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BUSINESS MODEL ORIENTED TOWARDS SOLUTIONS TO IMPROVE THE COMMUNICATION EFFICIENCY OF DEAF-MUTE PEOPLE

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Abstract: *A series of supplementary services to solve communication problems between deaf-mute people and society could decrease the additional risk caused by communication impairments and break the boundaries between deaf-mute people and doctors/society. This scientific article will serve as the basis of a future application to ease the social and medical burden of hearing-impaired patients. The economic effect that the integration of deaf-mute people can have involves both decreasing the costs allocated to social and health services for this category of people, and increasing the contribution of each deaf-mute person by increasing his productivity as an employee at a company/institution.*

Keywords: *Canvas business model, disruptive technologies, deaf-mute, economic impact, business opportunity.*

JEL Classification: M13, M14, M15, L26, L31, I15, I18

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1 INTRODUCTION

In the 1950s, the Scottish Department of Education, increased awareness of family support and the fact that the family should be a single unit, and not exclude the child, but give him all the support he neede (Backett and Brown 1956). Also in 1950, Ruth Morris Bakwin, pediatrician and child psychologist, shows that disability does not cause an alteration, or even destruction of personality, but wants to raise awareness of the importance of parental attitude in the necessary adjustments that will occur in the family along the way and beyond (Backett & Brown, 1956). Thus, in the case of disabled people, there is an additional need for family integration and adaptation to social conditions, to avoid possible future psychological or even psychiatric problems, which will become difficult to treat as the child grows older.

Language barriers are an important issue in any socio-economic or health field. Hearing-impaired patients (deaf-mutes) often do not have access to clear and effective communication in these areas, depriving them of critical information related to their integration into society. This aspect is more pronounced in the health field, where, due to the communication difficulties imposed by the language barrier, these patients may be deprived of certain specialized health and medical care services, critical in ensuring equal opportunities, quality of life, etc. Thus, they become dependent on a person who can communicate in both languages and who fulfills the role of translator between doctor and patient. The literature shows that deaf people are at greater risk of negative health outcomes compared to healthy (non-deaf) people, such as oral health (Ciger & Akan, 2010) and psyhiatric problems (Saha, et al., 2016). Moreover, this type of patients are susceptible to the deprivation of appropriate treatment in the case of psychological and psychiatric conditions, where appropriate language and communication are the key to finding the right treatment in solving these conditions (Saha et al. 2016).

For these reasons, deaf-mute people often end up in the hospital in serious cases, although, if they had resorted to preventive medicine, they could have been avoided (Goud et al. 2021). An example of a disease that can easily decompensate is diabetes, a disease that 1 in 10 Romanians suffer from, which if not detected in time and kept under close observation, causes a series of complications that significantly reduce the quality of life of patients - the development of some cardiovascular conditions, limb amputation, etc. (ARPIM - Romanian Association of International Medicines Manufacturers 2020).

Thus, treating severe cases among patients who have not benefited from preventive medicine services causes high costs, puts pressure on the medical system and complicates the process of providing adequate treatment.

A study carried out by the World Health Organization, in 2017, highlights the main types of costs regarding integration into society, but also the treatment of deaf-mute patients:

- the cost of treatment associated with hearing loss borne by healthcare systems;
- educational support for such persons;
- loss of productivity, more specifically the cost of the individual's inability to contribute to the economy;
- The stigmatization of both the individual and his family, which will limit integration into society (World Health Organization, 2017).

Although some of the costs cannot be removed, and can even be increased, it is clear that through the economic and social integration of deaf-mute people, a series of economic advantages can be achieved for the environment in which they are located. A range of additional services to

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address communication problems between deaf-mute people and society could reduce the additional risk caused by communication impairments and help to overcome existing linguistic boundaries between deaf-mute people and doctors/society. Moreover, the costs of achieving these types of benefits could be covered by the effective integration of disabled people into the socio-economic context.

Since currently existing medical solutions do not solve all the problems of deaf-mute people (for example the cochlear implant), it is imperative to discover, develop and implement alternative solutions that contribute to the proper functioning of interpersonal relationships between this special category of people and society. That's why this work has as its main goal the establishment of an economic basis in the creation of a digital application aimed at easing the social and medical burden of patients with hearing impairments, thus contributing to the improvement of the quality of life of these categories of people.

A recent statistic shows that, out of 8 billion people, about 0.5 billion are deaf-mute or have severe hearing problems that cannot be solved with hearing aids (Olusanya et al., 2014; World Health Organization, 2022) .

