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Increasing the Acceptance of Assistive Robots for Older People Through Marketing Strategies Based on Stakeholder Needs

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Abstract Modern assistive systems, such as robots, will have increasing relevance for support at home in the future due to changes in society, such as ageing. Older people, especially, can benefit from assistive robots that give physical, cognitive and emotional support. However, thus far, little is understood of how to increase currently low acceptance of assistive robots through marketing (DAA Design Brief, Acceptance of assistive technology, 2014). Therefore, marketing strategies need to be developed addressing needs and fears of the stakeholders, which is especially critical regarding utopian-appearing assistive robots. To understand what drives acceptance, conscious and subconscious needs, wants and barriers of use of the relevant stakeholders have to be analysed. As such, in this intelligence gathering process not only end-users should be integrated. Also other stakeholders (e.g. as users, decision makers and buyers might not be identical) should be identified and their needs understood. In this paper we report our findings on marketing factors for different stakeholder clusters for assistive robots that we identified during the EU-co-funded (FP7) Robot-Era project. We employed a user-centred way of identifying stakeholders and marketing strategies by analysing different stakeholders in an iterative design process from an early stage (Mollenkopf et al., AAL in der alternden Gesellschaft: Anforderungen, Akzeptanz und Perspektiven, 2010) with quantitative and qualitative methods. The most important acceptance factors we identified for assistive robotics include functionality, usability, safety, costs and financing, (non-) stigmatization and ethical aspects. The structure of the paper is the following: first we look at the relevance of assistive robotics and the challenge of missing acceptance. We then look at the 4p concept in marketing to structure our approach of user-centered marketing. We then describe our data collection and the results to end with a discussion.

Keywords Assistive robotics marketing · Stakeholder-centred design · User-centred design · Stakeholder cards · Demographic change · Ambient assisted living · Robot-Era

1 Introduction: Assistive Robots

1.1 Background: The Need for Assistive Robots

An ageing population paired with a shortage of care personnel make alternatives for the everyday support of dependent people increasingly important. In 2050 there will be 164 million people above 65 in the EU. 31.8 million people over 65 will live alone [3]. Already in 2008, almost 50 % of people older than 85 years relied on outside help to live. With more people getting older, the demand for care is expected to rise to levels, where traditional care cannot cope.

Against this background, the European Union supports—amongst many Ambient Assisted Living projects—the Robot-Era Project within the 7th Research Framework Programme (2012–2015) entitled "Implementation and integration of advanced Robotic systems and intelligent Environments in real scenarios for the aging population" (www.robot-era.eu). The goal is the development of an assistive-robotic systems and intelligent environments for domestic, condominium and outdoor environments.

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1.2 Classification of Robot-Era System Within Assistive Robotics

Assistive robots for older people care taking give assistance both in the professional nursing work and the tasks of daily living for older people.

Generally speaking, assistive robots for in-home use come in six major variants, as can be seen in Fig. 1.

Assistive robots can support health workers or seniors in providing physical support (e.g. for transportation, such as the Care-O-Bot [4]), cognitive support (e.g. in helping recognize and organize things) and emotional support (e.g. by providing emotional closeness, such as Paro [5]).

Robot-Era with a system consisting of three different robots provides assistance for both caretakers and for seniors on a physical, cognitive and emotional level. Particularly, the complex assistive system of the Robot-Era project combines indoor and outdoor support for older people. Thus, the three different types of robots developed in the project interact with each other and with people beyond the borders of the different contexts. The focus of the robots' functions is on relevant services that cannot be properly achieved by other technological devices [6]. Exemplary, the three Robot-Era robots can perform the following tasks:

- Indoor escort at night: the indoor robot supports the low-level autonomy user by guiding him/her to the bathroom to support safety, orientation and to prevent falling with a handle and a floor light to the toilet.
- Outdoor walking support: The outdoor robot guides people with soft cognitive impairments during outdoor walks via GPS and supports them physically with a handle. This prevents them from getting lost and provides a safer feeling
- Object transportation: The indoor robot can bring users certain objects (e.g. bottle of water).

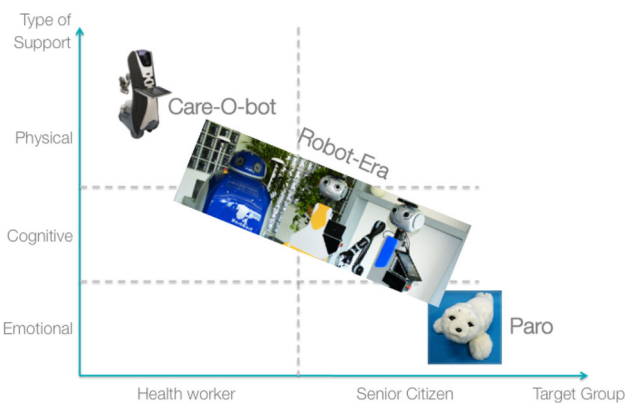

Fig. 1 Classification of assistive robots

- Laundry delivery: The condominium robot brings laundry to the washing room. The robot informs the user when laundry is ready.
- Food delivery: The indoor robot can take food orders via speech or GUI from the senior that are then delivered by the condominium robot.
- Drug and shopping delivery: The user orders drugs or shopping goods via interface/speech with the indoor robot. The outdoor robot gets the information and will be loaded by shop personal (e.g. drug store). The outdoor robot hands over the goods to condominium robot who hand them over to the indoor robot.
- Garbage collection: The indoor robot detects full garbage bin and picks it up. He brings it to the condominium robot, which hands it over to the outdoor robot. The outdoor robot brings the garbage to a designated place.
- Cleaning: The indoor robot is able to clean a table (e.g. manipulation and wipe dry).
- Surveillance: The condominium robot supports the user to monitor the entrance hall for safety.
- Communication: The indoor robot offers a video call system.
- Reminding: The indoor robot has a calendar function and reminds the user e.g. of taking drugs via speech.

As can be seen, some services necessitate the interaction between the three different robots developed in the project, while others can be performed by a single robot.

1.3 The Rise of the Robot: Against the will of the People?

The market for assistive robotics, where we look at robots for home-use, has seen a promising development for a couple of years [7]. According to the World Robotics evaluation about four million service robots were sold in 2013 for personal as well as domestic use which is an increase of 28 % compared to the sales figures of 2012 [8]. Those service robots were primarily household robots, such as automated vacuum cleaners, lawn mowers, entertainment and leisure time robots or toy robots. The sales volume was about US$ 1.7 billion. For the next years (2013–2016) experts predicted a growing sales volume of service robots within home environments.

