

ROBOT-ERA PROJECT: PRELIMINARY RESULTS OF ROBOTIC SERVICES IN SMART ENVIRONMENTS WITH ELDERLY PEOPLE

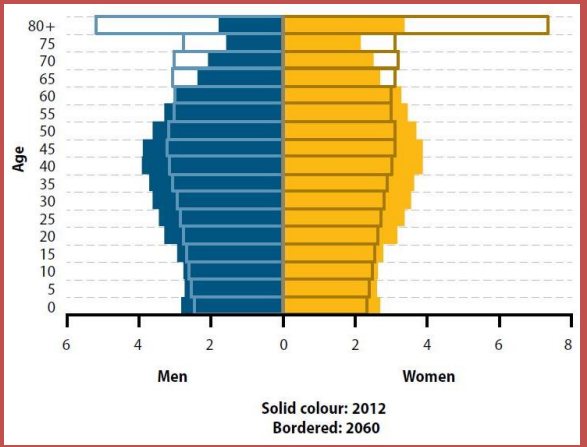
R. Esposito¹, F. Cavallo¹, F. Marcellini², R. Bevilacqua²,
E. Felici², P. Dario¹

¹ The BioRobotics Institute Scuola Superiore Sant'Anna (Pisa, Italy)

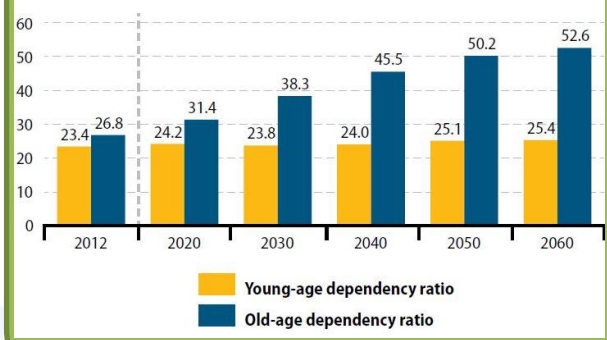
² I.N.R.C.A. Scientific-technological Area (Ancona, Italy)

Background in Europe

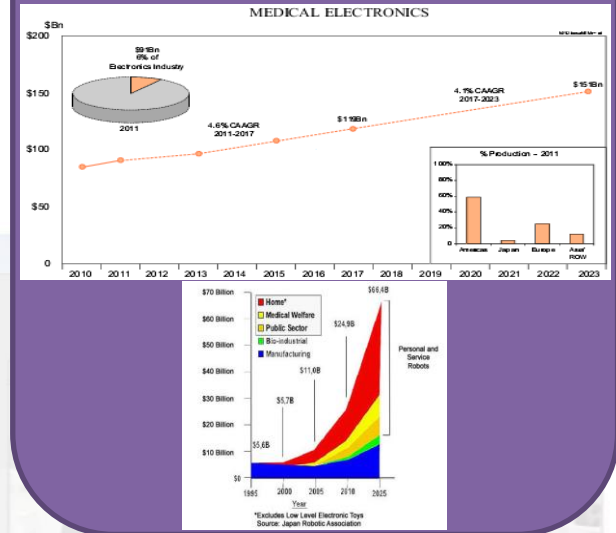
Increasing demand for elderly cares



Unsatisfied demand for elderly cares



Growth of smart technology market



Technology could develop a new sustainable economic and welfare systems in order to maintain independent older persons in their living environment as long as possible

Robot-Era Project

- **Title:**

“Implementation and integration of advanced Robotic systems and intelligent Environments in real scenarios for the ageing population”

- **Funding:**

European Community's Seventh Framework Programme
(FP7/2007-2013)
Grant agreement num. 288899

