials, the installation of numerous technological systems and plants are important factors of complexity in the face of jobs that also require thousands of people simultaneously engaged in the various stages of implementation. The life cycle of the naval product therefore entails a strong coordination of activities whose timely planning is of fundamental importance for the respect of the times and costs of realization and delivery of the product itself. This requires not only methodological skills but above all

the ability to set up an Enterprise Project Management system that supports all processes and projects managed in an integrated way. The management of a contract in shipbuilding requires in fact particular attention due to the overall investments and the division of labor into numerous micro-components. From this derives a careful planning of costs and cash flows, but above all a control of the same in phase of realization through the integration of the Enterprise Project Management system with the ERP system. The use of the evaluation of the Earned Value in large projects can be the most accurate way to verify the compatibility of the progress of a project with the preliminary estimates made and to anticipate anomalies and significant deviations well in advance avoiding the need to support excessive financial burdens.

On medium-sized projects and if we want to implement an "aggressive" approach from the point of view of scheduling, of containing time and constraints on resources, the application of the Critical Chain method could be considered.

In shipbuilding, another challenge is represented by the optimization of the use of resources both at the prime-contractor and sub-contractors level and the integration of the large amount of input necessary to achieve the objectives of each naval project. A project manager must therefore set himself in the perspective of identifying and then coordinating the methods to managing project risks by implementing strategies capable of containing possible negative impacts and maximizing the opportunities associated with each job order. The context therefore imposes the need to adopt a methodology that is shared by the whole organization and which constitutes the basis for training both managers and project teams to promote the homogeneity of internal project management practices and practices.

3.2   Automotive sector

The car sector certainly plays a big role, it has a significant economic impact in the world with a production of cars registered in 2016 of 94,976,569, of which 72,105,435 light vehicles and 22,871,134 commercial vehicles with a very high employment rate. Practitioners have forecasted the annual car sales to raise from 75 million in 2010 to 207 million and then 326 million in 2050 and 2100 respectively (Associates and Horizon, 2013).

The industry profits also show an upward trend, in 2012 they were (EUR 54 billion) much higher than in 2007 (EUR 41 billion) and the prognosis for future growth is even better. By 2020, global profits could increase till EUR 79 billion. The automotive sector has also been a sector of reference for revolutionary technological and organizational innovations, starting from Fordism and Taylorism to achieve lean production. In fact, the companies in the automotive industry are among the world's largest investors in research and development.

The definition of the automotive sector is not unique and, in its more meaning enlarged, it may include (Volpato Zirpoli, 2011):

- The final producers of the motor vehicles which are in turn subdivided into manufacturers of cars and commercial vehicles (which can be further subdivided into light commercial vehicles, weighing less than 3.5 tons, and heavy). These subjects are traditionally identified with the OEM English abbreviation which stands for Original Equipment Manufacturers.

- Manufacturers of automotive components that are indicated with the abbreviation "Cs" which stands for Component Supplier. These are further divided according on the economic importance of the component supplied. They are therefore distinguished in first tier suppliers that offer components that you place at the top of the supply chain, and second-tier suppliers specialized in some parts that subsequently flow into complex components

- All upstream activities must also be considered, therefore companies that produce goods and services for the final producers and components (for example the producers of steel or other generic materials), and downstream activities, which they concern the marketing of new and used vehicles and the activities of maintenance and repair.

All this set of activities is to form what is the value chain (Porter, 1985) of the automobile industry, also referred to as "car's supply chain ", seen as the set of activities that are carried out to design, produce, sell, deliver and assist products from the companies in the sector (Volpato, 2008).

3.2.1 A new challenge

For the last 20 years, OEMs and suppliers have drastically increased the pace of new products launches. As a direct consequence, automotive companies face an emerging challenge: to increase the frequency, reliability and profitability of the innovations developed in research and advanced engineering, and at the sale time to maintain their ability to develop more vehicles than ever in a context of very tight constraints on quality, cost and lead time.

Such a strategic challenge called for deep transition in car manufacturers product design processes in the last two decades. Many industry sectors have gone through a structural change towards complex project networks where project teams are geographically dispersed and several industry partners are involved in the development, production or sales of new products.

Owing to a steadily growing competition in the market, the number and percentage of automotive suppliers contributing to the value creation chain has highly increased and will still continue to rise. Therefore, organizations and associations within the industry have already begun to develop standardised methods and process to improve the efficiency and effectiveness of company project management. The time to develop new vehicles significantly reduced as projects changed from functional → lightweight → heavyweight project management [12].

A lightweight project manager is generally part of a functional organisation, where the project manager coordinates but has little influence over the content of the project and has a low status within the organisation. This is in contrast to a heavyweight project manager, who has direct responsibility for the project, has influence both inside and outside of the project boundaries and has a high status within the organisation.

A shift towards more decentralised and geographically dispersed product development teams, an increasing level of collaboration within strategic project partnerships, project transparency is reduced and status measurement becomes more difficult due to a lack of transparency.

To overcome these difficulties, the quality of collaboration in the automotive industry needs to be improved.

Usually an automotive company implemented a matrix organisation consisting of two

dimensions, the functional line (vertical) including sales, development, design, production etc., and projects in the horizontal line. In the pure project management structure, the project members were empowered by their functions to manage their respective contributors assigned by their department manager. They are responsible for the detailed scheduling and budgeting of their work, as well as for performing their activities following function procedures and efficiency plan. The understanding of common goals and of the mutual purpose to create new products is essential for high performance in collaboration.

4 Research Approach and Methodology

4.1 Projectification

We started our focus from the case study "Projectification of the firm: The Renault case" by Christophe Midler, indeed many industrial firms are implementing fundamental changes in their organizations to increase the efficiency of their product development processes. Renault industry was the first to start this process. In 1993, Midler coined the term "Projectification," an amalgam of project and organisational transformation. For Midler, Projectification has been leverage for innovation management. This paper focus on the relations between project management models and the permanent organization and processes of the firm, Projectification is more than a formalisation of project management. It refers to a major organisational transformation that organisations still struggle with at the project and organisational levels.

It is possible to figure out three steps about the Projectification of the firm, in the first the processes involved only the top of the firm. Its focus was essentially to manage the project portfolio in a way that would be coherent with the global strategy of the firm. Another important point is that the projects have no champion to enforce their identity and negotiate with the strategies of the skill-based departments. The project is a result, a compromise between existing professional goals and methodologies. Finally, this phase is oriented towards implementation of the standard Project Management tools: planning, budgeting and the ROI criterion.

In the second phase of Renault "Projectification" process, cross-professional dialogue was limited to the top of the firm. In the third phase cross-professional communication had been generalised to the bottom of the firm, in order to anticipate possible problems as to improve the trade-offs between the various logical systems involved. One of the most significant contributions by Midler is his formalisation of the relationship between the degree of manoeuvrability within a project on the one hand, and the level of knowledge gained over time on the other. The relationship between project knowledge acquisition, uncertainty and the cost of change has been acknowledged for quite a long time. But Midler took it a step further by showing the temporal progression of the project while the organisation moves closer to irreversible decision making, as information flows in and as the project gradually develops. "Project management has to control these coupled

processes from the upstream initiation phase, where virtually anything is possible but where nothing is actually known for sure, to the downstream phase when everything is known but virtually no free choices remain" (Midler, 1995, p. 369).
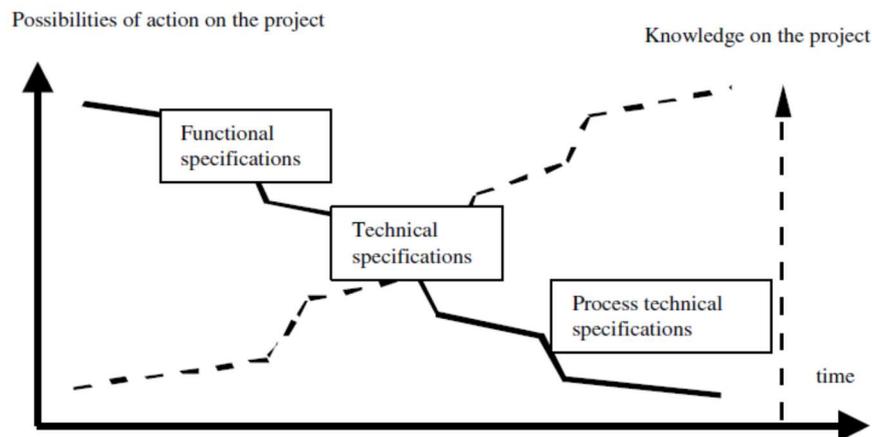

Figure 2 Projectification: The organizational impact of project management

In this model, a project is represented by two connected processes: A learning process (dotted line) in which uncertainty about product features, industrial feasibility and market reception is gradually reduced, and a work process (solid line) in which the freedom to change the project is gradually reduced as the degree of irreversibility of project decisions rises. Project management has to control these coupled processes from the upstream initiation phase, where virtually anything is possible — but where nothing is actually known for sure — to the phase downstream when everything is known, but virtually no free choices remain. The anticipation strategies approach can be visualised as in figure. In a first phase, project managers try to prevent early commitment in heavy irreversible decisions in the same time as they try to gather as much information as possible on the project. On a second phase, the project is locked as precisely and exhaustively as possible. Finally, at the end of the project speed and rapid reaction are given maximum priority in order to expedite the finding of solutions to the remaining technical obstacles [13].

4.2 Project Management Practices

A practice is a structured approach for delivering a project, and consists of a set of processes, with each process having clearly defined resources and activities (Turner, 2000). A project management methodology will set out what an organisation regards as best practice; improve inter-organisational communication; and minimise duplication of effort by having common resources, documentation and training (Clarke, 1999). Research by Payne and Turner (1999) has shown that project management practices can vary significantly from one project to another. However, Kerzner (2001) believes the best way to increase the likelihood of an organisation having a continuous stream of successfully managed projects is to develop a good project management methodology in-house that is flexible enough to support all projects.

The project management methodologies of most organisations are fairly standard with most using a common project-management language and framework across the organisation, often adapted from external standards like those of the PMI.

However, project life cycles and management structures are different in every organisation and therefore one project management methodology does not fit all. Selecting a standard methodology that does not fit within the framework of the organisation will not achieve its promised benefits. Generally speaking, Project management is used extensively in some form within many organizations. "There has been no identified profession or industry where project management practices will not work" (Cleland & Ireland, 2002). Using project management generally helps: to clarify goals and identify problem areas and risk; to isolates activities and easily monitor outcomes. (Project Management Institute (PMI)). Further, using PM enhances accountability as works can be isolated and responsibilities can be assigned; moreover, it helps focus attention on few specific and important tasks. Generally, Project management can best be applied when:

- Resources are to be shared among many units.
- Special attention or focus is to be given to important undertakings (example to focus attention on specific customers in specific market).
- Integration of systems and subsystems is sought within independent units.

- Dealing with ad hoc, complex, unfamiliar, unique, or rare; activities, problems and opportunities.

- Dealing with tasks that require pooling of many resources and capacities from diverse sources (example providing emergency response during disasters).

- It is desired to bring a wide range of experience and viewpoints into focus (example in research and product development or solving complex problems).

- Dealing with an undertaking that require massive input of capital, technology, skills, and resources.

- When it is desired to have unified management of a project-based contract in order to avoid the customer work with many different functional units.

- When there is a need to manage change.

4.3 Project Management Practices in the Automotive Industry

- **Collaborative Project Scorecard (CPS)** → It's a management system that incorporates a balanced set of financial and non-financial measures, that link corporate strategy with the business unit, and translates "a business unit's mission and strategy into tangible objectives and measures" (Kaplan and Norton, 1996, p.10). There are different benefits from its application, such as improves the alignment of project goals with departmental strategy, the efforts of employees to achieve objective, improves transparency and performance in networked project organizations. It improves also the achievement of long term strategies in a project partnership.

- **Agile Project Management** → Agile is an innovative approach to the methodology of project management used to manage turbulent environments, in contrast to the heavier traditional methods, the so-called Heavyweight. Agile methodology uses smaller and auto-managed team and short development cycles of product to keep the focus on continuous improvement of its development. The different groups meet very often to discuss specific objectives, to teach each other, to easier adapt to quick changes when necessary. This allows teams to be more 'agile', more effective and

increases the likelihoods of successfully meet the client's goals. for those who manage projects what matters is the value of the customer first of all. Within the family Agile there are some frequently used methods, such as Scrum (by far the most common), Kanban and Lean [14].

