

THE PROJECT MANAGEMENT TRIANGLE ASSESSMENT IN AERONAUTICAL INDUSTRIES, MOROCCO: FOCUS ON ECO-LOGISTICS

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Abstract:

The purpose of this paper is to study the management systems of quality, cost, and deadlines during the environment friendly transition process. Some 102 companies operating in the aeronautics industry in Morocco were surveyed during the period of May 2019 to December 2019. The results showed that about nearly 80% to 96% of the companies confirmed having effective systems for monitoring and improving quality, cost management, and respect for deadlines. But, unfortunately, below 80% of these companies are respecting the environment. The environment is considered as a constraint, and its respect is mainly related to the requirements of standards, certifications and laws. Therefore, we find a great shortfall of these Moroccan companies when it comes to respect the environment. The analysis of the results reveals that some indicators imply the desire and predisposition of these companies to go beyond the classic concept of the logistics triptych quality/cost/time to a whole new concept: quality/cost/delay/environment.

Key words: *aeronautical sector, quality/cost/delay, Brundtland report, environment respect, ISO 14001 standard*

INTRODUCTION

The aeronautics and space industry is an industry of major importance for itself than for the induced applications and its economic and strategic role [28]. It is very diverse in terms of products and services. It is made up of several sectors – passenger transportation planes, combat or mission aircraft (fighter aircrafts), helicopters, launchers, satellites, combat missiles, cargo vehicles, payloads [11]. Even though these markets evolve independently, it still has a great link because of the commonly used methods, techniques, and technologies [21]. For many years, quality management in the industries has undergone many changes. For that matter, the traditional approach has defined the performance of projects or even of the company based on three essential criteria. First, the quality which objective is to define and implement the means used by the project to create and verify products adapted to needs. Second, the cost that includes the logistics cost, product design cost, marketing cost, etc. And third, the delay which is the delivery or design time [25]. Thus, these are the main components that make up the quality/cost/delay triangle, which is also called the logistics triptych. In a scientific research carried out by a fellow researcher, he confirms in the

same way that: there is the need for companies to secure their supply chain, especially in terms of QCD (Quality, Cost and Delay). The control of these three elements is a solid asset that is used to remain competitive and to keep their strategic stake in the logistics chain [22].

Nowadays, the awareness of the world's organizations towards the protection of the environment and its resources has, therefore, become a priority issue to ensure quality life on earth for future generations [12]. Besides, sustainable development is a development that meets today's needs without compromising the ability of future generations to meet their own needs [6]. As a result, it seems clear that the environment's preservation should be one of the key factors and performance indicators of industries. However, the aeronautical industries are more sensitive than others to the international environment to our knowledge, there has yet to be a study to integrate the environmental concept into the traditional management approach in Moroccan aeronautical firms, and also to check if there are already prepared to adopt [5].

We chose the aeronautics sector, since the authorities and social actors are beginning to be more aware of the serious impact that this sector has on the environment.

And moreover, several neighboring countries have triggered action plans, namely: The National Action Plan for Civil Aviation in the event of a prolonged pollution peak was triggered for the first time on March 17, 2014 in the Ile-de-France and Rhône-Alpes regions. The North and Central East Interregional Civil Aviation Security Departments have implemented a number of measures under this action plan. During this day, certain circuit patterns were banned, control of the use of auxiliary power units (APUs) was reinforced and engine tests not intended for the purpose of flight were banned [8].

This leads us to explicitly formulate the following hypotheses:

The first hypothesis states that, there is a mid to high level of commitment to the classic QCD logistics triptych, with a different level of commitment for each parameter.

The second hypothesis states that the environment remains a factor that is seen differently by companies, and that it will require effort and engagement to integrate it within the classical approach.

We suggest that, first of all, we assess the commitment of industrial companies operating in the aeronautical sector in Morocco using the classic management approach. The effective potential measures to put in place by industries to preserve the environment, and in particular, the companies' commitment to a common cause were discussed. In the last part, a correlation between the studied factors to understand the limits of the traditional approach, as well as the challenges and perspectives of the new concept.

