SUITCEYES

1 Jan 2018 - 31 Dec 2020

Smart, User-friendly, Interactive, Tactual, Cognition-Enhancer, that Yields Extended Sensosphere Appropriating sensor technologies, machine learning, gamification and smart haptic interfaces

[D8.15]

Initial exploitation plan and report on IPR issues

Courtesy of LightHouse for the Blind and Visually Impaired, see http://lighthouse-sf.org

Dissemination level		
PU	PUBLIC, fully open, e.g. web	X
CO	CONFIDENTIAL, restricted under conditions set out in Model Grant Agreement	
CI	CLASSIFIED, information as referred to in Commission Decision 2001/844/EC.	

Deliverable Type		
R	Document, report (excluding the periodic and final reports)	X
DEM	Demonstrator, pilot, prototype, plan designs	
DEC	Websites, patents filing, press & media actions, videos, etc.	
OTHER	Software, technical diagram, etc.	

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Glossary	
Abbr./ Acronym	**Meaning**
D8.15	Deliverable 8.15 – Grant Agreement No. 780814 – SUITCEYES [deliverable number on pages 9, 35-37]
SUITCEYES	Smart, User-friendly, Interactive, Tactual, Cognition-Enhancer that Yields Extended Sensosphere - Appropriating sensor technologies, machine learning, gamification and smart haptic interfaces
WP8	Work Package 8 – Dissemination, Knowledge-sharing & Exploitation
HARPO	Harpo Sp. z o.o., Poland
HB	Hoegskolan i Borås / University of Borås, Sweden
HSO	Hochschule Offenburg / Offenburg University of Applied Sciences, Germany
CERTH	Ethniko Kentro Erevnas Kai Technologikis Anaptyxis / Centre for Research and Technology Hellas, Greece
LDQR	Les Doigts Qui Rêvent, France
SWOT	Strengths – Weaknesses – Opportunities – Threats

SDKs	Software Development Kits
APIs	Application Programming Interfaces
HIPI	Haptic, Intelligent, Personalised Interface
BCI	Brain-Computer Interface
GSR	Galvanic Skin Response
ECG	Electrocardiography
IPR	Intellectual Property Rights
TRL	Technology Readiness Level
VR	Virtual Reality
HMD	Head-Mounted Display
AR	Augmented Reality
DOF	Degree of Freedom
SCM	Source Code Management
MIT (license)	Massachusetts Institute of Technology (license)

Table of contents

1.   Executive Summary

This document presents the exploitation and marketing strategy for the solutions developed in SUITCEYES. This activity will be conducted during the whole project duration. It starts with elaborating the exploitation and technology usage plan of the SUITCEYES project based on a preliminary market survey, a SWOT (strengths, weaknesses, opportunities and threats) analysis, an analysis of competitors and business case development. This task will deal continuously with the ongoing progress in the project in terms of how foreseen activities actually take place, are modified in the light of circumstances, or where other actions and measures are to be introduced.
The work comprises:

- Creating a business case for the project with a market survey, SWOT analysis, and an analysis of competitors;
- Identification and inventory of competitor products, highlighting the differentiating and marketable outputs of the project;
- Defining a business model that will provide a structure that mediates the value creation process between the technical and economic domains in a viable and sustainable way;
- Development of individual and joint market exploitation plans to maximize the opportunities for market adoption of the project results;
- Considering to build up a platform for communication and cooperation on the target group, and for technical cooperation on building new ideas, features, solutions, R&D based on the available and growing state of the art (both hard- and software) if the complexity of exploiting the results in a rather small and nevertheless very diverse market may make the consortium reducing the expectations high in terms of immediate commercial success;
- Intellectual Property Rights (IPR) management, including monitoring of innovations that should be IPR-protected.

The potentially exploitable tools are still under development, in accordance to the work plan of the project. For that reason, clear exploitation paths in such developments have not been defined in detail yet. In particular, in the case of industrial partners, company-specific deployment policies for exploitation of SUITCEYES outcomes and business planning exist, requiring more details on the concrete products or services envisaged, supported by a clear understanding of the competitive advantage of the new technologies and the potential impact on the market. Thus, a more precise indication of the individual exploitation plans is foreseen for the final exploitation plan and report on IPR issues (D8.16, due by M34), when the relevant tools will be fully deployed and tested.

Based on this, the initial exploitation plan proposes the scenarios for addressing the project's potentials, evaluates possibilities and allows an educated decision on these activities.

2. Introduction and Rationale

In the framework of the Horizon 2020 programme, it is specified that proposals and funded projects need to pay special attention to the exploitation and results throughout the evolution of the project, and to guarantee the exploitation of final results beyond the lifetime of the project.

A preliminary plan for the exploitation of results is part of the project proposal itself, which after receiving the funding, is included into Annex 1 of the Grant Agreement signed between the beneficiaries and the European Commission.

Article 28 of the Grant Agreement addresses the contractual issues around exploitation. All beneficiaries are obliged – up to 4 years after end of project- to take measures aiming at ensuring exploitation of results such as:

- using them in further research activities (outside the action);
- developing, creating or marketing a product or process;
- creating and providing a service, or
- using them in standardisation activities.

Finally, regarding IPR issues, all findings and results of this project are covered and governed by the Consortium Agreement, section 8 as well by the Annex 1 of Grant Agreement, section 2.2.2.

This document is divided into the following main sections:

- In section 3 the expected exploitation strategy with the product concept, planned exploitation actions and the roles of the different partners in this strategy are presented.
- Section 4 introduces a business case of SUITCEYES. One can read here about a business scenario implementing the final product, the preliminary market, law and a support survey for solutions for people with deafblindness. Finally, a SWOT analysis including strengths, weaknesses, opportunities and threats of the HIPI is performed and the analysis of commercialized haptic devices for individuals with deafblindness is considered.
- Section 5 describes expected impacts of SUITCEYES on different aspects of life of people with deafblindness like communication, interactions, developing innovations and technology.
- Intellectual property rights and knowledge management with the inclusion of monitoring innovations are summarized in section 6.
- Section 7 features a summary of all considerations about the exploitation plan of SUITCEYES at the current stage of the project.

3. Exploitation strategy

SUITCEYES will follow multiple exploitation paths and scenarios for the use of its findings. The aim is to support rapid use of its solutions among the deafblind users. Moreover, the research community may be the target group of using the scientific results of the project in further investigations.

3.1 Product concept and its possible scenarios

The main idea of the product in the SUITCEYES project is to design, develop and deliver a haptic intelligent, personalised interface (HIPI). By combining machine learning, sensor technologies, image and signal processing, psychophysics, and affective computing, the localisation and environmental perception of the user is extended, and user's modes of communication via a haptic language is improved. Various studies performed during the project will inform the partners of user needs (in the framework of the WP2 *User needs, society and social inclusion*) and design elements (WP5 *Smart haptic interfaces* or WP6 *Haptic psychophysics and prototype testing*) that will allow customisation. To promote and facilitate learning, gamification is also going to be incorporated to capture and extend the user's interest, umwelt and engagement (WP7 *Gamified and social interaction)*. Gamification will be used to enhance a good user-experience.

For success, a soft, haptic, intelligent, textile-based, personalised communication interface should be accepted by the users. This solution is designed in an iterative process in which the partners are evaluating the user opinion regularly and develop the HIPI accordingly (users are involved in the design process). Therefore the very high level of acceptance of users will be reached among the test subjects (in the WPs mentioned above). The final product should be able to give the user meaningful haptic signals concerning the physical surrounding environment (e.g. "the ball is to the left"). It should also be made to order and shown to be producible at an industrial scale.

SUITCEYES will also impact the emerging field of smart textiles where typically sensorics are integrated. Incoming signals need to be analysed, interpreted and transmitted to the user in some meaningful often simplified and transformed form. SUITCEYES by its multidisciplinary approach where semantic technologies, image processing, object recognition and machine learning are all included and signals and feedback are elaborated a contribution to the paragon for coming smart textile artefacts also devoted to other applications than haptic communication.

Because of its holistic approach, SUITCEYES will take into account the users' broad spectrum of needs and adjust the product according to the present wave of evolution of haptic devices and haptic communication.

The SUITCEYES project will also deliver scientific results which can be exploited by research groups, scientists and university researchers from various areas such as assistive technologies, sensors, textiles etc. Moreover, the results of the project will be exploited by the research groups of the consortium partners and their collaborators to do further studies in a similar or related scope of knowledge. The ownership of the scientific results obtained and shared in the project are governed by the Grant Agreement and Consortium Agreement as mentioned in section 2.

The open platform for communication and cooperation on the target group, and technical cooperation and exchange, take-up, sharing and cooperating on building new ideas, features, solutions, R&D based on the available state of the art (both hard- and software if the consortium decides so) will be considered and shared.

