Interreg
North Sea Region
EXSKALLERATE
European Regional Development Fund

EUROPEAN UNION

EXSKALLERATE

Best practices report

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Introduction

The overall objective of EXSKALLERATE is to accelerate the adoption of exoskeletons into construction and industrial manufacturing SMEs, where heavy physical work leads to severe health issues, and thereby, strengthen SME competitiveness in the North Sea Region.
As many as 44 million workers in the European Union (EU) are affected by workplace-related musculoskeletal disorders (MSDs), at a total annual cost in excess of €240 billion to the European economy. Exoskeletons have the capacity to decrease the number of musculoskeletal injuries and increase quality of life at work, thereby reducing costs for a company in the long run.
Six partners (see table 1) cooperated in this project and compiled results in six different work packages with the overall approach to:
1) Identify SME challenges to influence the co-design of field labs where next-generation exoskeletons integrate improvements. Improved exoskeleton benefits are validated in end-user pilots sites.
2) Hold informative workshops for SMEs where exoskeleton experts present and receive feedback on tools to support SME decision making in exoskeleton adoption, a key challenge limiting adoption.
3) develop transnational benchmarking to accelerate industrial exoskeleton standardisation (Needed for SME decision making).
The results of best practice in these work packages are summarized in this document.

This report was put together by HAWK University on behalf of the EXSKALLERATE consortium.

Partnership

Six Northsea Region countries formed a partnership in this project and worked on identifying challenges for small and medium sized enterprises (SME) to implement and use exoskeletons and on how to improve existing exoskeletons for the areas tested in.

table 1 EU partners Exskallerate

The Netherlands	Belgium	Germany	United Kingdom	Sweden	Denmark
InnovationQuarter, TNO Netherlands Organisation for Applied Scientific Research, University of Twente	VUB (Vrije Universiteit Brussel), KUL (Katholieke Universiteit Leuven), POM - West Flanders	MoWiN - Regionalmanagement Nordhessen, HAWK University of Applied Sciences and Arts	Built Environment - Smart Transformation (formerly Construction Scotland Innovation Centre), National Manufacturing Institute for Scotland (NMIS) at the University of Strathclyde	University of Gävle	Aalborg University, Centre for Information Technology and Architecture (KADK)

Compilation of best practices and key project activities for replication (report)

Exoskeleton design improvements (WP3)

Design and Development Recommendations to Improve the Industrial Exoskeletons of Future

In EXSKALLERATE project, more than 400 SMEs, construction and logistics companies participated in the testing phase. The performance of more than 25 commercially available passive industrial exoskeletons was assessed by performing various tasks of common workers. These tasks involved overhead, shoulder level, bending, lifting, moving and kneeling position activities. It was found that each of the exoskeletons tested was merely effective for a limited range of motion and for a specific posture. For all other postures and positions, the same exoskeleton was not helpful. The tests were conducted in lab environment as well as pilot sites were also set up at the actual sites of various SMEs, construction, and logistic companies to evaluate the performance in real work environment. Indeed, many of these exoskeletons provided useful support to certain muscles and reduced the muscle activity of the workers by up to 60%.
Based on the findings of this project, this section presents its suggestions and recommendations to reduce the design problems found in these exoskeletons in order to improve the usability and acceptability of these devices among workers of small and medium companies. It is important to note that these design suggestions are mainly based on the experimental studies performed in this project.

i. Emphasis on more realistic simulation

Even though the exoskeletons tested in this project provided assistance and support, still these devices are predominantly rigid, heavy, having poor human-exoskeleton interfaces, and are less compliant. Therefore, there is a dire demand to develop several simulation models prior to the development of physical prototypes since developing these physical prototypes utilizes a lot of time, labor and financial resources. Therefore, it is vital for developers to perform co-simulation between digital human and exoskeleton models [1]. It may be accomplished by using Biomechanics analysis software such as OpenSim or Anybody. These simulations could be quite effective to enhance the usability aspects such as human-exoskeleton interfaces, and contour design of links and joints.

ii. Biomechanical Compatibility

Exoskeletons must be designed with a human-centered design process to achieve maximum acceptance. This is also true for kinematics, as exoskeletons influence their kinematics on humans. If biomechanical compatibility is not ensured, several unwanted consequences in the physical human-machine interaction happen.
The most common shortcoming in the design of these exoskeleton is that rotation joints are modeled as hinge joints. For example, the elbow joint in the upper-body exoskeleton is frequently modeled as a simple hinge joint, the elbow is actually a complex system with changing rotation axis over flexion/extension [2]. Therefore, the developed exoskeletons based on such a design where the elbow is assumed as a hinge will have misalignments between the joints of the physical prototype and the human user. This is only one example of how biomechanical modeling needs to be refined to provide productive input to exoskeleton developers to avoid such misalignments.