LITERATURE REVIEW

The literary review is a very important part of all scientific research. To answer the questions posed in the manuscript, a bibliometric analysis of publications contained in the Web of Science, Scopus, Google Scholar and other publicly available sources and industrial reports available on the Internet was carried out.

The review procedure consists of three stages, covering planning, searching with selection and analysis of the results obtained. The procedure thus prepared was used in the work [14].

First – various entries, e.g. "QCD", "QCD in Moroccan industry", "the environment in the aeronautical industries in Morocco", Second – the most judicious information has been sectioned, Third – by establishing the basic source of information in particular publications of the authors.

The outcome of the above, leads us to the following conclusion. Several studies in Morocco, and elsewhere in the world, have proven the importance of the logistics triptych in the continued development of industries. In particular, we will quote a study conducted here in Morocco and which states that: The control of these three

elements is a solid asset that is used to remain competitive and to keep their strategic stake in the logistics chain [23].

On the other hand, we found that several studies in Morocco, is beginning to alert us to the need of respecting the environment [1].

On a more general scale, researchers at the international level have underlined the importance of the implementation of green supply chain. Indeed, Customers especially with high environmental awareness may require products delivered with clean vehicles or in such manner that the emissions are minimized, forcing suppliers to go to green solutions [26]. In addition, Greening the supply chain is a growing concern for many business enterprises and a challenge for logistics management [26].

In other words, the researchers pointed out the importance of the integration of environmental awareness into supply chain management, including the product design phase, the extraction and selection of materials and raw materials, the manufacturing process and procedures, the delivery of the finished product to the customer and the management of the product's end-of-life cycle [17].

In our study and for the first time, we will approach the four parameters (quality/cost/time/environment) in parallel to see the possible convergences, and thus, we will give realistic suggestions for an effective integration of the environment in the old triptych.

METHODOLOGY OF RESEARCH

The aeronautical industry in Morocco is a very large sector. It is an industry whose associated challenges are important, whether in terms of technological development or in terms of qualified jobs, without forgetting its great contribution to the trade balance, which includes the flow of goods between a country and the rest of the world (raw materials, energy, manufactured products, etc.) [20]. In that sense, the survey that we carried out made it possible to clarify the imbalance between all the factors of the golden triangle and especially the environment as a new factor, the latter is defined as the set of natural or artificial elements and biochemical balances in which they participate [10].

To understand this commitment of companies to respect the traditional approach based on three factors, and moving away from one factor, which is becoming more and more essential. It seemed interesting to us to use the descriptive correlational method, which consists of a systematic analysis of the events that tend to occur together in a particular environment [18]. This method will allow us to validate our hypotheses and fully understand the phenomenon that we studied.

We have surveyed on a set of theoretically validated questions, which are easy, clear, and difficult to interpret using questionnaire sheet. The questionnaire sheet consists of 20 questions, divided into 2 main parts and 4 subparts.

The first main part attempts to clarify and provide answers to our first hypothesis, it consists of 3 subparts: The first one has mainly talked about quality management; the second one was dedicated to cost management, and the third one has focused on delays.

The responses to these first 15 questions are to validate the first hypothesis, which stipulates a palpable commitment of the companies in the classic approach of management.

The second part consists of a single subpart that is the respect of the environment. It is composed of 5 closed questions. Therefore, these main parts verify the second hypothesis, which stipulates that the environment is or not on an equal footing in terms of commitment and actions, compared to the factors of the classical approach. The formulation of questions and the development of the questionnaire are the foundation of the success of any study, the questions we have chosen are precise and formulated based on studies and documentary analyzes [13].

The administration of the questionnaire requires an average of 10 minutes. It was submitted to the entire sample individually and anonymously. Indeed, anonymity guarantees an honest expression of the people questioned, which avoids any kind of judgmental perception about these companies or their employees. We have used mainly three distribution canals for carrying out the survey: by email, using a Google forms link, where the questions were entered on the platform and thus the link to the questionnaire was distributed to companies, and by telephone call. Following the n efforts, we have obtained 102 responses using different distribution canals as follows: 52% of responses were collected by telephone, 34% of responses were collected from the questionnaire on google and 14% of responses were obtained by email.