However, thus far robots for maintenance and care of older people constitute the smallest share of the market yet. The prognoses, however, are promising. It is expected that about 31 million units of service robots for personal use will be sold between 2014 and 2017 thus indicating the continued strong growth of service robotics in this field [9].

Yet, to fully exploit the market and social potential of assistive robots, the acceptance toward these robots of the very heterogeneous stakeholders must be increased. A study by the European Union found that although about 70 % of peo-

ple in the EU have a positive or fairly positive view of robots, only 4 % could imagine robots taking care of older people [10]. For promoting the opportunities with assistive robotics, it is therefore essential to develop strategies and tactics for the market introduction of such products addressing the different stakeholders. Despite numerous years of research and development in assistive robotics, only few applications have made it from prototype to marketability so far. Therefore, assistive robots are still at the very beginning of the commercialization. Consequently also marketing activities are close to non-existent. Thus far, communication for promoting assistive robotics is usually function-, solution-oriented and scenario based—with a focus on the research community (e.g. NAO, Care-O-bot, RIBA, Giraff), rather than on the consumer markets [6]. In terms of assistive robots for older people, the most important exception might be commercially successful Paro robot (we specifically exclude cleaning robots).

This emphasises the relevance of this research contribution: How can the assistive robots for older people be made commercially successful through marketing?

2 Marketing Framework

While the development of assistive robots has been mostly technology-centred for years, implementation of tools of social science—from user-centred design principles to market research has become more pronounced over the past years. Although acceptance of realistic stakeholder needs often towards technological possibilities (to the dismay of some engineers), many research projects now include professionals in user-centred design methods to research and integrate stakeholders needs early into the design process—including for marketing.

When applying a framework for marketing, we wanted to employ a simple, easy-to-understand and yet powerful framework to understand how to market assistive robots. Already in 1960, E. Jerome McCarthy developed his "Concept of the Marketing Mix" [11]. It has become popular among marketing science as the 4 Ps: product, price, promotion and place (distribution). This framework has been extended to 7 Ps with people, process and physical evidence.

In order to focus on the most pressing issue in marketing for assistive robots for seniors, we covered specifically the 3 Ps people, product and promotion for the Robot-Era system.

2.1 People

People in the 7 Ps framework encompass employees, as well as stakeholders. The term 'stakeholder' refers to all the actors in a social system whose interests are affected positively or negatively by the introduction of a new product, such as assistive robots [12]. Thus, stakeholders are much broader than customers or users. Therefore the question we needed to answer:

- Which stakeholders are particular relevant to the success of Robot-Era?
- What are the needs, fears and wishes of different stakeholders?
- Which marketing strategies lead to a higher willingness to buy and use the assistive robots?

2.2 Product

A product's goal on a competitive market is to satisfy customer (and stakeholders) demands. In this, the product can be both tangible and non-tangible. For a robot, it could mean the design, the functionality and the surrounding services. The questions to be answered for Robot-Era were hence:

- Which functions are particular relevant to the success of Robot-Era?
- What problems (e.g. ethical) have to be taken care of when certain functions are implemented?
- How can these functions be developed within the available resources?

2.3 Promotion

Promotion refers to the way and the means by which the existence of the product is communicated to the relevant stakeholders. Promotion can generally comprise elements of advertising, public relations, and sales.

The questions that needed to be answered for Robot-Era were:

- Which ways of promotion are particular relevant to the success of Robot-Era?
- What kind of promotion is relevant for the different stakeholders?

3 Data Collection and Dissemination

3.1 User-Centered Design Methods for Market Research

As very little is yet understood about marketing of assistive robots for older people, we looked at methods from user-centred design for collecting data. This proved to be very successful, as user-centred design methods helped us mitigate many of the sensitive challenges in the field of human-machine-interaction, that are especially pronounced in high technological products and health care products for older people, such as assistive robots.

However, user-centred design has its limits that must be understood, as ex-ante market analysis and market segmentation are often more difficult due to the (yet) non-existent markets of assistive robots for older people [6]. In such markets, many stakeholders cannot easily be identified or classified, while not all stakeholders can be included.

In the Robot-Era project, the goal of applying user-centred design methods for market research was defined early on, while at the same time the limits of user-centred design methods were discussed with the whole development team to manage expectations.

3.2 Data Collection

To identify stakeholder groups relevant for Robot-Era and to gain detailed intelligence about them, we chose a mix of qualitative and quantitative market research and co-creation methods. We deliberately employed more explorative methods due to the novelty of the research.

Yet, we clearly started with an extensive secondary analysis focused the needs of end-users, family members, health care facilities and their staff was conducted.

Surveys, workshops and tests were conducted with experts and stakeholder groups. Acceptance criteria and barriers of stakeholders towards robots/AAL were discussed based on creative techniques (including Walt Disney method, brain writing and sticky dots voting) and than summarized in line with the Unified Theory of Acceptance and Use of Technology (UTAUT) [13]. Afterwards the relevance was evaluated in cooperation with the stakeholders.

A stakeholder workshop with the title "Acceptance of assistive technology" was conducted to find out about the most important acceptance criteria, facilitators and barriers regarding assistive technology/robotics from different stakeholders' point of view. It was held with 36 participants from nine European countries, focusing the acceptance of assistive robots. The participants were employees in the areas of health, insurance and municipal government, product development, or they were family members of elderly relatives.

Another workshop "Co-Creation & Prototyping using the example of service robotics" was organized with 35 marketing experts and stakeholders, the aim of this workshop was to find out about relevant touchpoints and communication channels regarding robots for different stakeholders. The results of this workshop provided evidence and thought-provoking impulses for the project Robot-Era about possible stakeholders and suitable marketing channels as well as marketing strategies for each of the five covered stakeholder groups.

To align application scenarios as early as possible with real and realistic user needs, further quantitative and qualitative data collection happened within the Robot-Era project. This took place in the first experimental loop in the form of tests and surveys with primary and secondary user groups in different test environments in Italy and Sweden with 70 participants. The second experimental loop will be held from May 2015. Thereby with the help of real users results will be tested and evaluated once more in even more realistic settings.

To get a deeper insight into the different stakeholders and their requirements an empirical study consisting of eight interviews with leading employees in the field of domestic constructors and ambulatory caretakers was conducted, to get insights into the residential environment of the older people. The interview structure has been created on the basis of the diffusion of innovations theory by Everett Rogers [14].