It is important to note that most of the exoskeletons rotation joints are modeled as hinge joints. Researchers and the industry need to generate a biomechanical rigid full-body model with detailed joint characteristics and anthropometric scalability [1].

iii. Enhancing flexibility and range of motion

The existing models lack inclusion of actual work-space related limitations, e.g., long protruded parts, as shown in Fig-1 below, exists in Eksovest restricts the mobility of workers while operating in narrow paths. Therefore, certain tools must be developed to simulate human-exoskeleton along with their work-space boundaries.

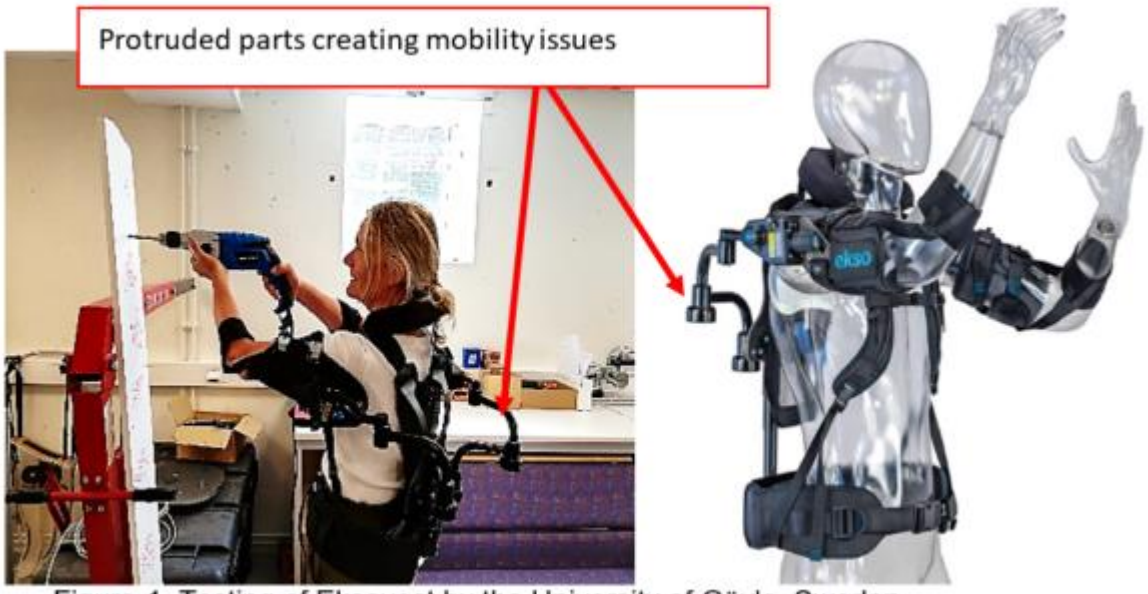

Figure-1: Testing of Eksovest by the University of Gävle, Sweden.

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iv. Kinematics improvements

For each joint of the human body, compatible external kinematics need to be designed in the sense of a morphological box. These kinematics need to be evaluated with standard mechanical and dynamic calculations, as well as with the simulation compatible with human biomechanics and with each other. Future developers need a database of exoskeleton kinematics for all human joints, including categorization and assessment [1]. Application-oriented research projects are required to develop such a database. Experts in the fields of kinematic synthesis and biomechanics are essential to secure the success of such projects.

v. Standardization and Planning Challenges

Lack of specific exoskeleton standards and certifications have been described as barriers to the adoption of exoskeleton technologies in the industry. While exoskeletons are not considered a traditional form of personal protective equipment (PPE) they are similarly wearable, and much of the interest in their application in the industrial/workplace domain is motivated by injury prevention [3].

