RESEARCH ARTICLE OPEN ACCESS

Innovation and Technology Applied To Paralympic Sports

Tiago de Melo Ramos*, Jaldemir Santana Batista Bezerra**, Wendel Fren Costa Dos Anjos***, Liária Nunes da Silva**** Robelius De-Bortoli*****
**(Postgraduate Program in Intellectual Property, Federal University of Sergipe, Brazil).*
*** (Postgraduate Program in Intellectual Property, Federal University of Sergipe, Brazil).*
**** (UNIAGES Faculty).*
*** (Postgraduate Program in Intellectual Property, Federal University of Sergipe, Brazil) – (Federal Institute of Piaui).*
****(Postgraduate Program in Intellectual Property, Federal University of Sergipe, Brazil).*
Corresponding Author : Tiago de Melo Ramos

ABSTRACT
Over time the sport has been presenting to society the best athletes in the most varied sports modalities. Technological innovations play an important role in the context of adapted and Paralympic sports. The objective of this research is to map the technological innovations protected by Intellectual Property aimed at Paralympic sports. Three searches were conducted in the World Intellectual Property Organization (WIPO) database to identify patents granted and deposited. For this, the expressions "Bicycle chair", "sports Wheelchair" and "handcycle" were used as search terms. The results showed an increase in the number of patent applications between 2015 and 2018, with the United States and China being the countries with the highest number of deposits. A more effective participation of independent inventors and companies in relation to patent applications was perceived, to the detriment of the low participation of universities in the production of assistive technologies.

***Keywords*:** Paralympic Sports; Assistive Technology; Patent; Handicapped.

Date of Submission: 20-12-2018 Date of Acceptance: 04-01-2019

I. INTRODUCTION

The science of sport is an area centered on the development of research aimed at the understanding and orientation of sports practice, as well as for the generation of scientific and technological products [1]. The consequent results of the researches developed in the area, like the technological innovations, can influence significantly in the sporting environment. Ghiggi, Damico, and Loguercio [2] point out that technologies appear as integrating elements of the new world scenario of sports and contribute to the improvement of athletes performance, technical procedures and safety.

The sports universe historically has always sought to identify and provide a prominent scenario for the most skillful, competitive and complete human beings in specific sports modalities. The privilege of honor and merit has always been directed to the genetically favored, to those who were born with a pre-disposition for a certain activity, since high level athletes have a distinct body constitution [3]. Thus, being a successful athlete is a factor that is not only related to the desire and will of the human being. Factors such as biological and genetic individuality have always presented themselves as determinants in the context of sports science. Souza, and Lopes [4] explain that the various sports modalities already determine the body patterns required of their practitioners, such as the ideal physical biotype, for example.

With regard to adapted and Paralympic sports, Matveev [5] clarifies that it is necessary to understand them as a practice developed and elaborated for people with some type of disability, being also composed by specific and systematized rules in order to allow equality and loyalty in the pursuit of sports and athletic improvement. Schmitt, Bertoldi, Ledur, Begossi, and Mazo, [6] analyzed the scientific production in Brazilian Physical Education journals and identified that among the points most cited in the articles are, sports initiation, physical fitness assessment associated with athlete performance and public policies, measurement of anthropometric measures, body composition and metabolic rates, physical tests, identification of motor skills related to modalities. Soon, one perceives a similarity with the sport thought for the people without disability and directed to the same focus, the maximum yield of the athlete.

The practice of sports needs to consider the abilities, capacity and limitations of each athlete [7].

Thus, adapted and Paralympic sports emerge as sports modalities that counteract the natural selection patterns traditionally imposed in the sports environment. In this context, technologies assume a relevant role in the possibilities of application and impacts on the achievement of athletes results and performance, such as the expansion of functional capacity [8].

In view of the above, some questions seem pertinent: What factors influence the athletes' inclusion in Paralympic sports? To what extent does technology contribute to the inclusion of athletes? Are technologies developed and applied in adapted and Paralympic sports being patented? Given this scenario, this research aims to map the technological innovations protected by Intellectual Property directed to Paralympic sports.

II. METHODOLOGY

Aspects related to the tabulation, organization and systematization of information are presented.

