View and field of Assistive Technology in Brazil

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Abstract:

The present study attempts to spatial analyses data fromThe National Research of Innovation in Assistive Technology (NRIAT), the article seeks to present conclusions and recommendations for Public Policies in assistive technology to people with disability and aging people in Brazil, by region and Federation Units (UF).

The NRIAT is an initiative of the partnership between Ministry of Science and Technology (MST), through the Department of Science and Technology for Social Inclusion (DSTSI), and Institute of Social Technology (ITS Brazil). The NRIATdid the identification and characterization of the institutions that produce Assistive Technology (academic researches, products and services) for social inclusion of people with disabilities and aging people. The first edition hold during the year 2005 and 2006; the second hold during the year 2007 and 2008, and the last edition take the year 2011 and 2013.

The research is aimed at institutions (higher education, business and third sector entities) that have developed skills and conducted projects (research, products and services) in the field of Assistive Technology.

More specifically, our goals are: (1) to delineate the intellectual structure of research on innovation in assistive technology, as represented in the academic literature; (2) to determine the spatial distribution of products and projects in Assistive Technology in Brazil; (3) to identify contributions that play a pivotal role in bridging two or more conceptual domains of research; and finally, (4) to map this intellectual innovations. The goal is to obtain knowledge of what was produced, for the elaboration of policies within the Science, Technology and Innovation, to seek solutions to improve the quality of life and social inclusion of people with disabilities and the elderly, is subsidized with more precisely.

Introduction

This article is based on data from the NRIAT, 2011-2013 round, we intends to present findings and recommendations on the Brazilian field of Assistive Technology (AT) view help the initiatives of public policy to be guided by the needs of people with deficiency in Brazil, as well as describe the characteristics of the market and services of the AT in Brazil. Recognitionthe field as one way to understanding and promoting social inclusion faces various challenges for people with disabilities.

Methodology

The article is constituted by two parts, in first are demonstrate how was consolidated the field of ATin Brazil by given a conceptual and theoretical approach more utilized nationality and the selected review we are defense by this article. In the second parte we show how the methodology was applied to build the scope and analytical approach of the database of theNRIAT. Finally we offer the first findings and recommendations based on the version 2011-2013 of the NRIAT.

1. Concept of Assistive Technology more disseminated in Brazil

The concept of AT is very recent. Just in 1988, the US law known as *Public Law 100-407* (The Technology-Related Assistance for Individuals with Disabilities Act), reauthorized in 1994 (P.L. 103-218) and again in 1998 (P.L. 105-394). But human activity to solve problems related to disability through instruments, artifacts or technology is as old as human. Since the beginnings, people have been make pieces of wood, canes or crutches to help the act of walking in cases of accidents or as canes for visually impaired persons. Recent studies with Egyptian prostheseswith more than 2600 years old, was excellent evaluation about its efficiency to mobility of amputees[1] people.

Before the use the term AT,it was used (and still use) other names as Technology for People with Disabilities and Older, Technical Aids, Technologies Rehabilitation, Wizards Technologies, Enabling Technologies, Countervailing Technologies, etc.

[1] See: http://noticias.r7.com/tecnologia-e-ciencia/noticias/dedao-do-pe-de-mumia-egipcia-e-a-protese-mais-antiga-conhecida-20110214.html

AT is an area of knowledge, a technology sector, a market framework and a field of public policies that guide the search for solutions in the field of full accessibility, with the user a universal audience, but, specifically, was principally directed for the disabled, handicapped and elderly people.

There are no significant differences on the concept of AT (Cook and HUSSEY, 1995; HEART2[2]; ISO standard, many years[3]; EUSTAT, 1999a and 1999b; CAT, 2007) when he refers to "products", they are met by the expression "technical aids"(since version in ISO 9999: 1999) or" product support "(from the ISO version: 2007). However, with the exception of ISO, which only aim at classification of products, other proposed definitions include also serviceswithin the concept of AT.