This will be achieved on three levels. In Level 1, the information will be directly communicated to standards developing bodies, specifically ISO, CEN and their members. In Level 2, assistance will be sought from organizations with interests in industrial robotics to add support to RoboMate when seeking to use the project's results to develop standards. Finally, the project details will be

distributed to increase the awareness of the Robo-Mate project to the public, end-users, manufacturers, and distributers of industrial exoskeletons.
ASTM F48 believes that standards and certifications for exoskeletons in their manufacture, deployment, and use would enhance their adoption in the workplace [3].

References:
[1]. Klaus Bengler, Christina M. Harbauer and Martin Fleischer, Exoskeletons: A challenge for development, 2022, Wearable Technologies (2023), 4, e1, doi:10.1017/wtc.2022.28.
[2]. Kapandji AI and Rehart S (eds). (2016) Funktionelle Anatomie der Gelenke: Schematisierte Und Kommentierte Zeichnungen Zur Menschlichen Biomechanik (Koebke J, Trans.) (6. Auflage). New York: Georg Thieme Verlag.
[3]. Lowe BD, Billotte WG, Peterson DR. ASTM F48 Formation and Standards for Industrial Exoskeletons and Exosuits. IISE Trans Occup Ergon Hum Factors. 2019;7:10.1080/24725838.2019.1579769. doi: 10.1080/24725838.2019.1579769. PMID: 31276081; PMCID: PMC6604650.

SME Pilot sites (WP3)

Within the EXSKALLERATE project, Aalborg University has performed several SME pilot sites (five up to date). This document will describe the procedures followed for setting up and running the pilot sites and the experience gained.
AAU and our department, in particular, are in close contact with the industrial world. SMEs have been reached by email, or contacts have been taken during dissemination events we have attended or hosted to raise awareness of exoskeletons in the industrial sector.
With SMEs who showed interest in testing exoskeletons, a first visit to the company was planned and carried out. The exoskeletons, including shoulder and back support exoskeletons, were presented to the workers during this visit and their application in the company was evaluated. It should be noted that in some cases companies have found that they could identify proper tasks to test exoskeletons. Upon a positive initial evaluation by the company, the actual tests began immediately after this first visit or on a second day.
Before starting to use the exoskeleton, all the workers willing to participate in the tests were interviewed. The first questionary was used to collect the feeling and expectations of the workers on the device as well as data regarding their job. The devices were then carefully fit on the workers, and the workers were instructed on how to use the device and configure it: change the level of support or fit. All the workers were then using the device for at least three days.
At the conclusion of the test, all the workers were interviewed a second time to gain feedback on the devices tested. For this purpose, the second questionary was used; it has both general and specific questions on the device and its effects during use.
We have prepared the questionnaires (presented in the Appendix) in two languages including English and Danish. Correspondingly, the interviews were also conducted in a language the workers were comfortable with.
From the completed pilot site tests, we found that exoskeletons for shoulder support are generally more mature than those for back support. Their use is more intuitive, and their first impression

from the users is generally better. Workers' first impression of the exoskeleton was critical as that can negatively influence the willingness to use the device.
In addition, we found no differences in the willingness to try the exoskeletons between age groups. A particular case was when young workers did not want to try the device even though older coworkers gave good feedback. It is very important to fit the exoskeleton properly from the start as some workers do not want to lose time changing its configurations as it will have to be used for a short time.
In general, the feedbacks received were very positive and showed the great potential of the exoskeleton in supporting workers during their shift.

Appendix A: Initial interview

1. Participant Characteristics

Date of Assessment	
Participant ID	
Age	
Gender	**Male / Female**
Dominant upper limb	**Right / Left**
Height (cm)	
Body Mass (kg)	

2. Initial question

1. Do you have any previous experience using exoskeletons? If so, on what occasion and which device have you used?

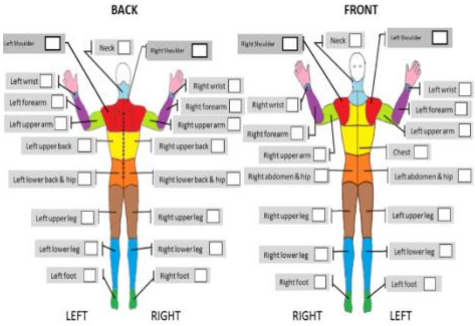
2. What do you expect from using the exoskeleton? Do you have a positive or negative idea of it?