II.I Search Type

This research is considered as quantitative, regarding the approach, and the data were organized and presented through numbers and graphs. Regarding the objective the research is descriptive, and as for the technical procedures it is documentary.

II.II Data collection and procedures

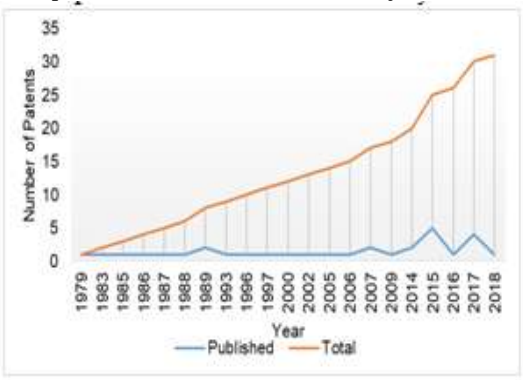
A search was made in the World Intellectual Property Organization (WIPO) database to identify granted and deposited patents for technologies developed for athletes who practice adapted sports. For this, the expressions "Bicycle chair", "sports Wheelchair" and "handcycle" were used as search terms. Initially, each search expression was entered in the "search" field, and then clicked on the "advanced search" tab.

After the identification of the patents that presented the defined search terms, we carried out the analysis of the abstracts to select only the patents of technological products that were developed to be applied in Paralympic sports and parathletes. Then, a structured script was elaborated with the information.

III. RESULTS AND DISCUSSION

With the search in the WIPO database and the search term "Bicycle chair" it was observed that there was an increase in the number of deposits and publication of patents (Figure 1). This increase was more marked starting 2003, with the highest results starting the decade of 2010. It is noted that researchers in the area are seeking not only to develop technologies, but also to protect them. These results are in line with the findings of Ferreira, Parreira, and Nabout, [9], when they showed that in the period between 2015 and 2017 there was an increase in the number of patent deposits on sports technologies for the disabled deficientes.

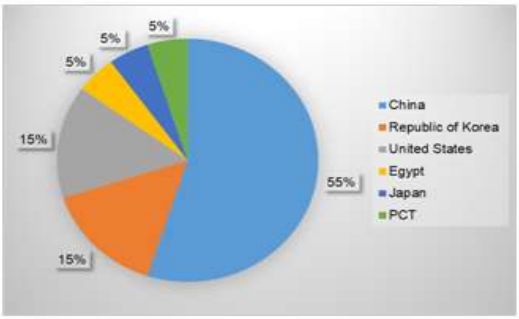
Fig. 1 - Evolution of the number of patent deposits with the search term "bicycle chair"



Source: Research Data (2018).

This growth in the number of request and publication of patents of technologies for use by people with disabilities was also observed by Silva, Costa, Ferraz, Quoniam, and Reymond, [10]. These results are presented as a source of technological information, signaling that researchers and inventors are developing research aimed at the generation of technological products with a focus on social inclusion and the improvement of parathletes performance. Information coming from patent documents are important indicators to support decision making in the context of Science, Technology and Innovation (C, T & I) policies [11].
Patent applications filed in the WIPO database come from different regions of the world. Of the patent applications with the search term "bicycle chair", 55% come from China, 15% from the Republic of Korea, and 15% from the United States (Figure 2). China's broad participation demonstrates that its researchers and inventors are developing research and technology that contribute to the inclusion of disabled athletes on the sporting scenario.

Fig. 2 - Patent depositor countries with the search term "bicycle chair".

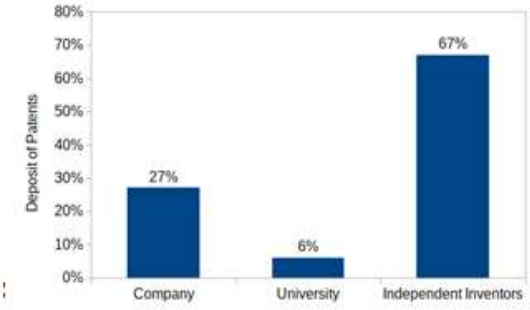


Source: Research Data (2018).