The consortium develops various scenarios for further exploitation of the project results in relation with establishing what is our product. Possible variants include (see also Figure 1):

1) HIPI as the prototype/platform for personalized development. This has been considered as a kind of generative platform, optimizing dynamical add-ons for a variety of purposes.
2) Free access to some elements of the code – open platform for developers. Such a platform can be open for those developers who want to build upon the innovative work of the project. Those developing can be researchers but also commercial actors. Thanks to a choice of license options developers who will be going to invest effort in further developing HIPI system will be able to use the code for their own benefit, and enrich the community by contributing to system progress.
3) A platform for user generated content and interaction. This can be in the form of a website where users can discuss and order customized add-ons to the haptic interface. The consortium will consider creation of additional functionalities enabling the communication with users, using the project website.
4) User driven platform for research and innovation. This can be seen as a combination of alternatives 2 and 3, above. The consortium will consider creation of an information sharing platform after end of the project which may require additional fundings from another project, creation of a foundation etc.

The project has ambitions on all four of these. Indeed, there has been substantial confusion among project members rooted in different disciplines regarding what kind of platform(s) is to be developed. It has been reasonable to talk about the platform in the sense of the second notion, above. However, the consortium must consider that sharing the code using open source software may hinder further commercialization of the project results.

A platform for user generated content and interaction, both according to alternative 3 and 4, is beyond the scope of the current project. Some type of such a platform is essential for the development of end-user driven personalization of the haptic interface. However, it is crucial that such a platform is developed and made public at a time when the prototype has become a more polished product than it is likely to be at the end of this project.

GitHuB[1] may become essential tool in sharing and keeping up to date the SUITCASE platform source code (and relative documentation). Further exploration is needed, but this solution can provide hosting for software development version control of SUITCEYES, offering all of the distributed version control and source code management (SCM) functionality of Git as well as adding its own features. It provides access control and several collaboration features such as bug tracking, feature requests, task management, and wikis for every project. Free GitHub accounts are commonly used to host open source projects and can be appropriate for SUITCEYES.

The consortium considers using some general licensing system that is to connect with other licensing systems (this issue needs further discussion in the last year of the project).
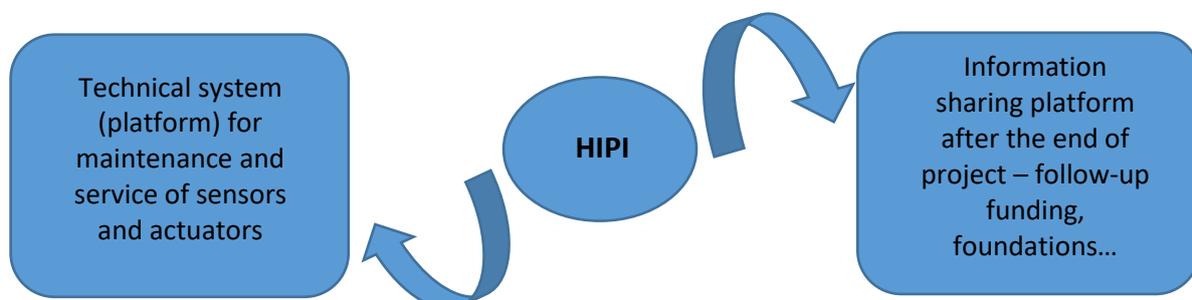

Figure 1. Possible scenario for the project's platform.

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[1] https://github.com/about/diversity/report

3.2 Exploitation actions

The consortium partners plan smaller exploitation actions for selected SUITCEYES elements (see Table 1). These activities will be performed during the project's duration and after its end to provide exploitable elements for the partners and the public in general. Additional services and support like trainings, certifications and technical maintenance will also be available.

Table 1. Exploitation actions for selected SUITCEYES elements.

Exploitable element	Activity
Specifications	Preparing and sharing the specifications of developed solutions will contribute to the standardization of assistive technologies, e.g. regarding the integration of gamification or social interventions. Elaborated specifications will be freely available to partners and the public in general (the open platform can be accurate solution for sharing this).
Guidelines, best practices, know-how	Technology adoption is central to our exploitation plans, particularly via our various promotion and dissemination activities, implementation of users' requirements and testing of the HIPI. Providing training and certification services, sharing datasheets, technical notes and user guidelines for working with deafblind or visually/hearing impaired persons will be provided.
Software	A subset of the developed software tools, modules and application programming interfaces (APIs) will be publicly released as open source, in order to maximize quick adoption by the respective communities (subject to Consortium Agreement specifics). The rest of the software tools will be released in "freemium" mode, i.e. there will be a free version with basic functionality and a paid one with more advanced features.
Hardware	Development of integrated solution prototypes, consisting of sensor and actuators (and the corresponding software integration). It will be sold as a product, together with professional support, maintenance, certification, and training (when the products achieve maturity). For this aim, revision of interfaces or the data-information exploitation will be done. Further, regular developer meetings are set up to discuss design, functionality, protocols and resolve problems. Depending on the consortium decision (to be taken during the last year of SUITCEYES project) results, software and/or hardware (garments) know-how, may be integrated into an open

	platform for reuse and further development, on an open source license. This should also support an easy and efficient rebuilding (e.g. manufacturing plans) of the textiles and garments. The instructions concerning the rebuilding of garments, storing and disseminating information in this case may be shared (in the other tool than GitHub) after further decision of the consortium (in the last year of the project).

3.3 Role of partners in exploitation actions

As mentioned above, according to Article 28 (Exploitation of results) of the Grant Agreement, the consortium is obliged to exploit its results up to four years after the project duration.
In order to exploit their own results, the partners give each other access to background information. Each partner examines the possibilities of adequately protecting their results if:
- the results can reasonably be expected to be commercially or industrially exploited and
- protecting them is possible, reasonable and justified.

The partners consider their own legitimate interests and those (especially commercial) of the other partners.

The business strategy of the consortium partners is summarized as follows. In the project, especially HARPO and LDQR have an experience in dissemination and exploitation of R&D project results.

HARPO has more than 30 years of experience in the area of IT solutions, serving persons with disabilities (in particular blind, low vision and deafblind) and has successfully developed many new products from concept stage to full commercial exploitation. HARPO is interested in transferring the SUITCEYES system into real products that can be introduced to the international market after the project completion. Based on its experience, HARPO will analyse requirements for future distributors of the interface in selected foreign markets (many years of cooperation with distributors in different countries). Detailed market studies are and will be continuously performed and distribution models analysed and recommended. As a result, the full recommended business model will be specified. Moreover, HARPO plans to use the experience gained during the SUITCEYES project in future internal product developments and other collaborative research projects.

In the Europe, HARPO has distributors in the following countries: France, Portugal, Norway, Austria, Greece, Cyprus, Czech Republic, Germany, Sweden, Great Britain, Finland, Belgium, the Netherlands, Switzerland and Italy which may prove to be crucial in the implementation of HIPI on the market. HARPO has already worked with partners from the USA and Canada and has effective distributors in these countries. Participation in sectorial fairs and conferences as well as individual meetings will also enable the extension of contacts with representatives interested in HIPI distribution.

The basic distribution channel of products by HARPO on the target markets are distributors. HARPO has, as a result of its current activities, a network of partners in 48 countries around the world. One of the partners is key, operating in the USA and Canada, and a dozen or so in the European Union. Even if an institution / product first wants to exist on a given market, then in the later stage of expansion the distributor is an indispensable intermediate link. After entering a given market, one can search for partners, for example, by giving invitations to conferences, competitions, and gaining sponsors. Another way of selling products in selected countries may also be finding new partners among non-governmental organizations.

LDQR supports the access of children with disabilities to reading and culture. Since 1994. LDQR publishes tactile illustrated books and develops multisensory materials for cultural mediation. These projects follow the principles of Universal Design, being accessible to all but especially to visually impaired people. LDQR also works side by side with researchers and publishers the Terra Haptica Journal. As part of the research activities, LDQR has already concluded 3 PhD projects based on participative workshops, one of them in collaboration with the well-known Institut ACTE (UMR 8218-University Paris 1, Panthéon-Sorbonne). In 2000, LDQR created The Typhlo & Tactus (T&T) International project. Its purpose is to improve the quality and quantity of tactile books available toblind and partially sighted children. Participants share their ideas, knowledge and expertise, and collaborate on production of simple books with multi-sensory illustrations which are fully accessible by touch. Nowadays this network is composed of 21 countries (mainly European). This network is an ideal basis for exploitation, together with HARPO and the other partners.

The rest of the partners, especially from academic and scientific units, will be also interested in exploiting scientific results of the project in future projects and research in similar fields (the idea of open platform with sharing the results using an open source license for further reuse and development is particularly encouraging for the scientific and technical partners of the SUITCEYES project). Every partner is an owner of the results that they created during the project according to the Consortium Agreement. Access Rights to the results will be granted between the consortium partners on fair and reasonable conditions.

