

Innovator Handbook

November 2017

TOYOTA
mobility
FOUNDATION

MOBILITY
UNLIMITED
CHALLENGE

Introduction

Entries to the Mobility Unlimited Challenge are now closed. This handbook will remain publicly available for reference purposes.

Welcome to the Mobility Unlimited Challenge's Innovator Handbook. This introductory section covers why we're running the Challenge, who's involved, how to use this Handbook to learn what we're looking for, and how to participate in the Challenge.

Foreword

In 2017, the Toyota Mobility Foundation launched the inaugural **Mobility Unlimited Challenge** - a \$4 million challenge which aims to harness creative thinking from across the world to accelerate innovations in assistive mobility devices that will transform the mobility and independence of people with lower-limb paralysis. The Challenge will reward the development of personal mobility devices incorporating intelligent systems.

The Toyota Mobility Foundation was established in August 2014 to address urban transportation challenges and expand personal mobility for all people. The Foundation aims to inspire the next generation of mobility solutions by sharing Toyota's expertise in technology, safety, and the environment with partners at universities, governments, non-profit organizations, research institutions and other organizations to address mobility issues around the world.

The mission of the Toyota Mobility Foundation is to enable more people to go more places by sharing knowledge, partnering with others, & using their innovative spirit to build a more joyful mobile society.

In service of its mission, Toyota Mobility Foundation has launched the Mobility Unlimited Challenge to attract a diverse pool of innovators, encouraging them to push boundaries, explore uncharted territory, challenge the status quo and go beyond what seems possible in order to change lives.

Who's Involved

Toyota Mobility Foundation

The Toyota Mobility Foundation was established in August 2014 to address urban transportation challenges and expand personal mobility for all people. The Foundation aims to inspire the next generation of mobility solutions by sharing Toyota's expertise in technology, safety, and the environment with partners at universities, governments, non-profit organizations, research institutions and other organizations to address mobility issues around the world.

To find out more visit www.toyotamobilityfoundation.org

Nesta's Challenge Prize Centre

Nesta's Challenge Prize Centre is an internationally renowned centre of expertise in the design and development of challenge driven innovation for societal impact.

To find out more visit www.nesta.org.uk and www.challengeprizecentre.org

Nesta is a registered charity in England and Wales 1144091 and Scotland SC042833.

How to Use the Handbook

- This Handbook is for innovators. It aims to support your participation in the Challenge. It contains all the information you need including what to expect throughout the Challenge.
- This Handbook will help you to understand how the Challenge works and the terms and conditions for participation.
- You can read sections independently, but we recommend that you read the entire Handbook before you apply to the Discovery Awards or enter the Challenge.
- If you've read the handbook and you still have questions, contact the team at mobilityunlimited@challenges.org or use the [online contact form](#).

Key Dates

Key Dates	
Global Launch and Opening of Entry Period	16 Nov 2017
<i>Deadline for applications to Discovery Awards</i>	7 Feb 2018 (23:59 GMT)
<i>Announcement of Discovery Awardees</i>	11 Apr 2018
Deadline for Entries to the Challenge	15 Aug 2018 (23:59 BST)
Announcement of Finalists	14 Jan 2019
Deadline for Finalist Written Submissions	8 Jun 2020 (23:59 BST)
Announcement of Winner	September 2020

Definitions and Abbreviations

Acronyms

AI - Artificial Intelligence

AT - Assistive Technology

CPC - Challenge Prize Centre

TMF - Toyota Mobility Foundation

Definitions

Assistive Technology - Any product or service that maintains or improves the ability of individuals with disabilities or impairments to communicate, learn and live independent, fulfilling and productive lives.

Artificial Intelligence - Replicating the cognitive and perceptual tasks of a human with a machine, encompassing learning, decision making, visual perception and proprioception.

Challenge (also known as a challenge prize) - A means of encouraging innovation by offering a reward to whoever can first or most effectively meet a defined issue or problem. Used as an incentive or 'inducement' to meet a specific challenge, rather than a reward for past achievements.

Functional Electrical Stimulation (FES) - A technique that uses low energy electrical pulses to artificially generate body movements in individuals who have been paralysed.

Intelligent System - A system comprising sensors and processors, taking a sense input and automatically transforming it into an output.

Machine Learning - a type of artificial intelligence (AI) that allows software applications to become more accurate in predicting outcomes without being explicitly programmed.