- **Adaptive Software Development (ASD)** → ASD is an agile methodology used to decrease development time, used mostly in big projects and is composed of three phases:

-Speculation: corresponds to the planning phase of the traditional method.

-Collaborate: underlines the central role played by teamwork.

-Learn: learn from mistakes made in previous projects.

The most important characteristic of this model is the response to changes, in fact all modules are independents and their development is possible without having to wait new requirements, they are finally tolerant to changes [14].

- **Platform Project Management** → Platform management is a very common practice used by car manufacturers to build up the entire car. All the new product projects share the same platform, and so component and industrial process, therefore it is necessary an ex ante standardization in order to reach, with its sharing, a higher value and consequently economies of scale. The utilization of platform is a big challenge for the car manufactures, in fact they need to meet the different customer needs for all the various range of model that they have to build up. Every platform is different from another and it depends from the components used and from the process line of the specific company, in fact not all the platforms can be shared. Sometimes they would like to put some components in the platform but they cannot due to their production process line [15].

- **Simultaneous Engineering (SE)** → Adopted in most of the projects in the automotive industry, within the SE core team, specifications, solutions and decisions are coordinated that are related to the whole vehicle and its interfaces between the modules and main functional groups at the level of technical project management. Each module includes a sub structure that requires another team, the

coordination of those teams is managed by an interdisciplinary and process-oriented SE team.

- **Total Quality Management (TQM)** → "Total Quality is a description of the culture, attitude and organization of a company that strives to provide customers with products and services that satisfy their needs. The culture requires quality in all aspects of the company's operations, with processes being done right the first time and defects and waste eradicated from operations. Total Quality Management is a method by which management and employees can become involved in the continuous improvement of the production of goods and services. It is a combination of quality and management tools aimed at increasing business and reducing losses due to wasteful practices" [16].

The Total Quality Management (TQM) approach is based on three fundamental factors:

  - **Process management**: a type of management that, crossing the company functions across the board, gives the possibility to view the entire product creation process or just refers to the operative and daily activities, as opposed to project management, which focusing on the management of innovation and changing. This type of management allows to face and overcome the problems of coordination and lack of interaction between functions, through the use and analysis of customer feedback, data market, operational result and other data, in order to reach the process efficiency and determined targets & goals.

  - **Kaizen**: from the Japanese "KAI" (change) and "ZEN" (well-being), the translated term literally means "change for well-being" and is used to indicate a type of approach based on the concept of continuous improvement. The Kaizen method is a method of improvement that requires a deep knowledge of the processes and the involvement of all people.

  - **Involvement of all**: the involvement of all people is crucial for the TQM approach, in which the quality management must be "total".

- **Quality Function Deployment (QFD)** → It's a tool used to transform customer need into engineering characteristics for a product or service. It identifies key

characteristics for the new product development. QFD is designed to help planners focus on characteristics of a new or existing product or service because QFD provides a system of comprehensive development process for understanding how customers or end users become interested and satisfied by carefully listening to the voice of the customer and then effectively responding to those needs and expectations.

- **ISO/TS 16949** → The ISO/TS 16949 international standard establishes the particular requirements of the implementation of ISO 9001:2000 in the automobile production. It's a Technical Specification that defines the quality management system requirements for the design and development, production and, installation and service of automotive-related products. The ISO/TS16949 can be applied throughout the supply chain in the automotive industry. The purpose is to assist organizations supplying product or service into the automotive sector to operate systems that not only ensure whether these products and services meet customer requirements but also provide continual improvement and reduce variation and waste in the supply chain [17] [18].

- **Advanced Product Quality Planning (APQP)** → This concept belongs to standardized quality management in automotive industry (QS 9000 demands). Product quality planning is a structured method of defining and establishing the steps necessary to assure that a product satisfies the customer. The goal of product quality planning is to facilitate communication with everyone involved to assure that all required steps are completed in time. APQP process uses a Cross Functional Team (CFT), which involves marketing, product design, procurement, manufacturing and distribution, and guarantees the Voice of the Customer (VOC) is clearly translated into specific features and technical specifications.
APQP develops the functions of:
  - Planning and Define;
  - Design and Development of the Product;
  - Design and Development of the Process;
  - Validation of the Product and the Process;

- Final evaluation.

- **PDCA- cycle: e: Plan-Do-Check-Act →** "Lean principles and improvement tools are typical in quality improvement in the automotive industry. Continuous learning and incremental development are basic elements of lean manufacturing" (Liker, 2004). Highly integrated manufacturing processes require continuous changes and quality improvements and the integrated information systems in the process enable the manufacturer to do so using real data. This is reflected in the PDCA- cycle:

  -**Plan**: OEMs identify the potential improvements before they launching a new vehicle, from field quality faults and from supplier quality results such as JIT or PPM5. In order to plan changes are used standardized tools, in particular cause-effect diagrams.

  -**Do**: The supplier use a small-scale production to try the cost of a new change, often done at the mother plant. Usually OEM evaluate a "batch" of products or processes and does not accept a zero-series. Most of the processes are well described and connected to integrated common quality systems used from the organizations to see if changes are working or not and to investigate the quality and efficiency of the selected processes.

  -**Check**: Normally quality requirements are well defined by the OEM. In this stage the organizations check if the "Do" is aligned with the "Plan". If there are misalignments or quality problems with the original plan, corrective measures are taken.

  -**Act:** The integrated processes need that changes have to be documented in order to mapped and standardized the processes. Depending on the size and type of the changes, the operators and people involved will do training and learning process to implement changes [19].

- **Lean Project Management →** Is the comprehensive adoption of other lean concepts like lean construction, lean manufacturing and lean thinking into a project management context. The main principle of lean project management is delivering more value with less waste in a project context [20]. To this end, for the organization it becomes necessary to map the flow of generation of the value and

analyse it with the aim of distinguishing the activities that produce added value from those with no added value in order to:

- Identify and eliminate hidden costs that do not add any value to the consumer;
- Reduce the complexity of processes (and consequently errors and waste annexes);
- Reduce the process lead time;
- Increase capacity thanks to better use of resources

Lean project management has many techniques that can be applied to projects and one of main methods is standardization.

The Value Stream Mapping (VSM) is the tool that the Lean approach uses to realize this, it is a map that represents a specific business process (from the order arrival to the delivery of the finished product), identifying the information and material flows, storage, expectations, controls and operations, explaining capacity, efficiency and stock levels. In addition, within it are distinguished the value-added activities from those not added value, thus allowing to follow the gradual creation of value gradually.

- **World Class Manufacturing (WCM)** → World Class Manufacturing is a concept which has proven effective in regaining competitive edge, the focus is on continuous improvement. As organizations adopt world class manufacturing, they need new methods of performance measurement to check their continuous improvement. WCM is a structured production system that promote long-lasting, systematic improvements aimed to evaluate and attack all types of wastes and losses applying methods and standards with rigor and through the involvement of everyone. It embraces the entire organization of the factory, starting from health and safety, involving quality system, maintenance system, workplace organization, logistics and environment.

World Class Manufacturing is the way in which organizations prepare to face these needs trying to support, with efficiency and effectiveness, the following three pressing pushes:

• **Life Cycle Cost**: frenetic need for overall cost reduction throughout the life of the product;

• **Time to Market**: reduce research, development and product market times;

• **Lean Production**: boost to rationalization and overall flexibility of production and absolute containment of stocks.

The WCM, like Lean Production, is based on the concept of continuous improvement and provides for the maximization of added value by eliminating all types of loss and waste and by involving all people who work at any level of the organization. From this it follows that this, like Lean Production, is based on three key concepts that are:

• **Added value**: what the end customer attributes value to;

• **Loss**: use of a resource associated with a cost but not the creation of value;

• **Waste**: loss that occurs when more resources are used than strictly needed.

The paradigm is "world class = zero". "Zero" means zero defects, zero inventories, even zero quality checks. These objectives are the basis of world class production. The zero reminds at the same time a target, the reference value, and an aggressive program of improvements.

5 Exploration of the Survey

As anticipated previously, in order to evaluate the "State of Project Management Practices in Automotive Industry" we used a survey addressed to employees of companies belonging to the automotive sector, in collaboration with Meccanica Meccatronica Associate Companies, AMMA of Turin. The use of an exploratory research and the subsequent processing of the collected data has enabled us to:

- deepen and understand the current size and level of implementation of Project Management within automotive companies;
- identify the main and most frequent project management practices adopted by companies in the sector;
- have an estimate of the number of qualified personnel;
- improvements in company performance following the adoption of Project Management practices.

Before analysing the various sections of the survey in detail, we can take a general look at the way in which the questions are formulated. Mainly multiple-choice questions have been used because the use of closed questions has several advantages such as:

- same reference framework;
- standardized answers that allow to compare the responses of each individual;
- lower response time;
- ease of use of data for subsequent processing;
- simplicity of compilation by the respondent;
- objectivity of the evaluation.

A logical succession of the themes dealt with was established, imposing a certain level of coherence on the topics dealt with, so as not to condition the response, thus avoiding data distortion. To verify the validity of the survey before starting the actual survey campaign, pre-tests were carried out, through meetings with sector Project Managers. We thus arrived at the formulation of questions that were equally understandable by all the interviewees and were not ambiguous. To this end, definitions have been added to

clarify the questions related to particular topics. Using a funnel succession, we then moved from general questions to more specific questions to help the respondent to better focus the attention on the proposed topic. The measurement scale used is an ordinal qualitative Linkert scale, since it allows us to obtain an ordering among the various attributes, producing a distribution according to an ordered qualitative character.

5.1   Respondent's Data

Before starting with Section 1, is inserted an introductory preamble to briefly illustrate the objectives and aims of the survey, to specify the promoters of the research and to guarantee the confidentiality of the interviewee's personal data. The first data collected concern general information on the interviewee and the company where he is employed, such as:

- Name of the Organization/Company;
- The size of the company in terms of number of employees;
- The designation of the respondent.

The method chosen for sending the survey and collecting the information is by e-mail accompanied by a letter of presentation.
The sample we analysed consists of 80 answers, of these:

- the 88.8% (71) of respondents accepted and correctly completed the survey;
- the 11.3% (9) of respondents refused to continue with the survey.
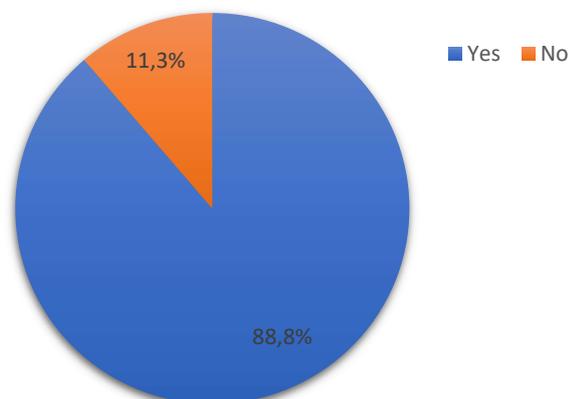
Figure 3 Survey Sampling

The majority of the companies involved are for the 76.1% a small company with less than 200 employees, 15.5% a medium-sized company with 50-250 employees and 8.5% a company with more than 500 employees [Figure 4]. The companies taken into consideration for the administration of the survey belong to the Automotive sector. On the total of the sample, for 71.8% Automotive turns out to be the relevant part of the organization, and only for 28.2% not.
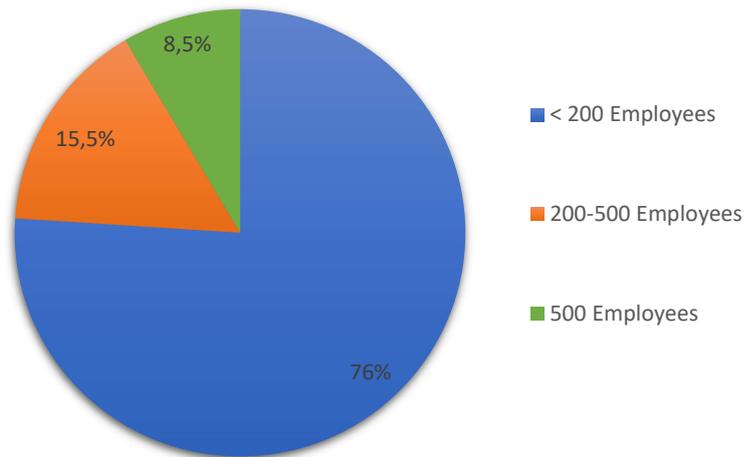