The NRIATis guided by the concept prepared by the Committee for Technical Aid[4], whereby the TA includes:

> "Products, resources, methodologies, strategies, practices and services that aim to promote the functionality related to the activity and participation of people with disabilities, disability or reduced mobility, seeking autonomy, independence, quality of life and social inclusion". (Committee Technical Aids - 2007: ATA VII)

By examining the concept of AT recognizes that:it is defined by its purpose, i.e., to be aimed at enhancing functionality, autonomy, independence, quality of life and social inclusion of people with disabilities, handicapped or elderly, whatever the subject field of this technology.

This purposed definition, related to the improvement of autonomy and participation of people with disabilities, reduced mobility and older people, makes AT remit, participate and are located explicitly in the context of the concept of social technology. This can be understood as set of technical and manufacturing developed and / or implemented in the interaction with the population and methodologies appropriate for them. That represents solutions to social inclusion and improvement of living conditions (ITSBRASIL, 2004: 26; ITSBRASIL, 2007).

Thus, this social dimension implies the adoption of an epistemological and methodological matrix that has starting point the problems, needs and barriers faced by persons

[2] The HEART Study (Horizontal European Activities in Rehabilitation Technology), arises within the TIDE program (Technology Initiative for Disabled and Elderly People), the European Union. The result of this research project that extended over the years 1993-1995, was coordinated by the Swedish Institute of Technology Assistive, and incorporated a working group composed of 21 institutions and companies in 12 countries. About 50 papers, books and brochures published.

[3] For example, in version 2011: Any product (including devices, equipment, instruments and software), specially produced or available generally, used by people with disabilities or for them to allow participation; to protect, support, train, measure or replace functions / structures and organic activities; or to avoid problems, activity limitations and participation restrictions (ISO 9999: 2011)

[4] Formed in Brazil, in 2007, to help the Ministry of Human Rights.

with disabilities, reduced mobility and the elderly, as the path (Method) the application of knowledge, are these scientific (in various specialties), methodological, or popular knowledge, as a modus operandi to participate, as principles of democracy and citizenship rights, and as a result sought to improve the quality of life, social inclusion, independence and social well-being . This epistemology calls for a sharp and clear connection between researches, formalization of that, scientific relevance, social relevance and practical application.

At the same time, due to its purpose, AT can be seen as a human right. Indeed, the products of AT can be considered as a true extension of their own corporeality and complementation of the disabled person who can express themselves through them, communicate, and perform as a person in the social and political environment. Then access and use of AT productsare constituted in the *sine qua non*conditionof which depends on its realization as individuals and their social integration. Therefore, the products of AT can be considered as part of human rights.

We highlight the concept of AT and its enormous diversity and range of products and services within the concept. The range of products can be seen in the following table:

Classes of Assistive Technology Products, according to the classification of ISO 9999: 2007

Class	Specification
4	Support Product for individual clinical treatment: Support Products to improve maintain or monitor the medical condition of the person. Excluded are supporting products for exclusive use by health professionals.
5	Products of support for skills training: Devices designed to improve physical, mental and social skills.
6	Orthosis and prostheses, orthosis are devices applied externally to modify the structural and functional characteristics of the neuromuscular and skeletal systems. Prosthetics are devices applied externally to replace all or a portion of the partially missing or alteration of body structure.
9	Support products for personal care and protection products for dressing and undressing support for body protection, personal care, tracheostomy, ostomy and incontinence, to measure the physical and physiological properties of human beings and the sexual activities.
12	Support products for personal mobility: Auxiliary to march as canes, wheelchairs, strollers, various accessories, bicycles, vehicles, auxiliary to raise, rotate, flip, etc.
15	Support products for domestic activities: Products for preparation of food and drink, to eat and drink, to wash dishes, to clean the house, to manufacture and maintenance of clothes, etc.
18	Furniture and adaptations to homes and other buildings includes, p. ex., furniture (with or without castors) for rest and / or work and accessories for furniture and supporting products and systems for residential buildings adaptations, training and education.
22	Support products for communication and information devices to help person to receive, send, produce and / or process information in different formats
24	Support products for handling objects and devices support products for environmental improvement, machinery and tools
27	Devices and equipment to help improve the personal environment in daily life, hand

	tools and motorized machines.
30	Support products for recreational activities: Devices intended for games, hobbies, sports and other leisure activities.

