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Open Innovation and Sustainable Development through Industry-Academia Collaboration: A Case Study of Automotive Sector

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Abstract

The purpose of this paper is to provide an insight on how companies based in Portugal and working for the automotive sector as spare-parts suppliers, uphold the notion of sustainable development and how they perceive the industry-academia collaboration as an adding value activity that improves productivity and efficiency. A qualitative study was conducted to collect empirical data by means of interviewing 29 representatives of the Portuguese automotive spare-parts manufacturers. It was found that, to a large extent, there is a significant gap between concerns, priorities and solutions amongst the respondents. The future will therefore depend on the way the stakeholders face problems, communicate and find forums for sharing ideas and build a well-developed world.

Keywords: Automotive sector, Innovation, Higher education, Sustainable Development, Cooperation, Sustainability.

1. Introduction

The automotive sector plays an important role in the world's socio-economics development by striving to become a knowledge and capital-intensive sector [1], and a vertically integrated and an established economies of scale [2]. The sector is globally interconnected with a large economic footprint [3]. It represents 5.7% of global GDP (Gross Domestic Product) [4] with vehicles and related spare-parts are accounted for the world's fifth largest export of product, representing around 8% of global exports in 2018. Whilst the automotive companies are in fact a major consumer of commodities of other manufactured products and services [5], they are renowned for being the

world's most innovative companies [6] who have invested more than 113.3 billion Euros globally on research and development in 2018, ahead of other technology-driven industries, including the software/internet sector and the entire global aerospace and defence industries [7]. The automotive sector has been the trigger of a technological innovation and management development, as well as the major driving force for the industrial production processes [8,9].

Despite the reputation, a recent study of the automotive sector's supply chain has revealed that the sector's actions towards environmental management and social responsibility are generally treated in isolation [3], as these actions do not seem to be well integrated into their corporate strategy.

However, when implementing new operating units, they have demonstrated a close alignment between their production processes and eco-efficiency/cleaner production requirements, many of which have been directed towards material savings, energy conservation and product recycling [3,10].

Sustainability is a longitudinal multidisciplinary issue and high education institutions, including universities, in Portugal appear to emphasise on economic sustainability at the expense of social and environmental sustainability [11]. As the growing importance of sustainable development constitutes a challenging trend for education [12], universities play an important role in meeting the challenges of sustainable development through education [13, 14] and can act as the change agents for several issues, including sustainability consciousness [13]. Universities have a relevant responsibility in solving the society's problem [15]. Conscientious leaders, with a strong motivation to contribute to the sustainability of their organisations, might significantly influence both the strategy and the employees.

In Portugal, the automotive sector, comprising car and spare-parts manufacturers, is a core sector and is of utmost importance for the future of the Portuguese economy, due to its diversity, capacity of creating qualified jobs, ability to boost other industry sectors, capability to grow exports, and also for being an important motivation for innovation, development and knowledge in the country [16]. In 2018 alone, the Portuguese automotive sector contributed to 6% of total GDP. The sector is represented by 240 companies and directly employs 58.000 people (8% of the manufacturing industry employment) [17]. Although the challenges faced by the automotive sector related to security, climate and energy are major, the opportunity for innovation and creativity is also vast. Good private and public partnerships practices are already in place, but there is a long way to ensure that the stakeholders involved are fully aware of the sustainability impacts of their activities [16].

The study described in this paper aims to discuss the extent to which the Portuguese automotive sector interacts with the universities, and perceives the notions of sustainable development and open innovation thinking. We studied 29 Portuguese companies in the automotive components sector to come up with the answers to our research question. We employed the formal, structured interviews consisting of both open and close-ended questions.

The paper is structured into five sections, setting off from this contextualisation of the problem in Section 1. Section 2 presents a literature review concerning the sustainable development and open innovation. Section 3 discussed in brief, the research methodology adopted in this research. Section 4 presents the findings before the Conclusions in Section 5.