Mobility - The ability for an individual to move from one place to another freely and easily.

Orthosis (adj. orthotic) - An artificial support or brace for the limbs or spine.

Paralysis - The loss of the ability to move one or more limbs or muscle groups. It may be associated with loss of feeling and other bodily functions. It may be complete (no movement or sensation) or partial (some movement or sensation, also known as palsy).

Challenge Pot - The total amount of money available for distribution to entrants in a challenge.

Robotic Exoskeleton - An artificial external supporting structure for the body with powered, motorised movement controlled in full or in part by a computer.

Smart System - A system comprising sensors and processors, taking a sense input and automatically transforming it into an output.

Smart Wheelchair - A wheelchair containing computer chips and sensors, which are capable of autonomous navigation / navigation assistance and other robotic functions.

Our Vision

Our vision is a world where everybody has the freedom to move. This section outlines why we are running the Mobility Unlimited Challenge, today's context, and tomorrow's possibilities. It explains how you can change the world and how the Challenge can support you.

The World Today

Enabling people to move freely is essential to unleashing human potential. We believe mobility is the key to helping every individual live up to their full potential – because when you are free to move, anything is possible.

Mobility is a fundamental part of being independent and free to participate in society, including everyday living, work and leisure activities. Yet, globally, society is not fully inclusive to millions of people with lower-limb paralysis.

The most common causes of paralysis are strokes, spinal cord injury and multiple sclerosis. While there are no statistics on paralysis worldwide, the World Health Organization estimates there are 250,000-500,000 new cases of spinal cord injury globally every year.

While there is no single experience of paralysis, people with paralysis face barriers to their mobility, and therefore their independence, because of inaccessible environments and inadequate technology.

Mobility devices can be life changing, but the pace of innovation is slow. Disincentives such as small and fragmented markets, regulatory burdens, and difficulties getting new technology paid for by healthcare systems and insurers are all impeding progress.

The World Tomorrow

The Mobility Unlimited Challenge aims to help change the lives of people with lower-limb paralysis through supporting groundbreaking personal mobile devices incorporating intelligent systems.

Technological advances, especially in digital technology, open up new possibilities for both functionality and usability of assistive mobility devices, if they are applied in the right way.

A new generation of advanced assistive mobility technology is emerging that provides new functionality, such as stair climbing wheelchairs, robotic exoskeletons for standing and walking, and functional electrical stimulation (FES) devices providing muscle movement and exercise.

However, such innovation is still in the early stages and few devices incorporate smart or intelligent systems to improve user mobility and independence.

The assistive mobility technology field could benefit from technologies and innovators from outside the assistive technology field as well as from greater support to those in the field.

This is where you come in - help us make people's lives better by bringing leading, smart technology to the world of assistive mobility devices.

Your Role

Challenge prizes are about inciting people to create new or innovative solutions to a problem without predetermining what those solutions will look like. Instead, a challenge will focus on what success against the problem will look like, allowing innovators to develop solutions that will achieve desired outcomes.

The Mobility Unlimited Challenge needs you to design the mobility solutions of the future and push the boundaries by incorporating intelligent systems into mobility devices.

By entering the Challenge, you join innovators from around the world who are working towards the same goal - improving the lives of people with lower-limb paralysis through better mobility and greater independence.

Building on universal design principles to create a more equitable environment, entries for the Mobility Unlimited Challenge must be user-centered. The Challenge will be a catalyst for innovation through co-creation with the people around the world who will benefit most from the solutions discovered by our entrants.

We want to find the mobility solutions of the future. The possibilities are endless - from exoskeletons, to artificial intelligence and machine learning, to advanced batteries.

How the Challenge can Support You

The Mobility Unlimited Challenge has been designed to support innovators around the world to develop their ideas.

Challenges (also known as challenge prizes) are a tried and tested method for supporting innovation. They offer a reward to whoever can first or most effectively meet a defined issue or problem. Challenges are effective tools for:

- Spurring and supporting innovative solutions
- Overcoming market failure
- Widening the pool of innovators, prompting collaboration
- Creating new markets
- Raising awareness

This Challenge is open to everyone - designers, engineers and technologists across the spectrum.

Our ambition is for the Mobility Unlimited Challenge to attract and support smaller innovators who might otherwise struggle to break into the assistive technology market. This includes start-ups, smaller companies, university departments and spin-outs. In order to achieve this, the Challenge will engage technologies and innovators from diverse specialities.