3. Regarding your job, what are the most common tasks you perform?

3.1 Using the scale provided from 0 to 10. What is the level of exertion of the tasks you perform? And of your job as a whole?

4. Have you ever experienced discomfort, ache or pain in the joints?
If yes, during which tasks?

4.1 If yes, enter in the figure below an appropriate value to quantify the discomfort that you have experienced. Please use the scores from 0 to 10 of the perceived exertion rating scale provided, to quantify it. Place the scores in correspondence with the affected body region.



4.2 Regarding the discomfort, ache or pain that you have reported can you describe it?

- How long after the start of the work does it start?
- Could you identify it as muscle fatigue or joint pain?
- After completing the activity does it cease or continue, for how long?
- Have you ever taken sick leave days due to this pain? Indicatively how many or how often?

Appendix B: Final Interview

Participant ID:

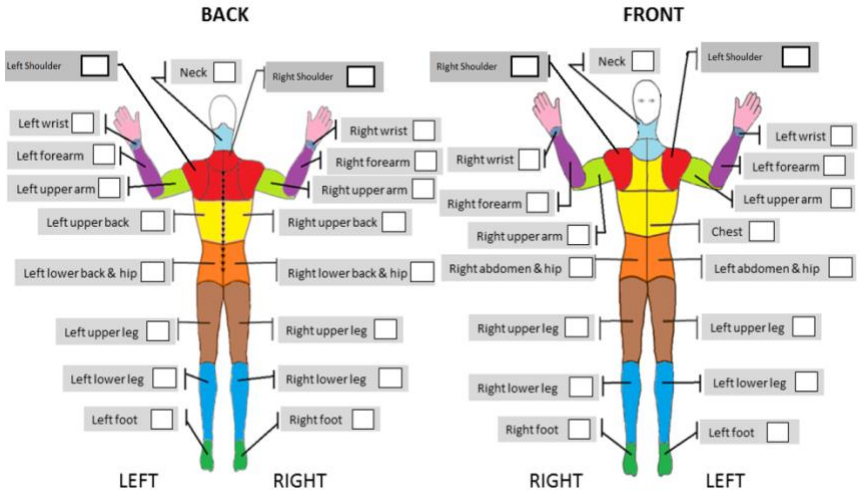
User Experience: Open Questions

1. Was your experience of using the exoskeletons the same, better, or worse than your initial impressions?

2. Have you encountered any problems with the exoskeletons? Please, describe the problem and with which exoskeleton you experienced it

3. Have you experienced a decrease in exertion in the tasks you perform and in all your job with the use of the exoskeleton?

Please use the scale provided to quantify the level of effort for the tasks and the entire job



4. Please use the scale provided
   With the use of the exoskeletons have you experienced discomfort in any joints or in other parts of the body?

   Please use the scores from 0 to 10 of the perceived exertion rating scale provided, to quantify it. Place the scores in correspondence with the affected body region

	Overall	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1	**Learning to use the exoskeleton is easy.**	☐	☐	☐	☐	☐
2	**Interacting with the exo. is frustrating.**	☐	☐	☐	☐	☐
3	I find the exoskeleton: **Easy to put on**	☐	☐	☐	☐	☐
4	I find the exoskeleton: **Easy to adjust to comfortably fit my body**	☐	☐	☐	☐	☐
5	I find the exoskeleton: **Easy to take off**	☐	☐	☐	☐	☐
6	I find the exoskeleton: **Feel heavy**	☐	☐	☐	☐	☐

	Moving with the exoskeleton	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
7	**The exoskeleton moves in the desired direction. (Follows my motion well)**	☐	☐	☐	☐	☐
8	The exoskeleton restricts: **My speed of movement**	☐	☐	☐	☐	☐
9	The exoskeleton restricts: **My range of motion**	☐	☐	☐	☐	☐
10	**Moves at desired speed**	☐	☐	☐	☐	☐
11	**Stops when desired**	☐	☐	☐	☐	☐
12	**Moves smoothly (no jerky movement)**	☐	☐	☐	☐	☐
13	**The exoskeleton affects <u>NEGATIVELY</u> my balance**	☐	☐	☐	☐	☐