Considering further exploitation actions of the project results the roles of consortium partners in this strategy can be presented as below in Figure 2.
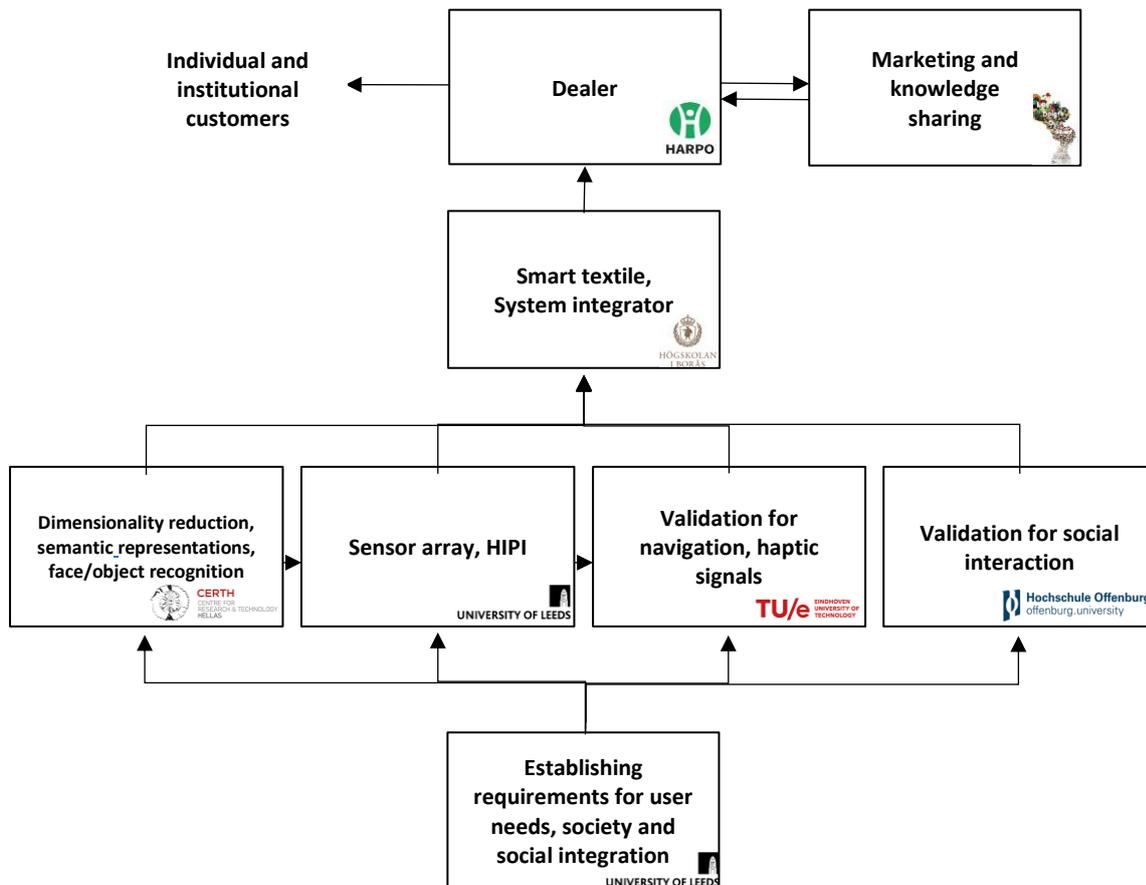

Figure 2. Role of partners in exploitation actions.

4.   Business case

Given the ease with which other groups of disabled people have been able to capitalise on increasingly sophisticated digital tools, there has been a growing digital divide as regards to the deafblind. The technology produced should be affordable and reasonable for at least 10-12% of the approximately 2.5 million deafblind in Europe. The target group was therefore estimated to 300,000 people. In the following, we make some moderate estimates regarding possible economic savings in relation to this target group. Although we have been able to access some rough estimates on the number of deafblind in Europe, more specific data on the character and extent of the disability is not available at this time. This makes more precise estimates difficult. After two years of the project we estimate that the numbers of possible SUITCEYES users is about ten times smaller than initially anticipated. Target market can be estimated to about 30,000 (most of 2.5 million individuals with deafblindness have level of impairment that does not justify a need the use HIPI).

The long-term benefits associated with the future implementation of the project's results should be emphasized in this point: first of all, it will be an opportunity for professional and social activation, increase of productivity and various forms of integration of deafblind persons, which in the long perspective gives invaluable benefits – also financial ones. It is therefore important to emphasize these far-reaching financial benefits first and then focus on the short-term ones related to the cost of care. However, based on the average costs of care for a person with deafblindness, SUITCEYES can also create a substantial impact: as it will allow the users to become more independent and more productive, costs for care will be reduced. There is definitely market potential for the exploitable elements of SUITCEYES, its major contribution lies in the increase of productivity and activation of people with deafblindness, and also in the reduction of costs for care in the short-term perspective. We would like to point out that in our considerations we do not seek to ignore caregivers and interpreters working with individuals with deafblindness, because we are aware that in the long run they play crucial role in selection of tools that will be used. HIPI is to be a technological supplement and facilitation enabling some independence from total care for people with deafblindness (this is in line with the opinions that are the result of interviews with end users conducted under WP2).

In this section the following questions are answered:

- What might be the main forces and trends driving consumers to purchase the product?

- How large is the potential market for HIPI?

- Who are the potential buyers/sellers?

- Where does this potential market stand?

- What forces could prevent HIPI from reaching its full potential?

4.1 Business scenario

While the price of mainstream electronic devices is falling the lack of accessible and affordable products on the market remains a key issue for deafblind people. The costs of assistive products remain high, and these often require the use of high-end devices (with the required operating systems) to ensure interoperability. Interoperability is essential to download content to a special

assistive device and 'reading' content. Some formats may not be compatible with specialist assistive technology - this should also be taken into consideration when providing content.

At the present time, people with deafblindness cannot find accessible mainstream goods; assistive technology they use is not compatible and interoperable with mainstream goods and they are not able to access instruction manuals. All of this means that they are not able to benefit from technology and all the advances that are being made in this area.

Many manufacturers and service providers continue to perceive disabled people as a non-profitable 'niche' market. There is substantial evidence to support the argument that statutory requirements for inclusion deliver access solutions of greater benefit and that a regulatory framework will drive innovation for inclusion.

In the US, for example, strong legislation in the education market and strong public procurement legislation have driven manufacturers to include solutions also for people with deafblindness. Many EU manufacturers are now at a commercial disadvantage as they are unable to supply off-the-shelf solutions for such markets. For deafblind people who can afford them, such products have made an enormous difference to their lives, e.g. Apple products including voice access in their mobile phones and internet access products. It is vital that European manufacturers catch up on these advances in accessibility [1].

For our business analysis we take into account the following data:

- Caretaking of deafblind people can frequently cost €100,000 per year. With moderate estimates of the average costs of care €50,000 per year, with 300,000 deafblind persons the total costs are €15 billon. Assessed target market of 30,000 persons translates to total costs at €1,5 billon.
- With the SUITCEYES solution, the person will be able to do more tasks him or herself, navigate more freely and maybe even do work in a sheltered work organisation.
- The average cautious cost reduction is estimated to be in the range of 1-10% (for the assumption that up to 10% of people with deafblindness in Europe will use the HIPI).
- This reduction of 1-10% should give potential savings of €15-150 million.
- In addition, it is possible to modestly calculate an average 1-5% increase in productivity within the target group (it is prudential model taking into account that only about the 20% of people with deafblindness of working age actually work on the base of data from Towarzystwo Pomocy Głuchoniewidomym[2], i.e. the Society of Help for Deafblind People in Poland). This would lead to an additional saving of €15-75 million per year.

We are well aware that this is a constructed case, as it presupposes a fair coverage (1-10% of the deafblind persons uses SUITCEYES). However, even 1% of the estimated total potential represents substantial savings. This value is the most likely to be reached, but in conducive circumstances, we can reach a higher percentage. Moreover, this "business case" only looks at the financial side. The ethical aspects of improving the communication space of deafblind persons are also important and hard to quantify.

The haptic device and smart textiles designed in the project are the main objective of the project' partners to improve the quality of life of people with deafblindness. However, the potential benefits of SUITCEYES and contribution to the other fields after the project' duration do not have to be limited only to the group of deafblind people. Development of systems able to make useful, adaptive and personalized conclusions of the surrounding environment around a human being is valuable for a wide range of situations. For example, fire fighters in rooms filled in smoke would need a perception of the surroundings and will benefit from an analysis of the room where noisy sound environment makes haptic communication the only available channel. The same goes for professional divers and certain classes of construction workers when in dirty, dusty and noisy working environments such as in steel

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[2] http://tpg.org.pl/

mills. Similarly, in sports training, where the sportsperson would need to use hands and arms for conducting the sport, the ability to communicate with the coach haptically through the garment will be invaluable. For example, a down slope skier could utilize the HIPI as part of the garment he or she is wearing, through which instructions from the coach are received, while the body angle, the speed and other information are fed back to the remote coach.

Regarding the tools and solutions developed for video-game industry, a part of the technology developed within SUITCEYES can be implemented or exported in areas of virtual reality and augmented reality. The project results could be scalable in multiple areas (including e.g. gaming and sports training, and other potentially related areas). However, considering the project goals and due to the short duration of the project our efforts will need to be focused primarily on assistive technology.