Figure 4 Size of Organizations
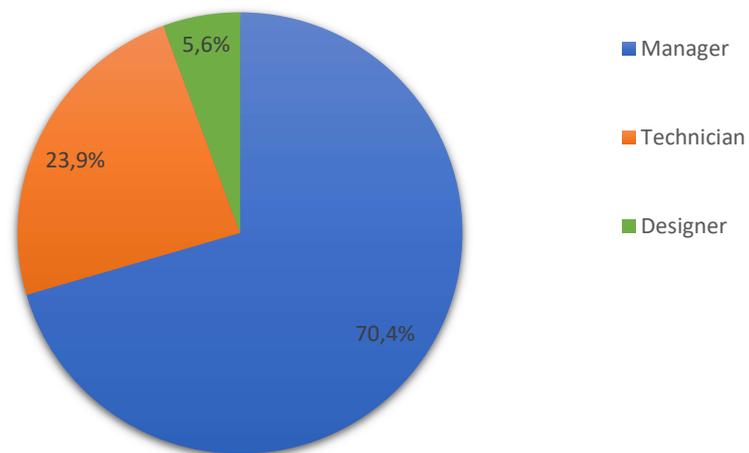
Figure 5 Role of Respondents

The analysed sample is composed of 70.4% by Manager, 23.9% by Technicians and 5.6% by Designers [Figure 5], with work experience ranging from 1 to 60 years, see Figure 6. As shown in the histogram, a large part of the respondents demonstrates a lasting

experience in the sector with an average work experience of around 22.8 years. In our subsequent analysis we will analyse how the project management vision differs between these different company figures.
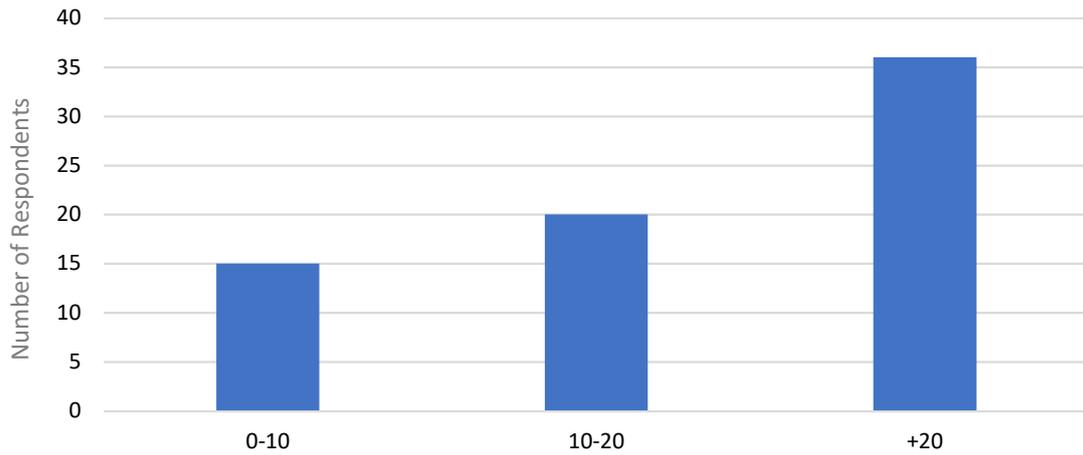
Figure 6 Years of Experience

5.2 Section 1: Current state of Project Management

Section 1 aims to evaluate the current level of Project Management within the organization using an ordinal scale in order to express the values obtained in order of magnitude and to compare the relative positions within the numbers assigned to a certain variable. An ordinal scale from 1 to 5 was then used according to table 1.

1	Not at all.
2	Basic Level
3	Moderate Level
4	Moderate/Advanced Level
5	Complete Implementation

Table 1 Response table

The first question, more general, requires for the respondent to evaluate the level of implementation of Project Management practices within the organization. As it is possible to understand from the Figure 5, the most common situation about the level of implementation is Moderate for 46,5% and only in the 11,3% of organizations it does not appear to be any implementation. In line with the documentation presented above, it is clear that companies have now begun to integrate Project Management practices within their own organization.
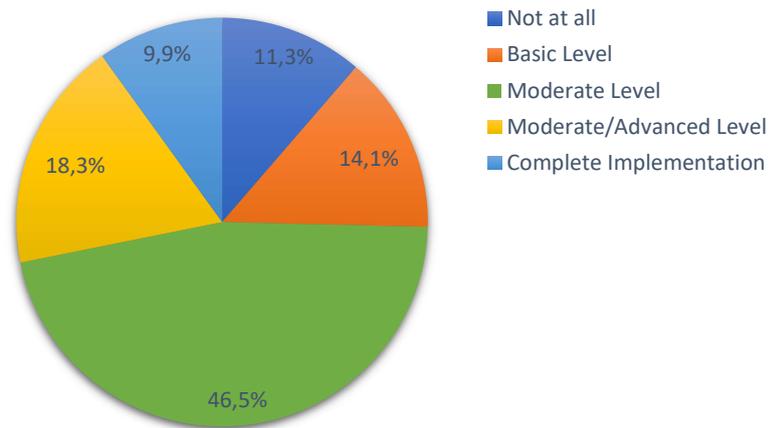
Figure 7 Project Management Implementation

As already mentioned previously, the Project Management aims to reorganize the work by centralizing the role of the team project, through the use of temporary structures within which all the skills and resources necessary to achieve a given objective are brought together. In this way, the strengthening of the role of the team project allows to simplify the role of functional/departmental managers, allowing each team to self-manage on the basis of real needs without waste of resources. The second question goes into the specific, by trying to measure the level of integration of functional / departmental activities at the platform level or team projects. The main activities of interest with relative response graph are:

- **ICT management tasks**: In close contact with customers and team members, they relate to the planning, coordination and management of a range of activities in the field of IT or telecommunications projects.

They also ensure that personnel and equipment are optimal and functional for the achievement of the project's goal.
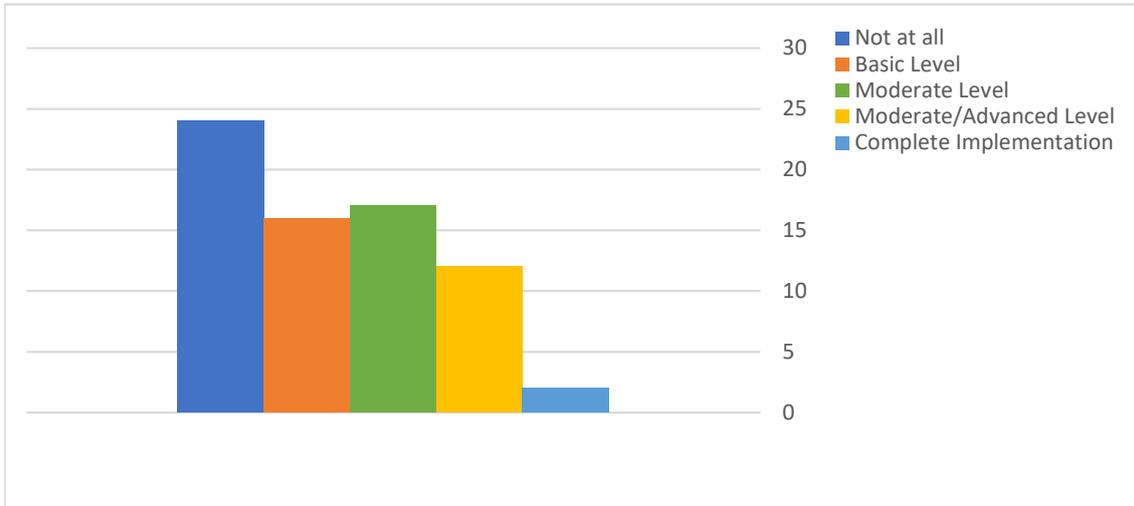
Figure 8 ICT implementation

- **Logistics tasks**: the main functions relate to the execution of projects in compliance with the requirements of customers and companies in order to achieve the goal at the lowest cost with the appropriate quality.
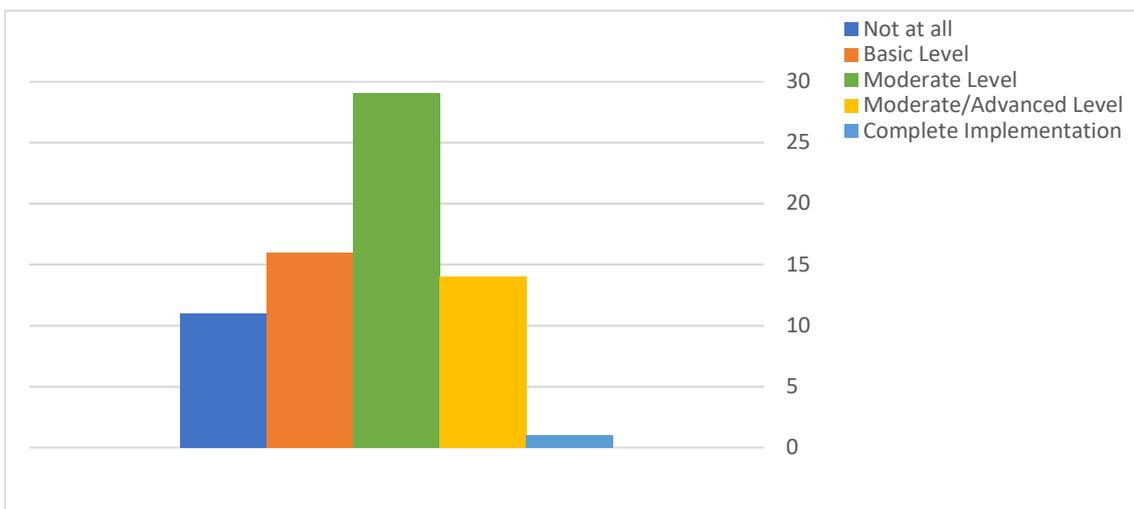
Figure 9 Logistics tasks implementation

- **Purchasing Procedures**: everything related to the purchase of materials, tools, services and supplies for the project in question, then provide the project team with all the means to achieve the final objective.
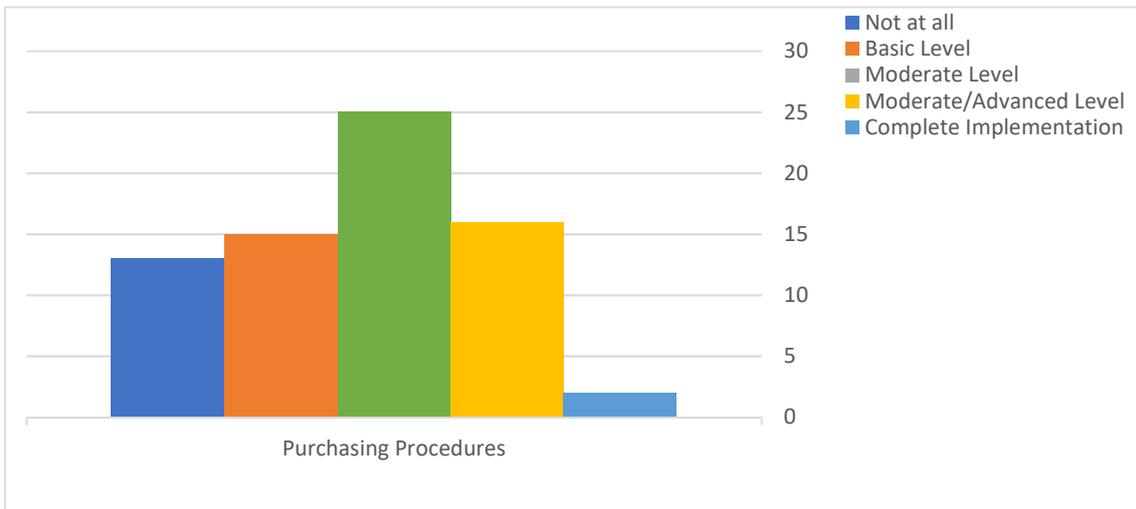
Figure 10 Purchasing implementation