Source: ISO, 2007.

The range of TA services can be enjoyed from the Public Law 108-364, describes what is intended by TA Services (US PUBLIC LAW 108-364, 2004):

• The needs assessment of the individual TA with a disability, including a functional evaluation of the impact of the provision of an appropriate TA and appropriate services for the individual in their common context;

• A service that consists of purchasing, leasing or otherwise acquiring TA provides resources for people with disabilities;

• A service consisting in the selection, development, testing, customization, adaptation, implementation, maintenance, repair, replacement or TA resources donation;

• Coordination and use the necessary therapies, interventions and services associated with education plans and rehabilitation programs;

• Training or technical assistance to an individual with a disability or, where appropriate, family members, caregivers, guardians or authorized representatives of such individual;

• Training or technical assistance for professionals (including individuals that provide education and rehabilitation services and entities that manufacture or sell resources TA), employers, providers of services and employment training, or others that provide services to employ or are otherwise substantially involved in key functions of life of individuals with disabilities; and

• A service that consists in expanding the availability of access to technology, including electronic technology and information for individuals with disabilities.

2. The NRIAT

The NRIAT is a research provide by the cooperation of the Department of Science and Technology for Social Inclusion (DSTSI), the Ministry of Science, Technology and Innovation (MSTI), in partnership with the Institute of Social Technology (ITS BRASIL). The goal is the identification and characterization of the institutions that produce AT (Technical Help or Product Support) for Social Inclusion of Persons with Disabilities and / or seniors.

The NRIAT is dedicated to the institutions (higher education, business and third sector entities) that carried out technological innovation projects (research, products and services) in the field of AT and skills developed during the period between the years 2005-2006, 2007-2008 and 2011-2013. This article takes the data from 2011- 2013 round.

In this research, technological innovation falls broadly, including research, technological development of new products (goods and services) or significantly improved and process innovation, as well as the marketing of these new products in area of Assistive Technology. IT does not include aesthetic changes or small changes in processes of production. Thus, the incorporating the research guidelines of Frascati and Oslo.

The NRIATis realized by the Internet, by a virtual questioner. Its main objectives are:

• Perform a researh on innovation in the field of AT in Brazil;

• Map and characterize institutions in Brazil that produced research, services and products in the area of assistive technology;

• Know the skills in Brazil in the area of assistive technology;

• To promote exchange of information between institutions, companies, researchers and users of assistive technology;

• Provide information channel for people with disabilities and / or elderly can benefit and get better knowledge about the research, services and products on Assistive Technology;

• Enable, more precisely, the development of policies within the Science, Technology and Innovation, to seek solutions to improve the quality of life and social inclusion of people with disabilities and / or elderly.

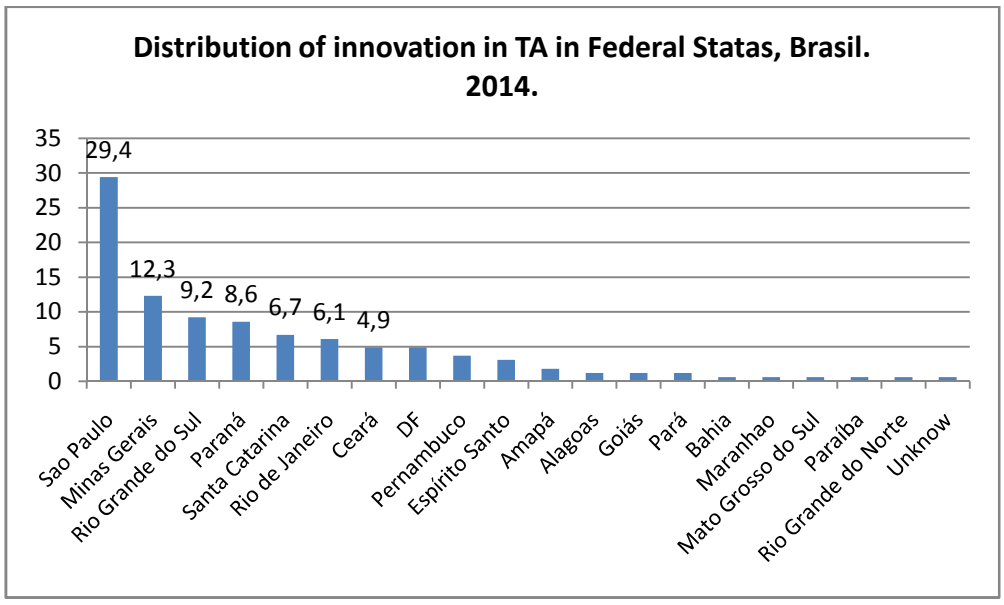
The collected data were analyzed using SPSS software (version 17 for Windows). It was done the statistical descriptive analyses to the variables of interests for this article.