- **Duration:**

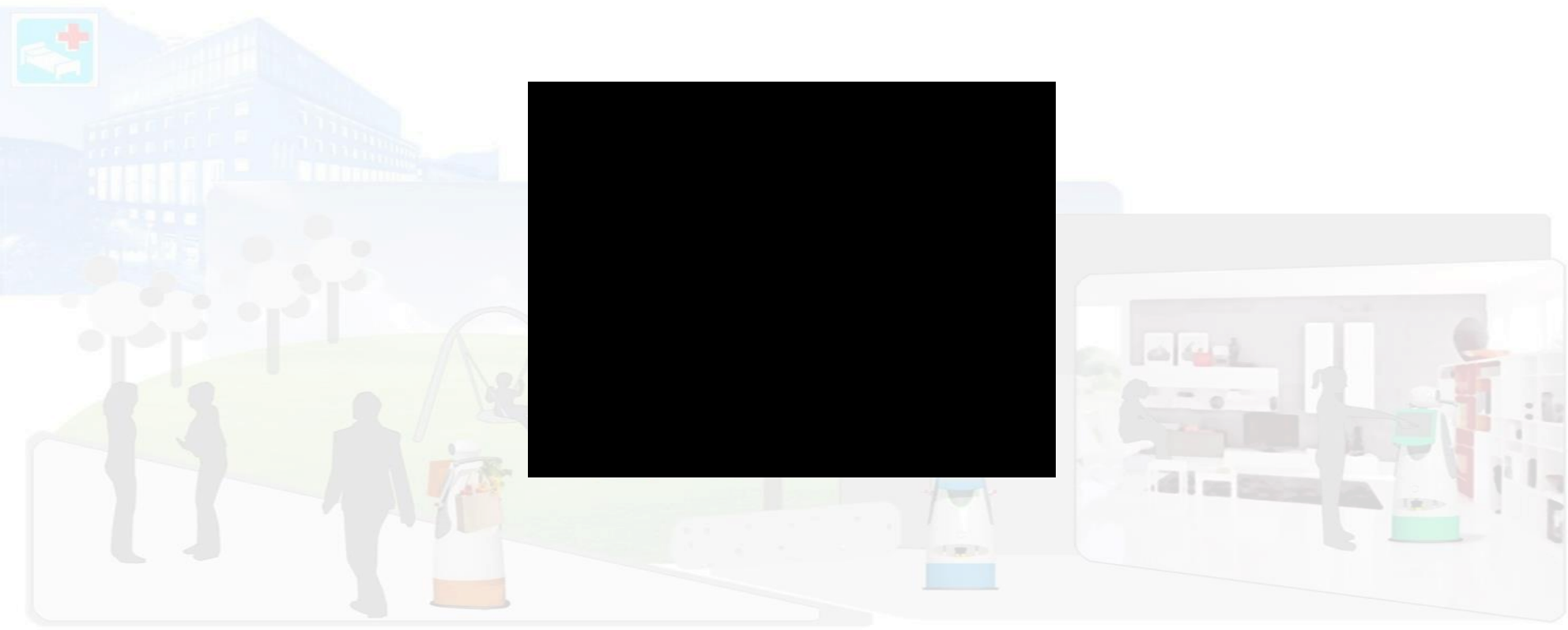
4 years, from January 2012

- **Consortium:**

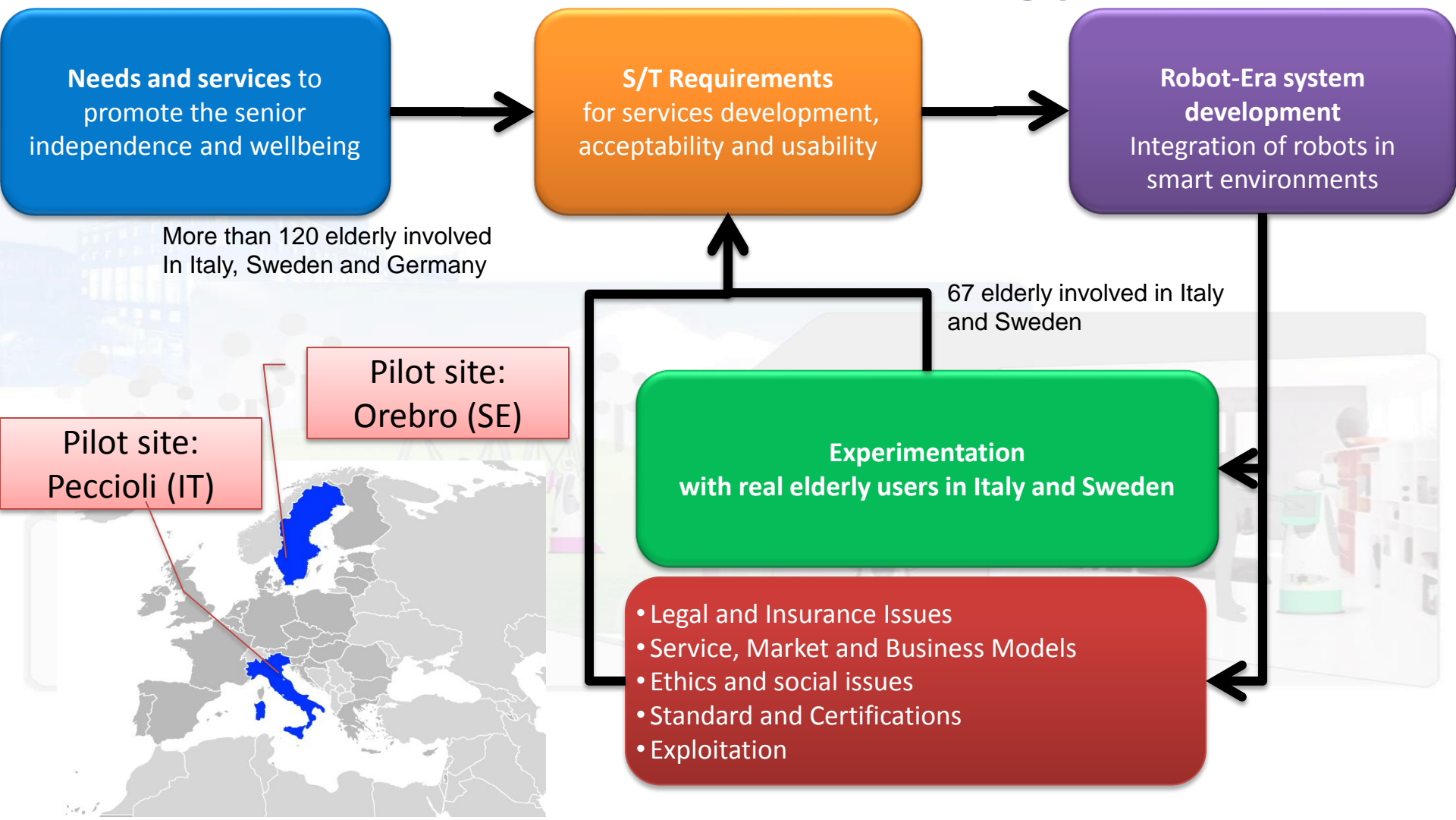
- Coordinator - Scuola Superiore Sant'Anna (SSSA), Pisa, Italy
- Istituto Nazionale di Riposo e Cura per Anziani (INRCA), Ancona, Italy
- Youse GmbH (YOUSE), Berlin, Germany
- Orebro University (ORU), Orebro, Sweden
- Universitaet Hamburg (UHAM), Hamburg, Germany
- University of Plymouth (UOP) United Kingdom
- Metralabs GmbH Neue Technologien und Systeme (MLAB), Ilmenau, Germany
- ST Microelectronics Srl (ST-I), Italy
- RoboTech srl (RT), Peccioli, Italy
- TechnoDeal srl (TED), Peccioli, Italy
- Municipality of Peccioli (MOP), Peccioli, Italy
- Lansgarden Fastigheter Aktiebolag (LG), Orebro, Sweden