Results of different projects were extracted and integrated e.g. of the research "User-centred innovation barriers in AAL" [15], funded by the Federal Ministry of Research and Education Germany. Also of a EU robotics project Adaptable Ambient Living Assistant (ALIAS) and of the EU project Design for Active Ageing (DAA) [1]. Persona cards from these projects were used as an input for the content, the structure and the categories of the stakeholder cards that were created here [16].

3.3 Dissemination of Information

While collecting and analysing market data in order to answer the above questions itself is not easy, disseminating the intelligence within the development consortium can also be a challenge, e.g. due to "different languages" in technology, design and marketing. However, it is crucial in order for all people involved in the project team to understand the needs, challenges and roles of different stakeholders, when developing the product.

In Robot-Era, the experts responsible for market research made the intelligence available in the form of easily understandable "stakeholder cards". These stakeholder cards served as reference point for the development of the services and features of the robotic systems (see Chapter 4.3). In the iterative design process, the cards provided orientation for people working on the technical features and design of robots and lead them to a more empathic way of creating innovation.

4 Results and Interpretation

4.1 People: The Stakeholders of Assistive Robotics

The analysis of the quantitative and qualitative stakeholder research led to the definition of twelve stakeholder groups relevant for Robot-Era. These groups can be pooled into seven clusters based on the employment sector and interest orientations. An overview is presented in Table 1.

Table 1 Stakeholder clusters, stakeholders and relevance

Cluster	Stakeholder	Relevance
Medical network	Outpatient and inpatient care	⋆ ⋆ ⋆
	Family doctor	⋆ ⋆ ⋆
Benefactors and insurances	Social insurance institutions	⋆ ⋆ ⋆
Domestic constructors and renters	Housing industry and real estate	⋆⋆
Service and product providers	Different service and product provider	⋆⋆
	Sales partner	⋆ ⋆ ⋆
	Service and component producers	⋆⋆
	Education	⋆⋆
Support network	Social context / family	⋆ ⋆ ⋆
End-User	End-User high level of user autonomy	⋆ ⋆ ⋆
	End-User medium and low level of user autonomy	⋆ ⋆ ⋆
Politics	Politics and legislation, municipalities	⋆ ⋆ ⋆

After identifying and pooling the stakeholders, their relevance for Robot-Era was assessed. The assessment of the relevance of each stakeholder (right column) is based on their power for the success of the robots. Assessment factors were, i.a., the potential to invest in and to finance the robotic systems, the potential to create infrastructure, or their power in legislation. One star stands for low and three stars stand for a high relevance of the stakeholder.

In order to be more efficient, we selected only the stakeholders with two or three stars (i.e. high relevance), which are also shown in the table.

Although stakeholders can be nominally separated, stakeholders can hardly be analysed individually, as they consciously or unconsciously interact with or influence each other. For example ethical issues that arise during the use of a robot with one stakeholder, lead to necessary reforms of the current legislation; or, the medical network will influence the insurance network—and vice versa.

We will look more specifically at the needs of stakeholders in chapter 4.3.

4.2 Product: The Features of Robot-Era

A relevant factor for accepting assistive robotics is the product itself: what features are wanted—and which challenges arise when implementing the functions and services? The UTAUT-model [1,13] provides a framework that unifies and matches influencing aspects and correlations of product acceptance in three dimensions: benefit and service expected by the user; effort expected by the user and social factors (see Fig. 2). Related to those dimensions six acceptance categories for assistive robotics were identified: functionality, usability, safety, costs and financing, stigmatization and ethical aspects.

Thus, for example, users would have to be introduced to the operation of the system and continuously have to have a contact person whom they can address regarding questions. Easy learnability and low error rate during the operation should be guaranteed at market maturity to finally reach the suitability for daily use. Furthermore to increase the acceptance and thus to facilitate the implementation, additionally desired services could also be developed. The following additional services were desired in the qualitative studies:

- Documentation of care process and physiological data
- More complex housekeeping tasks (e.g. cooking, complex cleaning)
- Support of rehabilitation
- Control of medication
- Telemonitoring, telemedicine also integrated in already existing structures e.g. emergency call environments
- Fast, interoperable, multidisciplinary care
- Interoperability of services and providers
- Compatibility with other devices
- Personal hygiene
- Stair climbing as feature of the robot
- Helping up, carrying and lifting heavy things
- Modular construction of services and functions
- Educational services and trainings

With regard to the concerns of end-users, e.g. ethical and legal aspects of policy and the legislative framework must be defined by the stakeholder cluster ‘politics’. Social factors need to be subject of discussion—for example, stigmatization and image [1]. Customizability of the modules and design, as well as the breaking up of the target group turning the attention away from the elderly alone could change the view of the robots.

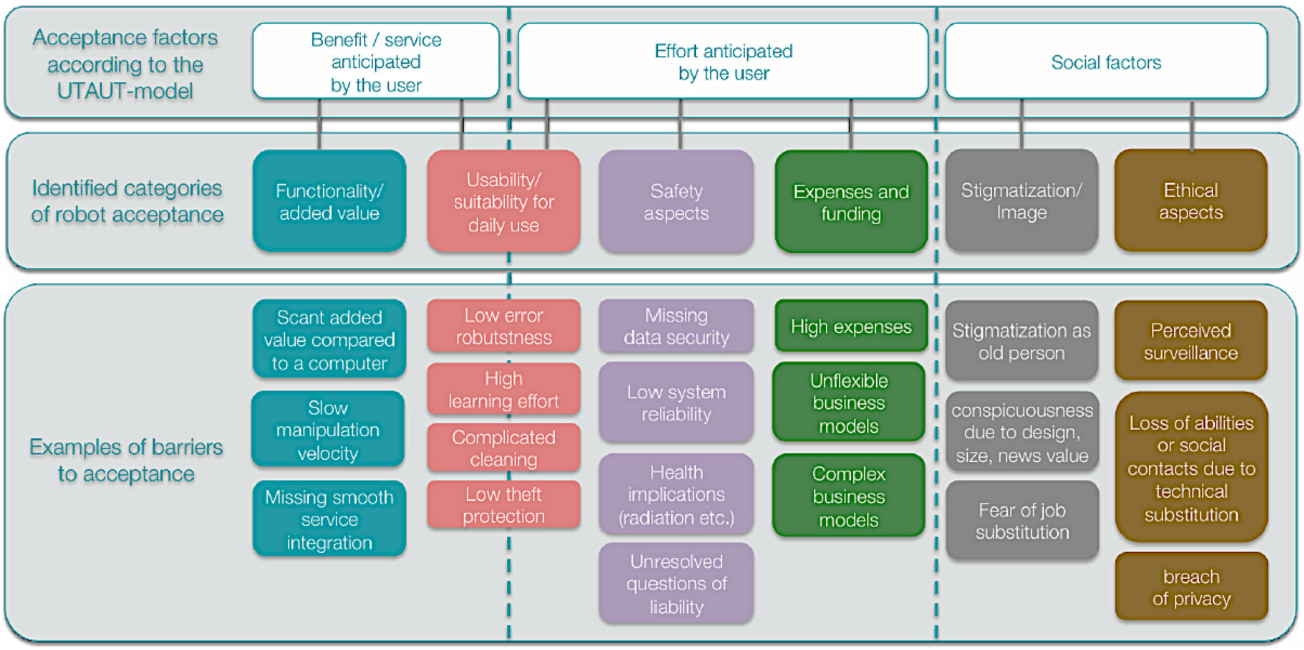

Fig. 2 Product acceptance criteria in service robotics [1]

Potential disadvantages of the perspective of all stakeholders have to be treated transparently to show possible solutions also for marketing—e.g. privacy issues.