In addition, Nadalini; Torres; Kalid [12] present China as one of the leading countries when it comes to patent publication. Authors [10] have carried out a mapping of assistive technologies and their applications from patent deposits and found that China is a strategic country in the registration of patents related to this type of technology and, in addition, most inventors and depositors are Chinese. The fact is that the interest in producing technologies directed to people with disabilities makes possible the insertion and integration of this public in the most different social spaces. This type of technology reduces the functional limitations, helping in the performance of the activities and the reduction of the incapacities [13].

Regarding the profile of depositors, it was observed that 67% of the patents were deposited by independent inventors, 27% by companies and 6% by University (Figures 3). There is significant participation of independent inventors in the development of research and technological products in the area. In studies carried out in several areas, it is possible to observe a more effective participation of companies, such as the results found by Gonçalves, and Bezerra [14] who, through a technological prospection in the Questel-Orbit database, found that 83% of depositors are companies and only 17% are independent inventors.

Fig. 3 - Profile of patent depositors with the search term "bicycle chair"

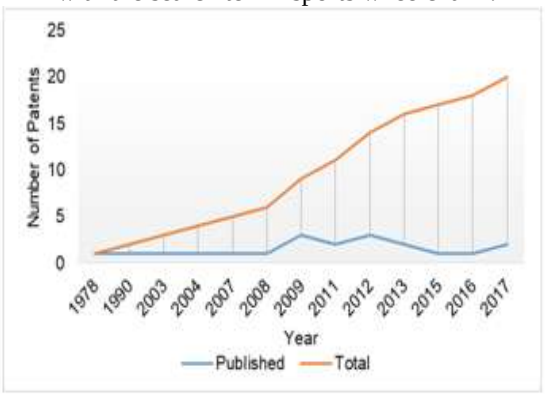


Source: Research Data (2018).

By analyzing the information in detail with regard to depositors, it was found that the inventor Zhuang Kexiang possesses the largest amount of patent deposits. And among the companies that have deposited the most, Selle Royal, manufacturer of saddles for bicycles, has the largest volume of deposits. These percentages indicate that universities seem to be far from the discussions about the importance of the development of researches and technological products aimed at improving the performance and the quality of life of people with disabilities, and it is therefore necessary to stimulate research in universities.

Applying the search term "sports wheelchair" it was found that there was an increase in the number of patent deposits. It is possible to notice that from the decade of 2010 the increase in the number of published patents is more pronounced, especially in the years 2015 and 2017 (Figures 4). These results corroborate the information presented in Figure 1, showing that the development of assistive technologies has been a subject of interest to researchers and inventors.

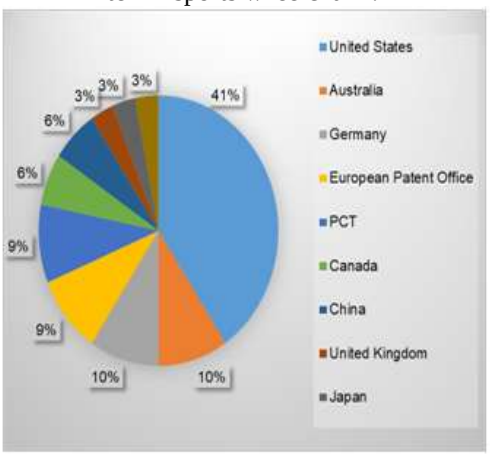
Fig. 4 - Evolution of the number of patent deposits with the search term "sports wheelchair".



Source: Research Data (2018).

According to Soares, Fontes, Ferrarini, Borras, and Braatz [15], there is currently a wide variety of artifacts that help people with some sort of limitation. They are assistive technologies that enable the integration and accessibility of people with disabilities. Specifically in relation to sports chair, it is observed that they are being produced and opportunized in the market, making their presence in Paralympic sports increase with each competition. Torri e Vaz [16] argue that man and machine complement each other, the results achieved being a consequence of this interaction. The fact is that technology is prominent in the Paralympic environment and its growth is noticeable.Of the volume of patent applications with the search term "sports wheelchair", 41% come from the United States. It is noteworthy that some countries, although recognized worldwide for their innovative potential and Science and Technology policies [17], such as Australia (10%), Germany (10%), showed significantly lower percentages relation to the United States (Figure 5).

