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ABSTRACT

Assistive technologies (AT) are essential in the daily life of elderly and people with disabilities. However, a growing demand for AT around the world remains unmet. The second-hand market has the potential to meet some of these unmet needs while reducing the amount of AT disposed of in landfills. The French government has recently engaged in financially supporting AT reuse programs. The current research aims at developing framework tools for project initiators. It was based on the literature on waste management and AT reuse and on a detailed analysis of seven innovative French local AT reused programs. Using a qualitative approach, the work resulted in an evaluation grid and a matrix scorecard of indicators for the management of future AT reuse programs. The aim of this tool is to consolidate the development of AT reuse programs to promote their access to people with disabilities while reducing waste production.

1. Introduction

WHO (2019a) recently estimated that over one billion people require one or more assistive technologies (ATs) including durable medical equipment (i.e., medical beds, hearing aids, wheelchairs, communication aids, walking aids, special computer keyboards, speech generating devices, etc.) which are an essential support to elderly or people with disabilities' daily living, social participation and quality of life. This number is expected to increase to over two billion by 2050 (World Health Organization, 2019a) due to the ever-increasing prevalence of non-communicable diseases associated with an aging population (Li Pi Shan et al., 2012). There are unmet needs, a growing demand for AT and a pool of abandoned or unused ATs. Such mismatch must be urgently addressed by public health and environmental policies for resource management and recycling as used ATs will eventually be disposed of as landfill waste (Sousa et al., 2021). Many countries are exploring the potential for AT reuse as a solution to reduce environmental and healthcare costs and increase availability (Cohen and Perling, 2015; Kniskern et al., 2008; Li Pi Shan et al., 2012; Ordway et al., 2018; Pitonyak, 2018; Sousa et al., 2021; Sund, 2017; Verbrugghe et al., 2015; Vincent et al., 2003; Wright, 2012).

In France, ATs are in most cases purchased new since the French health insurance system does not cover second-hand devices, except, since 2020, for some types of wheelchairs. This state of affair discourages any second-hand market and the recycling of devices (Denormandie and Chevalier, 2020). At the same time, there is no systematic procedure for recycling ATs that are no longer in us. In some regions and for specific groups (e.g., people with visual impairments, amyotrophic lateral sclerosis, certain motor impairments), there are associations that collect and distribute second-hand ATs with the dual objective of both (1) supporting people by improving matching between their needs and devices and by shortening acquisition time and (2) controlling the consumption of raw materials, but these are not widespread. In recent years, in connection with a 2015 call for projects to fund a new AT reuse programs by the CNSA ('Caisse Nationale de Solidarité pour l'Autonomie'[3]), new programs from the third sector have emerged. These programs offer refurbished ATs that extend their lifespan while maintaining their original performance.

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[3] CNSA : French social security agency, under the Ministry of Solidarity and Health authority, responsible for providing financial support and funding in-kind assistance services to people with loss of autonomy, whether due to infirmity, old age and/or disability)

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The present research aims to design a framework tool to support initiatives for the development of sustainable activities related to AT reuse programs. This framework tool is expected to foster the development of innovative practices in France combining a reasoned management of AT resources and the partial recovery of people with disabilities' needs. It also aims to identify good practices and risk factors for the sustainability of projects, to develop quality indicators and to recommend decision-making guidelines for project leaders. The tool presented in the appendix of this paper was developed using an iterative approach consisting of three main stages. At the first stage, we developed a process evaluation framework including the definition of objectives following the French approach of "modernization of public action", that is the main field of public policies which consists of assessing the different steps of a program's value chain. We built indicators following published practices developed in other countries, as well as practices developed in France (bottom-up approach based on an exploratory study). We conducted a review of the literature presented in Section 2 and the methodology used in Section 3. At the second stage, we conducted a qualitative analysis of the French programs following our guidelines, identified levers and obstacles impeding their implementation and assessed the ease of use of our guidelines. Main trends are presented in Section 4 as key lessons from the cross-sectional analysis. At the third stage, we built a balance scorecard following a top-down approach as an operational dashboard for stakeholders and/or donors.

2. Assistive technology reuse programs in the literature

Most of the scientific literature on AT reuse programs originates from countries where national legislation or guidelines on AT reuse exist (e.g., the United States, Quebec, the Netherlands, the Nordic countries). Much of this literature focuses on the recycling of mobility aids (Lau et al., 2008; Li Pi Shan et al., 2012; Rarrbo, 2010; Vincent, 2000; Vincent et al., 2003; Wilcox et al., 2013) and medical devices (Ordway, 2016; Ordway et al., 2018; Pitonyak, 2018; Wright, 2012). The existing research aims to contribute to the independence and quality of life of people with disabilities or the elderly while considering the: 1) the socioeconomic benefits of making more devices available and less expensive as needs increase; reducing healthcare costs through the availability of used devices; and controlling the quality of technical assistance services rendered to individuals; and 2) the environmental benefits of reducing the number of devices being discarded as landfill waste.

2.1. Socioeconomic benefits

The WHO Global Collaboration on Assistive Technology (GATE) defines assistive technologies (ATs) as "products and related services used by persons with disability to enable and enhance their inclusion in all domains of participation" (de Witte et al., 2018, p 467). Some AT are simple and low-tech while others are very expensive and complex devices. The diversity of AT users and the wide range of AT solutions make their allocation and the monitoring of their use a complex area of services delivery. The aspirations and individual characteristics of the user complexify the acceptability and use of a particular AT (AAATE and EASTIN, 2012; Andrich et al., 2013; Federici and Scherer, 2018; World Health Organization, 2019a).

Adapted AT (Federici and Scherer, 2018) translate into substantial gains in autonomy and independence for elderly and people with disabilities and their families, enabling them to lead dignified and independent lives (Agree, 2014; Boucher, 2018; de Witte et al., 2018; Gowran et al., 2020; MacLachlan et al., 2018). In addition, the use of an AT brings socioeconomic benefits by reducing direct health and social support costs, and by improving individuals' access to work, which indirectly stimulates economic growth (Rohwerder, 2018; World Health Organization, 2019a). Unfit AT may not be used and may be discarded. Existing literature shows that, in Western countries, AT abandonment rate is estimated to be one third after one year (Dijcks et al., 2006; Federici et al., 2016a). Wheelchairs represent an exception with an abandonment rate around 5% (Samuelsson and Wressle, 2008). Much of the scientific community (Demers et al., 2002, Demers et al., 2016; Desideri et al., 2014; Dijcks et al., 2006; Federici et al., 2016b; Gowran et al., 2020; McCreadie and Tinker, 2005; Phillips and Zhao, 1993; Scherer and Federici, 2015; Wanet-Defalque and Machabée, 2009) agrees that AT abandonment is the result of a complex interaction between four main factors: (1) individual factors (age, gender, diagnosis, self-expectations, social group expectations, acceptance of impairment, emotional maturity/internal motivation, disability progression, severity of disability, change in severity of disability, use of multiple devices); (2) assistive device factors (quality of the device, appearance of the device); (3) factors related to the environment of use (social group support, physical obstacles, presence of opportunities, market procedures for devices); (4) factors related to professional intervention (consideration of users' opinions, instruction and training, correct provisioning process and installation, length of delivery period, service follow-up).