4.3 Promotion

4.3.1 Promotion Framework

The promotion of assistive technologies requires patience and sensitivity due to the interaction of the many different stakeholders (see Table 1), the ethical dimension and an indeed bigger fear of technology in the main user group—seniors.

In order to develop promotion strategies in Robot-Era, we employed various frameworks for innovation marketing:

- diffusion of innovation framework by Rogers [14]. This framework gives guidance how radical innovations can be introduced to the market and helped us in the analysis and development of promotion strategy for the different stakeholders.
- adoption framework, that shows the importance of communications for overcoming adoption barriers of each target group [17].
- diffusion barriers framework by Talke et al. [19], which supports the notion that early identification of diffusion barriers can positively influence the course of diffusion [19].
- stakeholder management framework, which claims that a strategic stakeholder and relationship management can facilitate the diminution of contextual diffusion barriers [20].

In addition, we found that synergetic cooperation and the motivation of actors are central strategies of the market launch [21] and should be integrated.

The objectives of the communication strategy and the communication channels need to be clarified in order to express the marketing content and recommendations specifically for each stakeholder. Communication channels are promotion (e.g. advertising, managed social media), PR (e.g. newspapers, conferences and lectures) and sales (e.g. distribution network with sales personnel). In order to select appropriate communication channels and strategies, both the demand, the wishes and perceived opportunities as well as the concerns of the stakeholders must be understood.

4.3.2 Stakeholder Cards

The stakeholder cards provide detailed intelligence for the stakeholder and their specific marketing strategies concerning assistive robots and particularly for the Robot-Era solutions. Figures 3 and 4 show the contents of the stakeholder cards in general:

Each stakeholder card belongs to a stakeholder cluster (e.g. medical network). In the stakeholder description the stakeholder is defined, including its reputation within the social network, their working environment, difficulties and future developments in their surroundings. The "Opportunities and Advantages" describe possible opportunities for the

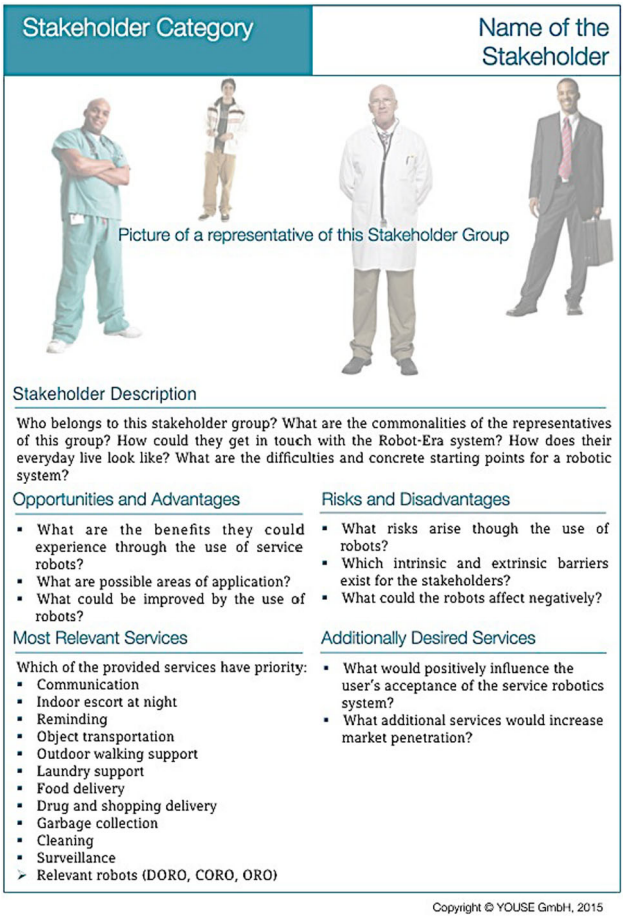

Fig. 3 Stakeholder card template, front

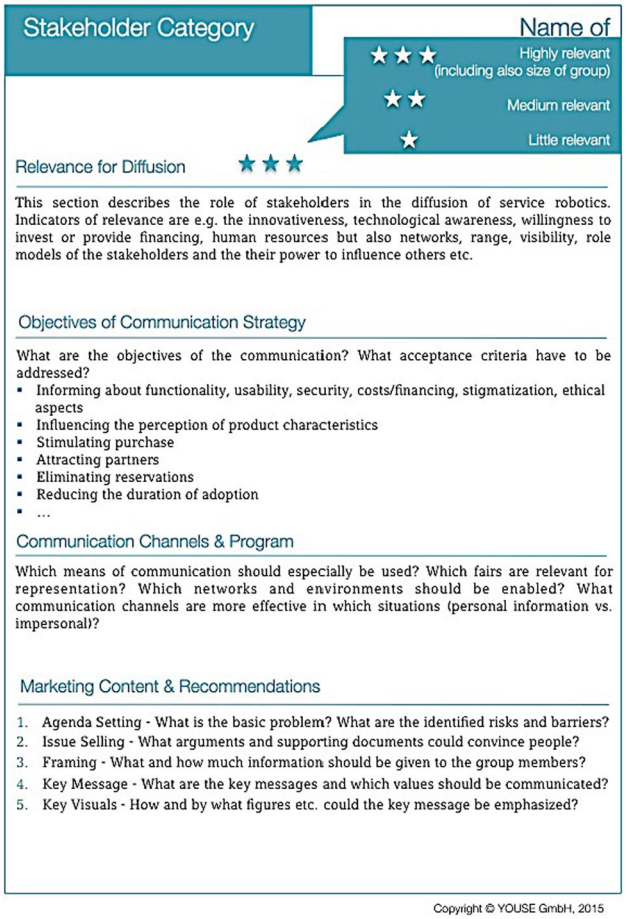

Fig. 4 Stakeholder card template, back

market launch of the robots, specific to this stakeholder. The "Risks and Disadvantages" section sheds light on the problems that this stakeholder might experience or fear with the robots. Moreover, a detailed description of relevant services, which are interesting for the stakeholder, is given.