- **HR management tasks**: the good integration of human resources involved in the project is fundamental for having a productive work environment. Usually the head of human resources is also responsible for monitoring the budget and supervising the project.
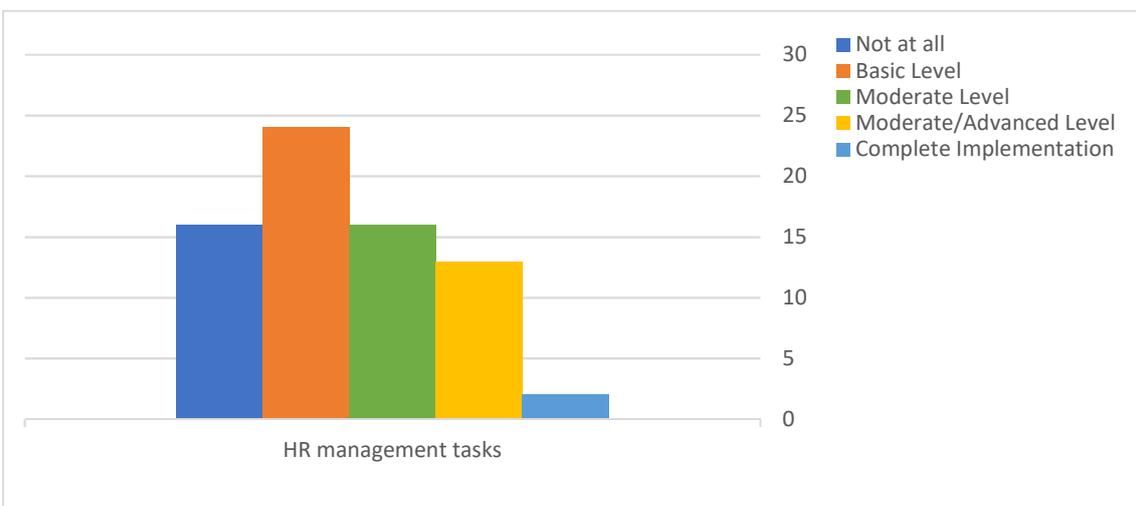
Figure 11 HR Tasks Implementation

- **Process Management tasks**: define the activities carried out by the project manager and the other stakeholders to control and manage a project, the main objectives are to increase the efficiency and transparency of production processes within the team.
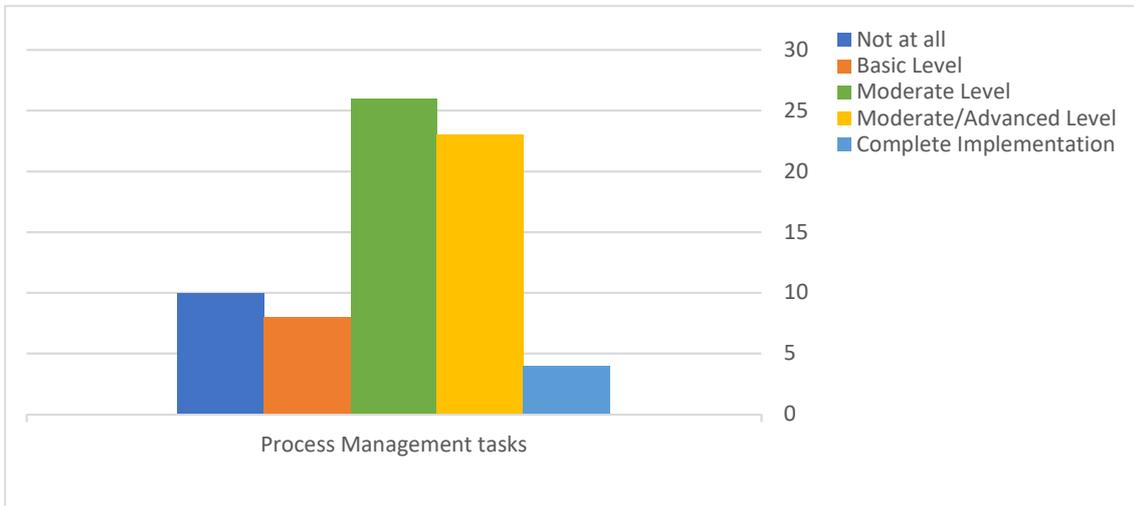
Figure 12 Process Tasks implementation

- **Sales Functions:** deals with the marketing and distribution of goods or services produced by the organization, among the main functions we find the management of customer relations, the collection and management of orders and the organization of the sales network.
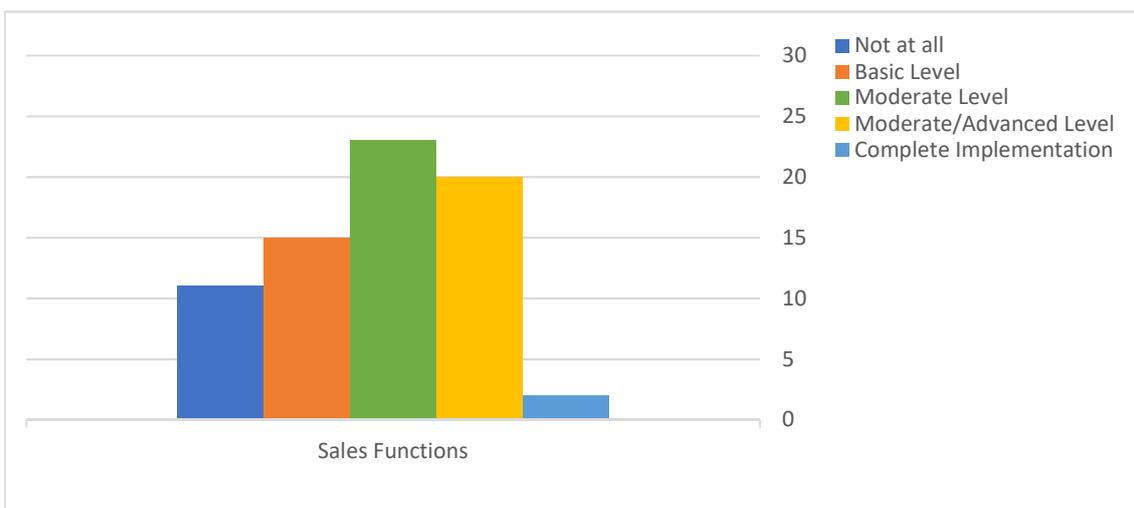
Figure 13 Sales functions implementation

- **Quality tasks:** deals with following the preparation and progress of project activities day by day ensuring the correct use of best practices and compliance with ISO standards in the production process in order to maintain a desired level of quality;
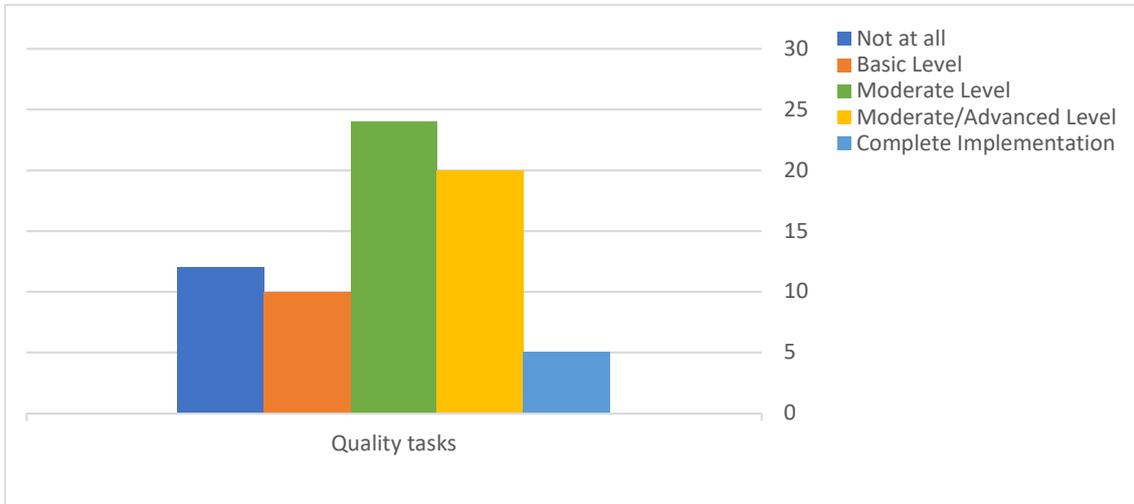
Figure 14 Quality Tasks implementation

- **Engineering & Design functions:** defines the materials and design that will constitute the final product;
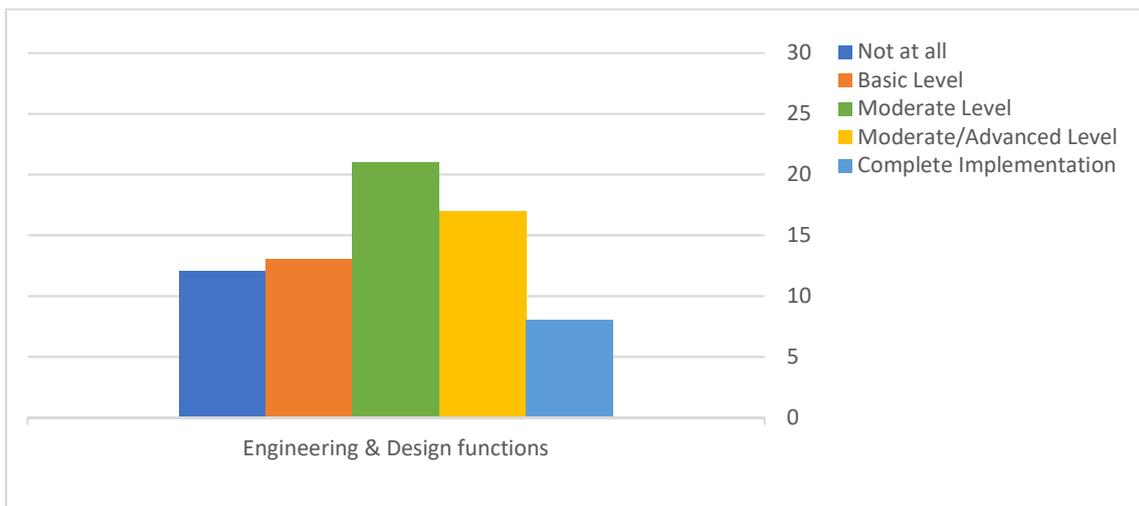
Figure 15 Engineering & Design implementation

- **Research & Development functions:** they study how to create technically advanced products and innovate production processes in order to improve the quality of the goods / services produced;
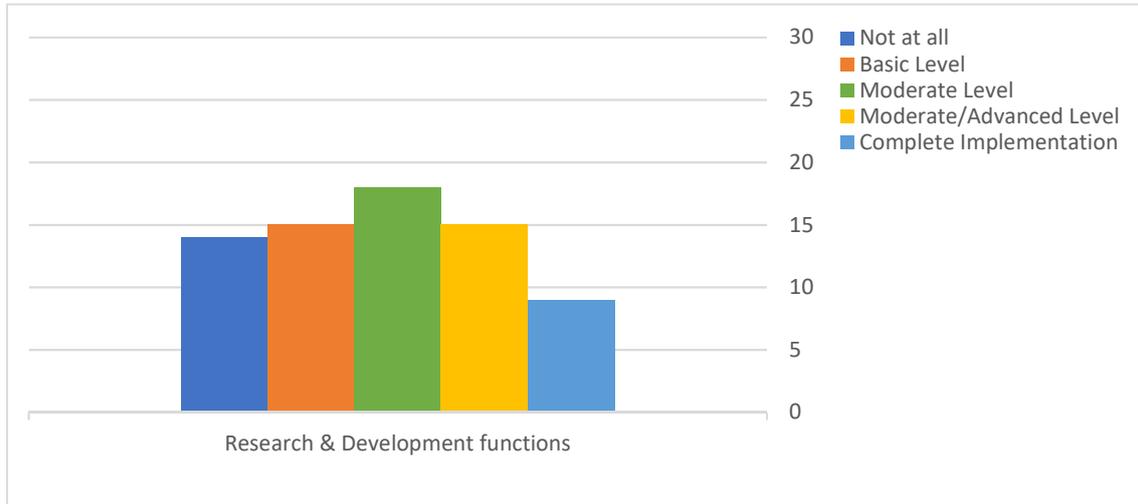
Figure 16 Research & Development implementation

From these data we can deduce, more generally, that in all organizations ICT Management tasks have the lowest rate of implementation among the various practices. On the contrary, Processes Management task represents the most implemented function with a level that settles between Moderate to Advanced, following by Engineering & Design and Research & Development.

5.3   Section 2: Strategic Alignment

5.3.1   Project Management Office (PMO)

Section 2 of the questionnaire explores the level of alignment of the company's strategic objectives with Project Management practices. In order to improve strategic alignment, companies try to increase and standardize the application of best practices and, at the same time, support a real and effective communication and collaboration with the various stakeholders involved in the projects.