The choice of the sample, which is a sub-part of the main target was considered to be one of the most sensitive tasks since the results obtained will then be generalized and quantified based on a population with the same characteristics [4]. The present survey was carried out among 102 companies operating in the aeronautical industry in Morocco. This survey lasted 8 months, from May 2019 to December 2019. The sample contains SMEs which are defined as companies with 1 to 249 employees and also of large companies [24]. The choice of the sample is mainly because the aeronautical sector is a sector that represents great perspectives for expansion. It has a growing number of companies and more job [2]. The obtained data shows the volume of the target population of companies operating in the aeronautical and Space industry in Morocco including 125 companies. We managed to contact 117 companies, which represent 94% of the initial population. The percentage of companies who agreed to respond to our survey is 82% (102 companies). This represents 87% of the surveyed companies. It appears that the high response rate reflects

not only the credibility of the study but also the interest in this topic carried by the surveyed companies.

It is important to note that those who responded to the questionnaire confirmed their knowledge and mastery of the policies discussed. Namely, more than 91.17% of those who responded are senior managers. When a person is unable or not enough informed to answer a question, we were referred to other managers. The ultimate goal is to have reliable and credible answers.

RESULTS OF RESEARCH

The classic management approach QCD (quality – cost – delay)

The quality management system is of unparalleled importance for all companies, it is a form of "Superiority, excellence in something [9]. As we noticed only 4 companies out of the entire sample, are not in the process of setting up a quality management system. Whereas, 96% of companies have a four quality management systems deemed reliable. In parallel, only 3 companies of those that have a quality system do not have a quality management certification. The graph below illustrates the facts that we described.

According to Figure 1 and Figure 2, the percentages below are relative to the companies having declared beforehand having a quality management system.

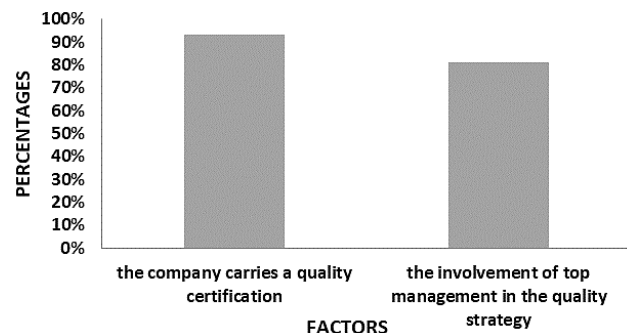


Fig. 1 Quality management

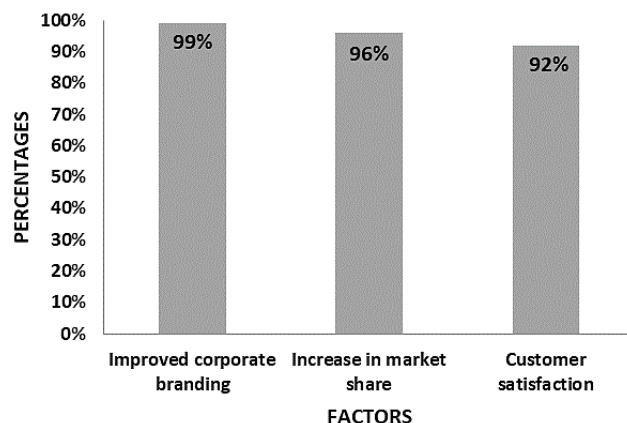


Fig. 2 The gains obtained from an efficient quality system

Both figures show the medium data about the top management's commitment in monitoring the quality management strategy, which could be explained by the fact