Findings

The first results of NRIAT 2011-2013 round can be summarized in the following points:

- **Distribution of innovation in TA in Federative Units**

By analyzing the State in which the innovation projects are developed in TA, the NRIAT shows that there is a marked concentration of registered projects in the state of São Paulo, 29,4% of the 163 projects registered.



Source: NRIAT, 2014.

- **Public or private nature of innovation projects in TA**

Table 1.

Kind of Instituion	N of projects NRIAT	Percent
Public Federal	57	35
Private profit-making	51	31,3
Private non-profit-making	36	22,1
Public statal	19	11,7
Total of project	163	100

Source: NRIAT, 2014

- **Type of Institutions of innovative in TA**

Table 2.

Field of knowledge	N of projects NRIAT	Percent
Services	21	12.9
Faculty	19	11.7
Industry	18	11.0
Center of research on TA	15	9.2
NGO/OSCIP	12	7.4
Center of Research	9	5.5
Institute	8	4.9

Laboratory	8	4.9
Institute of Research (Scientific and Technological non academic)	7	4.3
Business	6	3.7
Fundation (academical)	5	3.1
Fundation (third sector)	5	3.1
Extension Group	3	1.8
National Institute of Technology	1	0.6
Universitary Hospital	1	0.6
Public Company	1	0.6
Autarchy	1	0.6
Others	16	9.8
Other (third sector)	7	4.3
Total	163	100

Source: NRIAT, 2014.

- **Fieldof knowledge**

Analyzing the profile of TA projects in relation to the Areas of Knowledge, you can check that stand out mainly three areas, namely: engineer sciences, 27,6% Health Sciences, with 17% of projects; Human Sciences, with 17,4%; Exact and Earth Sciences, with 10,4%, and that each project could answer the questionnaire, standing at more than one area at the same time (multiple choice). The other areas were mentioned in numbers below.

Table 3.

Field of knowledge	**N ofprojectsNRIAT**	**Percent**
Engineering (civil, chemical, mechanical etc.)	45	27.6
Health Sciences (medicine, occup. therapy, physiotherapy etc.)	28	17.2
Applied Social Sciences (administration, economics, computer etc)	20	12.3
Exact and Earth Sciences (mathematics, physics, geology etc)	17	10.4
Humanities (pedagogy, philosophy, sociology etc.)	9	5.5
Linguistics, Letters and Arts (language, letters, arts, etc.)	2	1.2
Biological Sciences (biology, genetics, botanic etc.)	1	0.6
Others	29	17.8
Non knowledge	12	7.4
Total	163	100

Source: NRIAT, 2014

- **MT Development Type: Research, services and products.**

Table 4.