In this process, to achieve optimized project management and to generate greater profits and competitive advantages, the Project Management Office (PMO) is playing an increasingly pro-active role. The Project Management Institute (PMI) defines the PMO as "a management structure that standardizes the project-related governance processes and facilitates the sharing of resources, methodologies, tools, and techniques" [3] with the responsibility of reporting to the Top Management the status of ongoing projects. The PMO manager must be sure that the various teams use common processes, providing adequate support in case of problems, involving all the project managers in the same way. More deeply, PMI mentions that "a primary function of a PMO is to support project managers in a variety of ways which may include, but are not limited to:

- Managing shared resources across all projects administered by the PMO;

- Identifying and developing project management methodology, best practices, and standards;

- Coaching, mentoring, training, and oversight;

- Monitoring compliance with project management standards, policies, procedures, and templates by means of project audits;

- Developing and managing project policies, procedures, templates, and other shared documentation

- Coordinating communication across projects." [3]

5.3.2 Question 3: PMO Size

The first part of section 2 deals with the spreading of the PMO within the sample of the organizations involved. Not all companies in fact, while working for projects, present a specific PMO in their company organization, and from the survey's data we come out that just the 32,4% of organizations have a dedicated PMO, more specifically all the company with more than 250 employees, while the 60,6% not. For the companies in which it is present, it was asked whether the head of the PMO directly relates to the top management level and it happens just in the 39,4%. Overall, the size of the PMO looks to be mostly very Small or small, they count respectively for the 50,7% and 23,94% of total. No one among the organization claims to have a very large PMO office. It is possible to assume that for the moment there is not a strong spread and presence of Project Management Office within the organizations.
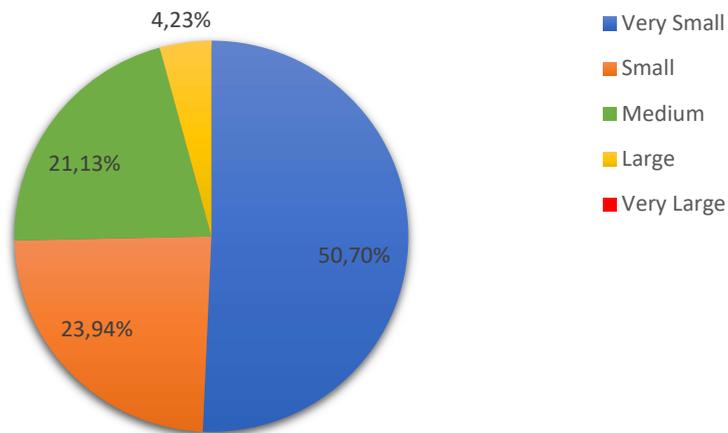
Figure 17 Size of Project Management Office

In the event that it was not present, it turned out that most organizations in the absence of a specialized PMO are replaced by the CEO Office, Quality Department and Human Resource Department. In the most case Quality Department take care about the strategic alignment of the organization following directly by CEO Office and HR department.
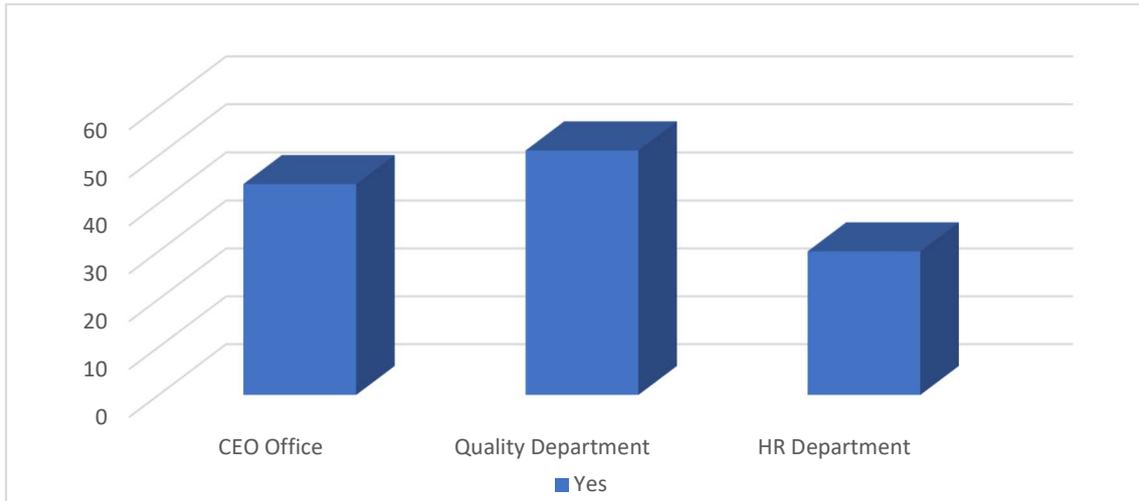
Figure 18 PMO sostitute

5.3.3 Question 4: PM certifications

Question 4 addresses the issue of certifications held by the company's project managers. Over the years, the ever-increasing use of Project Management systems has led to the emergence of numerous organizations at national and international level that have set standards in project management. Among all the organizations, identified worldwide, that define the project management criteria, we have selected two: the PMI and the IPMA.

- The Project Management Institute, also known as an PMI, is internationally recognized as the most authoritative institution in the field of Project Management. It aims to standardize the best common practices in project management in different sectors and his PMBOK (Project Management Body Of Knowledge) is a standard ANSI and an important base of the new ISO 21500 (A guide for project management) about Project Management.

- The International Project Management Association, also known as IPMA, is the first Project Management's association created. Today it is the most widespread federal association, composed by national associations, today we can count about 40, working in the project management area.

It is interesting that in the 80,3% of the sample, there are not organizations certifying the project managers of the company, just 7% use PMI and the remaining part have a partnership with global corporation, like RINA, BDM, that assist the companies during the entire life cycle of their projects.

It was therefore requested to provide an estimate of the number of qualified personnel within each organization. If we do not consider 33,8% of data not available, according to what we have just seen, the trend for Projects Managers to gain Project Management certification is Low / Medium in the most case, respectively 36,6% and 21,1%.
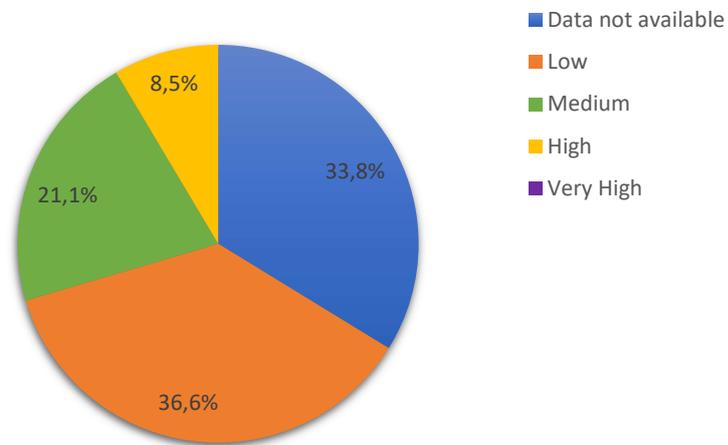
Figure 19 Level of certifications

5.3.4 Lean Project Management

At the end of the section there is a question concerning the use of Lean Project Management techniques. In the 56,3% of the sample the companies are not applying Lean Project Management Techniques to their own projects. For the 43,7% they are using them and more specifically all the companies with more than 500 employees are all using Lean PM techniques.
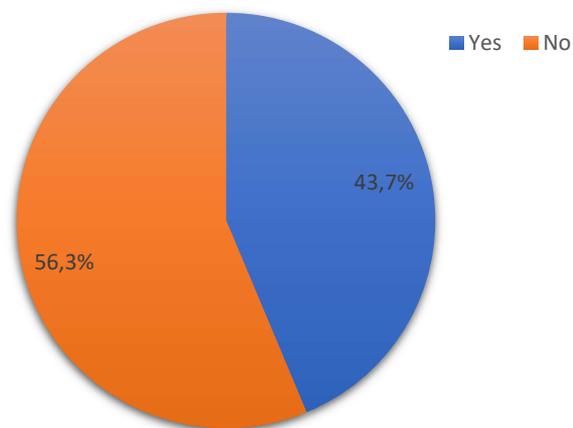
Figure 20 Use of Lean Project Management

5.4 Section 3: Effectiveness of Implementation of Project Management Practices (Firm's Experience)

Section 3 is about the effectiveness of implementation of Project Management Practices from the firm's experience. It consists of two parts:

- The first part investigates the use of certain management techniques within the organization.
- The second part explores the extent to which Project Management helps their implementation.

Among the techniques presented above, the most commonly used in the automotive sector were selected, namely:

- Collaborative Project Scoreboard (CPS)
- World Class Manufacturing (WCM)
- Platform Management
- Simultaneous Engineering (SE)
- ISO/TS16949
- TQM/QFD

From our sample, we will consider the companies where automotive is the main business, it is possible to see that ISO/TS16949 is the most applied in the automotive sector, following by the application of World Class Manufacturing and Simultaneous Engineering.
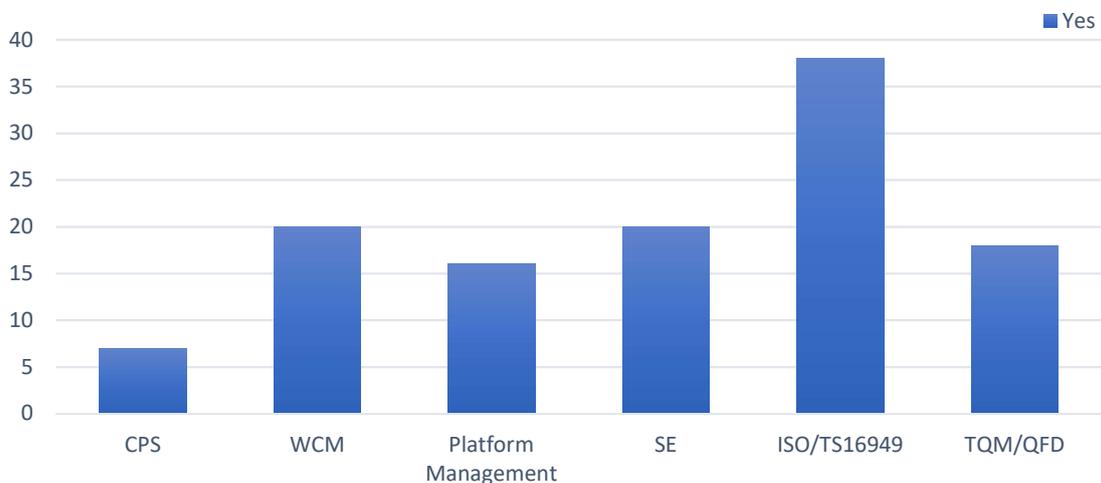
Figure 21 Application of Project Management Practices

To answer the second part, the following table was used as a reference

1	Strongly Disagree
2	Disagree
3	Don't know
4	Agree
5	Strongly Agree

Table 2 Response table

The most part of companies agree or strongly agree that Project Management support, mainly, the implementation of ISO/TS16949, World Class Manufacturing and Platform Management.