	Working with the exoskeleton	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
14	The exo. fully supported the weight of the device being handled	☐	☐	☐	☐	☐
15	The exoskeleton did affect positively the expirenced load	☐	☐	☐	☐	☐
	Working with the exoskeleton	**Strongly Disagree**	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**
16	The exoskeleton did affect positively the physical fatigue	☐	☐	☐	☐	☐
17	The exoskeleton caused thermal discomfort	☐	☐	☐	☐	☐
18	The exoskeleton affected positively my productivity	☐	☐	☐	☐	☐
19	The exoskeleton does create conflicts with my work tasks	☐	☐	☐	☐	☐
20	With the exoskeleton was MORE DIFFICULT performing my work tasks	☐	☐	☐	☐	☐
21	There is a good chance that I will use the exoskeleton if provided	☐	☐	☐	☐	☐

informative workshops (WP4)

Best practices and key project activities: the informative and networking workshops
Michiel de Looze | TNO

Informative and networking workshops

In Exskallerate numerous informative and networking workshops have been taken place in all NSR partner regions over the past years. The idea behind these workshops is to connect manufacturing and construction SMEs to exoskeleton developers, academic experts, and policy makers / governmental bodies.
The aim is to allow for dialogue between the relevant actors and to increase awareness of the potential of occupational exoskeletons across SMEs, to increase awareness of the specific needs for support to SMEs in the manufacturing and construction sector across exoskeleton

developers, experts and policy makers. By the workshops the barriers for adoption should become clear as well as effective means to reduce them. This is coupled with EXSKALLERATE partners showcasing the developed adoption guidance and cost-benefit tools.
Workshops has been organized of a varying size and scope. Smaller workshops have been organized, addressing on the specific needs in one specific (sub)sector (e.g. roof building) with the introduction of one ore two exoskeletons that could potentially be of help. On the other hand, relatively large workshops were held with a broad scope on manufacturing and/or construction and with multiple types of exoskeletons being demonstrated and discussed.

Best practice: Exobition & Talk
Aim
Exobition and Talk was organized by TNO as an informative and networking event in Rotterdam, The Netherlands, June 24, 202.
The workshop “Exobition and Talk” aimed at increasing awareness of exoskeletons at companies and gathering insights from companies about their challenges and requirements for successful adoption of exoskeletons. Especially small and medium-sized enterprises (SME’s) are often unaware of exoskeletons as an available solution for heavy work in their working environment, and were therefore invited. Specifically, the workshop was held to:

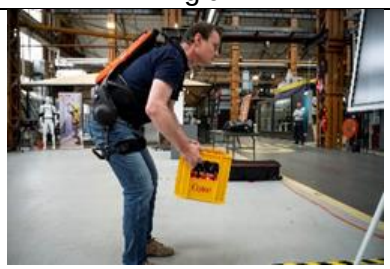
1) Connect exoskeleton developers with companies interested in exoskeletons
2) Identify and discuss challenges and barriers for implementation of exoskeletons
3) Share the knowledge of TNO on potential benefits of exoskeletons in industry

Attendants: exoskeleton developers
TNO addressed two types of exoskeletons during the workshop: arm-support exoskeletons and back-support exoskeletons, because these types of exoskeletons

- address the body regions susceptible for injury and needing mechanical support most frequently, namely the low back and the neck-shoulder area.
- are considered to be market ready

The following exoskleton developers were invited to the workshop: Auxivo, Laevo, German Bionic, Pretec/Hilti/Ottobock, Skelex and Comao, showing the exoskeletons presented below

Back-Support	Arm-Support
 Auxivo, LiftSuit, passive, soft	 Skelex, Skelex 360, passive

 Laevo, Laevo Flex, passive, rigid	 Comao, Mate, passive
Ottobock, Back,  Paexo passive, rigid	 Ottobock/Hilti, Paexo Back, passive
 German Bionic, Cray-X, active, rigid	

Attendants: potential exoskleton adopters

TNO made a selection of manufacturing and construction companies from the Netherlands where we believed based on our knowledge and experience a back-support or a arm-support would have potential. In other words, companies where workers perform work with the trunk bended or with the arms elevated for part of the working time.