AT abandonment represents a waste of 5 to 30% of their cost of acquisition which can represent significant amounts for funders (Federici et al., 2016a). Thus, many authors suggest that abandoned ATs could be sell at a lower cost by another person with similar needs (Gowran et al., 2020; Kniskern et al., 2008; Walsh et al., 2015). It is expected that promoting AT reuse programs will reduce difficulty of access. Currently, only 10% of people who need ATs have access to them worldwide (World Health Organization, 2016). According to WHO, this is due to their high cost, limited availability, inadequate funding in many regions, a very significant lack of awareness of the possibilities for gaining autonomy through their use, and finally a lack of adequate training for professionals. Barriers related to the price of ATs and obtaining funding are frequently cited (Cohen and Perling, 2015; Hammel and Finlayson, 2003; Kniskern et al., 2008; Wilcox et al., 2013; Wright, 2012). The situation is worse for children with rapidly changing levels of ability or growth (Lau et al., 2008; Li Pi Shan et al., 2012; Wilcox et al., 2013) or in the case of certain progressive pathologies (Li Pi Shan et al., 2012) that involve rapid turnover of ATs. In these situations, the reuse of ATs that are no longer appropriate provides an affordable alternative to expensive equipment for elderly and people with disabilities in need of them.

2.2. Environmental benefits

Environmental concerns justify the reuse of ATs. Most ATs fall under the obligations of their medical device (MD) class provided for by European regulations (Regulation (EU) 2017/745 of the European Parliament). French legislation remains ambiguous about the medical device status of ATs. According to the WHO, any product or equipment used for a medical purpose, that is, equipment for diagnosis, prevention, monitoring, and treatment of a health condition - fits the definition of a MD (World Health Organization, 2019b). MD waste management in the European Union (EU) is defined in the Waste Framework Directive (2008/98/EC), as amended by the Directive (EU) 2018/851, which defines the rules and conditions for waste management operations and planning taking place in the EU. It is complemented by a few Directives that set the rules for managing separate waste streams (e.g., packaging, electronic, etc.). The central principle of the EU waste management, as defined in Article 4 of the Waste Framework Directive, is referred to as the "waste hierarchy" (Hansen et al., 2002). The waste hierarchy determines different waste management options based on environmental and resource efficiency principles. Operations generating negative environmental impacts are considered undesirable and should be progressively limited, and ultimately replaced by waste management operations that are considered more resource efficient and environmentally sound (European Commission, 2008).

Fig. 1 describes the waste management hierarchy: (a) waste prevention including reuse; (b) preparation for reuse; (c) material and biological recycling; (d) energy recovery from waste; and (e) disposal to

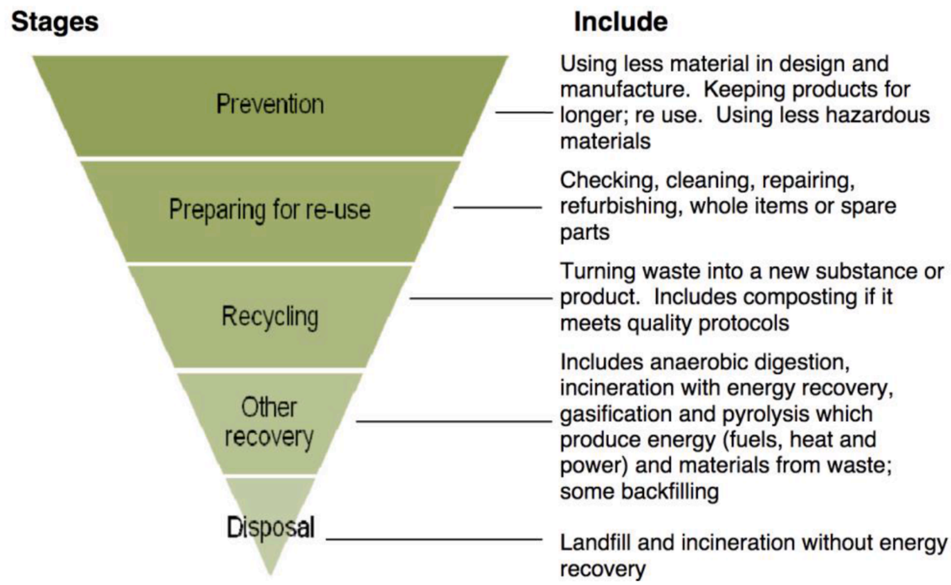

Fig. 1. Waste management hierarchy (*source:* *Defra, 2011*).

controlled or uncontrolled landfills, land, or water.

Waste prevention equals zero waste generation, and reuse prevents a product from becoming waste in the first place. However, step (b) might entail the refurbishing of a waste into a reusable product. The term "reuse" is defined in the Waste Framework Directive as "any operation by which products or components that are not waste are used again for the same purpose for which they were conceived" (European Commission, 2008; Article 3). Preparing for reuse is defined as "checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be reused without any other pre-processing." Product repair, refurbishment, and remanufacturing are all considered to be reuse operations (Ijomah and Danis, 2012). These operations are often preferable to recycling or manufacturing of new products. They save material, resources and energy. They reduce greenhouse gas emissions, and lead to safer handling of potential toxic substances (Sundin and Lee, 2012). AT reuse programs are more concerned with Prevention and Preparation for reuse.

2.2.1. *Prevention*

Prevention consists in reducing either quantity or harmfulness of waste produced, or both, by intervening in both its production and consumption. Production of ATs should consider their lifespan and duration of use. Companies are urged to assess the environmental impacts of their products. This assessment can be driven by different methods of production such as life cycle assessment and eco-design. Such methods ensure better environmental sustainability of medical devices (Sousa et al., 2021). Regarding consumption patterns, prevention should focus on the non-use of assigned ATs resulting from the mismatch between AT and personal needs or from a technical failure. The Norwegian Assistive Technology system model allows users to address practical/functional daily problems to avoid non-use and repair of the AT (MacLachlan et al., 2018). In principle, an AT will be repaired if its repair costs are lower than its residual value (Walsh et al., 2015).

2.2.2. *Preparing for reuse*

The economics of any reuse program plays a central role in determining its implementation and long-term sustainability. An AT reuse focused center has important operating costs (Milios and Dalhammar, 2020) that are primarily determined by the type of activities the center engages in. In the United States, the "Pass It On Center – the National Assistive Technology Reutilization and Coordination Technical Assistance Center" has conducted studies in different states about major models of technical assistance provision (Phillips and Persaud, 2014; Walsh et al., 2015). These studies elaborated a classification of all AT reuse activities and defined Indicators of Quality for Assistive Technology Reuse (IQ-ATR) programs of all types. These indicators established efficient practices in terms of program completion and sustainability (Pass It On Center, 2007, 2011). Different modalities of transfer between donors and beneficiaries are proposed by these programs: exchange, reassignment, rehabilitation, reconditioning, and recycling of AT.

Depending on the type of activities supported by the programs, increased volume of activities translates into higher personnel, transportation, and storage costs. When programs plan to recover used devices, the reuse cost is highly influenced by their collectability and redistribution. An efficient reverse logistics network where products are returned to the supplier uses different types of closed-loop supply chain (Walsh et al., 2015).

The cost of AT reuse is also influenced by the product's design that conditions the additional workload and time it takes to prepare the product for reuse. The product must be sorted, checked, cleaned, reprocessed, reassembled, quality assured, transported and finally delivered to a recipient. The right type of design can reduce the workload required for these tasks which determines eventually a successful reuse (Vanegas et al., 2018). Furthermore, acceptability of using a second-hand AT depends on its perceived residual value. According to Walsh et al. (2015), perceived residual value depends on: (i) product properties (i.e. products with an initial lower value, or with a high rate of technological innovation or with a short physical lifespan are not suitable for reuse) and (ii) on consumers' preferences (economic, ecological motivation, attitude towards reuse products, perception of performance and durability). Generally, both high price of AT and rapid change in user's requirements lead to a significant residual value of refurbished AT (Walsh et al., 2015).