2. Literature Review

2.1. Sustainable Development and Innovation

Sustainable development (SD) is defined as "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs". "The concept of needs goes beyond simple material needs and includes values, freedom to think, act and participate, relationships, all amounting to sustainable living, morally, and spiritually [18]. The Brundtland Commission's [19] pivotal definition of SD emphasises the interdependence among social, economic, and mental dimensions of sustainability. [20], using the so-called "triple bottom line", suggests that equivalent concern should be given to financial, environmental, and social dimensions when making business and policy decisions [3]. The study of the complex interactions between all three dimensions is needed, and this requires an adaptive process that involves the active participation of all stakeholders [21]. A good management relationship between stakeholders and enterprises may do the difference, as active relationship often benefits both players [22, 23]. Attracting sustainability requires innovations [24] and innovations are key elements through which organisations, supply chains, institutions, communities, regions, and countries can implement sustainability [3, 25]. The literature accepts that sustainability should be tackled based on innovation-centred approaches [25], but in practice, the pace of change towards a more sustainable world seems to be very slow [3]. There are urgent calls for further investments and initiatives from organisations, educational institutions, and governments to implement innovative multidisciplinary approaches to resolve our current and pressing sustainability challenges [26].

2.2. Open Innovation and Sustainability

Sustainable measures require investments in research and development of technical and managerial skills by the innovative agent, and require a significant period of time until they can be adopted as a new paradigm of production [27]. The effort of a company to be sustainable incurs costs that are expected to be recovered through the benefits resulting from its adoption [28, 29]. One of the most common practices adopted by companies successful in innovation is the establishment of interdepartmental and cross-disciplinary teams [30]. Due to the pre-disposition to sustainability in big companies, the inclusion of environmental issues in the innovation process becomes reasonably easier, considering the presence of a technical and managerial structure skilled of incorporating changes in the production process pushed by the technological development itself of the activity [31].

Being continuously under pressure, the automotive sector is suffering from frequent restructuring of communications systems and the needs to become more responsive, flexible and safe systems. This will subsequently trigger their players' ability to lead the network of specialised automotive suppliers and distributors [32], with agility and efficiency. Companies' internal departments must work in an integrated way, more efficient to produce a positive effect by the cutting non-adding values activities [33]. Although car makers are already aligning their production processes with the requirements of cleaner production and eco-efficiency, with actions aimed to material and energy savings and highlighting the aspects of recycling [10, 34], what is not yet obvious is their consciousness that sustainability is, in fact, a global competitive advantage [35].

3. Methodology

We developed our research method following a conceptual framework shown in Figure 1.
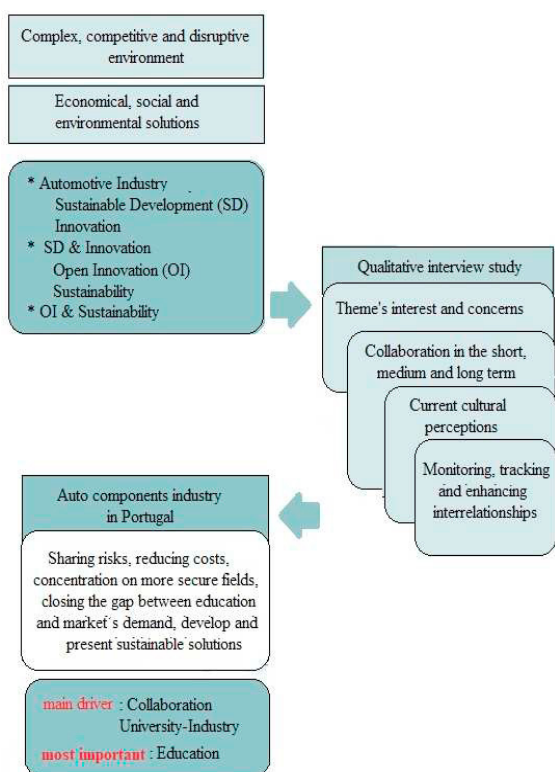
Fig. 1. Conceptual framework of the research.