Consequently, the utility of creating such a digital application, which approximately 1 in 16 people globally could use effectively in removing the language barrier between beneficiaries and medical staff, is established. Any delay in creating alternative solutions for effective communication contributes to the deepening of the functional deficit, with an emphasis on the medical and social, in the deaf-mute communities (McPhillips, 2022; WHO, 2020).

2 THE NEED FOR BUSINESS ENVIRONMENT INVOLVEMENT IN THE EFFICIENCY OF PUBLIC HEALTH SERVICES

It is increasingly evident that the health field tends towards the development of client/patient oriented services. And of the two major categories of institutions providing health services from the public and private sectors, the latter has become increasingly dynamic and more appreciated in society (Rodriguez et al., 2021). Moreover, large corporations, especially in the pharmaceutical field, through their policy of impact and social responsibility, play an increasingly important role in the liberalization and increase of accessibility to health services (Dănescu & Popa, 2020). Therefore, the role of the private business environment in increasing the quality of medical services is highlighted, whether they are provided by private health entities or adjacent projects involving multinational corporations and sometimes even local SMEs.

In order to ensure a functional symbiosis between the medical services provided by public and private institutions, the third element is needed, i.e. a business model that includes the use of disruptive technologies. By these are meant those technologies that open up a new market and that sometimes destroy/eliminate previously existing systems. Also, the technology implementers, who will ensure the identification and servicing of the final consumer in order to guarantee the sustainability of the business, represent an important element. Therefore, a feasible business model initiated by the previously mentioned actors must ensure the following conditions:

- Social impact and financial sustainability;
- Satisfying unmet needs;

- Equitable access to services – availability for everyone;
- Implementation of business principles such as intelligent specialization to increase the efficiency/quality of services offered;
- Compliance with ethical and methodological principles when referring to medical services (Velamuri, et al., 2015).

In this context, the pillars can be outlined that would ensure a sustainable business model for diversifying and increasing the efficiency/quality of medical services, but also for ensuring an economic and social impact.

At the level of the European Union and, implicitly, of Romania, there are policies and strategies to stimulate and support the development of innovative medical services, but also to ensure their sustainability. Valuable research efforts and the implementation of solutions aimed at solving problems faced by deaf-mute people and taking advantage of cutting-edge technologies are increasingly available. A research project in this category and which is funded by the EU is the SIGNALL project (European Commission, 2021, accessed November 21, 2022). There are also other projects and grants funded by the European Commission that allow the study of the theme generically called "Hand Gesture" (European Commission, 2016, accessed November 21, 2022).

Other examples of projects that outline a similar trajectory can be both the Talking Hands project and the SiMAX project (European Commission 2018a, 2018b). These are outlined on initiatives that can be incorporated into feasible business models, which involve disruptive technologies, integration with existing equipment and the identification of end consumers – deaf-mute patients/person.

Thanks to the disruptive technologies that exist today, advanced mobile applications can be developed that could lead to overcoming communication barriers in the case of deaf-mute people, attracting economic and social benefits. For example, through the use of phone cameras, automatic speech recognition, virtual and augmented reality, advanced interactive solutions can be developed to meet the needs of deaf-mute people through instant processing of sign language elements (Yousaf et al., 2018). Such high technologies can help develop a project that brings added value to society, both from a social and economic point of view, but also to increase the comfort level of deaf-mute patients/persons, hence contributing to improving their quality of life.

Starting from these considerations, our work aims to describe how we propose to develop a mobile application that incorporates similar technologies to support the medical system in providing specific medical care to patients with hearing impairments, therefore contributing to the development economically and socially, in terms of the support given to these types of people. The development of this business model requires a multidisciplinary approach, combining essential elements from fields such as medical, economic, but also engineering and information technology. The existence of a relatively poorly developed literature in the studied field proves the novelty element of our approach, hence contributing both to the development of specialized literature and to the development of the business environment by proposing an innovative solution for managing effective communication with people with hearing impairments.

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3 BUSINESS MODEL ORIENTED TO SOLVE THE PROBLEMS OF DEAF-MUTE PEOPLE

3.1 The potential of existing technologies to develop a feasible solution

The first step in developing a feasible business plan is to describe the working methodology. That is why, in the following, we briefly describe the solution implementation methodology from a technical point of view.

