Smart Working environments for all Ages

WorkingAge

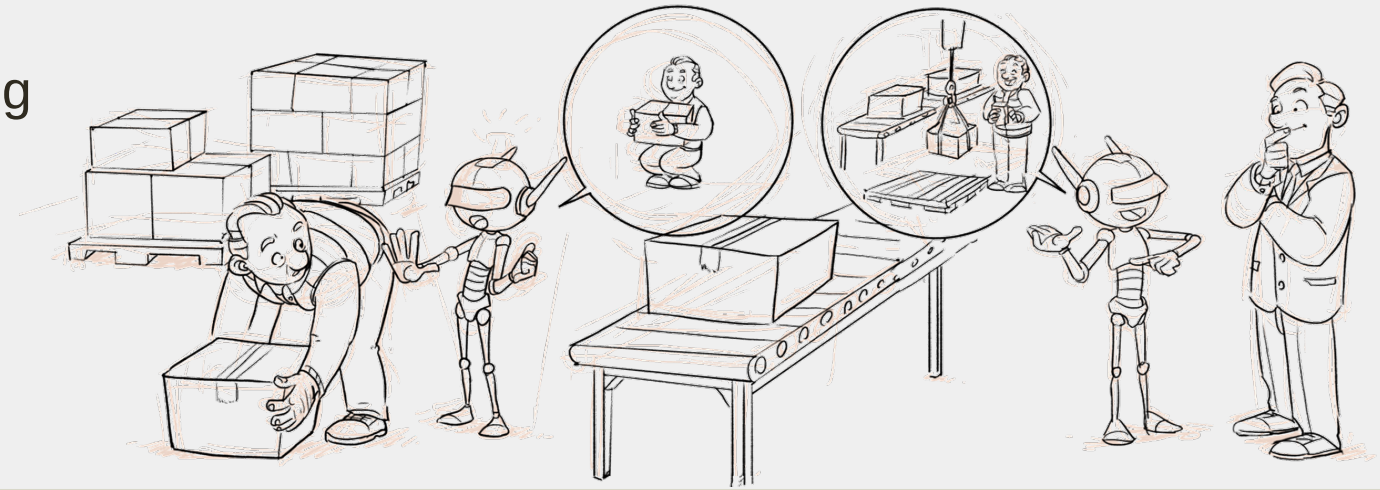
Overview

Marteyn van Gasteren
ITCL Institute of Technology

Kick-off meeting WorkingAge
ITCL, Burgos

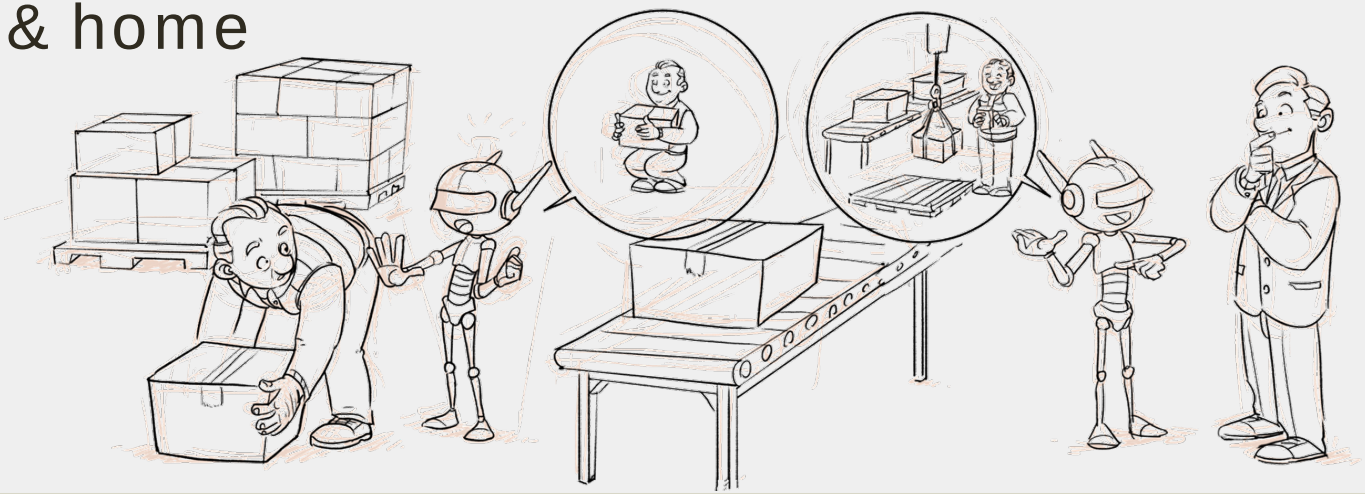
WorkingAge in brief

- The purpose is to promote healthy habits in working environment and daily living activities
- Workers aged over 50 & their working place
  - Office
  - Driving
  - Manufacturing