- What might be the main forces and trends driving consumers to purchase the product?

SUITCEYES will not solve all problems for these expanded types of cases but will contribute to the present wave of evolution of haptic devices and haptic communication through its holistic approach of taking into account the users' broad spectrum of needs and being accordingly customized.

Based on the preliminary market estimate, it can be concluded that there is no intention to introduce different product prices depending on the target market. SUITCEYES wants to show completely new HIPI values, which no competitor offers so far. One of the determinants of the modern solution in current competition trends is the use of competition factors other than the price. It is even claimed that the price plays an increasingly smaller role in purchase decision. In addition, in the equipment industry for people with deafblindness, functionality and quality of the product, as well as consistent marketing, which may be accompanied by, for example, a package of services including training, is of great importance. Therefore, in its strategy, the consortium intends to include, inter alia, these features of the offered goods. It is worth noting that non-price competition strategies result naturally from the development of the organization and the characteristics of its products. Their goal, in fact, is not to aggressively compete in order to eliminate competition. They are oriented mainly to meet the client's needs. It is extremely important that the offered solutions are unique.
In conclusion, in non-price competition strategies, it is important to provide:
- quality of products,
- functionality of products,
- complementarity of products - components that SUITCEYES intends to implement are intended for deafblind persons, and, although each of them is different, they complement each other,
- additional services, SUITCEYES intends to offer assistance in implementation, training, service, technical specifications, etc. after purchase or sharing, which permits to further develop the HIPI's platform (in its technical and information sharing/community building sense).

The HIPI product, due to the specificity of the industry, will be promoted mainly directly. Representatives of the consortium plan to take part in numerous workshops, exhibitions and industry meetings in the EU and North America. During the fair, talks will be held and meetings with potential and existing contractors as well as direct presentation (demonstration) of product functionality. Information will also be disseminated via the website. The consortium will also design uniform leaflets and specifications that will contain the required information about the product and universal roll-ups, which will also be used in the organization of exhibition stands.

4.2 Market survey

As a result of exploitation activities, the consortium intends to achieve main objectives:

- to place an offer to international markets, with particular emphasis on strengthening the European market (implementation of a completely unknown and untested product by the consumers may involve restrictions in all countries, especially those in which the consortium has no partners and existing contractors),

- to affect the recognition of the product's brand on international markets (the product will be new, unproven, which may significantly affect its effective sale and brand strengthening),

- in case of commercial immaturity of the product and the complexity of the results developed for a small and diverse group of users, to integrate all the results, software and hardware, into an open platform for reuse and further development, using an open source license. This may, depending on the consortium decision on the hardware know-how, support an easy and efficient rebuilding (e.g. manufacturing plans) of the textiles and garments. This way can be seen as an approach for dissemination and exploitation to make the results sustainable. Moreover, it should allow to find an interested community.

The market size and its trends is where the consortium wants to start understanding and analysing the market and its business potential, both with the potential readers of the business plan and with ourselves.

In order to plan the development of SUITCEYES operations, the specific internal conditions for implementing the strategy and the future market position of the product were analysed. When choosing a strategic plan, the possibilities offered by the environment, skills and resources of the partners, i.e. strengths and weaknesses (see subsection 4.4), as well as the consortium's preferences and commitments to the project, were taken into account. This analysis is performed both globally and disaggregated by target countries. Incentives, regulations and recommendations for each of the target countries are discussed to evaluate the economic feasibility of HIPI.

- How large is the potential market for HIPI?

The target group has been estimated at first to 300,000 people. Two years into the project we assess the target market at 30,000 individuals with deafblindness. Due to lax criteria of hearing loss and visual impairment defining the status of a person with deafblindness, this status is applied to a wide range of persons that will not need sophisticated systems like SUITCEYES.

Deafblind people's needs are not routinely considered in disability policy, so SUITCEYES is an attempt to bring into focus the extent of deafblindness and the ways in which we should seek to support deafblind people. Disparities between the current levels and types of product and service provision across Europe make it increasingly difficult for organisations, governments and health system evaluators to assess and compare different models of support available to deafblind people.

- Who are the potential buyers/customers?

A preliminary market segmentation for exploitation of project results is presented in Figure 2.
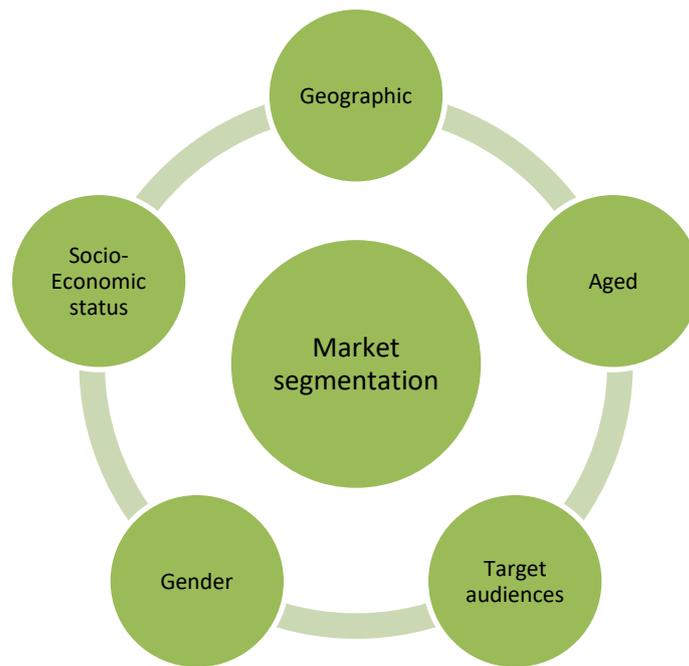
Figure 2. Market segmentation for exploitation of project results.

According to the segmentation of the market of the SUITCEYES results' commercialisation, three distinct categories of customers are considered:

- Academic community – researchers from different fields associated with technical institutes and universities, working in different topics related to the project (textiles, Assistive Technology, Information and Communication Technologies, computer-human interaction, disability, deafblindness etc.). They can be interested more in acquiring proprietary rights to the project's scientific results in order to extend their own research. It can also be institutes or universities linked to project partners or even their parent units that carry out research in an area similar to SUITCEYES. Providing know-how and code sharing as open source will allow to re-use of the resources and to undertake new approaches to the further development of project's results.

- Industry sector – organisations or persons involved in using, producing or distributing related technologies that could contribute to or benefit from the project's objectives (textiles, haptic interfaces, Assistive Technology, software engineering, sensors etc.). Business organisations and enterprises (like HARPO) can be interested in transferring the SUITCEYES system into real products that can be introduced into the international market after the projects' completion. These can be also future distributors of the interface on selected foreign markets. However, integration of all the project's results (software and hardware) into an open platform for reuse and further development, using an open source license, may hinder ability to commercial use of the project results by industrial entities (such as SME Harpo).

- Interest-group community – the end users' community including persons with deafblindness, their parents and family members, carers, support groups and educators, and their organisations, social service and school administration in a region, country and world (on the level of European and global communities). The project result will be customized for individual

customers and their needs, and may be sold to order to the persons with deafblindness. We aim to interact with stakeholders in the ecosystem to identify the road for possible market introduction. We consider not only end users (= persons with deafblindness) but also the diverse stakeholders in service provision chain - caregivers, educators, and family members as other types of end users, as well as public health institutions, including hospitals and other health care institutions, associations and NGOs supporting of people with deafblindness. To set up a community of stakeholders, which is the base for dissemination and exploitation of results and a work on technical, social and economic innovation the consortium plan to organise a set of workshops and demonstrations of HIPI (e.g. during the EuroHaptics conference in 2020 or at internal events organised by the project). Moreover, communication part of the platform (initially as project website) will be helpful in integration of such community around the project. It is important to add that a network of contacts and cooperation in co-designing the HIPI is being realized thanks to involvement of relevant organisations, individuals with deafblindness and their relatives/caregivers (https://suitceyes.eu/affiliated-organizations/) and the persons associated in the Project Advisory Board (https://suitceyes.eu/partners/project-boards/#PAB).

Gender is irrelevant - HIPI can be tailored to the needs of both women and men (garment and textile items can be individually tailored to the needs of the end-user). Age is seemingly irrelevant, however the older a person, the more difficult it is to persuade him/her to technological innovations. Moreover, the elements of gamification in the HIPI solution can determine younger people as target users.

● Where does this potential market stand?

It should be noted that in the case of the European Union, the entire Community, and hence all countries belonging to it, is considered as one of the target markets. A specific country is not indicated here, but all countries belonging to the EU. This is due to the fact that the market for products for people with disabilities is a specialized market with an international character and it is important to appear on the European market, not in one specific country. The premise is also that the sale of products for people with deafblindness is not massive and the target sale of such a solution would amount to a total of hundreds devices per year. If we were to estimate the volume of possible HIPI sales (if commercialization occurs), then in 10 years it can be estimated that 2000 installations would be a success.