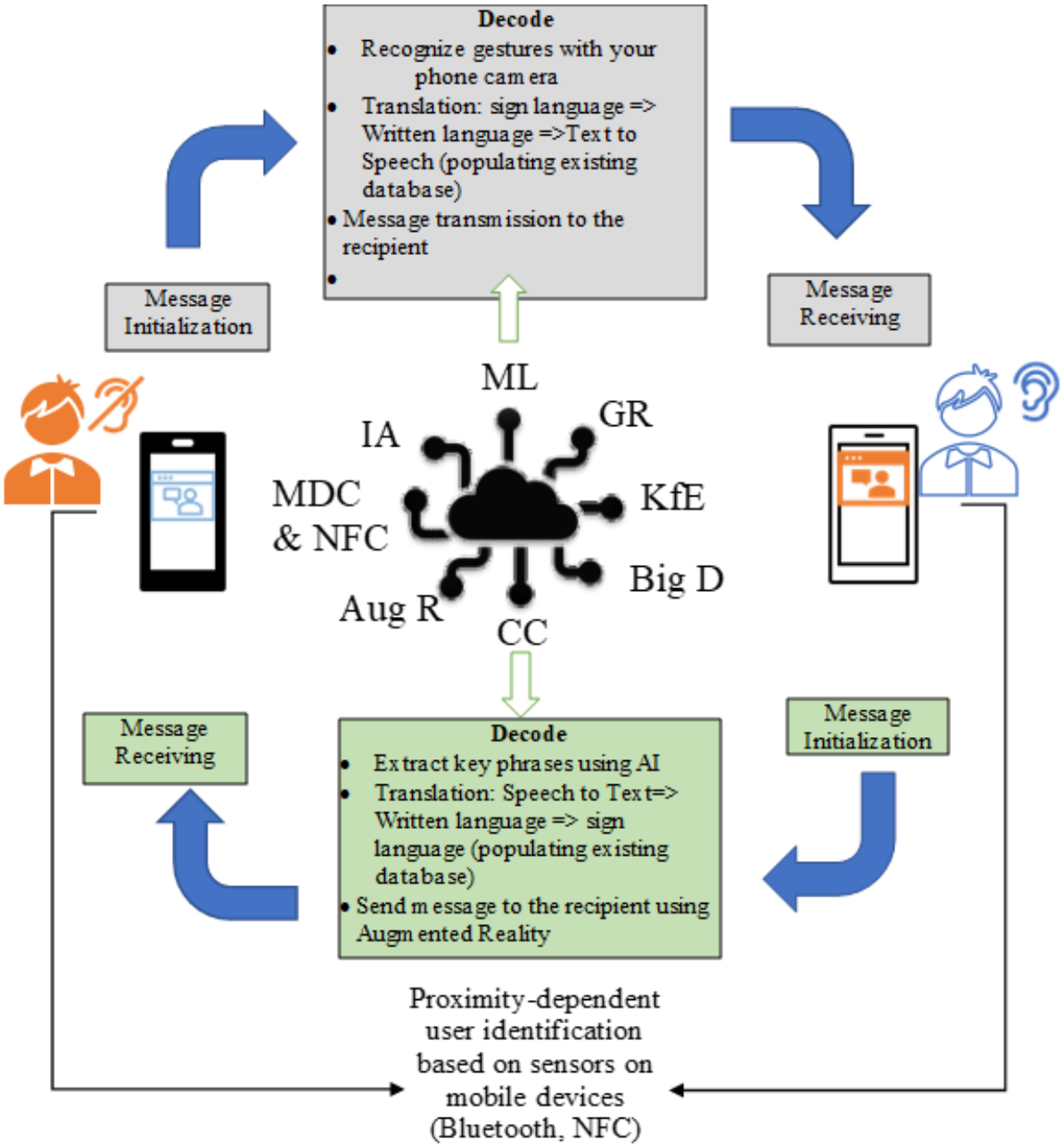
In the first stage of project implementation, we will rent a training server for artificial intelligence (AI). AI elements will help us to continuously improve the solution delivered to customers, being considered strengths of the business plan, aligned with current market requirements, but also with existing technology. Other technological elements such as Machine Learning (ML), Cloud Computing (CC), Mixed Reality, will play an essential role in ensuring the functionality of the application we intend to develop. So, in Figure 1 we schematically represented the process by which the functionality of the business is ensured.

Advanced mobile phone video cameras allow measuring the distance to a certain object. By means of distance cameras (depth camera) we can easily recognize the gestures/movements of the person who is in the field of view of the mobile phone camera. Thus, integrating this functionality into the mobile app is extremely useful and handy to facilitate both the app development process and the user experience.