We employed a structured interview technique to collect empirical data. The interview protocol covered formal open and close-ended questions. This qualitative approach was selected because it offers a level of depth and complexity that other research instruments, predominantly quantitative in nature, could not provide [36]. Our past experience suggested that interview questions were more likely to receive a considered response than that of questionnaires, and therefore provided better access to individuals' perceptions, views, values, opinions, understandings and experiences [36, 37].

Personal information about respondents was anonymised and each interviewee was assigned a unique ID. All questions were related to the aspects of industry-academia collaboration, considering the issues of sustainability and development topics, namely: i) interest and concern about the theme; ii) existing processes of interaction and collaboration in the short, medium and long term; iii) current cultural perceptions and iv) monitoring, tracking and enhancing interrelationships. These four items had a set of fifty-four questions, including five open-ended questions: two related to interaction and collaboration, two with current perception and culture and one with the topic of observatory. A guideline was co-developed with, and tested by, three experts on the field.

We applied the purposive sampling technique to obtain 29 automotive spare-parts manufacturers based in the north of Portugal. The interviews were conducted between January and September 2016. The companies are members of the Portuguese Association of Automotive Suppliers (AFIA) and have different backgrounds of social capital, size and structures

of capital intensity. All companies have already collaborated with universities and held various certification.

4. Results and Discussion

The collected sample represented 58% of the AFIA members and matched to a confidence level of 90% with a 10% margin of error [38]. The vast majority of the interviewees (97%) were the CEOs who determined the strategic directions of the companies. The companies were mostly SMEs, and just over one-fifth of them being large enterprises (see Figure 2).
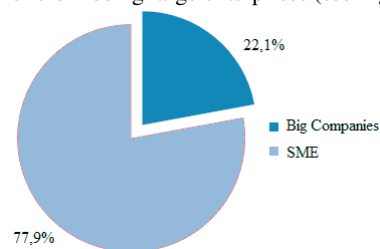

Fig. 2. Size of the companies.

From the interviews, it was apparent that all the interviewees were familiar with the concept of sustainable development as they commonly mentioned the three dimensions of economic, social and environmental sustainability. However, they seemed to be focused on the creation of economic prosperity along the value chain, typically via the optimisation and better use of resources/processes that resulted in the growth of the company, people's welfare and conservation of the environment. They did care about future generations and fully understood the importance of the integration of economic performance with respect to the environment and the pursuit of social justice. In all the interviews, the interviewees assumed that sustainable development included two key concepts: the needs and the idea of limitations imposed by the state of technology and social organisation on the environment's ability to meet present and future needs.

The mission statement, including concerns for sustainable development, was only represented by 12% of the companies. From those 12%, 80% highlighted economic, 12% environmental and 8% social issues (see Figure 3).

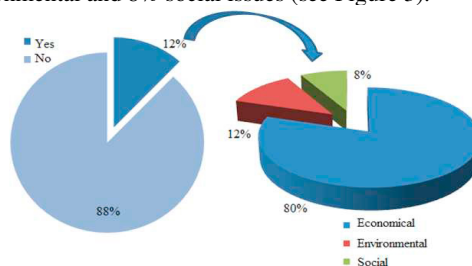Fig. 3. Sustainable development concerns on mission and highlighted sustainable areas.

Larger enterprises tended to spend their budgets on areas linked to sustainable development. The correlation between the adoption of sustainable development and company size seems stronger and more significant as the size of the companies grows, independently of their activity and origin of the social capital.

They were conscientious that the automotive sector has a profound impact on the natural and human environment, and plays a significant role in social and environmental development in a sustainability context. There are immense regulatory pressures on environmental standards and these have impacted both products and manufacturing processes, and have led these companies to adopt innovative business strategies, leading-edge information and communication technologies to achieve environmental and economic performance targets. Strong competitiveness causes the automotive sector to increasingly embrace 'servitization', a guiding strategy to sustain and benefit from the incorporation of services to their product offerings throughout the product life cycle.