WorkingAge in brief

- Use innovative HCI methods to measure the user & surroundings
- Design interventions & integrate in a WA Tool
- Evaluate effectiveness of Tool in supporting age group at work & home
- Prepare exploitation



Index

- Partners
- Objectives
- Expected Impact
- Methodology
- Gantt
- Organigram

Partners

=

People

OBJECTIVES

- Principle indicators of project achievements
- No less than 22 objectives were defined, covering all project stages
- Grouped into 5 different categories

QUALITY OF LIFE – QL
DIGITALLY ENABLED ADAPTIVE SERVICES AND SOLUTIONS – DEASS
SMART WORKING ENVIRONMENT – SWE
USER CENTRIC DESIGN – UCD
OTHERS - O

OBJECTIVES 1/5

QUALITY OF LIFE - QL

- **QL 1: Creation of a database of demographic, health, sociology, psychological conditions and its relation with the working**

QL1 Database w/ conditions worker & place D2.1 RWTH M4

connection to some existing portals of Public Administrations will also be included. The purpose is monitoring and brokering smart work initiatives to get information about the trends in the Labour Market of some EU Countries (e.g., via EURES). Measureable outcome: **D2.1 (RWTH)** on M4.

- **QL 2: Creation of a database of risks and labelling to set different working attitudes and environments to avoid instantaneous**

QL2 Database w/ risks for aged D2.5 POLIMI INTRAS M8/16

- **QL 3: Definition of causes for long-term stress and workload of employees and its impact on sickness and rest periods.** The

QL3 Causes & Impact of stress D3.2 RWTH INTRAS M16

on M16.

- **QL 4: Creation of a set of rules that enable adaptation of the changing status of the workers Aged >50** to their working/living

QL4 Rules for adaptation for aged D3.3/6.1 BS UCAM M16/22

D3.3/ D6.1 (BS/UCAM) on M16/M22.

- **QL5 Tips for independent living**

D3.4/6.2/6.3 INTRAS BS POLIMI M16/22

OBJECTIVES 2/5

DIGITALLY ENABLED ADAPTIVE SERVICES AND SOLUTIONS - DEASS

DEASS1 5 algorithms – Gesture Face Eyes Voice Neurometrics

DEASS2 User Models EXO UCAM AUD RWTH BS M21

DEASS3 4 interactive HCI techs for creating interactions

ITCL EXO AUD RWTH M21

DEASS4 Integrated system D4.6 GC INTRAS TMA

DEASS5 Location + emergency services D4.7 TPZ EENA M21

OBJECTIVES 3/5

SMART WORKING ENVIRONMENT - SWE

- **SWE1 Software Design Methodology** D5.2 GC M22
- **SWE2 Application for companies** D5.2 GC M22
- **SWE3 Ethics & security** D7.2 POLIMI M22
- **SWE4 Self-Management Occupational Safety and Health Supervision System (SMOSHS System)** D8.1 EXO M22
- **SWE5 Integrate SMOSHS into WA Tool** D8.5 GC M23

OBJECTIVES 4/5

USER CENTRIC DESIGN - UCD

UCD1 Integrate system in 3 working environments – office, driving, factory D9.2 EXO M36

UCD2 Validate by health supervision D9.2 INTRAS M36

UCD3 Assess improvement of working environment D9.2 RWTH M36

OBJECTIVES 5/5

OTHERS - O

O1 4 New sw licences	D10.4 10.5 EXO UCAM AUD BS TMA M36
O2 Business models	D10.6 TMA M36
O3 Evidence of RoI	D10.6 INTRAS M36
O4 Dissemination events	D10.2 INTRAS M36