Development Type: Research, services and products	N of projects NRIAT	Percent
Pesquisa (por exemplo, acadêmica, aplicada, protótipo etc.) Research (academic, applied,prototype, etc.)	73	44.8
Product (goods)	62	38.0
Services	16	9.8
Non knowledge	12	7.4
Total	163	100

Source: NRIAT, 2014

- **TA products by type of disability.**

Analyzing the data on the Target of projects, from a multiple choice question proposed by the questionnaire, it was found that the largest number of projects evaluated had targeted people with physical disabilities, with 27,6% of cases, followed people with visual impairments, that just as the elderly, appear as target in 23,9% of projects. Soon after, appear, people with hearing impairment, with 11%, multiple disabilities, with 8,6%, and people with intellectual disabilities, with 3%. People with reduced mobility, 12,3%.

Table 5.

TA products by type of disability	N of projects NRIAT	Percent
People with physical disabilities	45	27.6
People with visual disabilities	39	23.9
Disabled	20	12.3
People with hearing disabilities	18	11.0
People with multiple disabilities	14	8.6
Elderly	7	4.3
People with intellectual disabilities	5	3.1
Peoplewith pervasive developmental disorders (autism, Asperger, Rett, etc.)	3	1.8
Non knowledge	12	7.4
Total	163	100

Source: NRIAT, 2014

- **Participation of people with disabilities in innovation projects**

Considering the participation of people with disabilities in innovation projects, in different ways in their engagement at work, the results showed that is increasing the number of

people with disability participate in the projects 45% of registered projects there was participation of people with disabilities in their processes. This fact can be considered as very positive result, as different studies have revealed the importance of participation, where more intensive, the possible end users in all processes involving the Assistive Technology.

As highlighted by the EUSTAT Consortium (1999b: 3:10), the choice of AT is a matter that can affect significantly to life of its user. End users are seen as the main protagonists and those who have the final say in this choice. [...] Currently, disabled associations strongly advocate a user-centered approach, in which the end user is the main protagonist, is who makes decision on issues that affect your life.

Table 6.

Participation of people with disabilities in innovation projects	N of projects NRIAT	Percent
Yes, part (or) regularly	74	45.39877301
Yes, part (or) sporadically	59	36.19631902
Does not participate (or)	18	11.04294479
Non knowledge	12	7.36196319
Total	163	100

Source: NRIAT, 2014

Conclusion:

The analysis of data obtained in NRIAT can be highlighted some considerations, challenges and perspectives that are presented here by way of conclusions and recommendations:

- The high concentration of TA projects, developed in only three EU Member States (57% of them only in RS, MG, SP and RJ), suggests the need to study ways to increase the reach and distribution of actions and research throughout Nationwide, more evenly, mainly because the demands of TA, these yes, are distributed and capillaries . As a possible way to solve the problem, structure and provide new incentives in this area, primarily of research networks already nationally established and distributed, as the Core Network RD & I in AT, (in Federal Universities and Federal Institutes of Technology Education) coordinated by the National Reference Center in AT (CNRAT), could take place as the most suitable option available to generate, instantly more balanced distribution of initiatives.
- Although academic institutions have been established as type of institution with the highest number of registered research projects in this research, called attention to the participation in research and RD & I of academic-profit institutions - universities and private colleges non- philanthropic, whose activity has grown significantly in the

country; however, presents some significant results as regards the quantity of MT develop designs that: only 4,3% of the registered academic institutions.