At the end of the Mobility Unlimited Challenge, we will have supported teams of innovators around the world to create leading edge technological solutions, opening a new chapter in personal mobility for people with lower-limb paralysis.

What We're Offering

This section outlines how our \$4 million challenge pot will be used. It gives you the key dates for each stage of the Challenge and outlines how our selection process works.

Finalist Development Grant

We will be awarding **5** Finalist Development Grants of **\$500,000** to support teams to create their devices.

To enter, you will submit an application form by **23:59 BST** on **15 August 2018**.

The Finalists will be announced on **14 January 2019**.

First grant payments are scheduled for January 2019.

The grant is flexible, but you will need to outline how you plan to spend the money to develop your device in your application form.

The Prize

We will be awarding **1** winner a Prize of **\$1,000,000** to help take their device to market.

The 5 Finalists will submit their written documentation by **23:59 GMT** on **8 June 2020** and then demonstrate their device to the judges.

The winner will be announced in **September 2020**.

The purpose of the Prize is to support you to make your device available to users. The grant is flexible, but you will need to outline your business plan and budget you will utilize.

Discovery Award

The Mobility Unlimited Challenge wants to attract and support smaller innovators who might otherwise struggle to break into the assistive technology market.

We will be awarding **\$50,000** of seed funding to **10** groups with promising ideas who might otherwise lack the resources to enter the Challenge.

To apply, submit an application form by **23:59 GMT** on the **7th of February 2018**.

Seed funding will be awarded in April 2018.

The purpose of the seed funding grants is to support entry into the Challenge. The grant is flexible, but you will need to outline the planned spend in the application form.

What We're Looking For

We are looking for mobility devices of the future. In this section, find out what those could be and determine if your idea is suitable for the Mobility Unlimited Challenge.

Aims of Challenge

The Mobility Unlimited Challenge will seek to enhance the mobility and independence of people with lower-limb paralysis by incentivizing innovation and the creation of smart assistive mobility devices that incorporate intelligent systems to deliver new and improved functionality and usability.

We expect devices that help enhance user's mobility and independence through sensing and dynamically responding to one or more of the following: :

- The user's desired intentions
- The user's environment, proactively navigating space and managing risks
- The user's body and residual body function, supporting neurorehabilitation and the management of the user's health and wellbeing
- The usage of the device in order to improve its *functional parameters*

The Mobility Unlimited Challenge seeks to incentivize innovation and attract innovators from different fields, as well as motivate existing innovators in the assistive technology space.

The final Prize will be awarded to the prototype device that best meets the Challenge's aims as set out in the challenge statement.

The following are examples of the types of entries that the Challenge could receive:

- An autonomous powered wheelchair that can detect holes, curbs and obstacles in the environment and respond automatically to avoid crashes or falls.
- A device (or software patch) that can be attached to a wheelchair to monitor the user's body and activity. Generating data on user's body that can be used to support their wellbeing and continued independence as well as configure the wheelchairs functionality to deliver improved functionality e.g. longer battery life.
- A powered lower-limb orthotic brace that monitors the user's power input and varies the power assistance it provides in line with the user's need, maximizing the use of the user's body and residual body function.
- A robotic exoskeleton device that contains an in-built fall detection and prevention mechanism.
- A wheelchair that reads and responds to the user's intention.
- A robotic exoskeleton device that provides smooth and fluid motion by monitoring the environment and the user's body with a higher level of accuracy than was previously possible.
- A device that has not yet been created that could replace the wheelchair as a daily mobility device.

Challenge Statement

Our challenge statement sets out what we're looking for and defines success for the Challenge.

Mobility Unlimited is a \$4 million challenge seeking to support radical improvements in the mobility and independence of individuals with lower-limb paralysis through the creation of smart personal assistive mobility devices that incorporate intelligent systems.

Devices should use user-centered design and be capable of delivering measurable improvements in the everyday mobility and independence of a person with lower-limb paralysis. This could be accomplished through improved dynamic response to one or more of the following: user intention, surrounding environment, user's body or the functional parameters of the device. The device should enable increased participation in the activities of daily living, work or leisure, while

minimizing the cognitive load on the user; be comfortable and easy to use.

We are looking for the mobility solutions of the future - devices that make people's lives better by bringing leading, intelligent technology to assistive mobility devices.