that managers reportedly consider the quality culture in the company, as an asset well digested by all operators, and that the problems related to quality management remain minimal. The advantages of the quality management system are manifold, and these advantages are internal but also external. Internally 97% of companies find that their productivity improved thanks to their adoption of a quality management system. Besides, this system is considered by 92% of companies as a safe and direct means for reducing flaws. In the same way, we have observed that the benefits and advantages of a reliable quality management system are exceeding the internal dimension of the company. Afterward, we are almost unanimous on the fact that the quality management system improves the brand image of the company and guarantees customer satisfaction. Given that, its goal is to enable marketing, research, production, and services to achieve complete customer satisfaction in the most efficient way [3]. The lack of resources is a significant burden, which leads to a deterioration of the quality management system. Indeed, Moroccan industries are aware of it. so we find that 98% of companies consider the lack of resources as a brake or a constraint, which could explain the why continuous improvement of the quality management system may be slowing down. Monitoring the costs of a company is also important as monitoring quality in management. Among these costs are those related to non-quality which greatly influence the profitability of any business.

Figure 3 shows that the percentages are relative to all the companies selected.

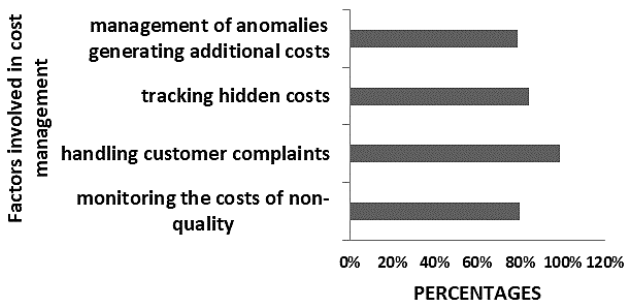


Fig. 3 Cost management

The results of the survey show that 82 companies have a system for monitoring non-quality. A total of only 62 of these companies have ease of identification and quantification of the costs of non-quality, that shows the difficulty of controlling this factor. To have an effective non-quality monitoring system, the questioned companies recommend that, an action plan and systematic monitoring of these costs be established for all companies, as well as identification of the different source processes of the anomalies is required. Almost all companies have a customer complaints system that would provide information on the external costs of non-quality. Hidden costs are also important for supplying management con-

trol. This is a set of charges not captured by the accounting system at the end of the period [19]. The investigation revealed that 86 companies have carried out hidden cost estimates to feed their management controls. A total of 81 of those questioned had confirmed that they have a strategy to limit anomalies caused by specific expenses that generate additional costs.

The management of delay aims to have a well-defined estimation of the duration of a project and then to ensure compliance with these deadlines. This also includes benefits and services, whatever their complexity or purpose are. Meeting deadlines takes great importance for all companies in the aeronautical sector.

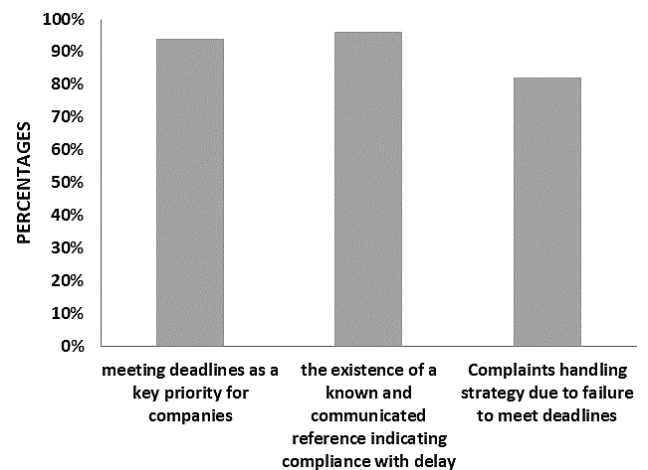
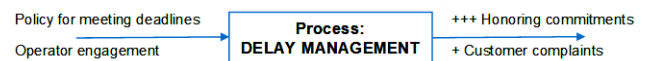