All the companies are already certified by IATF 16949, ISO 9001, ISO 14001 and OHSAS 18001/ISO 45001, amongst others. Only four companies are ISO 26000:2010 compliant and produce global reports on their impacts on critical sustainability issues, such as climate change, human rights, governance and social well-being. These have enabled a real action to create social, environmental and economic benefits for everyone. The main goal of the abovementioned standards are: (1) IATF 16949 intends to meet customer requirements efficiently and effectively; (2) ISO 9001 intends to provide the basis for effective processes and effective people to deliver an effective product or service time after time; (3) ISO 14001 is related to environmental management systems; and (4) OHSAS 18001 refers to the effective management of organisational health and safety including all aspects of risk management and legal compliance, in addition to any specific product safety matters.

All the respondents have had numerous collaboration projects in the short, medium and long term with universities and they all fully understand the relevance of knowledge and information being shared. The short-term interactions are usually triggered when companies have specific needs and want to try out cost-effective research by involving university students, typically via the internship schemes. This short-term collaboration also takes place when a company needs some support from the universities via consultancy work or when the universities require industry representatives to deliver guest lectures, workshops and seminars. In some cases, company executives need training and career development and they joined short courses at the universities while being active at work. Table 1 presents some of the collected illustrative phrases.

Table 1. Illustrative phrases for short time interactions.

"most of the times we need partnerships from university to get access to European community founds"
"usually we receive students from university as interns and teach them specific processes. If they are good we will keep them at the end"
"why not to get interns? We pay less taxes and get rewards from Government and Social Security"
"Yes, usually people ask me to go there and give some lectures, sharing my experience"
"Sometimes, when we need some Consultancy, especially in what concerns finance and ITC"
"Of course, we have relations with Universities from our local community. First for having access to qualified Human Resources and after for getting some specific training when our Staff need"
"It is not the first time we ask University to design a special short curricular unit for our Human Resources Training"

In the medium term, the collaboration takes place when companies want to evolve in the supply chain and managers have an emotional link with "a specific university" and market demands innovation. Other occasions are when companies need special skills and could not obtain them on the market, therefore wishing to improve their image by showing their closeness to students and young people in general. Companies also award prizes to, and reward, the students, with the hope to lure the top graduates to work for them. Table 2 presents some of the collected illustrative phrases.

Table 2. Illustrative phrases for medium time interactions.

"every year we sponsor the University where I took my degree. I have fantastic emotional relations with it. I am sure you understand"
"it is excellent to be in contact with students. We can get the best…. It is usual to participate on events as a sponsor or on job fairs organised by the University"
"we keep in contact with some researchers as we don´t have enough qualified HR to do some research and we don´t want to go into the market and pay more wages for more people"
"Of course, I make a point of honour and we always give an award to the student who had the best performance in our core area"
"yes, it is always good for all of us to have contact and think about present and future projects to develop"
"spin-offs companies come near us and try to work closely in order to gain market contacts and market dimension"

Regarding the long-term interactions, the companies are typically involved in and work on open innovations with universities. They believe that by working closely, people can grow creative thinking, develop better and thus result in effective partnerships that benefit both parties. Table 3 shows some of the collected illustrative phrases.

Table 3. Illustrative phrases for long time interactions.

"hard projects, evolving risks, surely demand closer relation with Universities"
"good ideas and good projects… but where can we get the know-how or, at least, the interested people to invest their time without being sure that profits will be high?... normally researchers get excited with innovative things… and have plenty of time to do it…. For us is more difficult as we have one important thing: exactly time-to-market…"
"it is good to be a member of the Advisory Board of the University… It is easier to comprehend the relevance of some matters that are not already taught at the University, but are relevant for the future of my Company"
"Us with University are stronger and can better discuss what is better for our region or country. Together we can shape a better future… and strongly contribute for GDP"
"when we trust our contact in the University, everything is easier… faster… and this is profitable for all of us."
"we both can think higher… more powerfully and more knowledge… and with more smart resources"

In terms of current cultural perceptions, companies feel that closer relations with universities are crucial for their competitive advantage as they can learn new knowledge and technologies in areas of high uncertainty and innovation. In this way, they can share risks, reduce development costs and concentrate on less risky projects. Assuming the characteristics of an oligopolistic globalised industry, the sample exhibits a wide range of providers of products and services, involving continuous upgrading of skilled employees, technology state-of-art, open-innovation, development and vast investments.