5.4.1 Business Performance

Question number 8 evaluates the impact of project management practices in improving business performance, a question to better understand the position of the organizations with the competitors, more specifically if the implementation of Project Management are improving business performance in terms of three different gap, factors that will determine revenues and costs of organization. Most of the organizations agree to say that a good implementation of Project Management practices help the organizations to better perform the work with lower time and lower waste of resource. In particular we examined:

- Time to Market Performance: it is one of the most critical factors within the automotive industry and includes all the operations carried out from the moment of designing the product to its commercialization. In other words, it is the period of time invested to design and launch a product on the market. The reductions of Time to Market leads to an improvement in business performance.
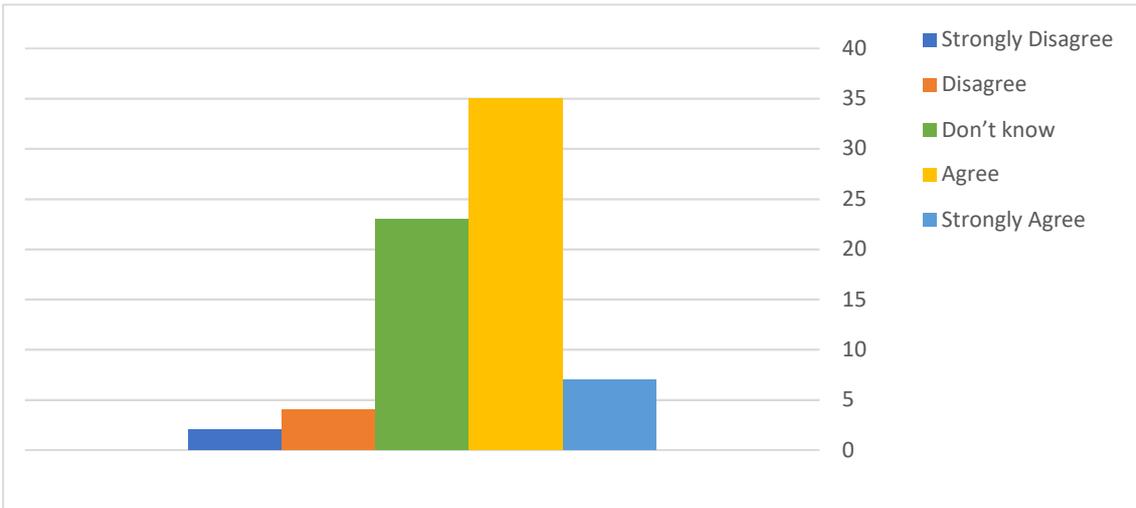
Figure 192 Time to Market improvement

- Budgeting Performance: the budgeting process in the management of a project focuses mainly on the identification of the characteristic costs of a project, on their time trend during the project life cycle and on the optimization actions to make the plan compatible with the availability funds to finance the project. A good project management methodology leads to a better technique of estimating the budget and the resources needed to reach the project's goal.
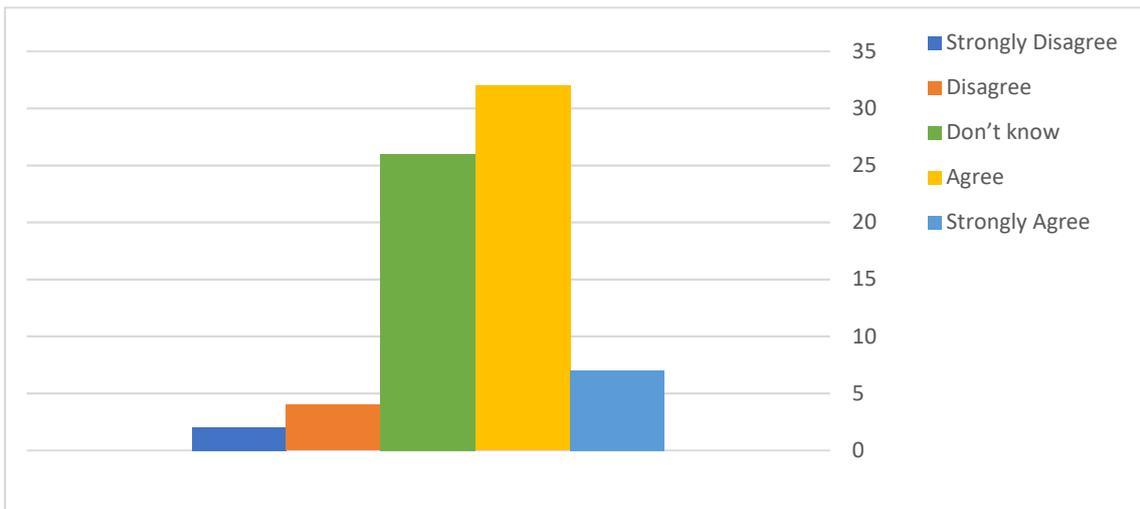
Figure 203 Budgeting Performance improvement

- Quality of the Product: the good implementation of project management within the company should lead to an increase of final product quality. The final goal should be to produce what contractor required, with specific features and characteristics. A quality gap can compromise the ability to compete in specific market, in this case a Project Management methodology give politics and guide line to improve quality
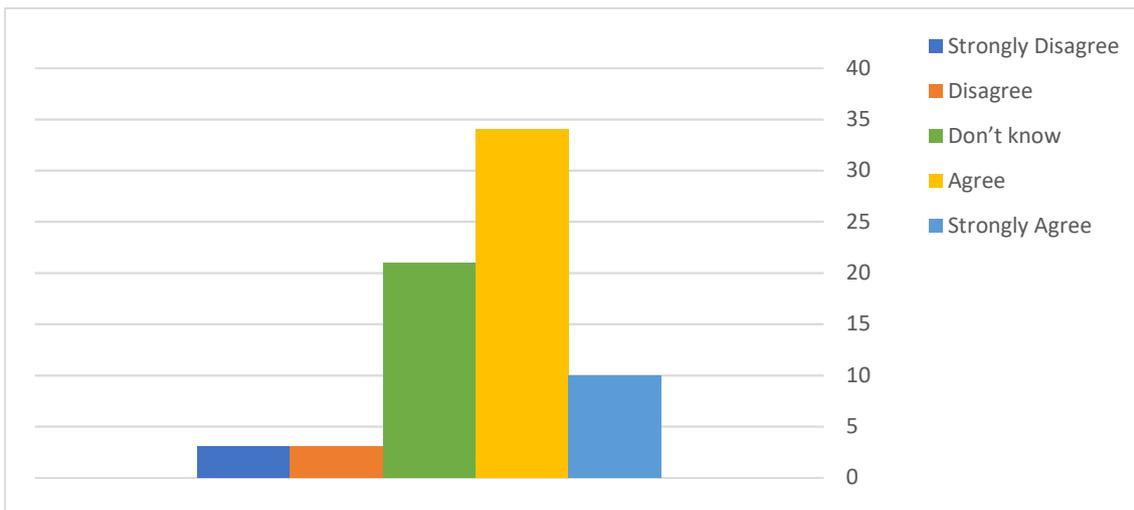
Figure 24 Product Quality improvement

5.4.2 Firm's Reputation

Closely linked to the business performances, the following question is about the improvements of company's reputation among its customers and suppliers. The improvement of the business companies just seen, through the application of Project Management practices, translates into an improvement in the company's reputation. In particular, the use of specific methodologies, tools and techniques ensures the efficiency of Time to market and that the product quality is in line with customer requests. All this leads to an increase in corporate credibility and reputation among customers and suppliers, also deriving from a stronger position on the market that allow the company to have greater contractual powers.

Most companies agree (50,7%) or strongly agree (9,9%) to say that the implementation

of Project Management practices improve firm's reputation among the customers and suppliers.
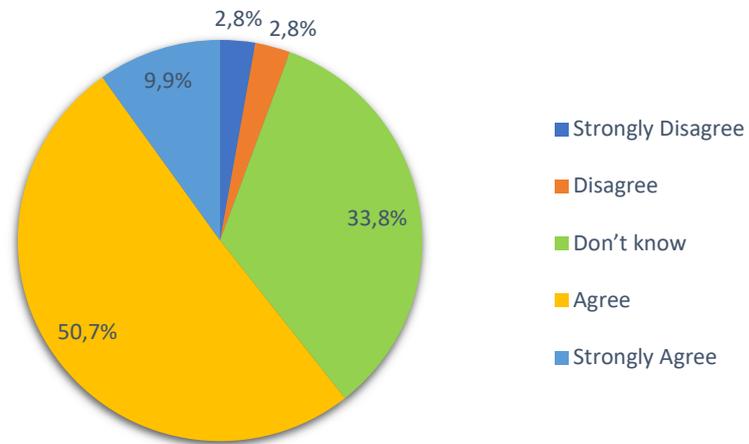
Figure 215 Firm's reputation improvement

5.4.3 Competitive Edge

" Has Implementation of Project Management practices helped your company in attaining competitive edge over your competitors?"

Many research shows that a good alignment between projects and business strategy is a source of competitive advantage. We can distinguish benefits that regard the strategic management of the project and benefits more closely related to the execution of the project but, ultimately, it is possible to bring all the benefits back to economic benefits. In all this, in order to increase the benefits deriving from future projects of the organization, a primary role is played by the correct implementation of the Project Management practices, in the absence of these in fact the success of the projects would be at the discretion of knowledge and experience of individual project managers. The implementation of Project Management practices allows a new way of managing projects, aligning company strategies in order to achieve company goal.
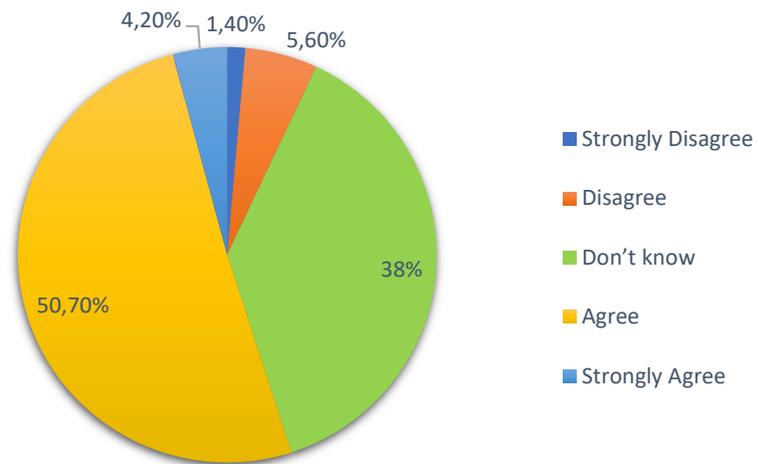
Figura 26 Competitive Edge improvements

5.4.4 Human and Material Resource

The last question of the section is about Human and Material Resources and more specifically if the implementation of Project Management practices has led to a better use of them. Today human and material resources are moving towards a more strategic level given the central role that modern management models attribute to them and their development in order to achieve the business goal. In the modern management are nearly the most important sections within the organizations.
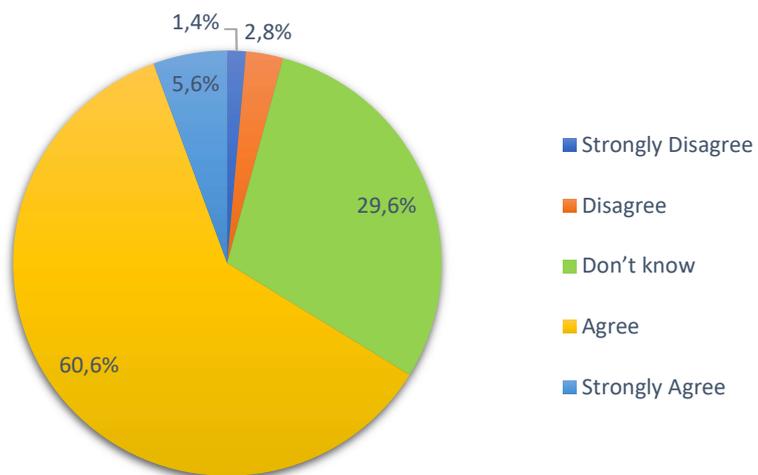
Figure 27 Percentage of consents

5.5 Section 4: Future direction

5.5.1 Project Management

The last part of the survey is about the future plans of the company. During this research we have figure out that Project Management is a real situation that is becoming more and more widespread in the automotive sector. The organizations also start to recognize the importance to aim a good implementation of Project Management practices. This is confirmed also from the future intentions of the organizations, in fact the majority of the sample agree or strongly agree on the will to improve the implementation of Project Management practices within the organization.
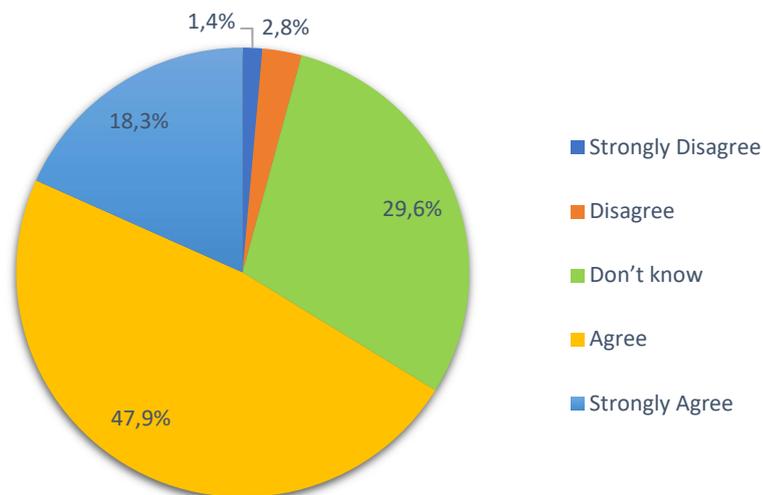
Figure 28 Project Management Future Implementation