The selection of target markets is dictated by several factors. Above all, SUITCEYES wants to appear in markets that it knows and on which it already has some experience. Not without significance is the fact that the markets that it wants to master are highly developed, which translates directly into the wealth of the society. Due to the fact that devices and equipment for people with deafblindness are not widely recognized as a product of "primary necessity", it is reasonable to state that it is easier to find the recipients of such products in the most developed countries.

From the other side it is not planned to restrict the recipients only to certain groups or types (e.g. only educational institutions), because the market of these devices is so small that it cannot be limited in any way. The end-user spectrum will be the same on each target market. The most important for SUITCEYES can be indirect customers, because, for example, HARPO operates through a network of intermediaries.

In the characteristics and justification of the choice of target markets, the most important issue is the rules that determine the access of a given product to a given market. The key here will be the statement that HIPI will meet all requirements regarding access to European and global markets without the need for additional rights. In principle, there are no procedures for HIPI access to selected target markets. Within the European Union, the procedures are the same for each country, so SUITCEYES does not have to meet any additional requirements. In contrast, in the US and Canada it is enough to meet technical requirements and have appropriate test protocols. There are no customs or other barriers to this industry. A commonly used trade practice in the field of equipment for the disabled is their sale through intermediaries, i.e. by specialized companies and direct presentation of products from stakeholders.

After the analysis of the final product, target markets and strategies will be selected to achieve sales and revenues. HARPO also has sales agents, so the HIPI product will use a market penetration strategy that involves continuing sales of products on the current sales market of the company. It is characterized by a low risk factor. SUITCEYES plans to penetrate the market by intensifying product promotion. Competitive pricing and verified distribution channels illustrate the quite strong position of the product on the European markets, in the USA and Canada. For example, HARPO products introduced to the market and the planned HIPI are complementary with each other, which increases the chance of selling it.

The introduction of HIPI to markets in countries where HARPO had no dealers to date requires a diversification strategy. The consortium is planning to enter the new market with a new product. This strategy is characterized by a high degree of risk, but in this case the product offered is similar to the current activity of the HARPO industrial partner.

Also, the exploitation plan might benefit from a relation to the studies done on other devices, as well as competitors' involvement and support by big IT industries, AT players benefiting from this work. Building an open platform may be a solution to make the project' results and resources sustainable. The studies done in other WPs will be consulted when working on the final platform creation. The commercial partner, Harpo, has some contacts with bigger AT players and will try to contact them in the last year of the project (the final outline of the product or platform must be first specified).

4.3 Law and support survey

Legal rights to special aids and equipment are present in the majority of EU states and most have practical examples of this service (table 2). Technology has advanced to the point where many everyday activities of people with disabilities can be supported with equipment such as: reading mail, answering the door and remembering to take medication and safety aides that monitor for flooding, gas leaks and extreme temperatures. The use of technology in supported living is potentially more widespread than in independent homes.

- What forces could prevent HIPI from reaching its full potential?

However, aids and equipment are not available in every state and people with deafblindness must sometimes rely on taking part in small-scale projects and on technology providers to access equipment. Other disabled people must go through an eligibility assessment to receive this type of support. Assistive technology has evolved rapidly and many items such as personal alarms are

becoming more common, low-cost and viable options for disabled people. However, it is important that it is adjusted for people with deafblindness and their families with appropriate support.

Table 2. Legal right to special aids and/or equipment for independent living and availability of this equipment [2].

State	Legal right	Examples
Bulgaria Denmark Finland France Germany Italy Malta Netherlands Poland Portugal Romania Spain United Kingdom	√	√
Austria[3] Czech Republic Estonia Ireland Scotland Switzerland	x	√
Hungary	√	x
Croatia	x	x

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[3] Austria provides support for devices, most often only partly. This is very complex depending on relation to private use (home), education or job.

SUITCEYES

Greece		
Slovenia	√	
Turkey		

Examples (√) refer to any item, piece of equipment or product system that is used to increase, maintain and improve functional capabilities of individuals with disabilities. This can range from simple equipment (such as magnifiers) to integrated systems such as environmental controls (computerised systems for home automation tasks such as answering phone calls, answering door, turning lights off).

Research indicates that disabled people and their families often incur additional costs to achieve a standard of living equivalent to non-disabled people – such as costs associated with medical care or assistive devices, or the need for personal support and assistance – and thus often require more resources to achieve the same outcomes as non-disabled people [3]. Disabled people are also more likely to face a higher risk of poverty compared to the general population. Focusing on income level, it can be identified from the national reports that in some countries (France, Germany, Iceland, Italy and Malta) the majority of people with disabilities are in the lower income brackets and have an income level below the poverty line. In most cases people with disabilities and their families rely on means-tested and other disability benefits. For example, in the UK even though there is a mainstreaming approach in relation to child poverty through support for families, there are no special measures to take into consideration the additional costs of parenting a disabled child or the additional difficulties that parents may have in working. In Iceland the level of disability pension is 27-40 percent below the minimum subsistence level of income. In the Netherlands people with disabilities generally have an income level at or just above the poverty line. Moreover, it is reported that, among people with disabilities, women have a higher risk of poverty and tend to be poorer compared to men. The socio-economic situation of women and the elderly is inferior to that of men and people with disabilities of working age (for example, in Latvia, Germany, Iceland, Malta and Sweden). In Norway the financial situation of people with disabilities is more satisfactory. The gender gap in income among people with disabilities is smaller than in the total population (the mean disposable income of disabled women being 80 per cent that of men). Concerning the age difference, the income gap between disabled and non-disabled people appears to be smaller among those below the age of 40 compared with those aged 40-66 [4].

This has a significant impact on the quality of life of disabled people and the ability to pay for equipment or support that is not provided via the state. Whilst benefit entitlements exist for disabled people across Europe, the ways in which these are administered have an impact on the general equality of deafblind people. There are various social welfare 'models' in operation across Europe and states differ in the ways that they provide financial assistance to disabled people. Broadly speaking, this comprises different approaches to allocating payments and expenditure per capita on social welfare. Scandinavian states tend to spend more on social insurance compared to Mediterranean states, which developed social welfare systems later. States also impose different restrictions on inclusivity: meaning that financial support is available more readily in some states regardless whether the disability is the same (see table 3). States, like Hungary, Poland, Slovenia, operate a system of 'disability pensions', the pay-out of which is a contingent on a number of eligibly criteria: the minimum

period of insurance contributions, age and degree of disability. Those that do not meet these criteria are assisted by allowances or minimum income schemes.

Nine states provide benefit assistances in all of the forms detailed above, with the majority of states providing at least two forms of financial assistance (Table 3).

Table 3. Types of financial support available to people with deafblindness [2].

State	Guaranteed minimum income	Financial Assistance For Life	Financial Assistance for Essential Devices	Specific Personal Professional Assistance
Denmark Finland France Germany Italy Netherlands Portugal Switzerland United Kingdom	√	√	√	√
Estonia Greece Poland Romania Slovakia	√	√	√	x
Bulgaria Ireland Scotland	√	√	x	x
Hungary	√	x	√	x
Austria[4]	√	x	x	x

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[4] Austria provides support for devices, most often only partly. This is very complex depending on relation to private use (home), education or job.

SUITCEYES

Croatia Slovenia Turkey				
Spain	x	√	x	x
Czech Republic	x	x	x	x

Financial support for essential devices, such as basic equipment and aids, is available in most states, but that does not mean that deafblind people do not have to pay for most items themselves in practice. For example, in Estonia, the state can compensate up to 90% of the cost, but in practice it is suggested that most disabled people will pay the majority of the cost. Most financial assistance is preceded by an application and assessment process that is conducted primarily in writing, over the phone or in person. This kind of process may be onerous on deafblind people and a lack of communication support to do so could delay or deprive some deafblind people's access to financial support. This system appears to involve a number of hurdles which a deafblind person may be unable to navigate without the assistance. For example, in Poland, deafblind people are reliant on the presence of those to fund devices. It seems unlikely that this support will be systematic and widespread as there are special rules at what point one can receive particular equipment and support and to which amount co-financing is possible by the state. There are legal rules in providing state funded equipment in Romania, but the law is rarely put into practice due to the low budgets for social care and the lack of funding within the health care system. In UK and Scotland, schemes often exist on a local commissioning level and can be provided by social services depending on a person's assessment outcome and the availability of resources [2].

The above analysis confirms that solutions, developed in the SUITCEYES project, may not be available for everyone in various countries. To regularly collect standardised data relating to deafblind rights, opportunities and services in each state, a common framework, publications of the data related to deafblindness (e.g. via Eurostat) should be established, in order to assess and compare differences and developments.

4.4 SWOT analysis

This section provides a synthetic perception of the positioning of SUITCEYES compared with the needs of the market and potential competition. This is represented by a SWOT (= strengths, weaknesses, opportunities and threats) analysis (table 4).