Robot-Era Project



General Robot-Era Methodology



End-Users involvement and Robot-Era Service Definition

- ▶ Refinement of the older people needs
- ▶ Refinement of the initial scenarios

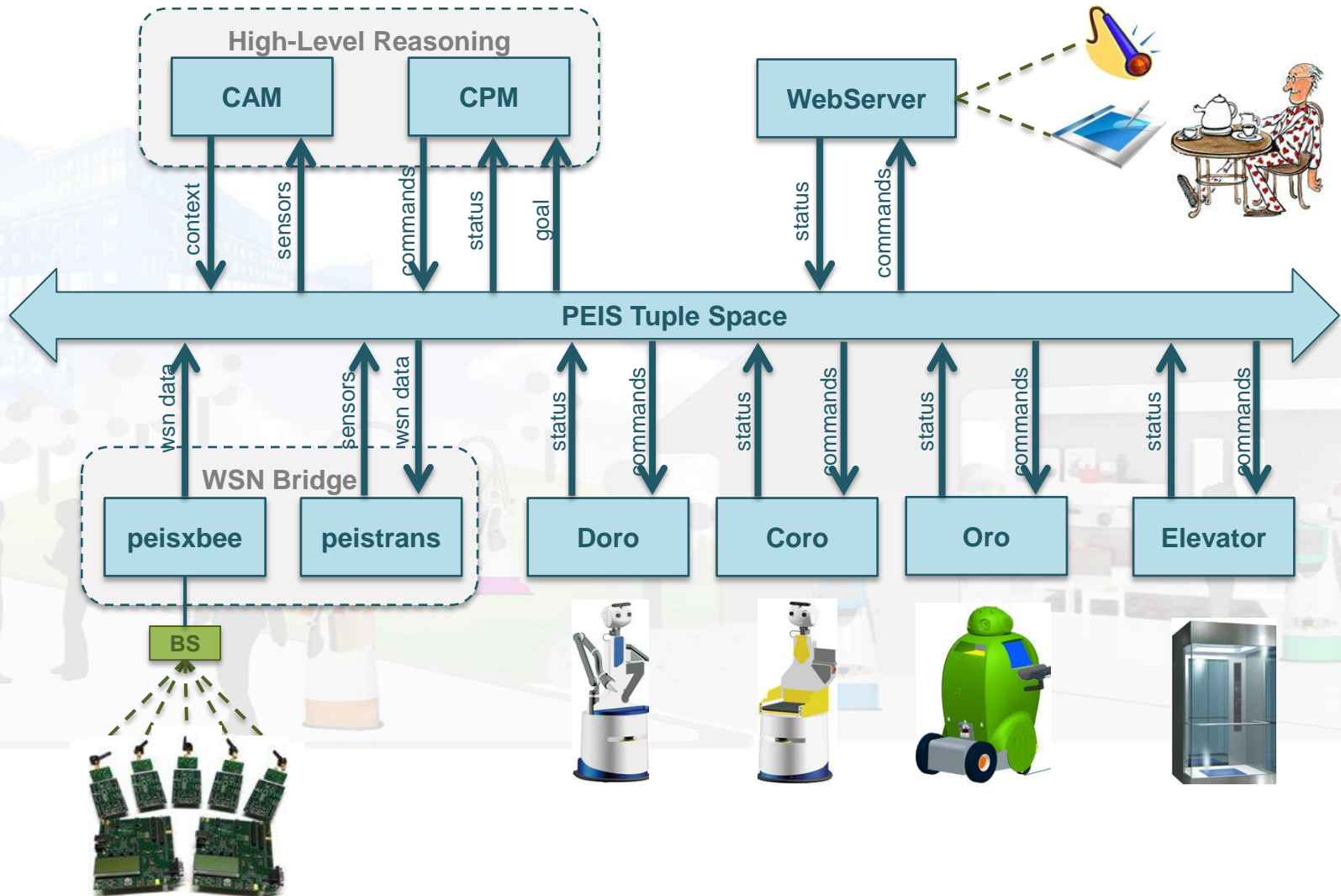
- ▶ Refinement of services
- ▶ Development of new scenarios