According to Walsh et al. (2015) and Pass It On Center (2011), some external factors can also influence the likelihood of reuse: these include the absence of conflict with producers of new AT, ethical and ecological motives, and existing legislation. The influence of legislation is significant as systems of AT service delivery are part of the local welfare system and differ greatly according to countries and regions. The scientific literature on the reuse of AT comes primarily from countries where AT reuse legislation and regulation exist. In Europe for instance, very little research can be found on AT reuse programs. Walsh et al. (2015), argue that this is the result of the European funding models characterized by government full cost coverage. This encourages the purchase of new rather than second-hand AT products. This state of affairs has driven the ongoing reflection in France.

3. Research methodology

Our methods for the design of an **assessment tool** follows three main steps: 1) we defined the main objectives and the framework for the evaluation process based on the existing literature of reuse of AT; we designed a program assessment guide built on several existing programs aiming at improving access to ATs in France; 2) using this assessment guide to conduct a cross-sectional analysis and evaluation of these programs to identify the levers and obstacles to running a program. The main trends are presented in Section 4 as key lessons from the cross-sectional analysis; 3) Section 5 introduces the design of a matrix of quantitative indicators as an operational scorecard for stakeholders (and/or the funders), which is presented as the main result in Section 5.

3.1. Step 1: The evaluation process and the design of the assessment guide for AT reuse programs (bottom-up approach)

We designed an evaluation grid for AT reuse programs. This grid was been constructed using three categories of sources: a) the gray literature related to the management of public policies; b) the cross-analysis of several monographs of programs involved in promoting access to ATs funded by the 2015 CNSA call for projects, with potential for second-hand supply practices; c) a review of the scientific literature on AT provision programs.

The guide for AT reuse programs is an evaluation reference framework taking the form of a checklist in an Excel table. It covers the eight dimensions included in the French approach of “public action modernization” as a main intervention area of public policies implemented by the *Ministère de la transformation et de l'action publiques (Ministry of Public Transformation and Action)*. Fig. 2 presents the main steps involved in the value chain of a public action: once specific needs are identified in a territory, objectives are assigned to new programs, resources are allocated, and actions are undertaken. The evaluation aims at the results of the public actions, and more generally, the programs are evaluated on their overall impact. It is necessary to evaluate the value chain through a

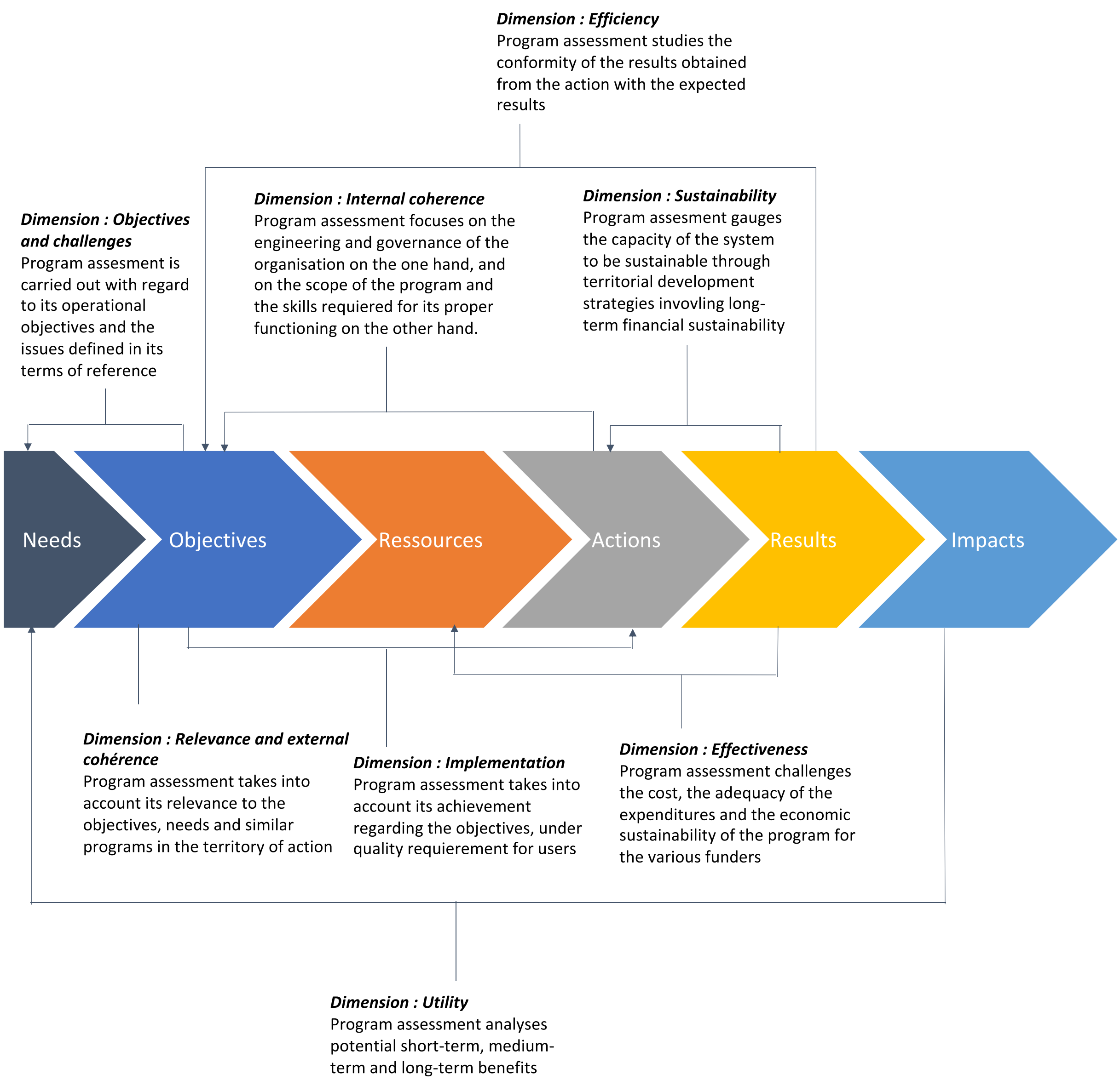

Fig. 2. Value chain of a public action in France and evaluative criteria. Adapted by the authors from MTAP (2015).

set of criteria. To implement the evaluation process, eight dimensions of the program can be characterized: objectives and challenges; relevance and external coherence; internal coherence; implementation; effectiveness; efficiency; sustainability; and utility. These eight dimensions are defined and described in Fig. 2.

As a result, the guide for AT reuse programs provides key questions and in-depth criteria for each dimension that can help stakeholders, project leaders, or funders to identify strengths and weaknesses of their current program or of their ongoing project. This guide is based on the same principle as the American guide "Indicators of quality for assistive technology reuse – IQ-ATR" (Pass It On Center, 2011; Phillips and Persaud, 2014), adapted to the French context and to the evaluation requirements of public policies.