Fig.5 - Patent depositor countries with the search term "sports wheelchair".

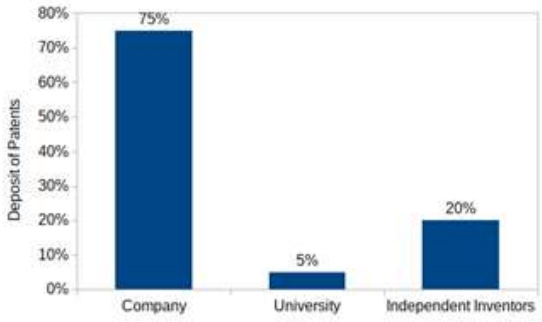


Source: Research Data (2018).

The results presented in Figures 2 and 5 also show the countries that are most engaged in the development of research and production of assistive technologies. Comparing the percentages presented in the two figures, it is observed that China and the United States stood out in the volume of patent applications deposited in the WIPO database in relation to assistive technologies. These results are in line with those presented by Consoni, and Moura [18], who highlighted the participation of the two countries in the volume of patent deposits in the world context.

Regarding the profile of patent depositors with the search term "sports wheelchair", it was observed that 75% of patents were deposited by companies, 20% by independent inventors and 5% by University (Figure 6). By analyzing the collected documents, Guangdong Shunde Yitu Sports Technology Co. Ltd., a Chinese manufacturer of plastic pipe and fittings, has been found to have the largest number of patent deposits.

Fig. 6 - Profile of patent depositors with the search term "sports wheelchair".



Source: Research Data (2018).

Comparing the results presented in Figures 3 and 6, it is observed that the participation of the independent inventors and the companies behaved differently in both situations. While in Figure 5 the independent inventors assume greater participation, in Figure 6 this protagonism is assumed by the companies. However, what stands out most is the low percentage of participation of universities in the two contexts, which are practically equal, 6% and 5% respectively. This reinforces the need to stimulate the participation of the university in the production of research and assistive technologies, something already indicated previously in this research.

IV. FINAL CONSIDERATIONS

The technological innovations developed from the actions of independent researchers, companies and universities are fundamental for the insertion of people with disabilities, both in Paralympic sports and in any social context. The increase in the volume of patent applications evidences an interest on the part of researchers in developing assistive technologies, as well as a special attention to the protection of the intellectual property of their creations.

Research in the field and the consequent technological products have been taking place prominently in the United States and China. It is still necessary to stimulate a more effective participation of universities in the development of these researches, since these institutions are poles that generate intellectual capital and have, tacitly or explicitly, in their missions or values the desire to generate results that will be applicable to the improvement quality of life of society.

The articulation between science and technology is the initial step to transform the knowledge generated in technological products. Investments in Science, Technology and Innovation are fundamental to expand the range of technologies capable of improving the performance of disabled athletes, expanding the possibilities for inclusion and promoting the quality of life of other people with disabilities.

ACKNOWLEDGEMENTS

This work would not have been possible without the support of the Postgraduate Program in Intellectual Property of the Federal University of Sergipe. Special thanks to the LADEC team.

REFERENCES

[1]. Viveiros, L., Moreira, A., Bishop, D., & Aoki, M. S. (2015). Ciência do Esporte no Brasil: reflexões sobre o desenvolvimento das pesquisas, o cenário atual e as perspectivas futuras. Revista Brasileira de Educação Física e Esporte, 29(1), 163-175.