- ▶ Evaluation of new scenarios
- ▶ Usability/Accessibility requirements analysis



(N=12 stakeholders)
 (N=5 professionals)

Robot-Era architecture



First Robot-Era experimental loop



Pilot sites management and setting



Experimental protocol definition



Robot-Era First Experimental loop



Domestic Environment

Condominium Environment

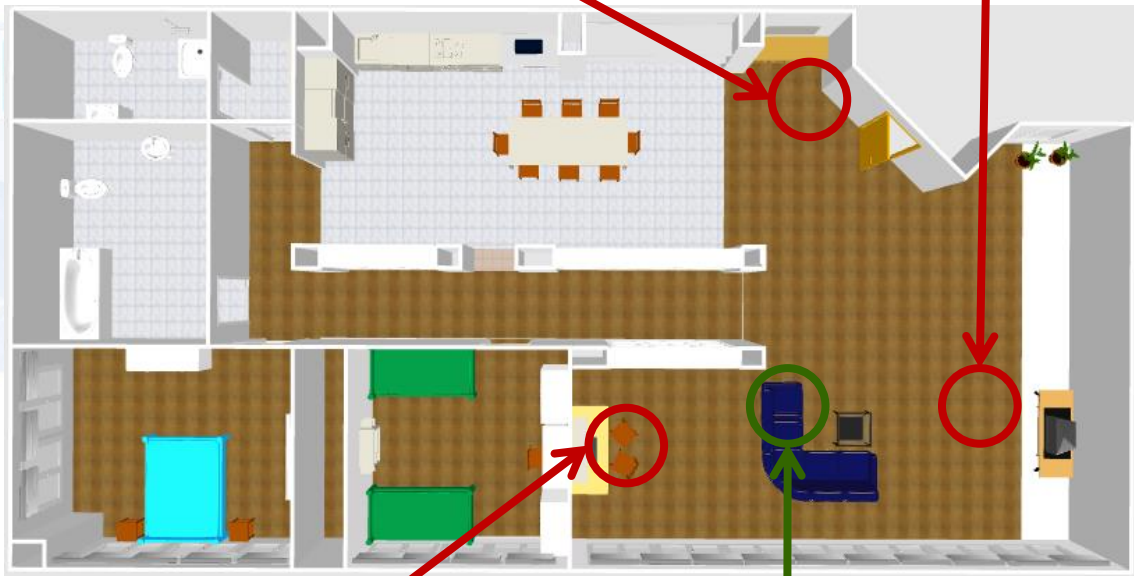
Outdoor Environment





One: handycam

One: Interviewer



One: overall supervision for ORO

One: overall supervision for DORO

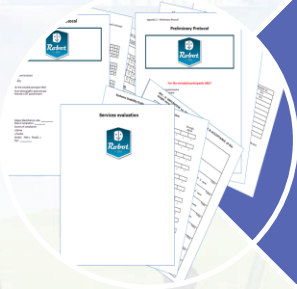
Subject

One: overall supervision for CORO





Who is the Target?



Which are the aims?
How to measure them?



How to conduct the
experiment?

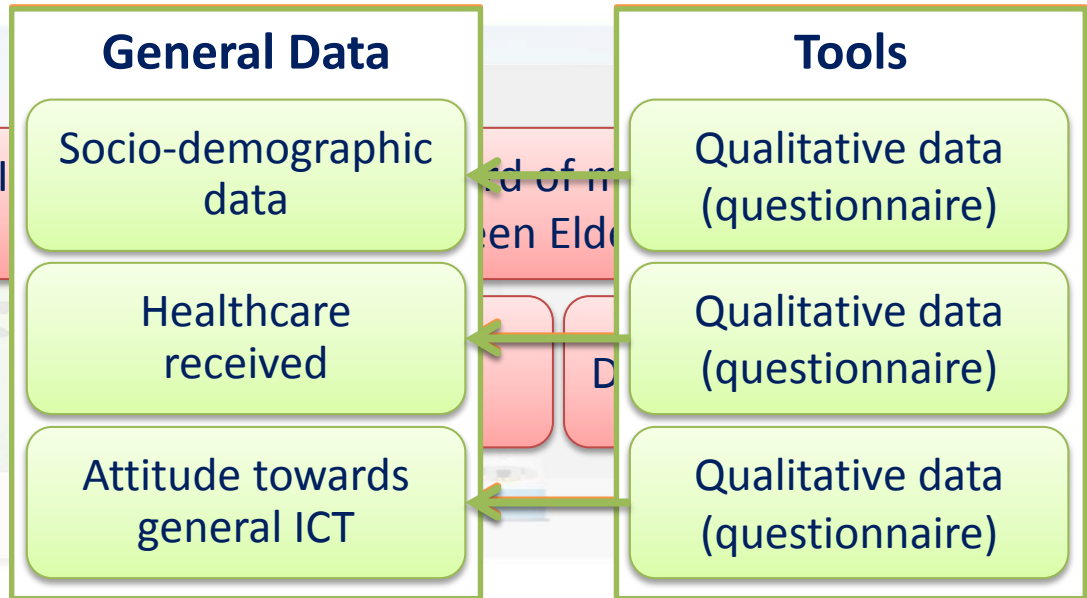


Recruitment
 Strategies

Elderly
 Enrollment

Elderly
 Profile

Elderly
 Profile



with
 which
 elderly

* cut off to be enrolled= nr. Errors ≤ 3
 ** cut off to be enrolled= score >2



Which are the aims?
How to measure them?