Each dimension can be documented using qualitative data such as statements, activity reports, job descriptions, contracts, interviews. The guide is built on empirical knowledge of experiments and surveys. In France, access to ATs is dominated by the purchasing of new equipment and alternative circular economic models are still rare. In this context, we compared this approcach to seven innovative models of AT provision with different status of stakeholders, target beneficiaries, main objectives of the program, and types of ATs provided. Our approach consists in identifying alternative models rather than in comparing them in terms of relative performance. We reviewed the available documentation (website, activity report, etc.) for each program. We conducted half day on-site visits consisting of an interview with the person in charge of the program and, as deemed necessary, other key team members (president, occupational therapist, etc.). Fig. 3 and Appendix A provide an overview of the seven programs. This figure positions the programs regarding two criteria, i.e. the target beneficiaries in terms of territories of action and of eligibility conditions, the activities carried out with regard to the recycling of technical aids.

3.2. Step 2: Proceeding to cross-sectional analysis

The qualitative study and cross-sectional analysis, based on step 1 results, were conducted in two separate stages:

- during the exploratory work, the different interviews of ten programs that were funded in 2015 by the CNSA allowed an initial characterization of each to be built through a cross-sectional analysis: particularly, activities undertaken (advice and support, circularization of ATs, and accessibility to ATs), levers of activities (reimbursement of ATs, for example), gathering and renovation of the ATs, and the economic conditions for the sustainability of the programs. This first stage generated valuable material to enhance the evaluation guide and its eight dimensions, a set of criteria and, if applicable, the identification of indicators;
- once the evaluation guide was "ready-to-use" as a reference assessment frame, it was applied to a selection of seven programs, some of which were not in the subset of ten programs. The assessment was first conducted dimension by dimension, and then was synthesized through management project tools to provide a critical analysis of each program. During this diagnostic process, we aimed to collect self-elaborated indicators to design the matrix scorecard.

3.3. Step 3: Designing the matrix scorecard or dashboard of quantitative indicators (top-down approach)

The in-depth study of the programs made it possible to construct a matrix of quantitative indicators as a tool for steering, analyzing, and evaluating program activity. This matrix was discussed by the project leaders, the program funders, and external members of the advisory committee during a workshop in fall 2019.

The matrix is composed of three perspectives: the direct beneficiaries of the project, the project leaders, and society, including the State, the funders, and citizens, for instance for their concern, for instance, about waste management and use of resources. For each perspective, four categories of evaluation criteria had to be identified: attractiveness and accessibility; organization of services and functions; quality and socio-economic value of the service; and cost and price of the services (Table 1).

Some of the indicators had already been collected by some programs (such as activity indicators) at the time of investigation, while others would require specific reporting by program holders, local authorities, or even at the national level.

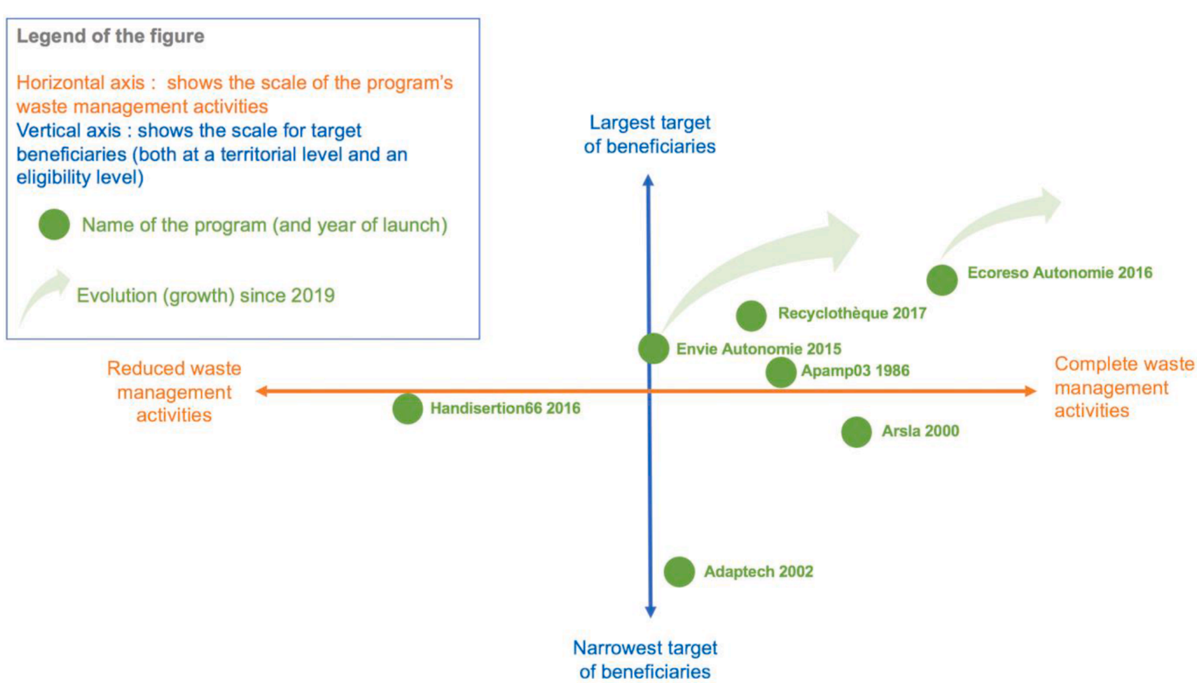

Fig. 3. Seven French programs suitable for an AT circular economy in 2019 according to their beneficiaries and their waste management activities.

Table 1
Matrix scorecard for program monitoring.

		Set of criteria and indicators							
		Attractiveness and accessibility		Organization of services and activities		Quality and socioeconomic value		Cost and price of the services	
Settings		Criteria	Indicators	Criteria	Indicators	Criteria	Indicators	Criteria	Indicators
Perspective	Beneficiaries								
	Project leaders								
	Society / funders								

4. Seven French AT reuse programs: cross-sectional analysis and key lessons

To identify the levers and obstacles to promoting AT prevention and reuse programs, the evaluation grid was applied to the seven programs selected for the evaluation process and for the identification of relevant steering indicators (Fig. 3, Appendix A). This investigation was conducted between March and July 2019 and it is possible that some programs have evolved since then, particularly in terms of their goals and issues.

4.1. Objectives and challenges

Most of the programs evaluated had several objectives that may have evolved over time. The objective most frequently pursued by the programs related to the accessibility of ATs: equal treatment for elderly and people with disabilities (in France, people with disabilities benefit from certain aids for the acquisition of ATs that are not available to elderly people), affordable access and shorter access times (currently in France the access time can be up to several months, because of delays in processing files for the financing of certain AT). Another widely shared objective was to ensure that Ats were fitting individuals to the individual's needs and used properly. Four of the seven programs also had the explicit objective of creating an eco-responsible circuit for ATs.

All programs developed activities related to the provision of ATs, including maintenance, sanitization, disinfection, distribution, and installation at home. All but one also offered collection, refurbishment, and aftersales service or maintenance. On the other hand, activities related to the proper matching of ATs to individuals' needs were not always fully covered. While all programs provided information, advice, and support in handling the equipment at the time of delivery, they did not systematically provide recommendations or follow-up on the use overtime of the equipment at home. This generally implied the employment of occupational therapists in the program. Moreover, there was a great diversity of ways to provide ATs (donation, loan for trial or use, rental, sale), while French regulations encourage AT acquisition and ownership. Thus, while loan for trial was widely offered, loan for use was rarer, as was donation. Rental and sale of new ATs were quite common, while sale of second-hand ATs concerned three of the seven programs. Only one program covered all these options.