Once two people who are going to initiate a conversation are in proximity, through the application they will join a common virtual conversation space, using Bluetooth and NFC technologies, through which the two people will be identified. Once the message is initiated by one of the parties (for example, from the deaf-mute person), it is captured by the camera, and the AI and ML algorithm, access the database located in the CC and translate the movements of the deaf-mute person into key phrases that later they can be displayed on the interface of the second user (the person without hearing impairment) in the form of text or through the *text to speach* function, in the form of a verbal message. Later, when the message is initiated by the person without hearing impairment, it is also processed by the artificial intelligence algorithm, which extracts key phrases to be able to select the correct sign language elements. While analyzing the written text or verbal message recorded on the other person's screen, an *Avatar* will appear using Augmented Reality - *Aug R* that will reproduce the gestures identified by the AI algorithm.

It is desired that the mobile application to be easily accessible from any device that contains the minimum elements for its proper operation (e.g. Internet access, Bluetooth, NFC). Having documented the technologies with the potential to implement a feasible solution, the next step is to describe the business plan that results from the development and implementation of the presented solution.

Figure 1. The potential of disruptive technologies for the development of communication solutions for deaf-mute people



Source: Authors' Elaboration

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3.2 Business model for ensuring the sustainability of support services for deaf and mute people

In order to highlight the essential elements necessary for the development of a business that requires a digital solution to facilitate the communication of deaf-mute people, we used the Canvas Business Model. This model can also be used for businesses that, through their products/services, bring social impact. Some of the advantages of modeling a business plan in this form are considered to be: providing possibilities for continuous adjustment/updating, possibilities for comparing various business variants from the point of view of the nine elements that the standard format of the Canvas model contains: value proposition; consumer segment; channels after; customer relationship; income streams; key resources; key partners; key activities and cost structure (Desai 2014). Thus, the business plan proposed by us to develop and implement a two-way communication application between deaf and mute persons/patients and medical personnel/society is detailed according to the Canvas Business Model.

1. Value propositions

The business model illustrates a company in the technology industry, but which collaborates with a multidisciplinary team of professionals from various fields (medical, economic, social), which aims to remove important communication barriers between medical staff and deaf-mute patients, so that the latter to be able to benefit from all the advantages and opportunities that society offers. The proposed value of the project consists of the following:

- Deaf-mute people's access to easy and effective communication with other people in the community who do not know sign language;
- Easier integration of deaf-mute people that would lead to their greater autonomy, respectively less expenditure from the state budget for treatment and/or social assistance;
- Increasing the quality of medical services offered to people with communication disabilities through the use of appropriate digital translation tools.

2. The consumer segment

The segment of direct and indirect beneficiaries to whom the business is addressed is made up of people with speech disabilities, especially deaf-mute people, (both adults and children), medical personnel and those in the public domain and healthcare, respectively the general public with whom deaf and mute people interact. Thus, the direct customers are represented by those who will ensure the sustainability of the application, and this category includes: public institutions, respectively companies that offer social assistance services, but also other commercial companies involved in the business model.

3. Channels

The main way of communication regarding the access to the mobile application by the targeted persons (with hearing impairments) will be through associations dedicated to helping deaf and mute people, who will emphasize the benefits of using this solution within the deaf and mute communities. Where this communication is not possible (in the case of hearing-impaired people

who are not integrated into such an entity), a web page will be created that includes a live-chat section (permanently assisted by an authorized translator), accessible non-stop by the general public.The targeted communication channels are the traditional ones (direct contact by phone, visits, meetings, work meetings, etc.) and the electronic ones (via e-mail, via the Internet, etc.). Direct collaboration with both public authorities and private companies or non-governmental organizations (NGOs) is intended. Moreover, it is desired to communicate with the competent government bodies in order to disseminate the benefits of integrating such a solution into national programs (both long-term economic benefits - reducing the costs generated by this type of disadvantaged people - and socio-cultural benefits - effective integration in society, respecting equal opportunities and the culture of individuals, key elements of the European Union agenda for the year 2030).

4. Customer relationships

Customer relations are a priority for the proposed business model. On the company's official website there will be a section called Customer Relations, structured according to the types of customers described previously. Thus, a special sub-section will be dedicated to clients from the private sector in which the communication channels will be mentioned, as well as indicators and statistics regarding the proposed or ongoing partnerships. For government clients, the sub-section dedicated to them will be customized according to the identified needs, focusing on increasing the transparency of the company's economic and socio-cultural activity. NGO clients will also have a dedicated sub-section that will include all the information needed to conclude an effective partnership. Also, within the same section, two effective communication management solutions will be made available, namely: a subsection with answers to frequently asked questions and a live chat assisted by an authorized translator in verbal and non-verbal communication, adapted to the target audience.