Before deciding on the exploitation of the SUITCEYES results, it is vital to answer to the following three questions:

1. How well does SUITCEYES fit with the end-users' needs and expectations?

2. What are the advantages/disadvantages of SUITCEYES compared to competitor products?

3. What is the innovation and added value brought to the market?

The success of exploiting the project's results depends on the capacity of the SUITCEYES partners to capitalise on strengths and opportunities and minimise weaknesses and threats represented by internal, as well as external factors. The following table presents a SWOT analysis:

Table 4. SWOT analysis

STRENGTHS	OPPORTUNITIES
1. **Innovation and flexibility of the solution:** SUITCEYES will go beyond the available technologies by utilizing a haptic, intelligent, personalized interface that will utilize different parts of the body for communication with the deafblind persons.	1. **Lack of comparable products on the market:** opportunity to the quick implementation in the field of deafblind people.
2. **Independency of end user:** the proposed solution will free the hands of the user for other tasks, it will enable communication over distance, and it will allow detection and conveyance of important information.	2. **Dispersion of consortium partners across Europe:** a wide market possibility for the future product due to the presence of project partners from 7 European countries. Every partner can assess the market opportunities in his country, which may affect a wider expansion of the final product in various parts of Europe.
3. **Usage of existing technologies and development of them:** the novel integration of various competency areas, including disability studies, assistive technologies, machine learning, semantic representations, sensor technology, image processing, real-time face and object recognition, gaming, mediated social interaction and smart textiles.	3. **Impact of development on people with deafblindness:** the extent of the available vocabulary that can be conveyed will be increased by SUITCEYES. For those with marginal sight (e.g. they can distinguish flashing light) or hearing, further dimensions can be added, hence a more extensive number of haptic vocabulary becomes possible.
4. **Meeting expectations of end users:** the final product is developed based on the needs and wishes of people with deafblindness. The users are engaged in every stage of the project.	4. **Additional promotion and facilitation of learning:** gamification will be incorporated to capture and extend the user's interest, umwelt and engagement. The addition of game-elements in non-gaming environments can greatly improve the user-experience [5].

1. **A relatively small market:** specific, narrow industrial field of solutions for people with deafblindness. 2. **Potential complexity of the offered technology:** The final product connects various technologies like machine learning, sensor technology, image processing, face and object recognition, gamification, textiles etc. Each existing technological device should act properly on its own in order to develop a novel solution as planned. 3. **Distance between partners:** every partner comes from different European country, works separately and joint work together with the rest of partners is relatively rare. This could result in problems regarding the integration of different technological parts.	1. **A completely new, unknown product:** not available so far on the market, without reputation and references from users. 2. **Lack of financing of the solution for people with deafblindness:** insufficiently developed aid system and subsidies for medical products for people with deafness in all European countries and outside Europe. 3. **Dispersion of consortium partners across Europe:** a vague market for the future product due to the presence of partners from 7 European countries in the project. Each partner does not quite know the market realities in other European countries. 4. **Developing the preliminary prototype of HIPI without possibility to provide and sell the final product for every user:** main technology elements and concepts will be ready near or at planned operational system. An actual system prototype will be demonstrated in an operational environment, however achievement of next technology readiness levels (TRLs) can be difficult on the real market and environment (lack of commercialisation from the research and testing level).
WEAKNESSES	**THREATS**

The above SWOT analysis confirms that there are strengths of SUITCEYES and the final product that will be developed in the project. HIPI is innovative and can be adjusted to the real needs of end users (they are engaged in every stage of the project). SUITCEYES will go beyond the available technologies and utilize different parts of the body for communication with deafblind persons. It will also affect the independency of the end users. It will enable communication over distance, and it will allow detection and conveyance of important information. Moreover, this solution will help to increase the productivity and participation in the society of people with deafblindness. SUITCEYES will use of existing technologies and develop them. It connects the novel integration of various competency areas, including disability studies, assistive technologies, machine learning, semantic representations,

sensor technology, image processing, real-time face and object recognition, gamification, mediated social interaction and smart textiles.

There are also a lot of opportunities resulting from the implementation of HIPI and exploitation of the project's results. Thanks to the lack of comparable products on the market it is a significant opportunity to quickly implement it for deafblind people. The chances of the establishment of the product on the market are also very promising because of the presence of 7 European partners in the project. Every partner can assess the market opportunities in his country, which may affect a wider expansion of the final product in various parts of Europe (and also beyond the Europe). Additional functionality of the product may be also provided. Experienced HSO partner will incorporate game elements, in order to capture and extend the user's interest, umwelt and engagement. This aspect will also contribute to make the product more attractive.

However, the HIPI targets only a relatively small market. The society of people with deafblindness is not quite numerous, therefore the market of solutions is also quite specific and narrow. From the other side in sum, several small markets can reach a sufficiently large market (it is not good in practice to base only on the big customer due to the risk of losing it). Moreover, the technology that will be offered is potentially complex. The final product connects various technologies and each component should act properly on its own and together with the rest in order to develop a novel, complex solution. The distance and different expertises of the partners can be also a barrier. Joint work together with the rest of partners is relatively rare, due to large distances. This could result in problems regarding the integration of different technological parts and common agreement in the specific aspects of technology. Therefore, every partner takes special effort to avoid any incorporation problems.

Finally, the threats watch on the SUITCEYES partners and the results of their work. Because they are designing a completely new, unknown product which is not available so far on the market, this solution has not got any reputation and references from users (it is harder to sell something completely new, not checked). As was described in subsection 4.3 aid system and subsidies for medical products for people with deafblindness are insufficiently developed in European countries and outside Europe. Therefore, some deafblind people will not be able to buy this solution. The markets for the future product is quite vague, due to partner who are dispersed across Europe.

One idea for overcoming the threats can be building an open platform for reuse and further development of the project's results, using open source license (depending on the consortium decision in the last year of the project). We are aware that the chances for a commercial success of HIPI are restricted and therefore the idea of open platform is seen as the approach for dissemination and exploitation to make the results sustainable. This should also help to find more interested community.

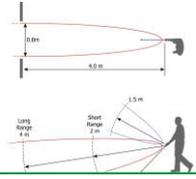## 4.5 Analysis of competitors

In this subsection an analysis of competitors for the potential commercial product (HIPI) and the inventory of competitor products are presented. This document provides a review of existing haptic devices, used for assisting impaired individuals. Hard haptic devices or physical mechanisms made from materials with reduced flexibility – e.g., steel and plastic are referred. We have focused on hard,

haptic devices due to their advanced maturity (as compared to soft, haptic devices). Products in the last stage of development and already commercially available products are included.
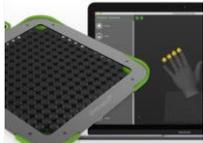
Hard, haptic devices are developing very quickly. One major reason is the developing technology of Virtual Reality (VR). Haptic gadgets supporting immersive gaming experiences, innovative therapy approaches, and new marketing strategies emerge continuously. Especially, in VR games, haptic feedback is a valuable method to enhance immersion and user experience. The predominant modality used for haptic feedback is vibration. Vibration marks a common way to communicate alerts to users, such as a vibrating smartphone when a call comes in, or rumbling controllers marking violations in a console game. By now, an increasing number of other haptic feedback modalities, such as thermal, ultrasonic and electro-tactile stimuli, are tested. Potential fields of application for those modalities are examined by numerous scientists. There are already great approaches of hard, haptic devices combining easy and classical components to clever and innovative devices with great results in user studies (e.g., Electro-tactile stimuli on the forehead [6], TeslaSuit or Haptic chair [7]). However, most of the devices seem to get stuck on a prototype level and never reach the maturity for market introduction. But even if the developments are not yet as promising as expected, it is necessary to improve the field of haptic feedback and to extend the range of its application. Although, gadgets offering haptic feedback enhance immersion and fun in games, there are groups of persons who rely on haptic feedback completely. For example, for rehabilitation purposes and for persons with visual impairments or deafblindness tactile feedback is mandatory. SUITCEYES tries to forward the level of development in haptic feedback and aims to extend the range of its application on persons with deafblindness.

Another development, which is especially favorable for the SUITCEYES project, is the rising importance of design. Nowadays, not only functionality, but also design and appearance of a technical device matters. The rising importance of design is a beneficial development in this case, offering SUITCEYES the opportunity to support persons with deafblindness in an unobtrusive, but highly effective way. In parallel with the rising importance of design, also functionalities increasing fun and user experience are gaining more attention. Today's devices need to be more than just functional. They need to also enhance user experience and offer entertainment (ActiveBelt [8], Haptic Chair [7]). This is especially relevant for devices which are natively not designed for games and entertainment. Commercially available haptic devices are summarised in Table 5 (an overview of existing hard haptic devices also on the stage of research and development are presented in D5.1 Report on technologies used for existing (hard) solutions for haptic communication).

Table 5. Commercially available haptic devices.