Legal status could also vary between enterprise and association status, which has an impact on the AT market: social economy enterprise status places the program in a situation of local competition with other AT distributors, while patient association status confers on the programs a particular form of legitimacy and repute with the target audiences. Moreover, companies must develop a sustainable economic model, whereas this is not the case for associations.

4.2. Relevance and external coherence

To ensure their territorial anchoring, the programs have concluded formal or informal partnerships that could - and most often did- involve patient and users' associations, healthcare and medico-social institutions, independent healthcare professionals and even professional integration actors when the program participates in the inclusion of disabled workers in the workplace. The programs that offer second-hand ATs had also the stakeholders of the recycling sector (waste disposal centers, recycling centers, etc.) as partners. On the other hand, partnerships with other AT distributors in the territory were rare or nonexistent and it should be noted that innovative programs can be direct competitors (i.e., threats) for them on their territory.

Regardless of the dominant activity (provision of ATs or matching them with user needs), programs overall made little use of outsourcing services. When a function is outsourced, it is because it being based on quite technical skills, whether for renovation, or for expertise/advice from a professional on which AT to use for specific needs. The use of outsourcing is not related to the age of the program, but rather to its ambitions to cover all provisioning functions: the three programs that made more use of outsourced services were also those that offered all the activities in the value chain (provisioning and matching of ATs). This allowed them to complete the service package or to strengthen procedures. However, the price to pay depended on the partner, which could weaken the program: it is important to note that the main skills missing at the time of the program launch were logistics and refurbishment expertise. This probably hindered the deployment of programs around the supply of second-hand ATs. Only one program had these skills at start-up, as it already focused on recycling and refurbishment skills and developed ATs as a complementary branch of its activity. Thus, increasing programs' skills by hiring new people (internalization) or finding partners to delegate certain activities (outsourcing) is necessary for their success. All the programs that had not chosen referral activities as part of their scope of work seemed to be gradually opening their scope of practice to this activity, by recruiting or purchasing the services of occupational therapists.

4.3. Internal coherence

There was no relationship between the conditions of concrete implementation of the project and the status (private enterprise from the social economy sector or private association) of the program holder: overall, the schemes belonged to the social and solidarity economy and pursued a collective interest. Moreover, public subsidies had played a crucial role in the launch of projects, providing substantial resources for initial investments.

At the operational level, programs did not rely heavily on formalized needs assessments. In term of production processes, standardization practices vary considerably, but programs that were in a dissemination strategy tended to formalize their procedures. In all cases, the main difficulties in terms of "routine" arose from the fact that labor market skills were sometimes scarce: this is the case for AT renovation technicians for whom there is no tailored training in France. Training followed an on-the-job approach on their repair skills and their experience in renovating other types of products.

4.4. Implementation

To evaluate the level of implementation, several criteria were examined: concrete launch of the activity, respect of the timetable of deployment, evolution of the activity area during deployment, setting up of the conditions for sustainability, and formalisation of operating procedures. Not surprisingly, the main determinant of program realization was its duration: those created up to the 2000s were fully effective, while those created from 2015 onwards were currently growing and the most recent ones were not yet operational, sometimes due to activity reorientation. In general, the programs provided high-quality services to their users. Despite identifying conditions for their sustainability, sustainability was not always achieved to date.

4.5. Efficiency

As before, mature programs were more likely to meet all their objectives. Objectives related to financial barriers to access, equal treatment, or the creation of an environmentally responsible circuit were consistently met. The objectives that were only partially achieved were either related to a lack of access to ATs (probably due to administrative problems or insufficient stock) or to the approach of the use of ATs by occupational therapists. In the latter case, the difficulty stemmed mainly from excluding from the original program roadmap the issue of quality and of matching the AT with users' needs.

Setting explicit objectives at the outset of the activity and adjusting them as objectives changed (frequently) over time was essential to assessing program effectiveness: some programs were no longer effective according to their initial objectives, but rather according to the new objectives set as they grew. However, it is difficult to assess the efficiency of programs as they did not collect tangible indicators on this subject. Apart from one program, indicators were rare, yet they could help support the development of these programs. This included the need to develop four types of indicators:

- efficiency indicators related to the circular economy of ATs: for example, the average lifetime of ATs;
- efficiency indicators related to time to access ATs;
- efficiency indicators related to improvement of financial access to ATs: for example, the average price of a renovated AT compared to the average price of new.
- efficiency indicators related to support of individuals: for example, the AT dropout rate.

4.6. Effectiveness

Mostly, the schemes had been supported by a certain number of grants, donations, and sponsorships. Funds had been managed in a pragmatic and economical way, with a concern for optimization. However, these programs had difficulty in finding a self-financing business model.

The main limitation lay in the obstacles to designing a business model based exclusively on the circular economy of ATs: at the time of the study, the regulatory context did not favor this type of activity since the principle of reimbursement of new ATs, enforced in France, did not apply to second-hand ATs. Program leaders had therefore often struggled to finance innovative approaches and ultimately turned to rentals of new ATs that could be reimbursed by public health insurance (although in limited number), to provide the resources to develop their second-hand ATs' activity.

4.7. Sustainability

Regardless of the activities carried out, several conditions must be met to allow for the dissemination of the programs. The first condition is to find and implement an effective business model that allows for long-term self-financing (particularly) if the projects intend to avoid public subsidies. The second condition, on the over hand, is to benefit from strong institutional support at start-up of the activity but also during the program's lifetime. This support must be both financial and functional, and at the level of the territory (referral of the public by medical–social interaction, communication, sharing of good practices and experience, outsourcing of some activities, etc.). The third condition is to construct of a solid network of partners to maintain good relationships with the classic suppliers of ATs (also suppliers of spare parts that are essential for renovation). To maintain such relationships, programs targeted a precise area of activity that only partially overlapped with that of suppliers (e.g., they did not propose to sell new "consumables" such as incontinence and hygiene products). The fourth condition for sustainability and expansion concerns the formalisation of activities: formalisation of the offer, operating procedures, job descriptions, creation of contractual and monitoring tools for materials provided, and tools for managing requests and stock. Also, the competence and commitment of the teams are a major lever for sustainability.

For some programs, the question of dissemination did not arise, because the program was either inherently territorial or already national (e.g., in the case of a national association focusing on a rare disease). Other mature programs that wished to develop their activity at the national level generally did so without competing against each other, by deliberately choosing unexplored territories. The pool of second-hand ATs remained limited and requires promotion of the activities to collect and renovate AT and to make them available.

For this purpose, a study of the needs and resources of the territory was systematically conducted by the head office of the company. This also led to the search for harmonization of practices between territories and thus to the design of a toolbox and formalisation of the processes. Such organization saved time and accelerated the launch of activities. In addition, it made it possible to define target outcomes to be achieved at each acceleration phase, to make comparisons between local structures, and to guarantee the type and quality of the offer.

4.8. Utility

At the time of our investigation, there were no outcome indicators that could be routinely measured by the schemes. This was due to difficulties in identifying them: quality of life scores, autonomy scores, fall/fracture rates, duration of use of technical aids, and so on. Program leaders generally used satisfaction surveys, which were not homogenous or validated by public funders. In the short term as well as in the long term, these impacts are more difficult to measure, however they are key to the evaluation of programs: the impacts are on users' quality of life and on the environment. The use of socioeconomic evaluation could potentially provide a better understanding of the impact of the program, assessing monetary benefits for health and monetary benefits resulting from better access to ATs and also from better management of scarce environmental resources.