USABILITY

- The degree of a product's fitting to the characteristics of a person or of a group of people

ACCEPTABILITY

- “The demonstrable willingness within a user group to employ technology for the tasks it is designed to support” [Dillon 2001]



Which are the aims?
How to measure them?

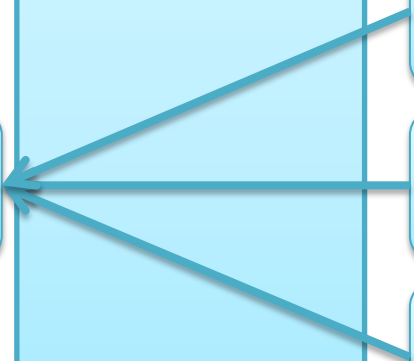
USABILITY

Towards

Robot-Era
Services

Tools

- Users' suggestions
(Qualitative data)
- Video Analysis
(Qualitative data)
- SUS questionnaire
(Quantitative data)





Which are the aims?
How to measure them?

ACCEPTABILITY

Towards

**Robot-Era Robotic
Platforms**

**Ad-hoc questionnaire
(Quantitative data)**

**UTAUT questionnaire
(Quantitative data)**

Tools

Towards

**Robot-Era
Services**

**Users' suggestions
(Qualitative data)**

**Video Analysis
(Qualitative data)**

**Ad-hoc questionnaire
(Quantitative data)**

Tools



Robot-Era experimentation section procedure

1) General introduction

- Welcome and Team presentation
- Introduction of Robot-Era project
- Agenda and test section explanation

4) Video to show Robot-Era services

- An introduction to different service was shown to the user

2) Informed consent

- Researcher hands out informed consent to the user and explain it

5)Conduction of Robot-Era service test

- User tested the Robot-Era service
- The test was audio-video recorderd

3) Evaluation of the aesthetics of Robot-Era robots

- All three Robot-Era platforms were showed to the user
- The user filled out a questionnaire

6) Evaluation of Robot-Era service

- Administration of questionnaires and interviews to investigate usability and acceptance



How to conduct the
experiment?

Experimental Protocol

**Recruitment
Phase**

**Elderly profile
evaluation**

Testing Phase

Final Phase

IADL test

Socio-demographic
questionnaire

Each Robot-Era
service is tested

Evaluation of all
Robot-Era services

SPMSQ

Attitude to ICT
questionnaire

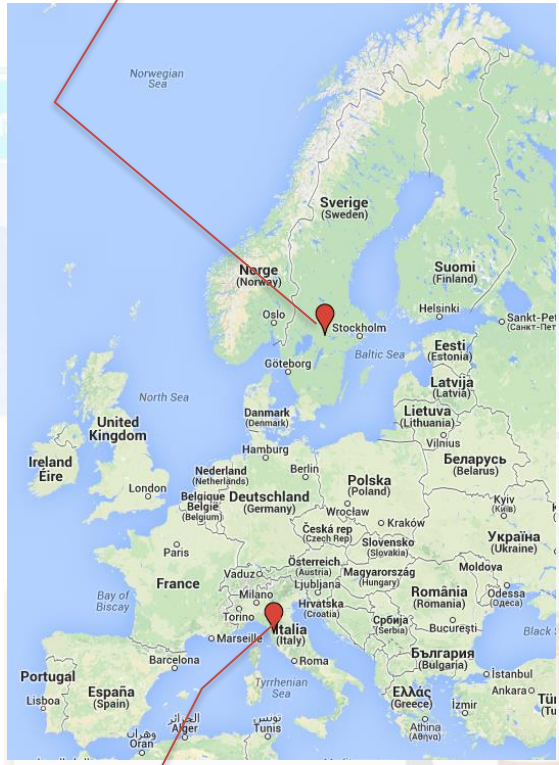
Evaluation of each
Robot-Era service

Robot-Era First Experimental loop





Pilot site:
Ängen (SE)



Pilot site:
Peccioli (IT)

Participants

- 67 elderly persons (28 male and 39 female)
- 65-83 years old (73.51±5.68)
- 58% of participants lived with own partner and 42% lived alone
- 51.5% of the sample had a low educational level and the 48.5% a high one

Attitude towards technology

- Home appliance and electronic devices for everyday use were used without problems
- PC and Internet for information or entertainment were used by 56.72% of them
- 20.90% and 14.93% were able to use a smartphone and a tablet