Name of device	Description	Cost	Source	Contribution to HIPI/ Disadvantages
UltraCane	The UltraCane looks like a cane. It detects obstacles because it is equipped with a dual-range, narrowbeam ultrasound system that provides a 100% hazard protection envelope in front of and, uniquely, forward of the head and chest of the user. Two ultrasound transducers provide range data on the closest potential hazards, such as street furniture, plants, people, road signs, and over-hanging branches. This makes the UltraCane equally usable on the street as in interior spaces. The feedback about obstacles is delivered through two small vibrating buttons mounted in the handle of the UltraCane.	c.a. 720 EUR	https://www.ultr acane.com/	Navigation device using ultrasonic sensor, encoding information from two directions with vibration, but on different locations. One-handed device. Information extraction with one hand, but two vibrating buttons need some practice.
TeslaSuit	Different actuators are imitating soft touch, warm rain, heavy impact, cold, 46 haptic points, weight simulation and motion and location capture for virtual environments. The user can also define custom animations. TeslaSuit is a thermo controlled, motion capturing, full-body haptic feedback suit which should enhance the user experience of Augmented Reality (AR) or VR environments.	c.a. 1340-2340 EUR	https://teslasuit.i o/	The suit gives completely new insights in different sensations which can be simulated on the body by electrical stimulation. Get inspiration by the electrical and thermal stimulation. It looks like a military suit, kind of futuristic and a little bit scary. A head-mounted display (HMD) to be worn which makes the awareness of the real-world environment difficult, but enhances immersion.
Taclim VR Shoes	Taclim Shoes give tactile feedback to your feet and transmits foot movements via 9-	c.a. 800-1200 EUR	https://taclim.cer evo.com/en/	Considering several body parts, not always torso and upper-limbs,

	axis sensors. Additional trackers for different VR devices can be attached (e.g., HTC Vive). Real-world walking is transferred into the virtual world and soil conditions, such as water, grass or sand are simulated by the shoes.			also feet could offer beneficial information. The shoes look clumsy and not very comfortable. Instead, if they are designed like normal shoes, they are really inconspicuous.
White Falcon 3D Haptic Controller	The Falcon is a 3D touch haptic device. In essence a small robot, it can provide a user with 3 Degree of Freedom (DOF) control and force feedback. It is therefore both a 3D input controller and 3D output device. The Falcon has 3 parallel arms that move in and out of the body, each connected to a motor. It connects to a computer with a USB 2.0 port. The computer can then keep track of the handle's movements through space (x, y, z or right-left, forwards-backwards, up-down) and output forces at 1000 Hz to give a realistic sense of touch in computing. The Falcon can simulate a detailed sense of touch including surfaces and textures, game effects like gun recoil or impact forces, and even medical simulation.	c.a. 240 EUR	https://hapticshouse.com/products/white-falcon-3d-touch-haptic-controller 	The device can be individually used. It is just plugged in to a computer and everyone can use it for different tasks ranging from games, over VR, 3D modelling and animation, visualizations to medical simulations. Handling seems to be very precise, which also means that practice is needed to adequately use the highly precise performance of the Falcon. The Falcon looks very futuristic and seems to be a large version of a normal mouse. It is not handy and certainly not very easy to transport.
Brailliant BI 40	Communication device for reading and writing on a computer or smartphone for blind or visually impaired persons. It can be paired via USB or Bluetooth. Every document, text message or webpage is displayed in Braille at the lower Braille display and entered Braille texts via the keys are translated into normal text on the screen.	c.a. 2995 EUR	https://store.humanware.com/hus/blindness/brailliant-braille-displays 	A haptic device making normal internet browsing and work on a computer accessible for deafblind persons. The device can be connected to various systems and a wide variety of interactions can be performed. Learning all feature certainly needs some time and needs regular

				practice. Understanding the different concepts of documents, browsing, webpage layout and interactions are complex and need higher-level cognitive abilities and understanding.
UltraHaptics (TOUCH and STRATOS)	An array of ultrasound speakers is used to create a noticeable pressure difference on a users' hand. This creates a feeling of touching something which is not actually there. Every interaction which can be done on a touch pad is theoretically also manageable with the devices from UltraHaptics. Possible application areas: industry, medicine, smart home, education, entertainment. The device looks unobtrusive, but also does not offer a hint what it is doing. A detailed introduction is needed to get the functionality and usage. It is small and portable.	c.a. 2300 EUR	https://www.ultrahaptics.com/	The device creates the haptic feeling of anything which is not there and normally cannot be seen. It can be quite difficult to recognize the actual shape of the object a user is 'touching'. Placing gestures of interactions on the correct position also needs some practice. UltraHaptics introduces a totally new modality which needs learning and practice to interact with it properly.
Tactus Technology Tactile Touchscreen	The touch display looks normal and the tactile buttons are only tangible and visible when needed. Otherwise, they are hided and not present. The user can interact normally with the touch display the visual cues of the keyboard keys are supported by tangible keys. In normal use, the touch display is just flat. If the user needs a keyboard, tactile keys are raised, offering haptic feedback while typing. It works by having some fluid between a polymer and the elastic covering.	-	https://tactustechnology.com/	The tactile buttons make normally only visually perceivable touchscreen keyboards tangible. Usually the tangible keys are triggered automatically, it would be useful to have the opportunity to also trigger them manually.

To summarize, there is already a few promising developments in hard haptic devices. Further, there are several attempts to extend the range of haptic feedback modalities to thermal, electro-tactile, pressure and ultrasonic stimuli. And even though, many areas may profit from further developments, such as therapy, game industry and marketing, there is still need for improvements.

In SUITCEYES a main focus is placed on drawing insights from the identified devices. Understanding the potential, and limitations of these devices, and how these devices can be extended is essential for SUITCEYES.

5. Expected impacts of SUITCEYES

The results of the project relates to the accessibility of the interface. We estimate the following expected impacts of the project on different aspects of life of people with deafblindness like communication, interactions, developing innovations and technology etc. Below we summarized the basic impacts of the SUITCEYES project (Table 6).

Table 6. Impacts of SUITCEYES.

Impact	Relation to SUITCEYES
Improved communication and interaction capability of people with disabilities and facilitate social innovation	People with deafblindness suffer from strongly limited communication and often social isolation. The focus of SUITCEYES is to create a wearable with sensors, actuators and haptic devices, to facilitate their communication as well as afford them a more informed perception of their environment surrounding them, while enriching the solution with gamification. The solution will allow deafblind persons to navigate more freely and engage in social interactions, ranging from simple activities like expressing emotions and thoughts to more complex activities like going shopping or even gaining employment.
More affordable products and technologies that support interactions for people with disabilities	The project mainly aims to create a "combinatory innovation", i.e. to integrate sensors, actuators and methods, and adapt them to work together, rather than develop completely new solutions. Thus, the price range of the final product should be comparatively low. Furthermore, the solution will allow the users to become more independent and more productive, resulting in reduced costs for care.
New generation of services that is highly adaptable and personalizable to individual contexts	The integrated solution will be adapted to the overall preferences of deafblind users as a result of the user-centred development process. Moreover, it will be scalable to the individual user's cognitive and communicative abilities and preferences. At the same time gamification and social interventions will trigger the desire to learn and as learning progresses the performance of the interface and the options available will be increased in line with the user's abilities and needs.
Research community impact	If the scenario regarding the transfer of the developed solution to the open source domain is implemented, the project will have an impact on new research and development opportunities, potential future projects and interest of the research community in using the project results shared through an open platform.

6. Intellectual property rights and knowledge management

6.1 Intellectual property rights

The ownership of IPR is defined in the Grant Agreement. The Consortium Agreement also defines the terms for granting licenses to consortium members and third party organisations wishing to benefit from the project's IPR. The Consortium Agreement was signed before the Grant Agreement came into force and set out the rules for all aspects of the projects' operation that are not completely specified in the Contract. It fills in the details of:

- the responsibilities of the project members, the composition and the conduct of the Project Management and Advisory Boards;
- the operating procedures for the Management structures, including decision-making and voting mechanisms;
- conflict resolution;
- IPR management, confidentiality and exploitation issues.

The most important aspects of IPR management are: protection of knowledge, use and dissemination of knowledge, and access rights to knowledge. It also supports monitoring opportunities for gaining and exploiting patents, evaluating all WPs annually for their expected patent applications and software copyrights. When asked, it will help the partners negotiate clear arrangements between inventors and would-be exploiters before going through formal and legal channels.

The members of the SUITCEYES project are committed to a common strategy in relation to the management of the knowledge generated. This is aligned to the conditions described in the Grant Agreement, and, furthermore, in respect of policies and objectives of the different partners. Similar to the SUITCEYES management structure and procedures, the SUITCEYES-management of intellectual property is accurately developed and outlined in the Consortium Agreement in order to achieve the project goals in regard to the exploitation of research results. Therefore, the SUITCEYES-Consortium Agreement was negotiated with all participants and signed before the start of the project. This stipulates the effective management of intellectual property, dealing with access rights needed not only for the implementation of the project, but also for the commercial exploitation of results in order to have all necessary conditions for the exploitation plan in place. Another important aspect of SUITCEYES' management of intellectual property are the open channels of communication among the participants in order to overcome potential obstacles (internal disputes, coordination, etc.) and to accelerate the dissemination activities.