The company executives claimed that there is a significant gap on the industry-academia collaboration and felt the needs of qualified graduates, especially people with the appropriate

skills for the work place. However, companies in general do not have staff with specific skills related to sustainable development, neither are they concerned about it. Usually people from Quality or/and Human Resources Departments are the people in charge of those matters.

Finally, we were able to verify that the companies do not seem to be concerned when questioned about the staff training and its school of origin, in particular those that are related to sustainable development. The sample showed that this theme is not relevant for the companies and is independent of the activity sector or even the company sizes. Companies want access to complementary technological knowledge (including patents and tacit knowledge), skilled workers, training for current or future employees, university infrastructure and equipment, public funding and incentives. They also aim to reduce risk by sharing R&D costs, and in general influencing the university educational research agenda.

5. Conclusions

Our study found that sustainable developed implied two key concepts: the needs and the idea of limitations imposed by the state of technology and social organisation on the environment's ability to meet present and future needs. However, interestingly, the companies under study are mainly focused on the creation of economic prosperity along the value chain, although larger companies do invest more on areas related to sustainable development, regardless of their business activities and origins of the social capital.

The companies representing the Portugal automotive sector are conscious that this industry has a profound impact on the natural and human environment, and thus plays a significant role in social and environmental development in a sustainability context. The companies are all under an immense regulatory pressure on environmental standards and these have impacted on both products and manufacturing processes, forcing them to adopt innovative business strategies and leading-edge ICT to achieve environmental and economic performance targets. All the companies are already certified by IATF 16949, ISO 9001, ISO 14001 and OHSAS 18001/ISO 45001, among others. Only four companies (13,79%) are ISO 26000:2010 certified and elaborate Global Reports about their impact on critical sustainability issues such as climate change, human rights, governance and social well-being.

All the companies have already collaborated with universities with varying degree of involvement. What is interesting for us is that those companies who have long-term interactions with the universities do work on an open innovation environment. In this way, the companies see university partners as strong stakeholders with whom they can go further and share new knowledge and technologies in areas that are highly uncertain but innovative. Sharing risks, reducing development costs and concentrating on less risky areas are the main purpose of this type of collaboration.

The company executives, however, pointed out the gaps on the industry-academia collaboration and remained adamant about their needs to access highly qualified graduates. This view is especially true in the case of those graduates with appropriate skills for the work place [39]. Notwithstanding of that issue, companies admitted that despite the dire need for specific skills related to sustainable development, the companies did not seem to show some concerns about it. The interviewees conceded that they shift this responsibility to their colleagues from Quality and/or Human Resource department. They also did not seem to be worried when questioned about the staff training and its school of origin, in particular those concerning sustainable development.

Finally, our study highlights that leaders of the companies being interviewed do care about sustainability and are concerned about it. Nonetheless, they prioritise the economic over the environmental aspects. Solutions can be pushed through creating a greater awareness of leaders for social issues and the impacts of their attitude/behaviour on the motivation of their employees and the performance of the organisation.

Going forward, companies and universities must work more closely and join up their endeavours in developing educational programmes in the area of sustainable development. As the future work, we plan to extend our study to include a larger population of the Portuguese Association of Automotive Suppliers (AFIA), particularly to better understand the fundamental difference between multinational and Portuguese companies' behaviours towards sustainable development.