Robot-Era services	Usability*		Acceptability*	
	Peccioli	Ängen	Peccioli	Ängen
Communication	85,57 ± 14,09	71,04 ± 20,30	88,54 ± 7,94	72,74 ± 7,86
Reminding	75,28 ± 23,12	56,09 ± 28,85	87,26 ± 12,32	84,36 ± 14,31
Object transportation	91,63 ± 11,11	81,48 ± 13,19	92,46 ± 5,43	86,67 ± 10,78
Shopping and drug delivery	80,86 ± 15,81		87,69 ± 8,23	
Garbage collection	90,14 ± 14,76		89,97 ± 8,33	
Outdoor walking support	83,44 ± 12,51		89,01 ± 8,06	
Indoor walking support	89,70 ± 9,29		88,70 ± 7,12	
Escort at night		75,17 ± 24,92		88,56 ± 14,31
Food delivery		77,34 ± 20,24		86,84 ± 11,20
Laundry delivery		76,72 ± 21,70		89,68 ± 11,02

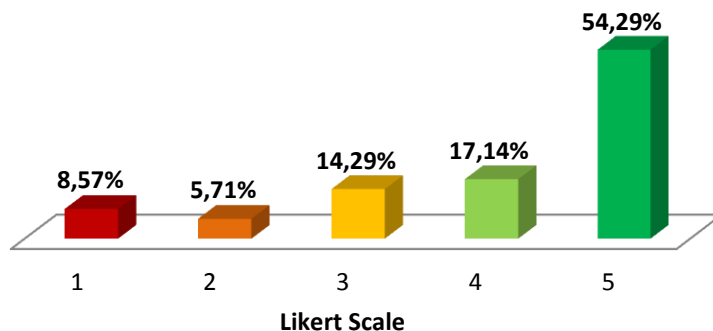
***0-64: not usable / acceptable - 65-84: usable / acceptable - 85-100: excellent**

Usability Results

Shop & Drug delivery Service

I thought the Shopping Service was easy to use

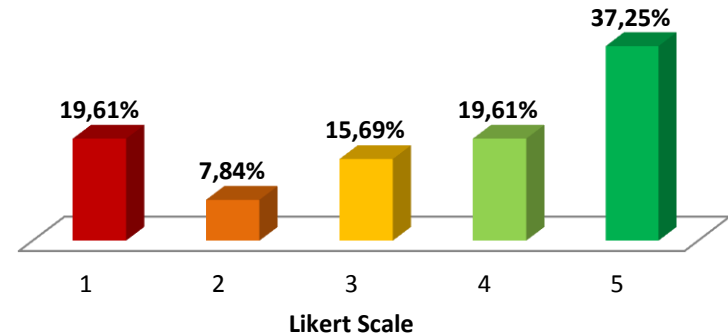
N=35



Reminding Service

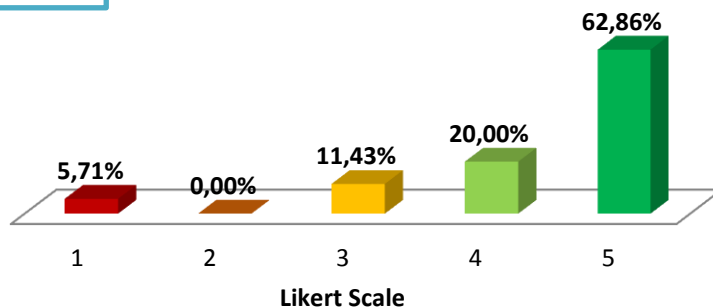
I thought the Reminding Service was easy to use

N=51



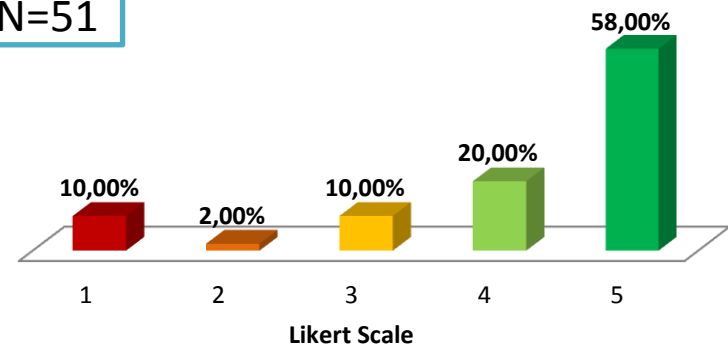
I found the various functions in this Shopping Service were well integrated