Each partner is aware to examine the possibility of adequately protecting its results. It is especially important, if the results can reasonably be expected to be commercially or industrially exploited and if protecting them is possible, reasonable, and justified. The consortium considers its own legitimate interests and the legitimate interests (especially commercial) of the other partners. Already on the stage of submitting the project application the consortium decided to opt out of the Pilot on Open Research Data in Horizon 2020. It is connected with:

- allowing the protection of results (e.g. patenting)
- incompatibility with privacy/data protection.

Among the consortium there does not found to be any strong intellectual property rights (after two years of the project), strongly favoring some type of open innovation. In the third year of the project

it is important that a license is adapted that does not allow for the interface becoming a platform for monitoring behavioral data of people with deafblindness.

Of course, the members of the consortium are interested in patenting possible results, but for now it has been found that there are not enough results for patenting.

The Dissemination manager (representative of LDQR) and Exploitation manager (representative of HARPO) have the responsibility to oversee the project, provide guidance to the researchers and to propose strategies for the use of the generated knowledge. The appropriate dissemination or exploitation channels are agreed upon at the Consortium meetings and with the approval of all partners. The partners are responsible for the development of a detailed strategy for publicizing results as well as for protecting the knowledge and IPR generated. Pursuant negotiations are in good faith with the contract partners in order to come to a mutually agreeable compensation of the research groups. With the main exploitation tracks, such as individualized services, guidance, theoretical contributions and consultancy, possible business models range from open access and public funding to commercial services. IPR protection may include copyright or the licensing of software, smart textiles, interactive tools or training modules.

The project investigates specific needs of deafblind people who constitute a vulnerable population. It is therefore of great importance that user studies, exploitation and development of the prototype do not have any negative impact on the well-being of the intended user group.

Taking into account further commercialization possibilities of the project results the consortium consider the access right of first refusal for Harpo. It means that the priority to enter in a business transaction with the IP owner/s, at equally economic conditions for Harpo, before the owner/s is entitled to enter into that transaction with a third party. If a better proposal arrives for the foreground to be licensed and Harpo does not match the proposed terms, foreground owners would be free to accept such proposal.

6.2 Monitoring innovations

The ambition in SUITCEYES is to have a pre-commercial product that will be brought to the end users via those with professional expertise who provide support and care for the user group. We plan to achieve the following elements/concepts of technology:

- Multi-to-low dimensional information mapping – Use of a cutting edge system of algorithms and databases for mapping the multidimensional space of environmental clues into a one or two dimensional space of meaningful information;

- Geo-location system – Development of a physical sensoric system for spatial positioning and navigation;

- Soft haptic interface – Development of a novel type of soft, textile device that serves as a haptic communication tool. It will be portable, wearable, of low weight, cheap, personalized and possible to move into industrial production. This interface solution extends haptic devices from being hard to soft.

- Face and object recognition – SUITCEYES applies face and object localization and recognition solutions that have been already deployed and evaluated in challenging visual content. The

technologies will be extended with embedded system constraints to support the demanding users' needs in real use case scenarios.

- Semantic representation and reasoning – The semantic framework is based on existing ontologies and models, which are being extended in order to represent all aspects pertinent to SUITCEYES (domain knowledge, user profiling, pathologies etc.) and to support the reasoning mechanisms. Existing experimental reasoning frameworks are being extended to support sophisticated interpretation tasks for managing incoming information and for retrieving information pertinent to the user's needs.

Such combination of various technologies and complex approaches has not been used and combined in order to develop a soft haptic device for people with deafblindness, yet. The partners will monitor the solutions available on the market for this group of users and the R&D projects, and prototypes which are a subject of various investigations of researchers. Moreover, the Project Advisory Board is an important body engaged in the SUITCEYES project which focuses the members from science, industry and interest groups on monitoring our solution in comparison to others.

7. Summary

The purpose of this document was to prepare a product exploitation strategy resulting from the SUITCEYES project for selected target markets after the completion of the project. After making many analyses and considerations, it was possible to propose such an initial strategy that could bring the consortium closer to achieving the objectives resulting from the implemented project.

The main conclusions and operating recommendations are the following:
- The SUITCEYES consortium, the originator of the HIPI interface for people with deafblindness, would like to exist through its design activity on international markets.
- In order to influence the market, it must focus on expansion in the most important markets, trying to sell a product with a large technological and market potential in relation to competitive solutions.
- Three main target markets with the highest sales potential were selected: European Union, United States, Canada. In addition, these markets are characterized by relatively liberal regulations that condition the access of products from the industry of assistive devices.
- The HIPI is a product with a unique technology that combines several industries, the highest quality and competitive prices. Therefore it is predestined for effective sales on various foreign markets.
- On selected target markets, a market penetration strategy is recommended. It will be done by intensifying product promotion and acquiring dealers, applying a strategy for diversification, production and market development (because the subscriber is planning to enter a new product on the new market and is looking for new sales sites).
- The price of the HIPI, planned for the sale of the interface, will be attractive in relation to its competitors (nevertheless proportional to the advancement of the product).
- The consortium intends to compete mainly on the basis of other factors than the price, i.e. quality, functionality, additional services. In the industry of assistive devices competition is weak and scattered, the interface has many advantages that competitors do not have.
- Distributors may be the primary distribution channel because the HARPO partner (the company) operates mainly through intermediaries. Another channel is establishing cooperation with selected, important industry organizations on the markets in question, which may expand the network of potential partners who want to distribute and promote the product.
- Promotional activities were also selected, which will serve the purpose of the consortium best: participation in foreign fairs and exhibitions as exhibitors. On the occasion of trade fairs devoted to the subject of deafblind persons, the partners will promote their product and hold meetings with potential contractors and industry organizations.
- The implementation concept of the final product is and will be developed on a regular basis and will be presented at the end of the project (in D8.16).

Based on the analyses carried out in this document, it is possible to assume that the risk of failure to implement the HIPI product is minimized (at the initial stage of first year of the project, where certain factors can be taken into account). The planned expansion of unique technology, and above all the vast knowledge and experience of project team members, including many years of experience in the equipment and software market for people with disabilities, guarantee the implementation of strategies with a fairly low level of risk.

However, some circumstances cannot be influenced, so one has to consider the possibility of their occurrence. In addition to purely hypothetical events characterized by force majeure, it is possible to point out some real risk factors in the implementation of the product implementation. There is a

threat of new players appearing on the market. This is unlikely as the risk of new entries in this industry is small, mainly due to the fact that the size of this market will always be limited by the number of people with deafblindness. This danger may slowly grow when Chinese companies intending to enter the market through side channels (intermediaries) that will "break the market". Another threat is more pressure from existing competitors who may be more likely to fight for market share.

The consortium of SUITCEYES will try to minimize potential risks, offering better quality of its product, more attractive price, widening the offer (e.g. by adding additional elements and services), etc. Strong positions of the consortium partners allow us to optimistically look into the future.

The complexity of exploiting the results in a rather small and nevertheless very diverse target group is seen after the second year of the project and it may decrease the high expectations in terms of immediate commercial success of the project. Therefore, the focus is on R&D for fundamental new interaction principles and potentials for further exploitation of the project results. The consortium considers building up an open platform for technical cooperation and sharing new ideas, solutions, R&D results based on the available state of the art (depending on consortium's decision software and/or know-how of hardware assembly methods). The final shape of the platform and the level of its openness for further investigations will be decided upon during the last year of the project.

8. References

[1] Deafblind Europe. The Magazine of European Deafblind Network. Volume 1/2012

[2] European Deafblind Network, Mapping opportunities for deafblind people across Europe. Government and voluntary sector responses to the growing issue of deafblindness in Europe. May 2014

[3] World Health Organisation and the World Bank, World Report on Disability 2011

[4] I. Shima and R. Rodrigues, The implementation of EU social inclusion and social protection strategies in European countries with reference to equality for disabled people. Report prepared for the Academic Network of European Disability Experts. Human European Consultancy and the University of Leeds. May 2009

[5] O. Korn, M. Funk, A. Schmidt, Design approaches for the gamification of production environments: a study focusing on acceptance, PETRA '15 Proceedings of the 8th ACM International Conference on PErvasive Technologies Related to Assistive Environments, Article No. 6, Corfu, Greece — July 01 - 03, 2015, DOI: 10.1145/2769493.2769549

[6] H. Kajimoto, Y. Kanno, and S. Tachi, Forehead Electro-tactile Display for Vision Substitution, 2018

[7] S. Nanayakkara, E. Taylor, L. Wyse, and S. H. Ong, An Enhanced Musical Experience for the Deaf: Design and Evaluation of a Music Display and a Haptic Chair, in Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, New York, NY, USA, 2009, pp. 337–346

[8] K. Tsukada and M. Yasumura, ActiveBelt: Belt-Type Wearable Tactile Dislay for Directional Navigation, Springer-Verlag, 2004, pp. 384–399