References

[1] Araújo WFS, Silva FJG, Campilho RDSG, Matos JA. Manufacturing cushions and suspension mats for vehicle seats: a novel cell concept. Int. J. Adv. Manuf. Technol. 2017;90(5-8):1539-45.

[2] Schulse A, MacDuffie JP; Täube FA. Introduction: Knowledge generation and innovation diffusion in the global automotive industry—Change and stability during turbulent times. Ind. Corp. Chang. 2015;24,603-11.

[3] Silva FJG, Gouveia RM. Cleaner Production - Toward a better future, Springer Nature, Switzetland, 2020. ISBN: 978-3-030-23164-4. doi: 10.1007/978-3-030-23165-1.

[4] Timmer MP, Dietzenbacher E, Los B, Stehrer R, de Vries GJ. An Illustrated User Guide to the World Input-Output Database: The Case of Global Automotive Production. Review of International Economics 2015;23(3): 575-605.

[5] UNECE. World Forum for Harmonization of Vehicle Regulations (WP.29) – How It Works, How to Join It. United Nations Publications, New York, U.S.A., 2019.

[6] BCG. The Most Innovative Companies 2019: The Rise of AI, Platforms, and Ecosystems. Bostn Consulting Group, Boston, MA, U.S.A., 2019.

[7] Bainwol M. Auto Alliance: Driving Innovation. Statement of the alliance of automobile manufactures before the Senate Energy and Natural Resources Committee, 2016. [Online] https://www.energy.senate.gov/public/index.cfm/files/serve?File_id=05AFE552-7C48-4802-A7BE-8F13465C4CA2. [Accessed on 18th December 2019].

[8] Pinto B, Silva FJG, Costa T, Campilho RDSG, Pereira T. A Strategic Model to take the First Step Towards Industry 4.0 in SMEs. Procedia Manuf 2019;38:637-645. doi: 10.1016/j.promfg.2020.01.082.

[9] de Mello AM, Marx R, Motta FG. A preliminary analysis of Inovar: Auto impact on the Brazilian Automotive Industry R&D activity. Revista de Administração e Inovação 2016;13(1):22-28.

[10] Vaz CR, Rauen TN, Lezana AG. Sustainability and Innovation in the Automotive Sector: A Structured Content Analysis. Sustainability 2017;9:880.

[11] Dieguez T, Porfirio JA, Amador F. Institutions and the Emerging Challenges of Sustainable Development: The Case of Automotive Suppliers Industry. ICERI2012 Proceedings, 2012.

[12] Sady M, Zak A, Rzepka K. The Role of Universities in Sustainability-Oriented Competencies Development: Insights from an Empirical Study on Polish Universities. Adm. Sci. 2019;9:62.

[13] Mochizuki Y, Fadeeva Z. Competences for Sustainable Development and Sustainability. International Journal of Sustainability in Higher Education 2010;11:391-403.

[14] Boström M, Andersson E, Berg M, Gustafsson K, Gustavsson E, Hysing E, Lidskog R, Löfmarck E, Ojala M, Olsson J. Conditions for Transformative Learning for Sustainable Development: A Theoretical Review and Approach. Sustainability 2018;10: 4479.

[15] Dieguez T. Systemic Approach to Quality Enhancement and Competitiveness. in Higher Education. In Michael Sony, Kochu Therisa Karingada and Neeta Baporikar (Eds.). Quality Management Implementation in Higher Education: Practices, Models, and Case Studies, Ch. 3, pp. 48-71, 2020.

[16] Portugal In. Key Industries: Automotive industry. Retrieved Online from http://www.portugalin.gov.pt/automotive-industry/, Accessed on Jan. 26th, 2020.

[17] AFIA. Portugal auto components industry. Associação de Fabricantes para a Indústria Automóvel, Leça da Palmeira, Portugal, 2019.

[18] Sahah MM. Sustainable Development. In: Sven Erik Jørgensen and Brian D. Fath. Encyclopedia of Ecology, Elsevier Science, Amsterdam, The Netherlands, 2008, pp. 344-346. ISBN: 978-0-08-045405-4.