Fig. 4 Delay management

According to Figure 4, namely 99% of the companies surveyed consider this factor as very important, exactly: 94% think it is too important and 5% think it is very important. One of the proofs of companies' awareness of the importance of this factor is that 98 companies of the initial sample, which represents 96%, have a defined and communicated strategy concerning the management of delay. (The percentages below are relative to all the companies that were selected). The presents introduces delay management as a process, diagrammed below:



We have observed that the limits of this system are downstream. A total of 82% of companies declared that they had a reliable system for the effective treatment of customer complaints concerning non-compliance with deadlines. Whereas, only 18 companies are in accordance. This is might be due to not only that companies deeply believe they have mastered this process, since they declare that they mainly honor their commitments concerning the respect of delays vis-à-vis their customers (also internal customers). But also, that the customer complaints service is absorbed by the treatment of complaints having a direct impact on costs, thus, on the financial balance of the company.

Environmental management

Environmental management is defined as a set of technical, organizational and administrative measures in the organization directly linked to at all its hierarchical levels and for all its processes, In order to assess and monitor for the environmental impacts, its compliance with legal requirements, and its improvement of environmental performance [29]. Figure 5 indicates that 79% of the aeronautical companies in Morocco have an environmental policy.

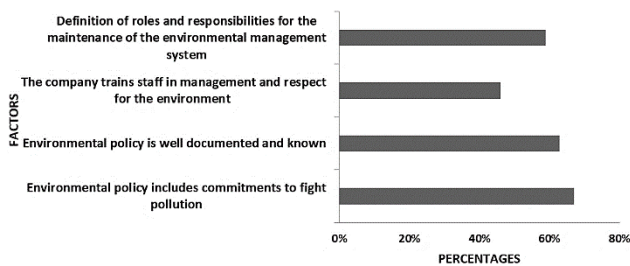


Fig. 5 Environmental management

Although, the roles and responsibilities for maintaining a fairly effective environmental management system are unfortunately not sufficiently defined since only 48 companies from the entire initial sample were able to clearly define roles and responsibilities. Thereby, environmental policy in the aeronautical industries exists but not enough; the tools and resources that are necessary for its development and its sustainability are even fewer. The presence of a policy underlined minutely on the official documents of the company is not sufficient, we can, moreover, observe that just 51 companies declare that the environmental policy is known by every operator. That would mean that 37% of companies' operators ignore or are not sufficiently informed about their companies' policy about the respect of the environment. The process of introducing inclusive environmental management are ineffective [27]. Figure 5 illustrates the affirmations outlook that the percentages are concerning companies that previously declared having an environmental policy.

DISCUSSION

The classic dimension of management is based on three criteria of project efficiency Quality, Cost, and delay [15]. These latter are perfectly in line with the requirements of companies in the aeronautics sector in Morocco. Once these factors are examined individually, each one appears to have its limits and strengths.

Regarding quality management, total involvement, and real commitment from all stakeholders are mandatory. It is even considered by many people to be the best differentiator factor in the market. Within companies, the processes are clear and understood by everyone, it is a well-instilled culture generating habits that are acquired forever. As for cost management, this factor is strongly linked to quality in companies. One of the problems

highlighted by 20% of companies is the difficulty of tracking the costs of non-quality. We noticed that there is in general a correct management of all costs.

The management of delay represents a major concern, a source of great debate and subject to several meetings and action plans. This factor is properly respected and is often accompanied by a commitment to respect it. Eventually, a global vision of the logistics triptych allowed understanding that these factors complete each other, to have efficient companies with sustained returns. Within the targeted companies, it is not frequent to dissociate these parameters.

The study of an additional factor which is the environment allowed understanding the current situation, and the awareness about the environment in the culture, and the practices within companies. A total of 79% of the companies questioned underline the fact of having an environmental policy, this can be explained by the willingness of companies to be friendly to the environment, but the necessary mechanisms and tools for the effective implementation of this system are developing timidly within these companies. The environment is considered as an unprofitable obligation for the company, while Environmental Impact Assessment (EIA) is sometimes called the study of the impacts on the environment, which is a procedure for examining the consequences; that are beneficial [7]. In other words, the companies should ensure the productivity and quality of jobs managed by businesses, taking into account the requirements of a sustainable economic and nature development [16].