5. A matrix scorecard for prevention and AT reuse programs

Evaluation in the form of our comprehensive approach has shown great disparity between the programs, and this is also the case for criteria and indicators that have been developed. This makes comparison and benchmarking difficult to implement. One of the motives of this research was to design an operational scorecard of relevant indicators, not only for operational programs, but also for future project leaders or public funders (Appendix B).

Indeed, more general indicators should be designed to provide public funders with tools, to help them decide how to allocate resources to programs. The final goal would be to estimate the impact of programs on society, including altruistic concerns (e.g., better access to ATs and a better quality of life for beneficiaries) as well as environmental ones (e.g., better management of resources and waste), so this would ideally imply consideration of program costs as well as results. Costs should include not only direct costs (investment, operations, including saved costs relating to the second-hand market) but also indirect costs (e.g., productivity of beneficiaries, if relevant for people with disabilities) and intangible costs (withdrawal of resources from the environment, waste management, and loss of quality of life for beneficiaries and their caregivers, etc.). This approach would require methodological consideration of 1) the way benefits or losses relating to the quality of life (for beneficiaries and caregivers) would be valued (and in particular the most appropriate scale in the case of disability and loss of autonomy and its compensation); 2) the way benefits or losses relating to environmental resource management would be valued, as negative or positive externalities.

Thus, the matrix shows not only the indicators that already exist in some innovative second-hand AT programs, but also the indicators that should be collected or even designed in the future. Some of these indicators are complex to design and collect at this stage, although they should ideally be included in the evaluation process. Furthermore, these evaluations should also include an assessment of accessibility (coverage of needs), use and proper use of assistive technologies (in the sense of the abandonment and real usefulness of assistive technologies), horizontal equity (in the sense of the correction of socially unfair inequalities in access between categories of beneficiaries) and vertical equity (in the sense of the correction of unfair inequalities in the individual financial effort to access the technical aid). Finally, as mentioned before, these evaluations should ideally consider positive environmental externalities when a program includes a circular economy dimension and the provision of second-hand assistive technologies. This approach to general indicators would of course require in the future more in-depth methodological research. Yet, a subset of criteria is already established, allowing stakeholders to use it in order to perform a tangible assessment of their activities and their results.

6. Discussion

This research aimed at developing an analytical framework to encourage the development of AT reuse programs in France. To design the evaluation grid for these programs, three categories of sources were used: the gray literature related to the management of public policies, the cross-analysis of several French programs' monographs, and the scientific literature on AT provision programs. Precisely, this guide was based on the same principle as the American guide "Indicators of quality for assistive technology reuse – IQ-ATR" (Pass It On Center, 2011; Phillips and Persaud, 2014), adapted to the French context and to the evaluation requirements of public policies. In the United States, assistive reuse programs emerged from the 1988 federal "Tech Act", and its 2004 AT "reauthorization" amendment (Cohen and Perling, 2015; Kniskern et al., 2008; Wilcox et al., 2013; Wright, 2012). The influence of this legislation has been instrumental in structuring the AT reuse programs regulated by the IQ-ATR. According to the ATs Act Data Brief Report, a compilation of data from 56 AT programs nationwide, 59,149 consumers received a total of 70,673 reused devices from 55 AT programs resulting in overall savings of $28 million in fiscal year 2018 (Domin and Shepard, 2019). Mobility, seating, and daily living ATs accounted for 87% of all devices provided by reuse programs.

Another example of good practice in assistive technology system is the Norway model that arguably offers the most advanced model of an AT circular economy (MacLachlan et al., 2018; Nyland, 2018). A systematic system of refurbishment of used AT includes thorough cleaning and replacement of worn parts before reuse. In 2016, 439,174 assistive devices (including accessories) were distributed to 138,150 users (26.3 users per 1000 inhabitants; Sund, 2017). On average, 29% of existing AT were refurbished devices. The refurbished devices represented a new price value of approximately 78 million euros. At the end of 2016, a cumulative total of 414,824 users received one or several assistive devices, representing 8.0% of the population.

Thus, these examples show that in addition to providing an analytical framework guide to project leaders, there is a requirement for a legislative framework to sustain them as suggested by Walsh et al. (2015). Additionally, it is necessary for the public authorities to activate several levers to support this type of program:

- in legal terms: the reimbursement of second-hand ATs in France, for which some progress has been evidenced for wheelchairs in 2020 (e.g., French social security financing law for 2020);
- in regulatory terms: the definition of a standardized framework that guarantees the quality of services. This concerns both the quality of assistance provided to people in choosing and using new and second-hand ATs (whether they are sold, rented, loaned, or given away) and the various services provided to individuals and professionals. The construction of standardized frameworks aims to guarantee quality products and services and thus earn the trust of AT users, prescribing health professionals, and funders, and to contribute to the sustainability of the systems. The implementation and massification of these devices, even in the form of a platform, can only succeed with the construction of such frameworks;
- in regulation rules for the supply side: greater regulation of the competition between AT providers is necessary to provide incentives to cooperate with providers in the second-hand market, or to offer second-hand ATs also; greater regulation is also required in reuse practices and in the various stages of the circular circuit.

This study has certain limitations: first, insofar as the programs studied depend on the field of social and solidarity economy, the question of formal evaluation often appears to be secondary for project leaders. They have a highly empirical knowledge of their programs. Consequently, there are few operational indicators of activity at this stage. Second, while some of the indicators proposed in the matrix can be collected by project leaders, others need to be designed soundly from a methodological point of view and discussed by the company: how to define a subset of relevant and shared indicators provided to public authorities, whose purposes are mainly to assess and compare their performance in the short term and mid-term; a how to value the quality of life gained or lost depending on whether the program is accessed; and how to value the gains or losses depending on the use of the circular economy. In other words, how to operationalize these measures and make them accessible to project leaders and evaluators alike in order to promote them. Third, environmental indicators need to be designed. Further research is needed to determine the optimal environmental lifetime (OEL) for each class of AT. Indeed, Hummen and Desing (2021) showed that the assumption that a longer product use is per se environmentally beneficial is not necessarily the case for all products. The optimal environmental lifetime indicator (OEL) takes into account non-linear dynamics of technological efficiency improvements and efficiency degradation during usage, even including lifetime extension strategies such as re-manufacturing (Hummen and Desing, 2021). The establishment of this indicator for each type of AT presents a major research challenge in identifying which AT needs to be rehabilitated in order to ensure both environmental and social benefit.

7. Conclusion

The main challenge of this research was to provide an analytical framework to encourage the development of reuse programs for ATs, to increase their accessibility while guaranteeing their performance, and to decrease their costs, both financial, social, and environmental, in view of growing needs. The approach used was both bottom-up and top-down, drawing on conceptual frameworks and tools from the scientific literature and on innovative programs already developed in France. This approach has made it possible to create an evaluation framework for projects and programs that combines qualitative and quantitative indicators to enable various stakeholders to identify obstacles and levers to adjust their decisions.

This research is in line with the political priorities set by the French public authorities in their 2022–2027 roadmap: environmental concerns are now ranked as one of the ministries' primary and cross-cutting objectives, associated de facto with the requirements of their assessment. Moreover, it covers a field that has been little explored to date in France, insofar as the rules for reimbursing new technical aids (purchase or rental) do not encourage reflection on the waste caused by the misuse or abandonment of AT. The reluctance to use this second-hand market is also due to the legal liability issues associated with the refurbishment of equipment.