On the backside of the card, the number of stars rates the relevance of each stakeholder regarding diffusion.

The marketing strategies are explained by means of goals, communication channels/strategies and suitable marketing contents [22].

Since all stakeholders have different interests and needs, a specific approach should be chosen to get people to buy, use or to participate in related services of the robot systems.

The following chapters provide insights into one of each stakeholder cluster. We provided figures of the fronts of the cards, while we elaborate on the relevant communication strategies for each stakeholder cluster in written text.

4.3.3 Medical Network

Figure 5 displays the front of the stakeholder 'outpatient and inpatient care' of the stakeholder cluster 'medical network'. The stakeholder cluster "outpatient and inpatient care" is highly relevant for the diffusion of service-robotic solutions. This cluster could use robots to substitute routine activities and save time for qualitative care activities. Robots could support their daily work and could help to provide services with increased efficiency.

For convincing this cluster marketing strategies and communication channels must reach a wide network. Most care institutions don't know about service robotics and its potential. And often the personnel is not too open-minded about or interested in using new technologies. Priority should be at spreading the idea of service-robotics and create awareness and knowledge about this technology in the field of outpatient and inpatient care.

Possible communication channels to create first awareness are professional journals and relevant fairs with focus on care topics to generate knowledge. To reduce doubts in using technology it is recommended to give care personnel the opportunity to experience the technology by testing it in real environments, e.g. by renting or leasing the robots. Besides training for handling the systems have to be provided.

Specific marketing contents and recommendations are important. Service-robots should be communicated as tech-

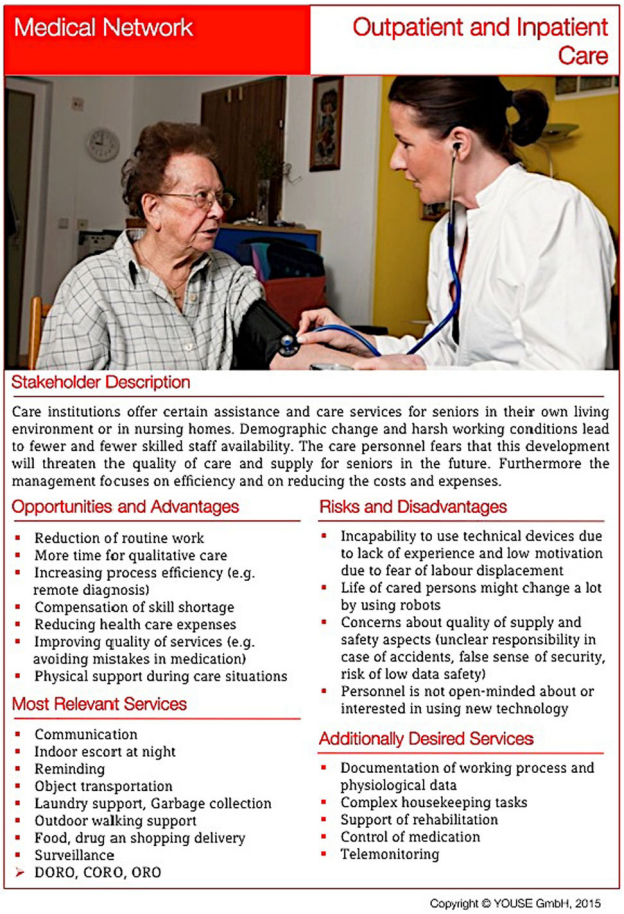

Fig. 5 Stakeholder "Outpatient and Inpatient Care"

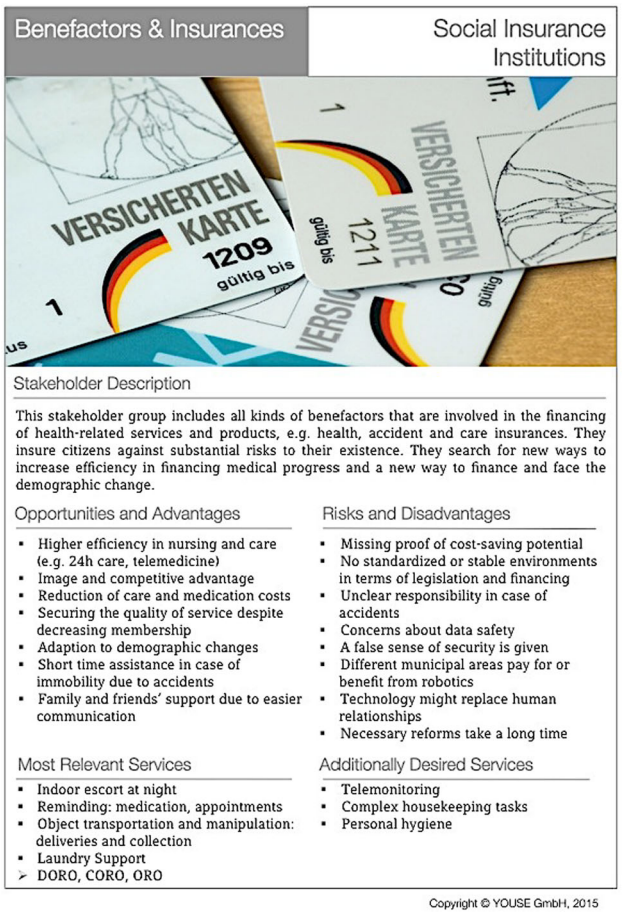

Fig. 6 Stakeholder "Social Insurance Institutions"

nical devices that reduce a repetitive work process and help to gain more time for the individual care of seniors. The key message should be the high level of liability at work. It has to be communicated, how safety and data security issues have been covered. The main value added is the potential to anticipate a more efficient process in outpatient and inpatient care institutions. Therefore it should be clearly communicated that robots are easy to handle and easy to use, so that the care personnel won't have mutual reservations concerning the use of complex technologies. Concerning the management, the focus should be on the cost-saving potential. Care staff must be convinced that robots are not competitors but a complementary resource that improves the quality and efficiency of the services. Thus, the communication strategy should avoid the impression that robots will lead to the loss of jobs, but can help to close upcoming personnel shortages in areas where no social interaction with cared persons happens.