Finally, Our contribution consists first of all, in making industries aware of the existence of a weak environmental culture. Then, to give a strong recommendation based on the observation and the analysis of the success of the classical approach according to THE QCD AS SINGLE PARAMETER, that is the judicious way for intelligent and effective integration of the environment within companies, to no longer study and use this factor separately but to study it in parallel with the other essential management factors.

In this way they no longer talk about the QCD (Quality-cost-Delay) logistics triptych but they rather consider the QCDE (quality-cost-delay-environment) logistics lozenge.

CONCLUSIONS

The research carried out has allowed identifying the important points that defined the classic management approach, as well as to prospect a new one. For the achievement of the survey, we have studied 102 companies operating in the aeronautical industry in Morocco. This sample contains large companies and SMEs. Then we proceeded to the administration of the questionnaire as well as the counting and presentation of the results. For the first time, we were able to determine and understand the elements on which the classic management

approach is based. This made it possible to identify three main factors: quality, cost, and delay. For a second time, first, we have proposed two hypotheses. The first underlines the effectiveness of the logistical triptych in the development of businesses while demonstrating the success of companies in combining these three factors together. We put forward a second hypothesis which states that the respect of the environment does not receive the same importance as the factors of the triangle quality/cost/delay, despite its importance on a global scale. From these hypotheses, we were able to study the factors of the logistical triptych separately, and then as a single component. A second part of the study was developed to point out the place occupied by Environment in the aeronautical industries in Morocco.

In brief, the interpretation of the hypotheses results from highlights that companies in the aeronautical sector in Morocco seek performance at lower costs. The experience of these companies in management has shown that compliance with the classic management approach allows for obtaining helps to obtain satisfactory results. The environment is not on equal terms about tangible commitments, compared to the factors of the traditional approach. This is a reason to justify the adoption of a developed approach with an ecological dimension of the logistical triptych.