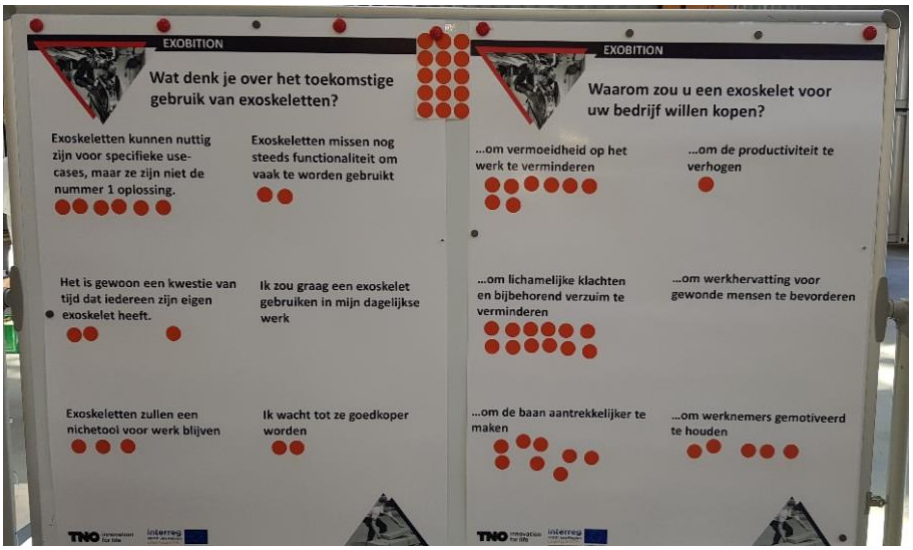
This selection resulted in a mixture of SMEs and large companies to attend the workshop. These companies represented a wide range of occupations, such as tilers, logisticians, rail constructors, painters, floorers, airplane cleaners, postal services, and concrete workers. In total 15 companies (on average 2 people form each company (mainly managers and health and safety specialists) joined the workshop. The estimation was that half of the companies would be interested in the back-support exoskleton and the other half in an arm-support exoskeleton.

Program part I: 'Exobition'

The workshop started with a short introduction by TNO, explaining the goal of the workshop and the course of events. After that, each exoskeleton developer had 2 minutes to pitch their booth and the regarding exoskeleton(s) to the participating companies. Afterwards, the companies shortly introduced themselves, sharing their field of expertise and any previous experience with exoskeletons. Subsequently, the companies could walk around for 2 hours, trying on exoskeletons and getting in contact with exoskeleton developers. Besides the exoskeleton booths, posters with statements were hanging in the hall, on which participants could voice their opinion by pasting stickers

Program part II: 'Talk'

After the demonstrations, the companies were divided into two groups. One group discussed challenges and barriers for exoskeleton implementation of back-support exoskeletons, whereas the other group did the same on arm exoskeletons. The companies could decide themselves which group they wanted to join. In these discussions TNO started by asking for the companies' positive and negative experience they made with exoskeletons. This could have been experience they collected during the Exobition, but also previous experience they made by e.g. testing an exoskeleton in their working environment. Subsequently, we asked each of the companies to think of a potential use-case in their company that might be feasible to be supported by an exoskeleton. Together with the company we discussed that use-case, by



writing down the postures of the employees, the frequency of these postures, and potential factors that might influence acceptance in the working environment.

Outcomes

All participants were given enough time to experience the feel of wearing all of the available exoskeletons in the workshop and discuss the exoskeletons with the exoskleton developers. Hereby, they received a good overview of the state of the art of the exoskeletons. All participants have been able to present their own use case (work situation) and got feedback form exoskeleton developers about the opportunities and barriers of exoskeleton adoption. Follow-up meetings were arranges among exoskleton adopters, potential end-users and TNO.