4.3.4 Benefactors & Insurances

The stakeholder cluster "benefactors & insurances" (Fig. 6), rated with three stars, is highly relevant for the diffusion because it might solve the not yet answered financial issue. If the insurances would bear parts of the costs or subsidise its usage, robotics might be more accepted and used by the elderly and in care institutions. Thus, robots might be more often used compared to privately financed medical aids. Through inclusion in the catalogue of therapeutic appliances robotics might also become more and more well-known between secondary stakeholders such as medical doctors.

To convince the insurances of the robotics' benefits, information (e.g. reduction of expenses) but also real usage should be the aims of the communication strategy. Verifiable study results to show the effectiveness and efficiency of the robots should be a focus. This Cluster can mainly be convinced by data and facts. At the same time the government and the legislation must be convinced to reform the current legislation.

To reach this stakeholder cluster it is recommended to fall back on scientific reports and newspapers including calculations. Additionally face-to-face demonstrations and trainings should be used to inform and convince the social insurance institutions.

This cluster should be involved in early stages of design and be regularly informed about the progress of research

and development. The focus should be on profitability as well as on quality and security. Insurances must see their business benefits. As a marketing strategy for the insurances themselves they could rent or lease the robot to the end-user to save costs. However, the quality of nursing and care should not be adversely affected by the usage of robots.

4.3.5 Support Network

With three stars the "social context and family (Fig. 7)" has also a high relevance, particularly younger family members. They can teach seniors how to handle technology, release their fear while using the robots and recommend it to others. Particularly recommendations regarding the personal environment could increase the acceptance of assistive robots. Hereby seniors could be encouraged to use the Robot-Era solutions. This cluster might even buy or rent the robots sharing the costs and give it to the seniors as a present. This might provide satisfaction by donating something really useful to loved ones, since it also means donating common time, independence and the opportunity to live at home as long as possible. So this cluster is potentially more willing to pay for robots than seniors themselves.

The aim of the communication strategy is to build up awareness and functional knowledge about assistive robots. Seniors, their social context and families have to be convinced of the daily benefits— they need to feel familiar with the technology to recommend this solution to others. This way curiosity could spread. The opportunity for seniors to stay at home and for families to keep their all-day routine while caring for their relatives is an important issue nowadays. Reservations about the reduced personal contact must be addressed. Assistive robots could take pressure off the supporting network enabling them to focus more on interpersonal closeness.

Because this cluster is large and very heterogeneous they need to be informed in any way possible due to mass media like radio, TV, magazines, brochures and newspapers or even with promotion in stores—maybe with the help of health insurance companies. But they also need personal information and contacts within environments where they frequently stay—like churches or clubs. Special courses about knowledge and training of the systems could be offered in educational centres, hospitals, rehabilitations or convalescence treatments. In hospital shops, care facilities, established long-term care support centres and in centres of consulting about technology they could disseminate the use of robots. The family doctor could reach the whole family; younger members could be reached by involving school activities like "day of technology".

Renting, leasing, borrowing and sharing models will increase the willingness of testing the solution. The benefits for seniors, family members and the social environment have to be communicated and felt. Timesavings as well as a sense of security are a precious support. Robots should not replace communication—they should enhance and strengthen families and social networks. Robots are a tool for making life easier—and thus social contacts are supposed to be preserved. Training by experienced people and a stable contact person will increase perceived usefulness und ease of use. Additionally users and also financiers could share the robot, so it could be a present of several relatives.

Fig. 7 Stakeholder card "Social Context/Family"

4.3.6 Service and Product Provider

For the implementation of planned Robot-Era services the participation of the stakeholder cluster "different service and product providers" is crucial. Winning sufficient and comprehensive business partners becomes the precondition to bring these services onto the market. Therefore the service and product providers (Fig. 8) are fairly relevant for the service deliveries. They are evaluated with two stars.

The aims of the communication strategy are to communicate the relevance of robotic services and modules, how robots can deliver extra value to customers, and how robots

Fig. 8 Stakeholder card "Service and Product Providers"

can be integrated in existing services and structures or be used to build new services.

The first step of the communication program is to inform the potential partners by information brochures or more interactive means, such as trade fairs and congresses. The second step is the personal contact. Partner relationship management and business-to-business sales and distribution are important strategies.

The marketing focus should be on market aspects: This stakeholder cluster can gain new markets and new customer groups by including robots in their products and services or the other way round. By this, the providers' image will become more innovative. The specific functionalities and possible services of the robots should be advertised. Advantages e.g. to reach more customers at once in rural areas have to be communicated. Concerns about insufficient sales and the unclear financing must be addressed. The focus should also be on legal conditions, regulations, liabilities and (quality) standards—where missing structures have to be built up before the market can really start to grow. To convince product and service providers, safety, reliability and technical feasibility should be demonstrated and proved. Qualified contact persons should be available for trainings to increase the acceptance and thus the use of the technology.

4.3.7 Domestic Constructors and Renters

In case of assistive robots it is considered that an implementation or investment in these technologies would not be passed-on to the end-users. So for this sector assistive robots does not implicate a clear added value at the moment. The stakeholder "housing industry and real estate" (Fig. 9) got rated medium relevant with two stars. Only after recognizing strong demand by end-users there is an incentive for housing industries to offer assistive robots to the renters. At the moment it is assumed that the housing industry is rather less relevant for diffusion of assistive robots technologies—but should continuously be informed and convinced to change their attitude and to enhance their relevance for diffusion. A higher relevance might be seen in the market of assisted living.

With regard to the objectives of the communication strategy, the domestic constructors could operate as intermediaries between end-users and technology providers. So the communication goal is to keep them up to date with the latest developments in the field of service robotics. At the same time the end-user should be in the focus of the marketing to be convinced of the benefits of robotics. If the end-users' demand rises, the domestic constructors would be more and more convinced to invest in these new technologies.

In terms of communication channels it is recommended to use newsletters, professional journals and relevant networking events to introduce service robotics technology to this stakeholder cluster. To address the renters, digital platforms for apartment search could advertise robotics information concerning assisted living. Real estate agents could be convinced of the new technology as they are holding a respected position in this field, therefore they will be relevant as a new target group for the diffusion of the robots. Also organised neighbourly help could arrange information events.

Marketing recommendations are hard to make because real estate owners are currently not willing to pay for complex assistive robots solutions. One of the main arguments against assistive robots is that robots do not support the housing industries' current business models. But as the stakeholder cluster housing industry and real estate could make use of lots of robotic functions, they should also be in the marketing focus, and can be a prospectively rising business segment. Initially marketing activities should inform about available technologies. At the same time the focus should be on the renters to raise demand and to indirectly influence the housing industry. The stakeholder cluster could put interested seniors in contact with the technology provider and could help to spread the innovation by individual product recommendations.