5.5.2 Lean Project Management

We can say the same also for the future implementation of Lean Project Management practices. The question asks respondents to express their opinion on possibility, for their organizations, to continue the future integration of Lean Project Management. From the following graphs is it possible to summarize, leaving 46.5% unable to answer, that organizations want to continue improving it in the future. Only 4,2% of respondents disagree, or strongly disagree, 1,4%.
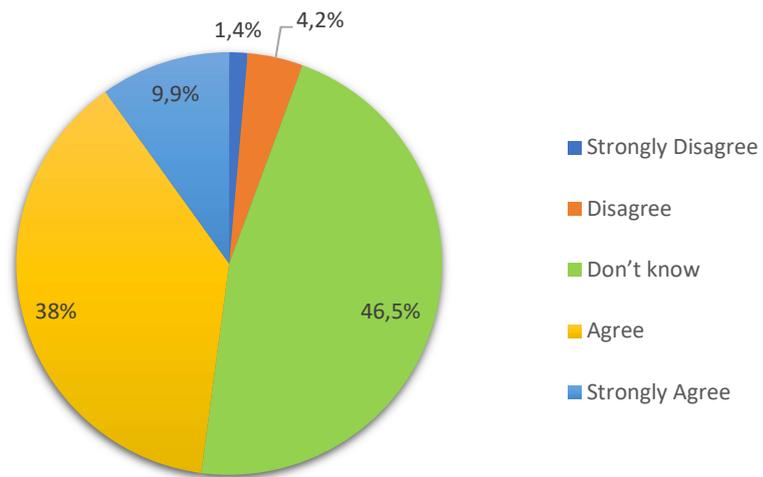
Figure 29 Lean Project Management Future Implementation

5.5.3 Project Management Certification

The presence of Project Management certifications within the organizations will increase in the future, the majority of respondents agree with the importance to obtain certifications to better apply the sector's standards.
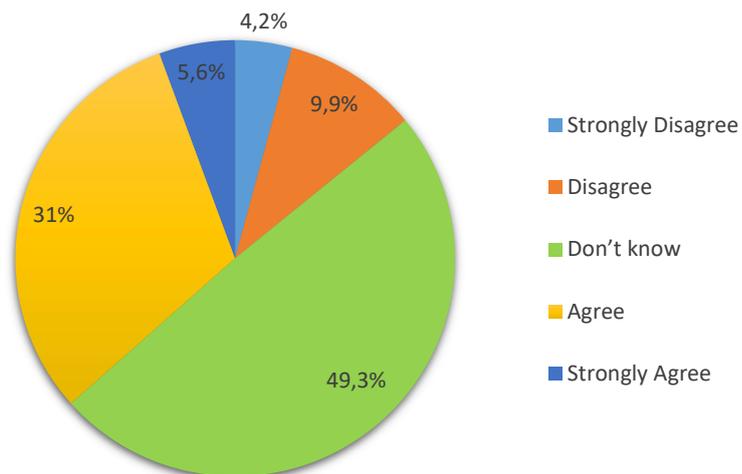
Figure 30 Obtain of Future Certifications

5.5.4 Information and Experience Sharing

The last question concern sharing information and experience along the supply chain, more specifically if it would increase the value of the supply chain itself. Today, information sharing is essential for the survival of companies and constitutes a real competitive advantage in the absence of which, according to many scientific research, we find inefficiency in the management of the various business units. The type of information that can be shared is wide, such for example, logistical, strategic, tactics, etc. Each project or team work involves flows of information, knowing how to better manage this information, exploiting it as resources, leads to better efficiency and a reduction in costs and time. Today, technological progress and globalization have made information sharing easier and more accessible. The analysed sample agrees (43.7%) or strongly agrees (15.5%) in recognizing that the sharing of information would lead to an improvement in the value of the supply chain itself.
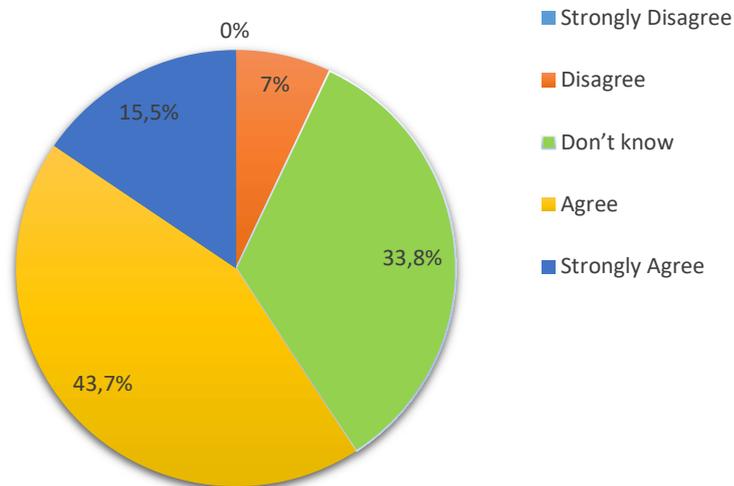
Figure 221 Improvement value of supply chain

6 Kruskal-Wallis Test

Rather than assuming a data distribution and testing the equality of population means with one-way ANOVA, we decide to select the Kruskal-Wallis procedure to test H_0: $\eta_1 = \eta_2 = \eta_3$, versus H_1: not all η's are equal, where the η's are the population medians.

The Kruskal Wallis test is, the non-parametric alternative to the One-Way ANOVA, used to determine whether the medians of two or more groups differ.

The test statistic used in this test is called the H statistic and it is used when the assumptions for ANOVA aren't met (like the assumption of normality). It is sometimes called the one-way ANOVA on ranks, as the ranks of the data values are used in the test rather than the actual data points. The test determines whether the medians of two or more groups are different. Like most statistical tests, we have calculated a test statistic and compared it to a distribution cut-off point. The hypotheses for the test are:

H_0: population medians are equal.

H_1: population medians are not equal.

The Kruskal Wallis test will tell us if there is a significant difference between the median of the group's member.

These are the assumptions that we have used for the test:

- Three independent variables with 3 levels (independents groups).
- Use of ordinal scale for dependent variables.
- Data does not have a particular distribution.
- Dependent variables are continuous.
- The observations are independents, there is no relationship between the members in each group.

In our test we have used as Factor levels (with relative participants for each group):

- Role:
  - o Designer (4);
  - o Technician (17);
  - o Manager (50).
- Size of the company:

- o < 200 employees (54);
- o > 500 employees (6);
- o 200-500 employees (11).
- Years of experience:
  - o 0-10 years (15);
  - o 10-20 years (20);
  - o 20+ years (36).

As it is possible to see, the size of the groups is unequal, especially "Designer" among Role Factor and ">500 employees" within Size of company Factor. Instead for the response variable, we have adopted a Likert ordinal scale, referring to the following response table taken from the different section of the survey.

1	Strongly Disagree
2	Disagree
3	Don't know
4	Agree
5	Strongly Agree

Table 2 Response table

We have therefore analysed the perception of the different Factors in relation to the issues dealt with in the survey, in particular if a respondent's answer, related to a specific topic, depends on his business role, years of experience or the size of the company in which he works.

The analysis was initially conducted on the total of respondents (71), in order to determine if the difference between the medians of the various group is statistically significant, we compared the P-Value obtained from the Kruskal-Wallis test with the level of significance chosen to evaluate the null hypothesis H_0 which states the population medians are all equal. The level of significance (α) chosen is $\alpha = 0.05$, it means a risk of 5% to rejected the null hypothesis when it is true. So, if:

- P-value $\leq \alpha$: The differences between the medians are statistically significant.
  If the p-value is less than or equal to the significance level, we reject the null hypothesis and conclude that not all the group medians are equal.
- P-value $> \alpha$: The differences between the medians are not statistically significant.

If the p-value is greater than the significance level, we do not have enough evidence to reject the null hypothesis that the group medians are all equal. [21]

Let's focus now on the key statistic results with a P-Value $\leq \alpha$., giving before a definitions and interpretation for every statistic, provided by the Kruskal-Wallis test:

- Sample size (N): total number of observations for each group.
- Median: the midpoint of the entire data set, at this value half of the observations are above and half of the observations are below the value.
- H: the test statistic for the Kruskal-Wallis test. Under the null hypothesis, the chi-square distribution approximates the distribution of H.
- Average rank (Ave Rank): is the average of the ranks for all observations within each sample. Minitab use the Average rank to calculate the H statistics.
- Z: Z-Values indicates how the average rank for each group compares to the average rank of all observations. It can be positive, if the group's average rank is higher than the overall average rank, or viceversa negative.
- Degrees of Freedom (DF): equals to the data's number of groups minus 1.
- P-Value (P): a probability that measures the evidence against the null hypothesis (H_0).

6.1   Respondents 71

Let's start our analysis with Kruskal-Wallis test conducted on the totality of respondents (71). In the following tables we will explore the relationship between Factors Level, in bold on the top-left, and the different sections of the survey. Each column represents, starting from left to right, the question for each section, the participant of the group with relative median and mean scores for each question of the survey in a scale from 1 to 5, and the last one is the P-value adjusted for ties from the Kruskal-Wallis Test. All the statistically significant difference between the medians of the participants have a P-Value in bold. You can find the Minitab output with complete tests attached at the end.

Role	Designer		Technician		Manager		Kruskal
Issue Under Study	Median Score	Mean Score	Median Score	Mean Score	Median Score	Mean Score	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 Response table

Size of Company	< 200 employees		200-500 employees		>500 employees		Kruskal
Issue Under Study	Median Score	Mean Score	Median Score	Mean Score	Median Score	Mean Score	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 4 Response table

Years of Experience	0-10 Years		10-20 Years		20+ Years		Kruskal
Issue Under Study	Median Score	Mean Score	Median Score	Mean Score	Median Score	Mean Score	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

Table 5 Response table

- Starting our analysis for the first table it is possible to see that the different roles, technician and managers in particular, working closely together within the project teams, recognize that the implementation of Project Management practices has improved the use of human and material resources in the execution of projects, P = 0,012. Designer feel less this perception, maybe due to their work not strictly involved in the production process. The use of best practices improves the possibility of ensuring an adequate involvement of personnel with the profiles required for the correct implementation of the project and a better use of material resources, all this means better management that bring to a successful manage of the projects. We can deduce the same about the improvements of the reputation of the firm, P = 0,049.

- Moving to the second table with the Size of Company as Factor Level, the Kruskal-Wallis H test shows that there is a statistically significant difference in number of trained staff between the three different groups of the independent variable, P=0,007. We can assume that the organizations with more than 500 employees and more generally the organizations with more than 200 employees, have a higher number of trained staff compared to the smaller company with less than 200 employees. It is also possible to find another confirm by the following Kruskal-Test applied on the future will of organizations to encourage the staff to obtain Project Management Certifications, also in this situation the medium-big organizations are more inclined to encourage their staff in this direction, P = 0,005. The certifications of Project Management play a role of increasing importance for large companies that are operating in increasingly international working contexts, hence the awareness that the application of laws, standards, regulations and languages can no longer be linked to a single company reality but must reach a universal dimension capable of reducing the communication gap between the various professionals in the field. In the section 3, Effectiveness of Implementation of Project Management, we have another statistically significant difference between the median of the groups, more specifically for the company with more than 500 employees, the Project Management practices give a help to the implementation of Platform Management within the line of process, P = 0,021.

In the section 4 we found a P-value P = 0,029 also about the importance to share information and experience along the supply chain in order to improve its value.

- The last table is about the relationship with the Years of Experience of the respondents, to better investigate the level of perceptions between junior and senior employees. We found a statistically significant difference in two questions of the section 1 about the current state of project management within the organizations. Following the results of Kruskal-Wallis test, the employees with a work experience from 0 to 10 years have a higher perception about the transfer level at the Project Teams, or Platform Level, of the ICT Management Task and HR Management Task. These two tasks seem to be more linked with younger employees rather than Senior, especially the ICT Management task which show a higher mean score compared to the second, HR Management Task. This maybe could be explained from the ease of use, for the youngest, of the new integrated computer systems made available by the project management.