These devices should be co-created with the devices intended users to ensure that devices are meeting the needs and wants of people with lower-limb paralysis.

Judging Criteria

This section outlines the criteria by which applications will be assessed and judged throughout the challenge process.

When selecting the Discovery Awardees and the Finalists, entrants will be assessed and selected on the basis of their **potential** against the judging criteria.

When the winner is selected, Finalists will have to **demonstrate** how they **meet** the judging Criteria.

There are 5 judging Criteria and the information provided below aims to help entrants understand the judges' expectations.

Criterion 1 - Innovation

The entry should be new or innovative, incorporating intelligent system(s) to support and deliver improved personal mobility and independence to the user.

What judges will be looking for:

- Devices or products that demonstrate a new or adaptive way of utilizing intelligent system(s) to deliver improved mobility and independence to people with lower-limb paralysis.
- Devices or products which plug-in or add on to existing mobility device(s) demonstrating a new or adaptive way of utilizing intelligent system(s) to deliver improved mobility and independence to people with lower-limb paralysis.
- Entries which are significantly different from what is already available. New, aspirational, exciting, but practical.

Criterion 2 - Insight and Impact

The entrant should demonstrate a real understanding of the wants and needs of people with lower-limb paralysis in relation to their mobility and independence and the challenges they face. The entrant should be able to demonstrate how their entry delivers improvements in the user's mobility and independence in comparison to products and devices currently on the market. The entrant should be able to demonstrate the extent to which their entry has been co-created with users.

What judges will be looking for:

- Evidence that the entrant understands the issues and priorities of people with lower-limb paralysis (potential users), in relation to their mobility and independence.
- Entries that will support meaningful improvement in the everyday mobility of people with lower-limb paralysis. Entry addresses specific needs and is likely to make a real difference to the mobility and independence of the users.
- Evidence of how the entrant has developed their entry through meaningful engagement with, and involvement of, people with lower-limb paralysis who are representative of the eventual users.

Criterion 3 - Functionality and Usability

The entrants should be able to demonstrate how their entry delivers measureable improvements in the functionality required by users while being comfortable and easy to use. The entry should also be attractive and enjoyable to use.

What judges will be looking for:

- Entries that deliver measureable improvements in functionality, improvements which reflect what is desired or required by the people with lower-limb paralysis.
- High-quality user experience - entries that are comfortable, easy and enjoyable to use.

Criterion 4 - Quality and Safety

Entrants should demonstrate that their entry is reliable and of high quality as well as how it will meet, or exceed, the relevant safety measures and ethical considerations. The entrant must demonstrate that intelligent system(s) incorporated into their entry are secure and resistant to malfunctions.

What judges will be looking for:

- Entries that demonstrate reliability and durability through user testing
- Entries that adhere to robust safety measures
- Entrants have considered how their entry will protect the privacy and security of the user, for example in relation to data collected or generated

Criterion 5 - Market Potential and Affordability

Entrants should demonstrate a route to market with consideration given to how their entry will be manufactured, marketed and eventually scaled. Consideration should be given to the cost to the consumer and how it can be made financially accessible to a wider user group.

What judges will be looking for:

- A clearly articulated business plan that sets out the path from prototype to a product which is widely available to users and has long term market viability
- How financially accessible the entry will be for its target audience

Selection Process

Entries to the Challenge will be assessed against our judging criteria, which have been designed to allow us to compare and assess what could be very different devices. This will ensure that the selection process is fair and that we are choosing the right teams and devices that will support the aim of the Challenge.

When selecting the discovery awardees and the Finalists, entrants will be assessed and selected on the basis of their **potential** against the judging criteria.

When the winner is selected, Finalists will have to **demonstrate** how they **meet** the judging criteria. This will involve written submission and practical demonstrations.

Every submission will be assessed and our independent judging panel will select awardees at each stage from the strongest in the field.

Who can Enter

We want the world's thinkers, problem solvers, and innovators to rise to the Challenge and create game-changing technology that makes the world more accessible for people with lower-limb paralysis.

We also want to attract and support smaller innovators who might otherwise struggle to break into the assistive technology market, or who aren't working in the assistive technology field.

This section gives you all the information you need to determine who we are looking for and if you're eligible to enter the Challenge.