N=35



I found the various functions in this Reminding Service were well integrated

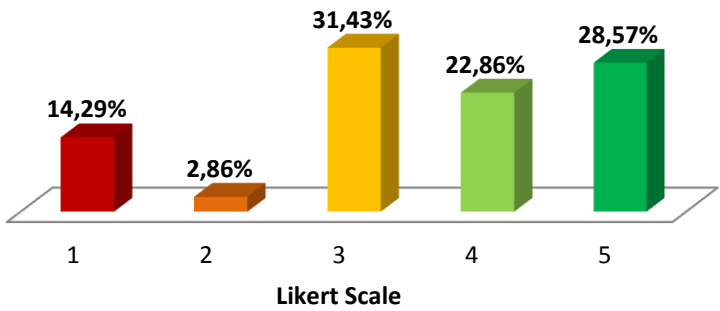
N=51



Shop & Drug delivery Service

I found the tablet easy to use to perform the Shopping Service

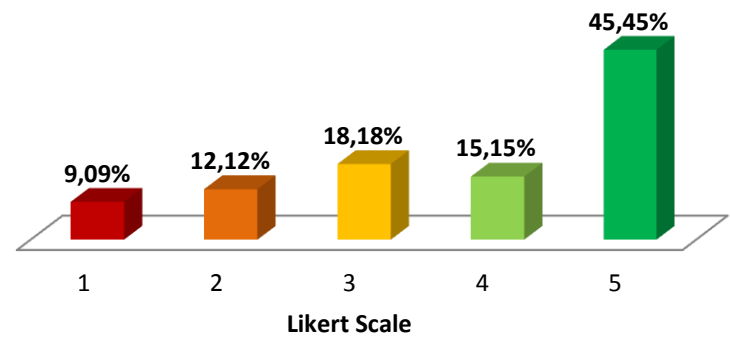
N=35



Reminding Service

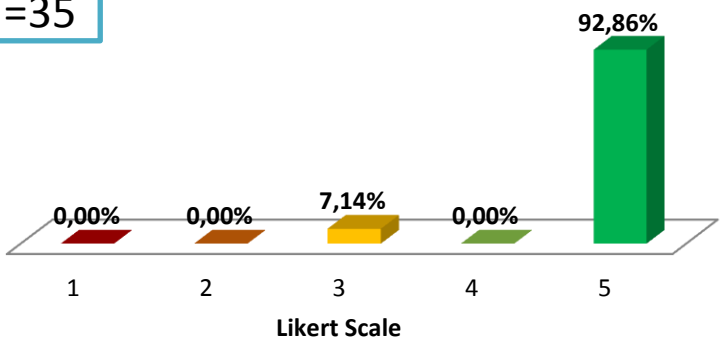
I found the tablet easy to use to perform the Reminding Service

N=51



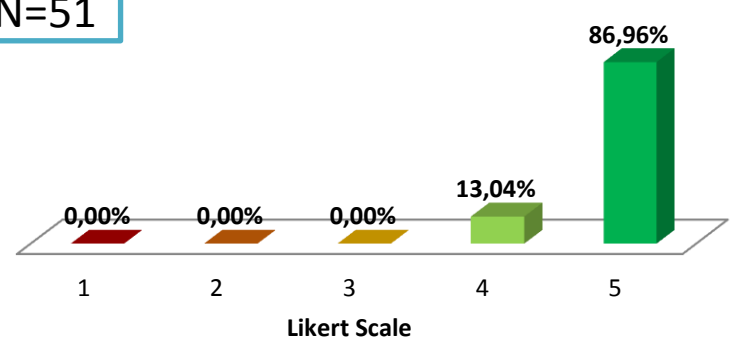
I found it easy to speak to the robot to perform the Shopping Service

N=35



I found it easy to speak to the robot to perform the Reminding Service

N=51

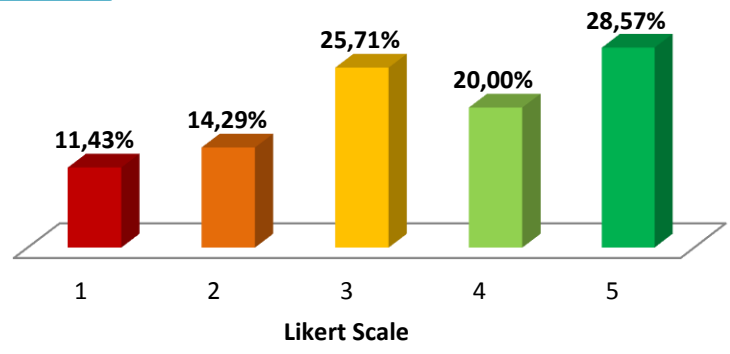


Acceptability Results - Attitude

Shop & Drug delivery Service

I think that I would like to use this Shopping Service frequently

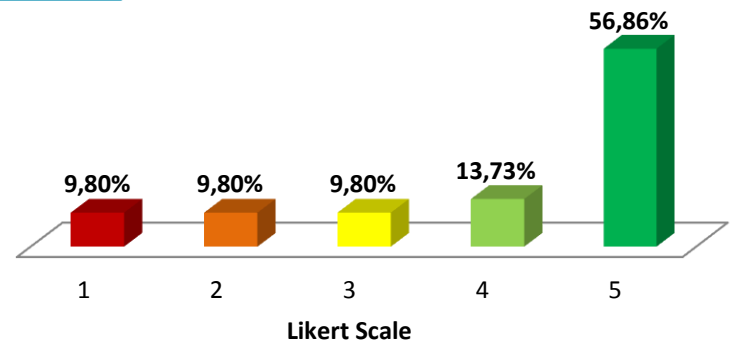
N=35



Reminding Service

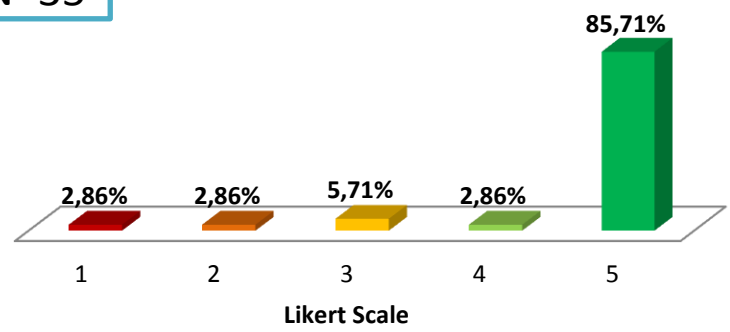
I think that I would like to use this Reminding Service frequently