5. *Revenue streams*

In the first phase, the sources of income related to making available to the public the solution developed within the business model will be multiple and in different percentages, since the target customers are the following categories of entities:

- Governmental and state institutions through specially dedicated programs – about 15% of revenues;
- Public and private medical institutions, social assistance institutions - about 20% of total income;
- Private companies wishing to invest in social responsibility projects – 10% of revenues in the form of donations;

In addition to these sources of income, we plan to add another source that will generate significant revenue: Earnings from promoted ads - 55% of income. These will come from showing ads in the app, only for those who can hear (target audience), before starting text-to-motion processing for the Deaf person's phone Avatar. For the reverse process, ads will be displayed to start processing the sign language of the deaf-mute person, into the text of the person without hearing impairment.

So, in this first phase, the revenues will be provided from licenses/annual subscriptions purchased by companies and state institutions; donations and public funding, income from promotion. In the second phase, we propose to collaborate with the state apparatus, by integrating the developed solution in the national strategy, respectively in the national programs. Thus, the

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percentages of income will be different, with a significant weight from government and state institutions, followed by the other categories of income described previously in smaller proportions.

6. Key resources

People are the key resource, because being an integrated digital system requires a lot of attention both in terms of implementation and user training. The development, implementation and continuous assistance of the proposed solution will be ensured by a team that will contain experts from different fields, who will collaborate for the same common goal: providing an optimal solution to achieve the proposed objective. This collaboration is considered to be a primary strength, as a multidisciplinary team can collaborate effectively taking into account various aspects from different fields. For example, the collaboration between medical, social and economic experts offers a wide spectrum of solutions to complex problems, such as the development of an effective solution to eliminate the language barrier between people with communication disabilities and healthy people.

Another important resource is the financial one. It is desired to establish a joint-stock company, which offers the possibility of attracting financial resources from investors. Thus, the invested capital will constitute an important source of self-financing to achieve the purpose of the entity, taking into account the latest technologies, communication channels and types of partnerships. Emphasis will also be placed on the development of public-private partnerships, on the integration of the solution in national health plans, which will ensure the sustainability of the business model, but also on the continuous improvement of the solution in order to satisfy the targeted needs (by ensuring permanent communication with target audience and receiving feedback).

7. Key partners

The key internal partners are: employees, stakeholders who will bring capital in the first period of activity, deaf-mute people in creating feedback to improve the user experience, medical and auxiliary staff who will communicate with patients through the application, as well as translators who will help create the first video dictionary for the deaf.

External partners are: medical and social care units, local, regional and national authorities, non-governmental associations, companies with public or private capital.

8. Key activities

The main key activities are considered to be:

- Ensuring the necessary infrastructure (equipment, access to databases, network, experts, etc.)
- Building a logical flow of the application
- User interface development
- Promotion to customers and partners
- Continuous testing and updating of app functionalities
- Promotion of partners/customers in the application
- Application maintenance.

9. Cost structure

In the initial stage, the cost structure targets 3 directions, as follows:

- Costs with staff salaries – approximately 50% of the total costs, being mainly represented by the provision of qualified human resources to develop the optimal solution;
- Equipment and infrastructure costs – 30% of the total costs, focusing on ensuring access to innovative, disruptive, but also classic technologies to achieve the proposed objective;
- Promotion costs – 20% of the total costs, being considered extremely important in the early stage, as it is necessary to know and raise awareness of the subject and the proposed solution.

4 CONCLUSIONS

By developing a business model that proposes the development and placing on the market of a digital solution to facilitate the communication of people with hearing impairments, we find numerous advantages. Among these we mention:

- The integration of deaf-mute people would have a significant impact from an economic and social point of view in the environment in which they are located;
- The involvement of the business environment in the provision of medical services would considerably improve their quality, contributing to the development of innovative health services and applied to the real requirements of society;
- The pertinent need for the integration of deaf-mute people opens up business opportunities that become more and more feasible with the advancement of technologies and the initiation of more and more social and public health funding programs;
- The economic effect that the integration of deaf-mute people can have implies both a decrease in the costs allocated to social and health services for this category of people and an increase in the social and economic contribution of each deaf-mute person.

In the creation of the paper, we encountered some limitations of the research. First of all, the existence of a vast literature in the studied field, but little focused on people with hearing impairments, made it difficult for us to document the existing similar digital projects/solutions. Second, the resources needed to implement the proposed idea may be difficult to access. However, this paper is the starting point of the targeted research. The objectives we are pursuing involve implementing and bringing to market a feasible solution to facilitate the integration of deaf-mute people. That is why the future research directions are broad, focused on identifying the optimal resources for the development of the digital application within the proposed business model and removing the identified limits.

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