An Open Call

The Challenge is open to all - designers, engineers and technologists across the spectrum. We are not prescriptive. We want to break down barriers to entry for teams with great ideas. We want to hear from innovators around the world.

You could be:

- An engineer
- A designer
- A specialist in machine learning or AI
- A product designer
- An AT specialist
- Or anyone with the right knowledge and expertise

You could be from:

- A start-up

- A university
- A small company
- An company with experience in the AT market
- Or, you could be an individual with a great idea.

The ambition is that the Mobility Unlimited Challenge also attracts and supports smaller innovators who might otherwise struggle to break into the assistive technology market. We've created the Discovery Awards, to help entrant who need financial support in order to submit their entry to the main Challenge.

Eligibility Criteria

The eligibility criteria set out who can enter the Mobility Unlimited Challenge and what will be required of you.

Before entering the Challenge, make sure you comply with the criteria outlined below.

Co-creation

The device must be developed, tested and refined through the meaningful engagement with, and involvement of, people with lower-limb paralysis who are representative of device's eventual users. This is to ensure that the resulting prototype device will support meaningful improvements in users' mobility and independence. The entrant will be expected to demonstrate how co-creation with people with lower-limb paralysis who are representative of device's eventual users has shaped the creation and development of the prototype device.

Skills

Entrants must have the capacity to develop their entry. If selected as a finalist, entrants must have the capacity to, by the final judging stage in 2020, develop their entry to the point of being a prototype device capable of user demonstration with a demonstrable route to making the device available to users.

English is the official language of the Challenge, all communications and entries must be made in English.

Global Entries

The Challenge is open to entrants from across the globe with the exception of any entrant based in a country that is subject to UN arms embargo. Entrants must have an understanding of their device's intended market and be able to demonstrate how the device is suitable for that market.

The Challenge welcomes entries from individuals, teams and organizations, however, if selected, individuals and teams must be willing to incorporate before they can receive funds.

Entrants to the Challenge should have reached the age of majority in their jurisdiction of residence at the time of entry.

Intellectual Property

Entrants must own, or have written permission to use, the intellectual property relevant to their entry. All entrants need to demonstrate a willingness to share information about their device for the purposes of the Challenge.

As part of the Challenge, Toyota Mobility Foundation, and its Challenge partners, intends to carry out publicity activity as well as publish research about the insights gained through the Challenge. These activities will not divulge information relating to Intellectual Property in the public domain.

Politics

The Challenge cannot fund activity which is party-political in intention, use, or presentation nor to support or promote religious activity. We also cannot fund activity that support or contributes to any criminal enterprise or anti-social forces.

Financial Need (only applicable for applicants to the Discovery Awards)

The Mobility Unlimited Challenge's Discovery Awards seek to break down financial barriers that could prevent people or teams from entering the Challenge, by providing financial support to fund the development of their entry. Discovery Awards will be given based on financial need and subject to the same eligibility and judging criteria, with consideration given to the fact that the entries will be at an earlier stage of development.

How to Enter

If you've got an idea for a device that meets our judging criteria and you comply with our eligibility criteria - this section sets out your next steps.

It outlines everything you need to know about the ways in which you can participate in the Challenge, the different paths to become the winner, and some tips to help you complete your submission form.

Check The Challenge is Right for You

Make sure that you understand what we are looking for and that you and your idea meet our criteria:

1. Have you read and understood the challenge statement, and are you confident that your idea supports the aims of the Challenge?
2. Does your idea meet all of the judging criteria, and are you clear on what our judges will be looking for?
3. Do you meet all of our eligibility criteria?

Entry Paths

The best way to win the Mobility Challenge is to enter!

There's only one path to winning the Mobility Unlimited Challenge. That's becoming a finalist. However, there are multiple paths to becoming a finalist - these are set out below.

Path 1: Finalist Development Grants

In January 2019, our judges will pick 5 finalists who will be awarded Finalist Development Grants of \$500,000 each to develop their products.

Entry Path 1

You don't require additional financial support to develop and submit your entry, so you can enter the Challenge directly.

Paths 2 & 3: Discovery Awards

We know that some innovators may need further financial support to enter the Challenge. Therefore we will be offering 10 seed funding grants of \$50,000 through our Discovery Awards in April 2018.