N=51



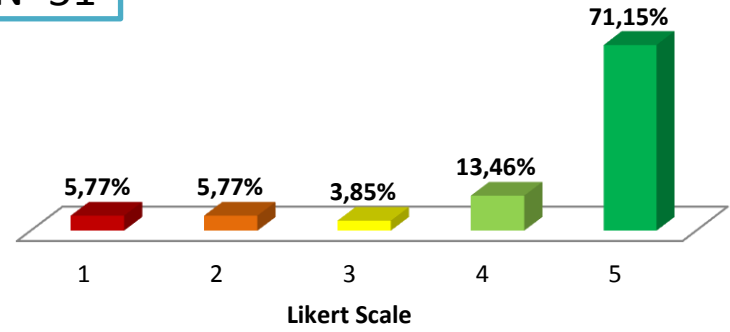
I would use this service for doing shopping, in case of need

N=35



I would use the robot for Reminding Service, in case of need

N=51



Acceptability Results - Attributes

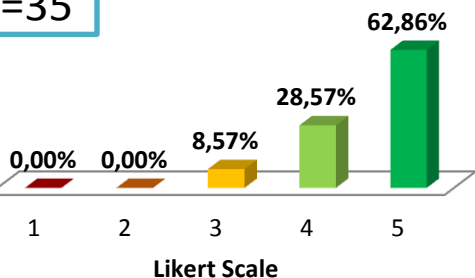
Shop & Drug delivery Service

Trust

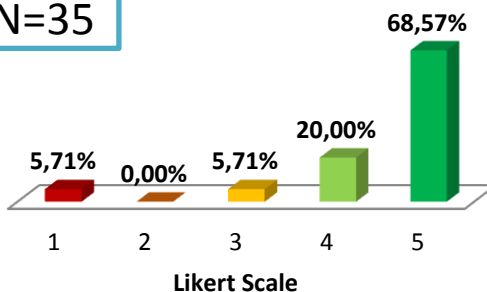
Perceived Enjoyment

Perceived Independence

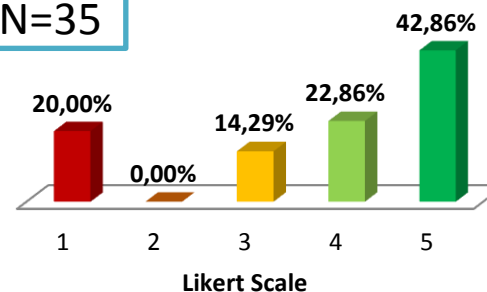
N=35



N=35



N=35



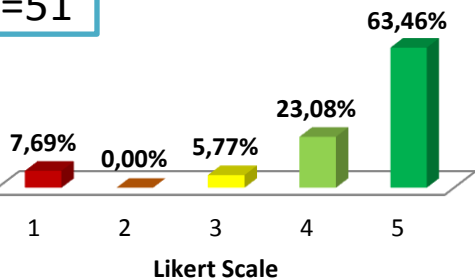
Reminding Service

Trust

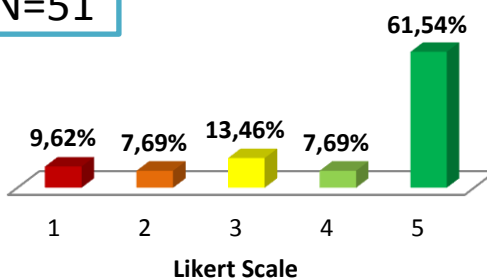
Perceived Enjoyment

Perceived Independence

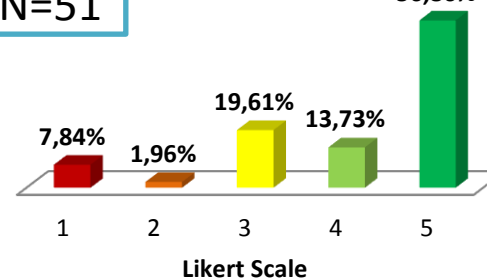
N=51




N=51



N=51



Conclusions

- The Robot-Era scenarios were considered easy to use and well integrated by the most of the elderly persons, demonstrating the usability of Robot-Era system
-  In consideration of a positive attitude towards the services and a high trust in Robot-Era system, the acceptability was goodly estimated by old volunteers
- According to all aspects discussed in this work and basing on the preliminary feedbacks given by end users, **the Robot-Era system has all the potentialities to be developed as a socially acceptable and believable provider of robotic services to elderly people**

Future work

- In order to enhance the usability and acceptability, the Robot-Era dialog manager should be improved to get a natural language to allow a higher interaction between user and the robot
- In fact elderly persons preferred the speech interaction than the tablet one, because the first was considered more simple to use