[19] WCED. World Commission on Environment and Development. Our Common Future. Oxford University Press, New York, U.S.A., 1987.

[20] Elkington J. Cannibals with Forks: the Triple Bottom Line of 21st Century. John Wiley & Son Ltd, New Jersey, U.S.A., 1997. ISBN: 978-1841120843.

[21] Buchholz TS, Volk TA, Luzadis VA. A participatory systems approach to modeling social, economic, and ecological components of bioenergy. Energy Pol. 2007;35(12):6084-94.

[22] Rodriguez-Melo A, Mansouri SA. Stakeholder engagement: Defining strategic advantage for sustainable construction. Bus Strategy Environ 2011;20(8):539-52.

[23] von Meding J, McAllister K, Oyedele L, Kelly K. A Framework for Stakeholder Management and Corporate Culture. Built Environment: Project & Asset Management 2013;3(1): 22-41.

[24] Silvestre BS, Neto RS. Are cleaner production innovations the solution for small mining operations in poor regions? The case of Padua in Brazil. J Clean Prod 2014;84(1):809-17.

[25] Silvestre BS. A hard nut to crack! Implementing supply chain sustainability in an emerging economy. Clean Prod 2015;96, 171–81.

[26] Almeida CMVB, Bonilla SH, Giannetti BF, Huisingh D. Cleaner Production initiatives and challenges for a sustainable world: an introduction to this special volume. J Clean Prod 2013;47:1–10.

[27] Santos J, Gouveia RM, Silva FJG. Designing a new sustainable approach to the change for lightweight materials in structural components used in truck industry. J Clean Prod 2017;164:115-23.

[28] Belz FM, Schmidt-Riediger B. Marketing strategies in the age of sustainable development: Evidence from the food industry. Bus. Strategy Environ 2009;19(7):401-16.

[29] Fang K, Uhan N, Zhao F, Sutherland JW. A new approach to scheduling in manufacturing for power consumption and carbon footprint reduction. J Manuf Syst 2011;30(4):234-40.

[30] Sivam A, Dieguez T, Ferreira LP, Silva FJG. Key settings for successful Open Innovation Arena. J Comp Des Eng 2019;6(4):507-15.

[31] Farias AS, Costa DS, Freitas LS, Cândido GA. Utilização de eco-inovação no processo de manufatura de cerâmica vermelha (In Portuguese). Rev. Adm. Inov 2012;9:154-74.

[32] Senhoras E, Dias JM. Tendências da Indústria Automotiva Brasileira: Um Estudo do Caso FIAT. Available Online: https://www.researchgate.net/ publication/237801184_TENDENCIAS_DA_INDUSTRIA_AUTOMOTI VA_BRASILEIRA_UM_ESTUDO_DO_CASO_FIAT. Accessed on January 2nd, 2020.

[33] Kotler P, Keller KL. Administração de Marketing (In Portuguese). Prentice Hall: São Paulo, Brazil, 2006. ISBN: 9788581430003.

[34] Lopes PV, Silva FJG, Campilho RDSG, de Almeida, F. Designing a novel and greener truck asphalt container. Procedia Manuf 2019;38:324-32.

[35] Autodata. Terreno Fértil—Setor Automotivo Intensifica Programas e Práticas em Busca de Sustentabilidade, 2nd ed. AUTODATA, Maidenhead, UK, 2011.

[36] Silverman D. Interpreting Qualitative Data: a Guide to the Principles of Qualitative Research. Sage Publications, Los Angeles, 2011. ISBN: 978-0857024213.

[37] Gillham B. The Research Interview. Continuum, London, 2000. ISBN: 9781441160232.

[38] Krejcie R, Morgan D. Determining Sample Size for Research Activities. Educ Psychol Meas 1970;30:607-10.

[39] Moreira M, Tjahjono B. Applying performance measures to support decision-making in supply chain operations: a case of beverage industry. International Journal of Production Research 2016;54(8):2345-65.