Fig. 9 Stakeholder card "Housing Industry and Real Estate"

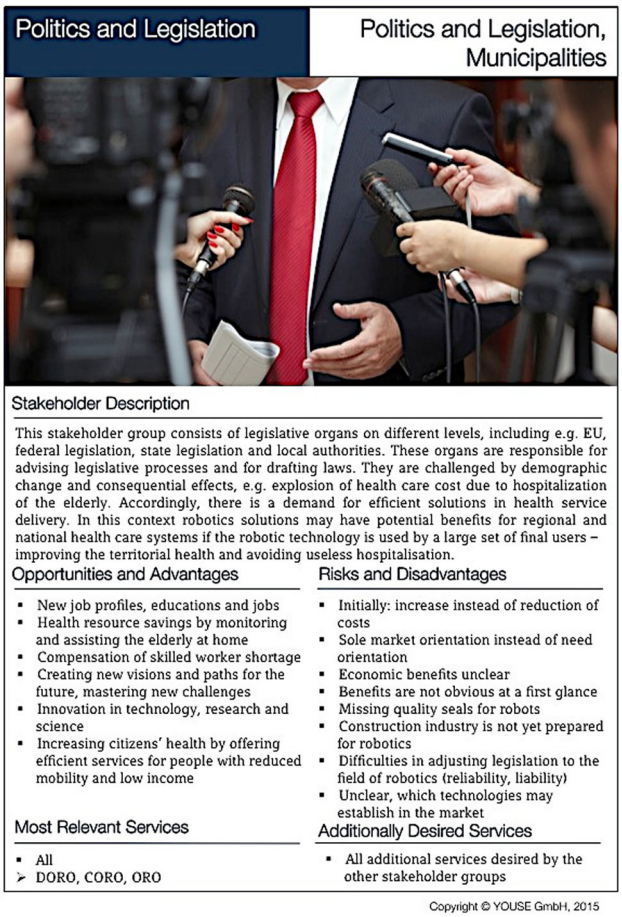

Fig. 10 Stakeholder card "Politics and Legislation, Municipalities"

4.3.8 Politics and Legislation

The stakeholder cluster "politics and legislation, municipalities" (Fig. 10) is very relevant for the diffusion of the Robot-Era solutions because representatives of this cluster can lay the foundations for increasing acceptance of other stakeholders who complain missing laws and regulations. Politics and legislation should address the following topics: legal conditions, liabilities, (quality) standards, financing, data safety and security aspects like responsibility in case of accidents. A cooperation of this stakeholder cluster with the other groups is necessary to address these issues.

The aim of the communication strategy is mainly to focus on the importance of this cluster for all the other stakeholders and to indicate the others' dependency from new laws and regulations. The main advantages must be communicated. This cluster has to be attracted as a promising partner for the marketing of the Robot-Era systems.

One of the main instruments to inform, convince and get this cluster on board—even if it is negatively connoted—is lobbying through different interest groups or associations. Relevant events and the work of think tanks, expert committees or committees of the parliament can influence this cluster and the formation of public opinion. A further way to evoke interest in the Robot-Era solutions is the promotion through public relations. Different activities are summer school events, open days, online media activities on platforms, TV and public radio reports.

To convince especially politicians, marketing contents and recommendations should emphasize topics they can use for self-marketing and enhancing their image. E.g. it can be focused on advantages like the innovation in technology, research and science compared to international standards. A further very important topic is the compensation of skilled worker shortage. Through the use of robots new jobs may be provided in innovative sectors. Health resource savings and the increase of the citizens' health can be other important arguments.

4.3.9 End-User

The stakeholder card in Fig. 11 displays the front of the card "End-users with high level of user autonomy (HLUA)".

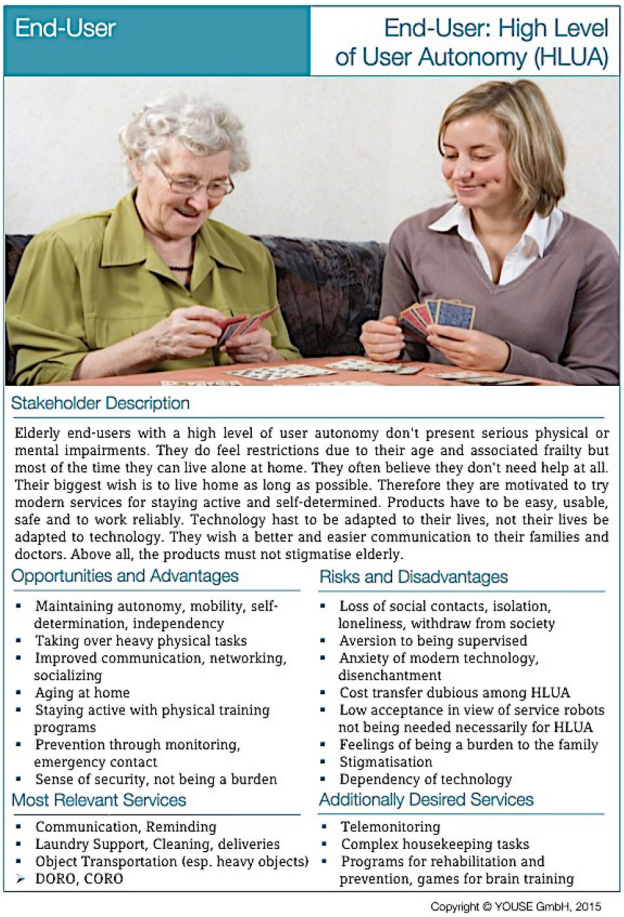

Fig. 11 Stakeholder card "End-User: HLUA"

The relevance of diffusion is rated with three stars. The stakeholder cluster 'end-user' comprises the primary end-user groups. The users with HLUA are very relevant because they can learn the use iteratively while aging. The robot can continuously be adapted to changes and increase acceptance that way. According to the study results only a restricted number of current seniors themselves will buy such a robot, but they can be convinced so that they and their relatives fall back on it when needed. They are more flexible to reach their aims like keeping in touch with friends and family. Elderly sometimes are loyal to brands hooked once, so they need to get very good services in order to recommend it to other seniors.