- Among the institutions participating in the research are public institutions municipal and state that appear as more would require a focus priority incentive for the development of AT projects. Just as in relation to the geographical concentration of projects, also relating to those state and local public institutions, it is necessary to study the feasibility of incentives, access to information and public recognition, perhaps through links with the federal institutions and with companies located in the region, awards or other related initiatives in the AT area.
- More than half of registered projects (52%) said that it was AT Research development projects. And the upper portion of the labeled Service (10%) and product (38%). Projects like "AT Research" are mostly developed in academic institutions in the same way that most research in other areas of knowledge in Brazil.
- The RD & I projects in AT developed by companies still appear in small numbers, in this research. This reality shows a RD & I fragility in the area of AT, which requires actions to strengthen innovation in companies. Similarly with the innovation policy actions in other technological sectors, and using the various support mechanisms to RD & I activities in the companies, as well as university-industry linkage, already legally established in Brazil, it is possible and desirable to promote advances in innovation in companies at RT.
- Although the institutions of civil society or third sector account for 10% of the registered innovation projects in NRIAT, a known problem, on the other hand, is the lack of recognition and encouragement of the official development agencies in the country, about the research developed by civil society or third sector. All the reflection and theoretical production developed in the country on Social Technologies can serve as a reference and alternative support to try to reverse this lack of recognition and incentive, since many institutions of Brazilian civil society perform significant research, knowledge creation and innovation.
- For the development of technological innovation, the vast majority of projects inform develop research to be applied in innovative resources (goods or services) in the area of AT. However, recent international studies on the concept of "Social Innovation", among them, the publications of Stanford Social Innovation Review, emphasize the importance of that establish new links and dialogue between the public sector, the private sector and civil society organizations especially in this case, the organizations of people with disabilities. The main purpose is to make all research and development process promotes and manages the production of innovations that are really pertinent and relevant to social inclusion and greater autonomy the disabled, handicapped and elderly

people, as reflected in the concept of AT. Caution, therefore, encouraging to these multi-sectorial collaborations should also be a target to be achieved in shaping public policies AT.

- The growing presence of AT research related to Information and Communication Technologies, together with the finding of accelerated advances and breakthroughs in this area, makes it essential to be especially aware of this reality. Technological advances today, especially in IT, have opened broad new horizons for people up with serious commitments. Even when it comes to features related to the use of computers and the Internet, you can find or develop small-scale and low-cost solutions, but high functionality. Today, control the computer by means of blows or even voluntary movement of a single muscle in the body, for example, is now a real possibility for students with severe handicaps. And one possibility often much more accessible and affordable than you thinks. Screen reader software for people with visual impairment is another example of a new AT feature that has become crucial for the autonomy of people with disabilities. Research, although they are still few in this area, have surprised every day with new discoveries, new devices, new computer programs, which open wide horizons for people with disabilities. Therefore their access to technological resources, such as the computer and the Internet, more and more should no longer be perceived as something only optional or secondary. For the person with disabilities, often it is a fundamental right that enables the full exercise of citizenship and access to other basic rights as learn, communicate, work, have fun, etc., making it easier in many cases one higher degree of autonomy of a conventional prosthesis.
- This study points to the need to increase the volume of direct public funding or public-private partnerships projects in the area of AT, due to the obvious needs of a large portion of the population that can benefitfor these projects. And also the fact that it was the "lack of funds" the answer that stood out among the difficulties encountered by the projects.
- For innovation in AT, not always becomes necessary to have high amounts of funding. Thus, it was possible to prove in another study (DELGADO GARCIA, SON GALVÃO, ROBERTO et all; ITSBRASIL, 2012) that modest investments can in many cases become important to support the development of AT products. Considering that it is possible to develop low-cost and effective resources for greater autonomy of people with disabilities,disabled and elderly would be appropriate to also promote notices to finance low cost AT resources.

The results indicate NRIAT be of paramount importance to seek ways to enhance the participation of people with disabilities in all stages of projects, whether in reflection and

planning processes, as in decision making and implementation. A constant claim and cornerstone of the social movement of disabled people say, "Nothing about us without us". This guideline for participation of people with disabilities as active subjects should be extended also to the scope of technological innovation, mainly for reasons of citizenship and democratic participation, but also the relevance and quality of the projects developed when this participation happens. It would therefore be necessary that the priority lines of research and RD & I within public policies are oriented at needs and articulated guidelines politically by different sectors of government with actions for people with disabilities. This means, among other things, that the development institutions prepare the notices in close conjunction with the guidelines of public policies, as well as being provided, also, your participation in the procedures for monitoring and evaluation of the results of the funded projects. Thus, researchers and developers of AT products, both in the academic sphere, as in the business world and within civil society can have a milestone that signals the lines and priorities object of funding in the area of AT. At the same time, as mentioned, should be encouraged the participation of people with disabilities in research teams and RD & I in AT.

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