REFERENCES

- [1] S. Ait Iaza and R. Daanoune, "Environmental Performance Measurement Tools: Case of an Aeronautic Company in Morocco", *Revue du Contrôle de la Comptabilité et de l'Audit*, Vol. 4, pp. 449-474, 2018.
- [2] C. Argyris and D. Schon. *Organizational Learning: a Theory of Action Perspective*, Reading, Mass, Addison-Wesley, pp. 8, 1987.
- [3] E. Ballery. *Evolution de la qualité: le bilan, vingt ans après I. Qualité et mouvement*, Vol. 62, pp. 20-30, 2004.
- [4] L. Bardin. *L'analyse de contenu*, Presses Universitaires De France – PUF, Vol. 2, 2013.
- [5] B. Braun and F. Collignon. *La France en fiches*, Editions Bréal, pp. 335, 2008.
- [6] G.H. Brundtland. "Our common future", Report of the World Commission on Environment and Development, United Nations, 1987.
- [7] R. Calvet. *Le sol: propriétés et fonctions. Phénomènes physiques et chimiques, applications agronomiques et environnementales*, France Agricole Editions, 2003, pp. 511.
- [8] H. Cormier. *Rapport environnement 2014*, DGAC, 2014, pp. 23.
- [9] C. Doucet. *La Qualité, Que sais-je ?*, Presses Universitaires De France – PUF, 2007, pp. 6.
- [10] D. Emmanuel and E. Kam Yogo and L. Ngo-Samnick. *Manuel judiciaire de droit de l'environnement en Afrique*, Institut de la Francophonie pour le développement durable, 2008, pp. 252.
- [11] Federal Aviation authority. *The Economic Impact of Commercial Space Transportation on the US Economy in 2009*, FAA, 2010, pp. 9.
- [12] M. Gaeta and G. Achilleas and G. Samaras and R. Archetti. "Numerical investigation of thermal discharge to coastal areas: A case study in South Italy", *Environmental Modelling and Software*. Vol. 124, No.104596, Feb. 2020.
- [13] S. Ganassali. *Enquêtes et analyse de données avec Sphinx*. Pearson France, 2014, pp. 234.
- [14] S. Grabowska. "Smart Factories in the Age of Industry 4.0", *Management Systems in Production Engineering*, Vol. 28, pp. 92, 2020.
- [15] G. Herniaux. *Commanditer un projet: le rôle des dirigeants pour la réussite des projets*, Insep Editions, 2001, pp. 119.
- [16] Ouédraogo. (2004). *Alliances stratégiques dans les pays en voie de développement, spécificité, management et conditions de performance*, Publibook 2, 2004, pp. 341.
- [17] "Inclusive Growth Commission. Making our economy work for everyone" Internet: <https://www.thersa.org/discover/publications-and-articles/reports/final-report-of-the-inclusive-growth-commission>, Mar., 2017 [Aug. 19, 2019].
- [18] R. Klassen and P. Johnson. *Understanding Supply Chains – Concepts, Critiques and Futures*, The green supply chain, Steve New and Roy Westbrook, 2004, pp. 229-251.
- [19] P. Lemaire. *Psychologie cognitive*, De Boeck, pp. 582, 2006.
- [20] G. Melyon and K. Melyon and P. Raimbourg. *Comptabilité analytique: Principes, coûts réels constatés, coûts préétablis, analyse des écarts*, Bréal. pp. 287, 2013.
- [21] Y. Metay and C. Rudelle. *Economie-droit Tle STG*, Bréal, pp. 223, 2006.
- [22] Y. Michot. "Rapport sur l'industrie aéronautique et spatiale française", République française, France, Paris, rep 08082003, 2004.
- [23] F. Moutaoukil. "Le Pilotage De La Performance Des Fournisseurs Par Les Pratiques De Gestions De Chaîne Logistique (Supply Chain Management) Et L'apport De L'audit Combine «Qualité-Logistique» « Cas De Renault Tanger"; *European Scientific Journal*, Vol. 14, pp. 117, June. 2018.
- [24] F. Moutaoukil and M. A. M'barki and S. Boungab" *Le Pilotage De La Performance Des Fournisseurs par Les Pratiques De Gestions De Chaîne Logistique (Supply Chain Management) Et L'apport De L'audit combine «Qualité-Logistique» «Cas De Renault Tanger"*, *European Scientific Journal*, Vol. 14, pp. 117, June 2018.
- [25] OCDE. *Le financement des PME et des entrepreneurs 2012* Tableau de bord de l'OCDE: Tableau de bord de l'OCDE, OCDE Publishing, pp. 212, 2012.
- [26] Office of Government Commerce. *Reussir Le Management De Projet Avec Prince2/Successful Project Management With Prince2 (Français)*, Broché, pp. 369, 2009.
- [27] O. Seroka-Stolka. *The development of green logistics for implementation sustainable development strategy in companies*, *Procedia Social and Behavioral Sciences*, Vol. 151, pp. 302-309, June 2018
- [28] A. Siddiqi and R. Collins. (2017, Feb.). "Sociotechnical systems and sustainability: current and future perspectives for inclusive development", *Current Opinion in Environmental Sustainability*. [On-line]. vol. 24, pp. 7-13. Available: <https://DOI.org/10.1016/j.cosust.2017.01.006>. [Sep. 23, 2019].
- [29] M. Stanley. (2017). "Space: Investing in the Final Frontier". Internet: <https://www.morganstanley.com/ideas/investing-in-space>.

- [30] M. Sheetz. (2018). "Space Companies Received \$3.9 Billion in Private Investment during the Year of the Commercial Launch, CNBC." Internet: <https://www.cnn.com/2018/01/18/space-companies-got-3-point-9-billion-in-venture-capital-last-year-report.html>
- [31] J.P Tack. Introduction à la norme ISO14001, *Wolters Kluwer Belgium*, pp. 13, 2015.

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