6.2 Respondents 51

Role	Designer		Technician		Manager		Kruskal
Issue Under Study	Median Score	Mean Score	Median Score	Mean Score	Median Score	Mean Score	P-Value
1. Current state of Project Management							
PMs implementation	3	2,33	3	3,08	3	3,11	0,488
ICT Management Task	3	2,33	2	2,17	3	2,47	0,796
Logistics tasks	3	3,33	3	2,83	3	2,89	0,658
Purchasing Procedure	3	3,00	3	3,08	3	2,81	0,683
HR Management Tasks	3	2,67	2,5	2,67	2	2,56	0,875
Process Management Tasks	3	3,00	3	2,92	4	3,25	0,328
Sales Functions	3	3,00	3	2,75	3	3,06	0,678
Quality tasks	3	3,33	3	2,83	3	3,22	0,623
Engineering & Design functions	3	2,67	3	2,83	3,5	3,14	0,491
Research & Development functions	3	2,67	3	2,75	3	3,03	0,718
2. Strategic Alignment							
PM current certifications	3	2,33	1,5	1,83	2	2,17	0,449
3. Effectiveness of Implementation of Project Management Practices							
PM for CPS	3	3,00	3	3,33	3	3,06	0,512
PM for WCM	3	3,00	3	3,42	4	3,56	0,220
PM for Platform Management	3	3,00	3	3,50	3	3,31	0,572
PM for SE	3	3,00	3	3,50	3	3,22	0,363
PM for ISO/TS16949	3	3,00	3	3,67	3	3,75	0,563
PM for TQM/QFD	3	3,00	3	3,42	3	3,28	0,563
Time to Market	3	3,00	3	3,67	4	3,61	0,142
Budgeting Performance	3	3,00	4	3,58	4	3,69	0,500
Product Quality	3	3,33	4	3,75	4	3,72	0,097
Firm's Reputation	3	3,00	4	3,92	4	3,67	0,217
Competitive edge	3	3,00	4	3,67	4	3,50	0,086
Human & Material Resource	3	3,00	4	3,83	4	3,64	0,086
4. Future Plan							
PM Future Implementation	3	3,00	3,5	3,83	4	3,81	0,128
Lean Future Implementation	3	3,00	3	3,50	4	3,56	0,357
Future Certifications	3	3,00	3	3,25	3	3,33	0,617
Sharing information	3	3,33	4	3,92	305	3,44	0,301

Table 7 Response table

Size of Company	< 200 Employees		200-500 Employees		>500 Employees		Kruskal
Issue Under Study	Median Score	Mean Score	Median Score	Mean Score	Median Score	Mean Score	P-Value
1. Current state of Project Management							
PMs implementation	3	3,00	3	3,33	5	3,06	0,259
ICT Management Task	2	2,33	3	2,67	2	2,39	0,668
Logistics tasks	3	2,86	3	3,11	3	2,90	0,348
Purchasing Procedure	3	2,86	3	3,00	5	2,88	0,282
HR Management Tasks	2	2,64	2	2,33	2	2,59	0,737
Process Management Tasks	3	3,12	4	3,33	5	3,16	0,125
Sales Functions	3	2,95	3	3,11	5	2,98	0,100
Quality tasks	3	3,07	3	3,44	5	3,14	0,127
Engineering & Design functions	3	3,02	3	3,11	5	3,04	0,172
Research & Development functions	3	2,93	3	3,00	5	2,94	0,375
2. Strategic Alignment							
PM current certifications	2	1,98	3	2,67	4	2,10	**0,009**
3. Effectiveness of Implementation of Project Management Practices							
PM for CPS	3	3,12	3	3,11	3	3,12	0,741
PM for WCM	3	3,4	4	3,89	4	3,49	**0,044**
PM for Platform Management	3	3,31	3	3,44	4	3,33	0,051
PM for SE	3	3,26	3	3,33	4	3,27	0,443
PM for ISO/TS16949	3	3,62	3	4,00	4	3,69	**0,046**
PM for TQM/QFD	3	3,26	3	3,44	4	3,29	**0,046**
Time to Market	4	3,52	4	3,89	4	3,59	0,117
Budgeting Performance	4	3,57	4	3,89	4	3,63	0,283
Product Quality	4	3,67	4	3,89	4	3,71	0,139
Firm's Reputation	4	3,62	4	4,00	4	3,69	0,204
Competitive edge	4	3,45	4	3,78	4	3,51	0,336
Human & Material Resource	4	3,60	4	3,89	4	3,65	0,336
4. Future Plan							
PM Future Implementation	4	3,74	4	3,89	4	3,76	0,360
Lean Future Implementation	3	3,45	4	3,78	4	3,51	0,360
Future Certifications	3	3,21	4	3,67	4	3,29	**0,011**
Sharing information	3	3,50	4	3,78	5	3,55	**0,022**

Table 8 Response table

Years of Experience	0-10 Years		10-20 Years		20+ Years		Kruskal
Issue Under Study	Median score	Mean Score	Median score	Mean Score	Median score	Mean Score	P-Value
1. Current state of Project Management							
PMs implementation	3	3,31	3	3,08	3	2,92	0,700
ICT Management Task	3	3,23	2	2,42	2	1,96	**0,007**
Logistics tasks	3	3,31	3	3,00	3	2,65	0,111
Purchasing Procedure	3	3,15	3	2,83	3	2,77	0,721
HR Management Tasks	3	3,15	3	2,67	2	2,27	**0,057**
Process Management Tasks	3	3,23	3,5	3,42	3	3,00	0,597
Sales Functions	3	3,23	3	2,83	3	2,92	0,781
Quality tasks	3	3,23	3	3,00	3	3,15	0,981
Engineering & Design functions	3	3,38	3,5	3,17	3	2,81	0,434
Research & Development functions	3	3,23	3,5	3,17	3	2,69	0,417
2. Strategic Alignment							
PM current certifications	2	2,38	2	1,92	2	2,04	0,329
3. Effectiveness of Implementation of Project Management Practices							
PM for CPS	3	3,15	3	3,42	3	2,96	0,151
PM for WCM	3	3,31	3	3,58	4	3,54	0,452
PM for Platform Management	3	3,38	3	3,33	3	3,31	0,922
PM for SE	3	3,31	3	3,25	3	3,27	0,807
PM for ISO/TS16949	3	3,85	3	3,67	3	3,62	0,379
PM for TQM/QFD	3	3,15	3	3,50	3	3,27	0,379
Time to Market	4	3,46	3,5	3,67	4	3,62	0,719
Budgeting Performance	4	3,54	4	3,58	4	3,69	0,909
Product Quality	4	3,77	4	3,58	4	3,73	0,580
Firm's Reputation	4	3,62	4	3,83	4	3,65	0,752
Competitive edge	4	3,54	4	3,67	4	3,42	0,797
Human & Material Resource	4	3,69	4	3,75	4	3,58	0,797
4. Future Plan							
PM Future Implementation	4	3,62	4	3,83	4	3,81	0,675
Lean Future Implementation	4	3,62	3	3,50	3,5	3,46	0,837
Future Certifications	3	3,23	3	3,42	3	3,27	0,888
Sharing information	3	3,38	3	3,75	3	3,54	0,888

Table 9 Response table

- In the first table with Role as Factor Level, we do not have found any statistically significant difference between the medians of the groups.

- In the second table with Size of Company we have found the same statistically significant difference, with the sample of 71 respondents, for the questions concerning to: the current level of project management trained staff in the organization, the future will of organizations to encourage the staff to obtain Project Management certifications and the last one about the importance of share information and experience along the supply chain in order to improve its value.

- The last table with the Years of Experience shows the same result of the previous one, with the complete sample of respondent, with a statistically significant different for the transfer level of ICT Management Task and HR Management Task to the project team or platform level.

6.3   Reduced Size of Company to Two Factor Level

It's very interesting, considering the Kruskal-Wallis test with 51 respondents, that for all the large companies, the Project Management improve the implementation of World Class Manufacturing (WCM), ISO/TS16949 and Total Quality Management (TQM). All these practices are very common in the Automotive industry. We have found an important statistically significant difference between the medians of these group but we cannot except these results because the number of observation for the Factor Level ">500 employees" is equal to 3, this goes against the assumptions of the Kruskal-Wallis test that requires a minimum number of observations equal to 5 for each group of the factor level, if this assumption is not respected, there is an inaccuracy in the final calculation of the P-Value. In order to limit this problem and see what happens, we have taken the liberty of aggregating the last two levels "200-500 employees" and ">500 employees" in one, more general level, as "> 200 employees". Following the Kruskal-Wallis test for the three practices before and after the aggregation of the Factor Level.

Kruskal-Wallis Test: PM for WCM versus Size of Company

```
Kruskal-Wallis Test on PM for WCM

Size of Company     N  Median  Ave Rank      Z
< 200 employees    39   3,000     23,5  -2,18
>500 employees      3   4,000     38,0   1,44
200-500 employees   9   4,000     32,9   1,53
Overall            51             26,0

H = 5,00  DF = 2  P = 0,082
H = 6,25  DF = 2  P = 0,044  (adjusted for ties)
```

Kruskal-Wallis Test: PM for WCM versus Size of Company

```
Kruskal-Wallis Test on PM for WCM

Size of Company     N  Median  Ave Rank      Z
< 200 employees    39   3,000     23,5  -2,18
> 200 employees    12   4,000     34,2   2,18
Overall            51             26,0

H = 4,74  DF = 1  P = 0,030
H = 5,92  DF = 1  P = 0,015  (adjusted for ties)
```

Kruskal-Wallis Test: PM for ISO/TS16949 versus Size of Company

```
Kruskal-Wallis Test on PM for ISO/TS16949

Size of Company     N  Median  Ave Rank      Z
< 200 employees    39   3,000     24,1  -1,65
>500 employees      3   4,000     42,0   1,92
200-500 employees   9   3,000     28,9   0,65
Overall            51             26,0

H = 4,47  DF = 2  P = 0,107
H = 6,15  DF = 2  P = 0,046  (adjusted for ties)
```

Kruskal-Wallis Test: PM for ISO/TS16949 versus Size of Company

```
Kruskal-Wallis Test on PM for ISO/TS16949

Size of Company     N  Median  Ave Rank      Z
< 200 employees    39   4,000     23,8  -1,91
> 200 employees    12   4,000     33,2   1,91
Overall            51             26,0

H = 3,65  DF = 1  P = 0,056
H = 4,31  DF = 1  P = 0,038  (adjusted for ties)
```

Kruskal-Wallis Test: PM for TQM/QFD versus Size of Company

```
Kruskal-Wallis Test on PM for TQM/QFD

Size of Company      N  Median  Ave Rank      Z
< 200 employees     39   3,000      24,1  -1,65
>500 employees       3   4,000      42,0   1,92
200-500 employees    9   3,000      28,9   0,65
Overall             51              26,0

H = 4,47  DF = 2  P = 0,107
H = 6,15  DF = 2  P = 0,046  (adjusted for ties)
```

Kruskal-Wallis Test: PM for TQM versus Size of Company

```
Kruskal-Wallis Test on Project Management for TQM/QFD

Size of Company      N  Median  Ave Rank      Z
< 200 employees     39   3,000      24,1  -1,65
> 200 employees     12   4,000      32,2   1,65
Overall             51              26,0

H = 2,74  DF = 1  P = 0,098
H = 3,76  DF = 1  P = 0,052  (adjusted for ties)
```

Kruskal-Wallis test, with two aggregate groups, confirms the statistically significant difference between the median of the groups that we had in the test with three groups about the implementation of World Class Manufacturing (WCM) and ISO/TS16949, while the test for the Total Quality Management (TQM) does not meet the result found before. From this come out that Project Management helps the implementation of World Class Manufacturing and ISO/TS16949 particularly for the organizations "> 200 employees" where automotive is the core of the business. This is an important result because these two practices are the most common and the most implemented in the automotive sector and organizations agree to say that Project Management helps their implementation.

7 Conclusions

The results in general show how the larger companies have a greater awareness of the importance and benefits deriving from a good implementation of Project management practices compared to small businesses, which do not yet seem to be interested in implementing such practices within the organization. In particular, for large companies, the use of project management best practices gives added value to products, processes and organizational models, making it possible to align company strategies with those of the project, as well as helping the implementation of industry best practices. In conclusion, the application of Project Management standards and practices improves crucial factors within the company such as cost, time and quality. The benefits are not limited solely to project objectives but also to the management of relationships with suppliers, the company's reputation and the best management of human capital. Large companies have therefore started a Projectification process and are particularly ahead of small businesses in the implementation of Project Management within the organizational structure, small businesses do not seem interested for the moment in carrying out this process for project management.

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