The following ‘take away messages’ were listed

1. Before implementing an exoskeleton, a company should check whether there are more ‘simple’ solutions other than exoskeletons possible
2. Making a good analysis of the usability and potential effectiveness of an exoskeleton prior to testing and implementation is important
3. Currently existing exoskeletons are quite similar but do show some differences in wearing comfort, motion of freedom, and level of mechanical support
4. Good instruction on how to use the exoskeleton and how to adjust the exoskeleton to the user is important
5. Be aware of your goal: Is that the health of the employees or the improvement in efficiency?
6. To reach a high level of acceptance, the users have to feel the effect of the exoskeleton
7. Implementing the exoskeleton in a team might ease the implementation process

Conclusions

Multiple workshops have been organized in the NSR regions in the past years. By these workshops we have met the objectives. we connected many exoskeleton developers with many companies interested in exoskeletons. We increased the potential end-users’ awareness of exoskeletons as a potential solution. Due to the intensive discussions we could listen to the companies’ challenges, barriers and opinions on exoskeleton implementation. The workshops often lead to follow-up actions (i.e. next steps towards adoption) like further discussions between exoskleton developers and companies, field observations, exoskeleton testing in the field, and further presentations to dedicated groups of people (e.g. sector organizations, policymakers).

Follow-up with standardization bodies (WP5)

Standardization is not only a tool to assess and compare the performance of different exoskeletons, but also a way to define and support certification necessary to introduce exoskeletons to the market. However, it is not straightforward. Based on our experience, we have summarized some best practices to guide future work.

1. Standardization bodies

Before starting the preparation of standard drafting work, It is necessary to identify the target level of the standard and the organizations that will be involved. There are the organizations dealing with standards in different levels and fields. For instance, standard work at different levels is as follows:

- NBN: Belgian standard (national level)
- CEN: European standards (European level)
- ISO: Worldwide standards (worldwide level)
- Additionally, there are also some specialized standardization bodies, for example:
- CENELEC: It is the European standardization committee for electrotechnical standards.
- ETSI: It is responsible for European standards in telecommunications.
- IEC: It is the international standards committee for all electrical, electronic and related technologies.
- ITU-T: It stands for international standards in telecommunications.
- DIN: Deutsche Industrie Norm

IEC and CENELEC are aiming at standards in the field of electrical systems, at worldwide level and European level, respectively. And the organization CEB-BEC is the Belgian representative/member of IEC and CENELEC. The counterpart to CEB-BEC for more “general” standards is NBN, which is the Belgian representative/member of ISO and CEN.
Therefore, it is important to know which level and organization the standard will reach. Based on our contact with experts from different organizations, they thought that the standard that we are engaging and developing is more general, so it would better to submit to ISO rather than IEC. Furthermore, it would be better to launch the proposal through national level first. However, since our partners are working from different national channels, it is still unknown that the proposal should be launch in one single country or all different countries.

2. ISO, Technical Committee (TC) 299 and Working Group

ISO has numerous Technical Committees, and a first step to propose the elaboration of a new standard is the identification of an appropriate TC. A list of ISO Technical Committees is available through the following link https://www.iso.org/technical-committees.html . In our case, we are not starting a new working group or TC, there is an existing TC 299, under which a large number of robot related standards has so far been developed. Also, recommendation from ISO experts, TC 299 could be an appropriate choice, as there is already an ISO/CD 5363 “Robotics — Test

methods for Exoskeleton-type Walking RACA Robot" in ISO/TC 299/JWG 5 "Joint ISO/TC 299 - IEC/SC 62A - IEC/SC 62D WG: Medical robot safety".
The current structure of this TC, its (joint) WGs, chairs, and main activities are summarized in figure 1. As it can be seen, there are eight working groups at present. As discussed with Prof. Gurvinder Singh Virk, who is leading ISO/IEC work groups on robot standardization, WG 3 and 4 may be suitable for submitting our work to. However, the focus of these two working groups differs. If the standard related to exoskeletons is submitted to WG3, the focus will likely be on safety. On the other hand, if it is submitted to WG5, greater emphasis should be placed on the extent to which the exoskeleton can improve performance from an industry perspective.