[2]. Ghiggi, M. V., Damico, J. G. S., & Loguercio, R. D. Q. (2015). O discurso esportivo no prémio jovem cientista (2012): pela prática científica para a produção tecnológica. Revista Panorâmica online, 19, 148-161.
[3]. Crivelin, V. X., Moreira, A., Finotti, R. L., Lopes, C. R., Ramos, M., Aoki, M. S., & Capitani, C. D. (2018). Correlação entre altura do salto e composição corporal em atletas profissionais de voleibol. Arquivos de Ciências do Esporte, 6(1).
[4]. Souza, E. B., & Lopes, F. J. (2013). Consequências dos Transtornos Alimentares em Atletas de Alto Rendimento: uma Revisão da Literatura. Cadernos UniFOA, 8(1), 41-45.
[5]. Matveev, L. P. (2001). Teoría general del entrenamiento deportivo. Barcelona, Editorial Paidotribo.
[6]. Schmitt, B. D., Bertoldi, R., Ledur, J. A., Begossi, T. D., & Mazo, J. Z. (2017). Produção Científica Sobre Esporte Adaptado e Paralímpico em Periódicos Brasileiros da Educação Física. Kinesis, 35(3), 68-79.
[7]. Barrozo, A. F., Hara, A. C. P., Vianna, D. C., Oliveira, J., Khoury, L. P., Silva, P. L., Saeta, B. R. P., & da Silveira Mazzotta, M. J. (2012). Acessibilidade ao esperto, cultura e lazer para pessoas com deficiência. Cadernos de pós-graduação em distúrbios do desenvolvimento, 12(2), 16-28.
[8]. Ferreira, N. R., & Ranieri, L. P. (2016). O uso da tecnologia assistiva por professores de educação física. Revista Eletrônica de Educação, 10(3), 215-229.
[9]. Ferreira, R. B., Parreira, M. R., & Nabout, J. C. (2018, April). Tendências de artigos e patentes publicados sobre frutíferas do Cerrado com interesse econômico. In Anais do Congresso de Ensino, Pesquisa e Extensão da UEG (CEPE)(ISSN 2447-8687) (Vol. 4).
[10]. Silva, F. M., da Costa, P. R., Ferraz, R. R. N., Quoniam, L., & Reymond, D. (2018). Tecnologias Assistivas E Suas Aplicações: uma análise a partir de patentes. Revista de Gestão em Sistemas de Saúde, 7(1), 1-15.
[11]. Baltazar, L. F., Vilha, A. M., Ferreira, F. D., Chinellato, A. C., Vidotti, S. E., & Rodrigues, R. C. (2017). Patentes como fonte de informação tecnológica para subsídio à pesquisa: uma análise amostral da Universidade Federal do ABC. Cadernos de Prospecção, 10(4), 681.
[12]. Nadalini, A. C. V.; Torres, E. A., & Kalid, R. A. (2018). Prospecção de artigos e patentes sobre métodos para valoração econômica de serviços ecossistêmicos através da utilização de indicadores emergéticos. Cadernos de Prospecção, 11(1), 41.
[13]. Scatolim, R. L., dos Santos, J. E. G., da Cruz Landim, P., de Toledo, T. G., Fermino, S. C. M., Cardozo, D., Garavello, M. F, & Sanches, R. S. (2016). Legislação e tecnologias assistivas: aspectos que asseguram a acessibilidade das pessoas com deficiências. InFor, Inov. Form., Rev. NEaD-Unesp, 2(1), 227-248.
[14]. Gonçalves, L. A., & Bezerra, J. S. (2018). Estudo prospectivo do processo tecnológico da pirólise com ênfase no programa de patentes verdes do INPI. Cadernos de Prospecção, 11(1), 74-86.
[15]. Soares, J. M. M., Fontes, A. R. M., Ferrarini, C. F., Borras, M. A. A., & Braatz, D. (2017). Tecnologia Assistiva: revisão de aspectos relacionados ao tema. Rev espacios, 38(13), 8-22.
[16]. Torri, d., & Vaz, A. F. (2017). Esporte paralímpico: difícil inclusão, incorporação tecnológica, corpos competitivos. Práxis Educativa, 12(2), 19-33.
[17]. Arbix, G., & Miranda, Z. (2015). Inovação em tempos difíceis. Plural. Revista de Ciências Sociais, 22(2), 18-36.
[18]. Consoni, L. A. A., Moura, A. M. M. (2017). Patentes de biodiesel indexadas na Derwent Innovations Index entre 2008 e 2009: primeiras considerações. XVII Encontro Nacional de Pesquisa em Ciência da Informação, Rio de Janeiro, 2(1), 7.

Tiago de Melo Ramos" Innovation and Technology Applied To Paralympic Sports" International Journal of Engineering Research and Applications (IJERA) , vol. 8, no.12, 2018, pp 55-59