Since the objective of a sustainable economy is stated as a guideline for public action in France, the way to achieve it is to promote regulatory and financial strategies - as well as further scientific research - that foster the development of the circular economy, even in the health and long-term care sector: rationalizing the amount of resources used in order to improve the well-being of disabled people in France are two mutually compatible objectives.

CRediT authorship contribution statement

Isabelle Barbet: Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft. **Laurence Hartmann:** Conceptualization, Methodology, Investigation, Formal analysis, Writing – original draft. **Diane Deville:** Conceptualization, Methodology, Validation, Writing – review & editing. **Marie-Sophie Ferreira:** Formal analysis, Validation, Writing – review & editing, Project administration.

Declaration of Competing Interest

None.

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Appendix A. Seven French programs suitable for an AT circular economy

Program	Stakeholder and legal status	Program launch	Target beneficiaries	Main objectives of the program	Program activities	Waste management activities	Waste Management level 1: prevention, keeping products for longer	Waste Management level 2: preparation for reuse including checking, cleaning, desinfection repairing, refurbishing, whole items or spare parts	Waste Management levels 3 to 5: recycling, other recovery disposal
Adaptech	Private not-for-profit health insurance at one county level (Mutualité française – *Ille et Vilaine*)	2002	Workers with disabilities at one regional level (*Bretagne*)	•To maintain employees in employment after the onset of a disability •To promote access to employment for people with disabilities	Advice and information on computer and office automation assistive technologies, recommendation, loan and follow-up activities for the use of professional assistive technologies	Prevention Preparation for reuse	•counseling and information •recommendations •collecting/stocking •support in the taking in hand •use follow-up •maintenance and aftersales service	•cleaning •disinfection	no procedure for the disposal of technical aids or components that cannot be reused
APAMP03	Association under the 1901 law (private not-for-profit association) at one county level (*Allier*) - Association for the loan of equipment to paralyzed patients in the Allier county	1986	Any beneficiary at one county level (*Allier*)	* To improve home support for people * To extend the life of the material by allowing its reuse * To improve access to assistive technologies for any beneficiary	Free loan for trial or use with no time limit, sale of new equipment with no out-of-pocket payment (registered or not on the list of reimbursable products and services [LPPR]), rental with no out-of-pocket payment and donations to associations	Prevention Preparation for reuse Recycling and other recovery	•counseling and information •support in the taking in hand •logistic and technical assistance after delivery •collecting/stocking	all preparation activities for reuse	procedures for the disposal of technical aids or components that cannot be reused
ARSLA	Association under the 1908 law (private not-for-profit association of public interest) - Association for research on amyotrophic lateral sclerosis	2000	People with amyotrophic lateral sclerosis diagnosis at the national level	* To make assistive technologies available with short time frames in emergency situations * To reduce inequalities in assistive technology access between elderly and disabled people under age 65	Loan of assistive technologies to patients with ALS diagnosis	Prevention Preparation for reuse	•counseling and information •formation •recommendation •use follow-up •logistic and technical assistance after delivery •collecting/stocking	all preparation activities for reuse	no procedure for the disposal of technical aids or components that cannot be reused
Ecoreso Autonomie	At first, this was an association under the 1901 law and it became a social enterprise (public interest cooperative society) – national level	2016	Any beneficiary at three county levels (*Val de Marne, Manche* and *Calvados*)	* To improve adequacy between assistive technology provision and the individual's needs	Evaluation and adaptation of assistive technologies to the needs of beneficiaries, followed, in most cases, by the provision of AT (sale of new and second-hand equipment, rental and loan)	Prevention Preparation for reuse Recycling and other recovery	•counseling and information •recommendation •support in the taking in hand •use follow-up •technical assistance after delivery society) •collecting/stocking	all preparation activities for reuse	procedures for the disposal of technical aids or components that cannot be reused
Envie Autonomie	At the beginning, it was an association under the 1901 law and it became a social enterprise (public interest cooperative society) – national level	2015	Any beneficiary at one county level (*Maine-et-Loire*)	* To create reintegration jobs for precarious people * To develop an eco-responsible circular economy for assistive technologies * To improve financial access to assistive technologies	Supply of "second-hand" assistive technologies, collected from individuals and institutions (sale, loan for trial and more rarely rental)	Prevention Preparation for reuse Recycling and other recovery	•maintenance and aftersales service •collecting/stocking	all preparation activities for reuse	procedures for the disposal of technical aids or components that cannot be reused
Handisertion66	Association under the 1901 law (private not-for-profit association) at one county level (*Pyrénées orientales*)	2016	Any beneficiary at one county level (*Pyrénées-orientales*)	* To promote professional integration for disabled people * To bring options to people facing financial or social difficulties and needing temporary assistive technology	Low-cost repair service for technical aids and short-term rental of technical aids while they are being repaired	Prevention Preparation for reuse Recycling and other recovery	•support in the taking in hand •collecting/stocking	•cleaning •repairing	procedures for the disposal of technical aids or components that cannot be reused
Recyclothèque	Association under the 1901 law (private not-for-profit association) at a regional level (Nouvelle *Aquitaine*)	2017	Any beneficiary at one regional level (*Aquitaine*)	* To develop an eco-responsible circular economy for assistive technologies * To support the use and proper usage of the assistive technology * To improve responsiveness in terms of timeliness and adaptation of technical aids to needs.	Information and advice, needs assessment and collection of assistive technologies, provision (loan for trial; rental; exchange and barter, donation, sale (new and second-hand AT)	Prevention Preparation for reuse Recycling and other recovery	•counseling and information •recommendation •technical assistance after delivery •collecting/stocking	•Ecoreso: cleaning, disinfection, repairing, refurbishing	procedures for the disposal of technical aids or components that cannot be reused

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Appendix B. Matrix scorecard for AT reuse programs