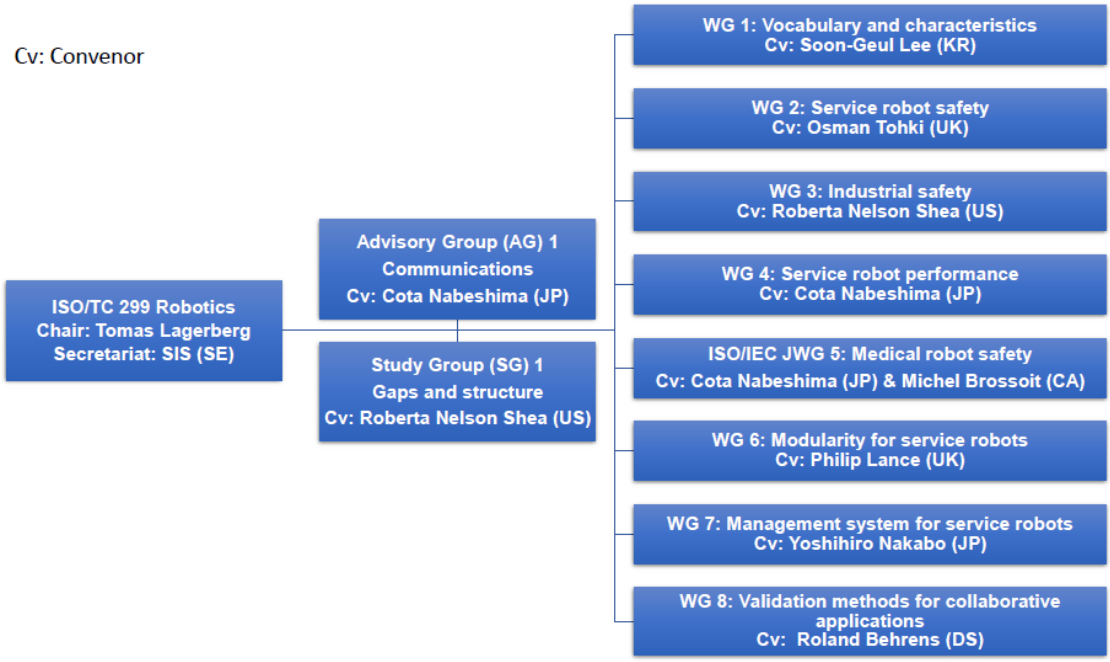


Figure 1. The current structure of TC 299 (Projects (iso.org)).

3. Standards development

There are four steps in standard development: proposal, draft, public inquiry, and publication.

1) Proposal:
The development of a new standard starts with a proposal. This proposal can be submitted by anyone. The template for the proposal can be found in this link https://www.iso.org/stages-and-resources-for-standards-development.html. As mentioned above, careful consideration should be given to which working group the standard will be submitted to, as the different focus of each group can have a significant impact on the proposal. After submitting the proposal, the proposal shall be introduced in the system. This can be done by the national mirror committee. the expert from national certification body will look for the appropriate work group. And the proposal will be discussed in a work group meeting or at a plenary meeting in order to create awareness and to find at least 5 countries sending experts to elaborate the standard. Following this, the proposal will be voted and if the result is positive, the draft work can start.

2) Draft
After the proposal is accepted, the standard is considered by a standards committee or technical committee, which works to create a draft standard in collaboration with national standardization bodies. In Belgium, this could be done in partnership with NBN, along with its sectoral operators.
3) Public inquiry
The Standards Committee carefully reviews all comments received from the public and makes necessary modifications to the draft standard
4) Publication
After all comments and feedback have been incorporated, and the draft standard has been amended and approved, the new standard is officially recognized and published

4. Conclusion

The discussions around standardization, certification and benchmarking of exoskeletons are still (and will be) ongoing. As it is a topic that has growing interest and relevance, here are multiple parties worldwide contributing to it. On the other side, “exoskeletons” is a very broad term, that can point to very different devices with very different characteristics, purposes and features. It can be assistive, augmentation or rehabilitation devices, powered or unpowered (or something in between), to be worn for minutes or permanently during an entire day, and finally aiming lower limbs, upper limbs, specific body parts or the entire human body. It is also important to realize there are many different parties involved, all with their own interest and maybe different expected outcomes: the standardization bodies themselves, academics, exoskeleton manufacturers/suppliers and the end users.

In short, if you want to contribute to the discussion, the best way is to contact your national standardization body and inquiring about which are the relevant WG’s for your specific application. From there, you should be able to come in contact with the right people. Inquire about the process and the stage they are in, and see how far your engagement will go. The standardization is a lengthy process requiring the engagement of experts for a long time, and simply depositing your knowledge there might not lead to the desired outcome.