Communicating longer independency and therefore not being a burden to relatives is central for the communication strategy. Seniors have to consider that they will need help in the near future to stay independent, and that learning in a step-by-step process will be easier. This could help stay autonomous as long as possible. Some seniors struggle with accepting help and that help can come in form of technology also. Scepticism about new technologies must be taken into account. Robots are not that stigmatising as walking frames; instead they are modern and futuristic—and can even be seen as a status symbol. A robot able to monitor vital signs could probably detect health risks earlier. But there is also the need for an increasing sense of security to enhance the peace of mind of relatives. This approach could help seniors staying at home longer before moving to a retirement home. Relatives need to be convinced of the benefits of buying a robot for their family members.

Communication channels and programs have to be thought-out well. The family doctors, who know the medical history and follow the aging process, can spread information and recommendations. Other personal environments like churches, clubs, events (concerts, theatres), fitness and sport courses, community and charity activities could support a positive marketing for robots. Advertisement could also be placed in trains, airplanes and on cruise ships. Public relations could evoke interest in the robots and therefore increase the users' trust. E-mails and personal letters can be used for direct marketing. TV, radio and print media (newspapers) are further suitable channels. The use of the internet can be interesting in the future, as its use already increases among the target group.

Marketing content and recommendations have to be appropriate as elderly are sensitive, demanding and professional customers. They have to be addressed as a competent target group. Clear descriptions of functions and benefits as well as the unique selling proposition (USP) should be used. The content should be structured for the elderly by considering physiological age related changes. Very striking slogans, foreign and technical terms and an overload with complex information should be avoided. Authenticity, objectivity and addressing the elderly in an active and positive way are important. Seniors involved in social networks interacting with different generations could be of advantage. A maxim could be: "I may be retired but that doesn't mean I'm getting old."

4.4 Summary of the Marketing Focus for Stakeholder Clusters

Longer independency through neutral support in everyday life as well as increased safety and health should be communicated directly and understandable—because these are the main benefits and the greatest added value. End users are drawn more into the receiver and the social network in the donor's position; therefore donors primarily are to be focussed.

The medical network is interested in the reduction of the physical workload and in the higher availability of skilled labour to be able to increase the personal contact with patients with parallel cost and budget savings. For this purpose, improving the quality of care of patients, data security, reliability and liability must be clarified and communicated.

Insurance companies especially think about the challenge of sufficient care supply in the course of demographic change. Their focus is on the profit due to new, sustainable supply methods that could be addressed with financing models like hiring the robots.

Domestic constructors and renters are hard to reach, because they do not yet see the full value of the robot and the market potential, therefore they are not willing to pay for it. The marketing focus should lie primarily on the renters by offering individual services to achieve a change of supply by increasing demand.

The perspective of the policy refers to the legislation (e.g. liability for accidents, data protection, data security), cost and resource savings and sustainable improvement of the health of the society. Timeliness of the research and creation of new fields of work would be effective self-marketing aspects of this stakeholder.

The service and product providers are interested in the costs and revenues from the provision of the services and the infrastructure. They need to keep up with the market to innovate and identify market potentials and user requirements at an early stage. This is where marketing contents are set, to draw the attention of educational institutions, suppliers, vendors and technicians on the multidisciplinary robotic systems.

Generally, all marketing activities can only be successful if robotics are really fulfilling the promises made and therefore the requirements of the addressed stakeholders.

5 Discussion and Conclusion

5.1 Discussion of the Methods

Due to the high degree of innovation of assistive robotics, there are few empirical studies on marketing available yet. This required a very comprehensive analysis of the sensitive user groups and their characteristics. The mix of methods proved reasonable and necessary in detecting the heterogeneous interests. The little data on assistive robotics marketing emphasizes the need for an exploratory overall approach.

The selected methods resulted in findings that answer the relevant questions of the analysis and can therefore be considered effectively. On the basis of theoretical preconsiderations the studies could be merged to understandable results. The barriers, which were used as a basis for finding recommendations for actions, could be identified in detail due to the guided interviews. Since not every stakeholder cluster could be interviewed in large samples, possible starting points arise for further analyses. The survey provides qualitative results that should be confirmed quantitatively in future studies, which will be done e.g. in the upcoming experiments within the Robot-Era project.

5.2 Conclusion and Prospects

The acceptance of social robotics has been poor and the market largely untapped. The presented study identified twelve multidisciplinary stakeholders belonging to seven stakeholder clusters as well as acceptance barriers and recommendations for marketing contents concerning assistive robots for elderly in Europe. In future the stakeholder cards can be used as guideline for the stakeholder view for other service robotics projects.

Stakeholders have been evaluated by their relevance and correlation with each other. Which stakeholder plays the greatest role and thus has priority for the marketing orientation cannot be said, as this depends on the future developments and activities in robotics. It can be assumed that the acceptance of products that are targeted to the abilities and needs of users is higher than for products developed mainly from a technological perspective. It can be seen that for the user for example the design of a robot is sometimes more important that its technological complexity. But the perception on that also depends on the culture of the target group. This should be kept in mind when designing a robot. However, long-term success cannot be guaranteed nor for the development process neither for the specified marketing strategies. For this purpose, experiences with similar products are lacking and qualitative and quantitative long-term studies must be conducted. Another limitation regarding the stakeholder needs is the focus on Europe. There is further research needed to analyse the needs of stakeholder of undeveloped countries, because there are different economic structures resulting in different needs. The results of this work are based on studies of a continuing project meaning that they should not be seen as written in stone. The second experimental implementation of the Robot-Era project in spring 2015 will provide additional results.

In long-term studies the robots would have to be used or brought to market in an established system involving all relevant stakeholders and considering quantitative evaluations. Besides technological limitations of the current prototypes there are mostly ethical and social, organizational and market-driven barriers identified.

The major priority in future is on the spreading of knowledge. This could be achieved through more effective communication between science and industry and by incorporating mass media. The potential application fields of assistive robots for elderly are evident, but the services and business models must be compatible with existing structures and should be evaluated with that focus. This includes also sharing, leasing and renting of robots. It is necessary to take the cost carriers up on their promise for the clarification of costs' acquisition and financing, especially for private households. This depends on the proof of the cost efficiency in long-term studies. Due to unknown variables such as main-

tenance costs, energy costs and economies of scale, a realistic estimation of the prices is hardly possible today. Likewise, the assumed operating time of the robot remains unclear.

Furthermore, the clarification of judicial parameters is a basic requirement for the diffusion. Due to the lack of an institutional framework, it is important to clarify legal issues relating the liability for damages and the assumption of responsibilities. So far, the robots are focused exclusively on the application in the target group of seniors.

Stigmatisation is a topical issue for older users. An extension of the target group with the inclusion of physically disabled people, single parents or pregnant women may throw a different light on robotics.

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