		Set of criteria and indicators							
		Attractiveness and accessibility		Organization of services and activities		Quality and socioeconomic value		Cost and price of the services	
Settings		Criteria	Indicators	Criteria	Indicators	Criteria	Indicators	Criteria	Indicators
Perspective	Beneficiaries	•Access to an AT •Benefit of an occupational therapy assessment •Benefit of a home assessment •Benefit of early access to AT •Willingness to purchase second-hand AT •Recurrence of purchases (i.e., consumer loyalty) •Target audience •Knowledge of available AT (refunded basket classification, technology levels, etc.) and service provision •Building or consolidating the care pathway	Collected indicators: •Rate of answers regarding expressed needs •Rate of equipment regarding assessed needs •Rate of follow-up : number of occupational therapy consultations / expressed demand or per equipped beneficiary •Rate of consultations in ecological environment (county scale) •Timeliness of AT provision regarding expressed needs or assessed needs Indicators to be designed: •Indicator of acceptability by user: rate of refusal of an offered second-hand AT •Customer retention rate : number of recurrent buyers / total number of buyers •Eligibility score (elderly people with loss of autonomy, disabled people, people with a specific disability) •Evaluation of the individual's level of information (score) •Capacity to meet an external prescription within the framework of the care pathway	•Territorial scope of action and current expansion of the system (multi-indicators)	Collected indicators: •Number of territories (regions, counties) involved in the program •Population targeted by AT (number of elderly people in the territory and number of people with disabilities) Indicators to be designed: •Travel time: average number of kilometers traveled by the beneficiary or by the technical and occupational therapist for one person and for one intervention •Rate of home visits: number of people who have benefited from a visit of the program in their home / number of people equipped •Rate of loans granted during the time of the equipment repair •Intervention delay : time taken by the aftersales service to intervene	•Matching of the equipment to the user's needs and abilities •Results of the intervention on the beneficiary's autonomy and on the prevention of autonomy loss •Impact on access to information about AT •Impact on beneficiary's quality of life	Collected indicators: •Frequency and duration of trials before acquisition •Rate of satisfaction of the beneficiaries Indicators to be designed: •Service rate or reorientation rate: adequacy of the recommendation to the request: •Rate of AT return •Share of trials in the whole activity of the program •Rate of AT abandonment due to misuse, by type of AT •Share of aftersales service in the activity by type of AT •Rate of returned products under warranty and out of warranty •Rate of AT abandonment or replacement due to changes in the beneficiary's needs •Impact of the service on the autonomy scale score •Impact of the service on quality of life score (including level of social participation) •Number of different referrers (as a sign of knowledge of the system in the ecological area) •Rate of job retention / duration of employment •Decrease in work stoppages	•Beneficiary's Out-of-Pocket Payments (if third party funding) •Willingness to pay of the beneficiary •Price of maintenance for the beneficiary	Collected indicators: •Price ratio or discount comparing second-hand AT/new AT •Average sale price of renovated ATs Indicators to be designed: •Structure of legal and extra-legal aid funding •Rate of people who give up applying for extra-legal aid because of administrative complexity •Structure of the use rate (conversion rate of the loan into a purchase, rate of purchase of AT to duplicate, mix of new and second-hand AT purchases, portability of legal financing in case of purchase of second-hand AT (and/or AT maintenance), rate of renunciation of AT equipment due to RAC or delays, rate of AT loss when not returned •Rate of use of spare parts (indicator of the extension of useful life) by type of beneficiary (users or institutions)
	Project leaders	•Start-up / development / maintenance of the activity •Level of competition •Target audience or estimated market size •Integration into the ecosystem •Political support •Sources of referring	Collected indicators: •Number of second-hand ATs, typology of second-hand ATs and annual growth rate •Number of beneficiaries of second-hand Ats and annual growth rate •Growth rate of the activity of the program Indicators to be designed: •Eligibility score (elderly people with loss of autonomy, disabled people, people with a specific disability) •Rate of contribution in terms of public funding (as a political guarantee) •Share of self-financing (and annual evolution) •Market share in the territory •Revenue by type of service (rental, sales) and by type of AT •Share of referrals by partners	•Business by function •Typology of second-hand ATs •Target audience	Collected indicators: •Structure of AT supply (by type of provision and by type of AT) •Custody rate (number of ATs kept for production/number of collected ATs), annual trend and typology •Average number of occupational therapy consultations by AT type •Renovation rate (number of renovated ATs/number of ATs collected), annual evolution and typology Indicators to be designed: •Number of ATs collected that are refunded, annual evolution and typology •Donation acceptance rate: number of ATs accepted as donations by the carrier/total number of donation proposals made to the carrier •Share of standard second-hand ATs •Share of specific/customized second-hand ATs •Rate of internalized functions in the program •Rate of return of second-hand ATs (rotation) •Share of ATs stock accessible from all the territorial structures of the system (when there are several stocks) •Average number of home interventions needed for an adequate follow-up •Average storage time per type of AT •Average storage costs per type of AT •Average lifespan of the AT by type of AT	•Quality indicators (process and result) •Ongoing improvement process and internal evaluation	Collected indicators: •Number of hours of training for technicians/professionals (on certified training, certifications to be pursued) •Rate of employees who have completed labelled training ("service providers and equipment distributors") if new ATs selling or renting •Average warranty duration by AT and by AT category •Degree of implementation in the territories Indicators to be designed: •Number of hours of training for beneficiaries (including with attendance of caregivers) •Number of ISO certifications (not yet relevant in France, to be continued with AFNOR certifications) •Rate of declaration relating to material vigilance •Rate of pooling for support functions (share of budget/support functions)	•Productivity •Investment •Operations •Human resources	Collected indicators: •Cost of collection per year and per AT (if relevant and if cost borne by the program) •Number and structure of full-time equivalents (FTEs) and value in budget •Average relative cost of occupational therapy services by type of assistive technology •Renovation time by type of AT and sequence time by type of AT •Relative shares of provision modes (rental, sale, donation, loan) by type of AT and share of non-profit activity (AT loans or donations) •Production activity indicators: sales of spare parts, share of home deliveries of AT, share of AT testing, number of aftersales service interventions •Proportion of institutional clients and structural share of maintenance in sales •Program margin rate and annual revenue growth rate •Duration of loans (if followed by purchase or acquisition) and amount of cash advances •Useful floor space Indicators to be designed: •Relative share of internalized functions in total operating costs •Cost per product line resold if new and connection with occupational therapy services and independence level of the occupational therapist (for an appropriate choice of AT) •Sales structure for new AT (value of AT to estimate the quality of entry-level, mid-range and high-end AT) for impact on the duration of use
	Society / funders	•Impacts on AT supply •Impacts on AT access •Target audience with a concern for equity •Impacts on the environment, thanks to the extended duration of use •Systemic impacts on healthcare organization •Prevention of pathway disruptions	Collected indicators: •Share of public and para-public funding Indicators to be designed: •Eligibility score (elderly people with loss of autonomy, disabled people, people with a specific disability) – indicators on horizontal equity level (accessibility to AT whatever the "category" of the beneficiary) •Market share in the territory and annual evolution (judgement on responsiveness, in the sense of the capacity to satisfy the demand) •Theoretical duration of AT use through circularization •Average effective duration of AT use / type (if new / if renovated) •Number of beneficiaries per AT (over the lifespan of the AT)	•Impacts on the recycling sector (waste disposal centres, etc.) •Cooperation between professionals in the sector •Certification of professionals in the sector	Collected indicators: •unit cost of AT collection (by piece or by weight) and annual trend •Rate of AT reuse Indicators to be designed: •Mapping of partnerships by function •Rate of AT collected / estimated deposit •Number of tons of AT waste saved •Brands and models of equipment recommended by occupational therapists (theoretical useful lifespan and ability to be reused)	•Vertical equity (i.e. relationship between out-of-pocket payments and income level) •Impacts on family caregivers •Impacts in terms of externalities	Indicators to be designed: •Affordability ratio (annual OOP payments for ATs/annual income) •Cumulative annual OOP payments refunded by the program •Number of training sessions with ecosystem actors •Value of circularization (valuation of the effective additional use of AT by type) •Estimation of the added value of the system (valuation of the quality of life) •Estimation of the environmental value created (valuation of external effects) •Satisfaction rate of family and professional caregivers (including rate of trial at home of spouse, beneficiary and caregiver) •Evolution of the number of musculoskeletal disorders among caregivers	•Subsidies •Impact on public funding •Impact on competitors' supply	Collected indicators: •Share of public financing in the turnover and value of public subsidies •Share of new AT sales in the turnover (market share indicator and local competition) •Number of direct jobs created by the activity Indicators to be designed: •Saving costs for health insurance (direct and indirect) or for other funders (individual and collective human aid when the AT can replace human aid) •Hidden costs saved for the system (e.g. administrative costs saved when the beneficiary is in charge of financing) •Impact on price regulation/market power of distributors •Evolution of rental prices over time and share of public financing in turnover

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