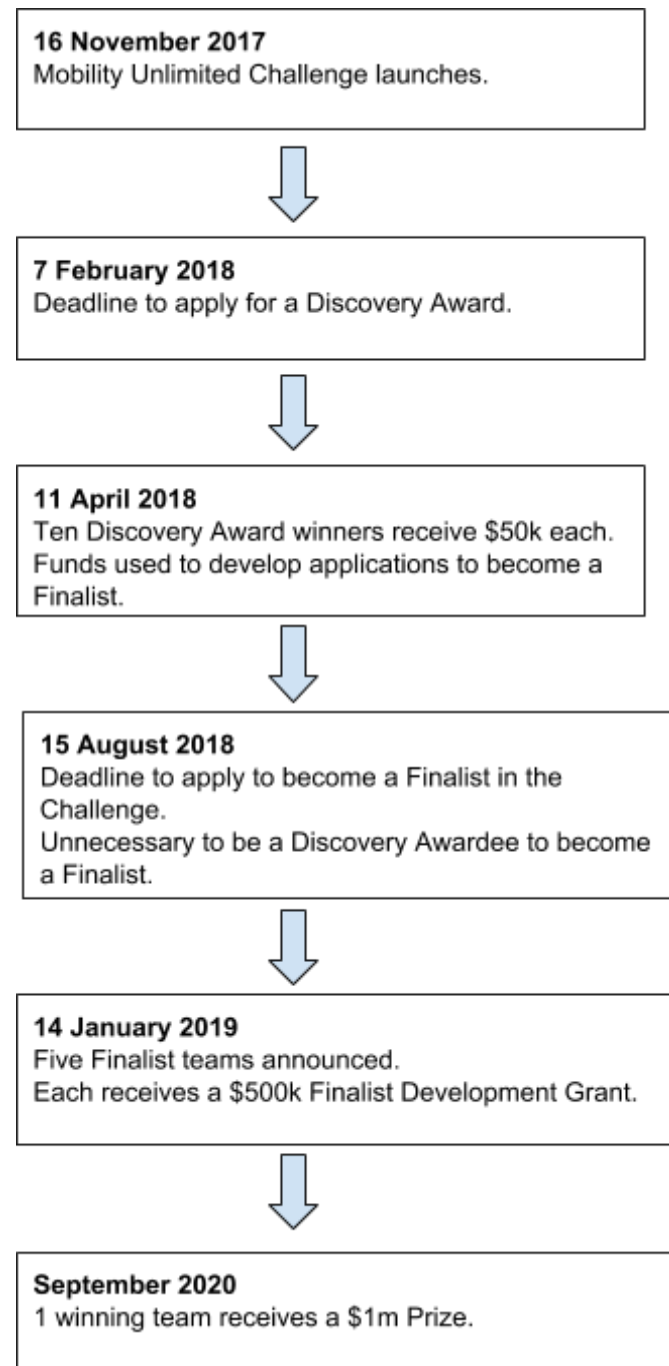
Entry Path 2

You require financial support to enter the Challenge, so you can apply for a Discovery Award, and are successful. Then you use the Discovery Award funding to enter the Challenge.

Entry Path 3

You require financial support to enter the Challenge, so you apply for a Discovery Award, but are unsuccessful. **However, you are still able to enter the Challenge directly.**

Timeline



How to Enter

To enter the main Challenge, you will need to enter using an online form that can be accessed [via our submission platform](#).

Please note, if you are applying for a Discovery Award, this will require you to submit a separate application also hosted on our [submission platform](#).

When you click the link, you will be taken to the submission platform. New users will be asked to register first to access the entry form. You can save your entry and come back to it later using the same registration details.

Please note we only accept entries submitted electronically.

The deadline for entries is 23:59 BST on the 15th August, 2018.

Entry Checklist

Before submitting, review the following checklist to ensure you are ready:

1. Have you read and understood the challenge statement and are you confident that your idea meets the aims of the Challenge?
2. Do you understand all the judging criteria and know what the judges are looking for?
3. Do you meet all the eligibility criteria?
4. Have you read carefully through the Terms and Conditions?
5. Do you understand the requirements and timeline of the Challenge?
6. Have you reviewed the entry form and the questions you will be expected to answer?
7. Have you read the Frequently Asked Questions?
8. Will you be able to complete the online application form in full by the deadline?
9. Have you co-created your idea and are you sure that it responds to the wants and needs of people with lower-limb paralysis?
10. Ultimately, do you have a good idea that can change the lives of people with lower-limb paralysis?