IMPACT

FACT AND FIGURES	INTERVENTIONS	EXPECTED GOAL	IMPACT	KPI
Optimal Life/ Work balance **• 25 % of European citizens will experience a mental health problem.** **• Around 10% of long-term health problems are due to mental and emotional disorders.** **• Depression by 2020 will become the second most important cause of disability.** **• Absenteeism, unemployment and long-term disability claims due to work related stress and mental health**	Flexible working hours (e.g. flexible time, part time, time off in lieu, sabbatical), flexible work place (e.g., home or tele-working), enhanced work processes and finalized contents of work (e.g., job sharing, job rotation, cooperative work), ameliorated possibilities to find a job through request-offer match engines.	Decrease stress related to working conditions (from the physical, cognitive, social, and personal points of view)	Decrease stress absenteeism. Improved work performance due to higher motivation and involvement in decision-making and to higher confidence in the possibility to change or find a job.	Worked hours vs missed hours, worked documents, production items,
	Financial and social support (e.g., child or adult care , unemployment subsidies, education and qualification support to improve personal skills)	Reduce stress due to life charges		
• People with a mental disorder are at greater risk of contracting somatic diseases, such as heart diseases, strokes, diabetes, respiratory problems and cancer	programmes, support for women workers, management training) monitor the development of work ability.	Individual realization of one's own potential. Increase self-esteem; work-mastery-coaching. Improving cooperation and relationships Create universally accessible working groups.		worked cooperatively in teams
	Culture of enterprise, participation, equity and fairness, and challenging stigma and discrimination in the workplace. Enhance ethical conditions at work (promote equality in careers, balance opportunities, enhance transparency of company strategies, etc.)		Increase the sense of belonging. Increase self-esteem	Number of doctor visits, hours dedicated to fitness/self-education
	Positive working environment and clear job roles & expectations (e.g. promoting employee participation in decision-making..)			
	Supporting, retaining and employing aged people.	Fulfil the needs of ageing workers (physical, intellectual, personal and social)	Increase integration of workers within working environment	Nbr of new employees >55, nbr of retired but working.
	Measures to promote employability of older workers and improve their working conditions.	Restructuring work areas, supporting cooperative & accessible sessions	Smart environment	Nbr of areas monitored via IoT

Independent living and quality of life for age group 50+

IMPACT

ASPECT	FACT & FIGURES	INTERVENTIONS	EXPECTED GOAL
Noise	Hearing impairment, because of noise exposure, is a serious public health problem; worldwide 1.3 billion people suffer from this condition and the World Health Organisation (WHO) estimates that 10% of the global population are currently exposed to noise levels that could lead to hearing impairment. Health effects related to environmental noise result in a cost for society. Cost of medical treatment (e.g. hypertension or mental illness); loss of efficiency at work due to illness or fatigue resulting from sleep deprivation or ineffective resting periods; reduced creativity and learning – even less prosocial behaviour – caused by noise stress, resulting in safety and security costs. Loss of healthy life due to UK noise exposure valued at €1.34 billion	Isolate noise, use of cabins and headphones, use of Individual Protection Equipment (IPE)	Increased risk awareness
Thermo-hygronomic conditions	Thermal discomfort may impede workers' performance and safety behaviour, hence increasing the probability of occupational accidents Research indicates that thirsty individuals who drink water prior to performing a mental task have faster reaction times than those who do not drink water. Being dehydrated by just 2% has been shown to impair cognitive performance.	Regulate temperature, recommendations on suitable conditions according to the task, recommendations about heating/ conditioning, humidification, hydration reminders, other tips on food and liquids assumption	Increase prevention, Decrease typing errors
Exposure to hazardous substances (Initially CO	Exposure to occupational carcinogens, ie. Resulted in an estimated 1.6 million disability-adjusted life-years (DALYs; one DALY is one lost year of 'healthy' life) and approximately 152 000 deaths. In 2005 in the UK	In WA, the first sensors will regard CO-CO2, which will enable future inclusion of other sensors. Ventilation. Air Filtering Plants	Increase attention
	suffer from sleep apnoea (about 10% of these are actually diagnosed), and people aged from 50 - 60 are mostly affected.		
Physical Inactivity	40-50% of the working age population do not take enough physical exercise to maintain their health and the low physical activity causes 2-3 extra days of absence (sick leave) annually. Low physical fitness is a risk factor for both sexes early retirement [238]	Physical Activity campaigns. Sport groups, Sport activities promotion	Increase the number of users physically active
Smoking/ Drink Cessation	Worldwide, tobacco is the second cause of morbidity and the 4th most common health risk factor in the world. It causes diseases such as lung cancer, chronic obstructive pulmonary disease and coronary heart disease	Smoke quitting campaign, planned healthcare visits. Psychological support groups. Gamification for smoke attitudes changing.	Decrease the number of smokers
Nutrition	15% elders are affected by poor nutrition & malnutrition.	Diet Planning.	Improve diet
Work overall amelioration	Increased safety-related aspects in the work environment.	Identify safety of used resources, work activities and environment.	Indicators to show/ prevent risks.

Enhanced health and safety **working conditions**, enabling older persons to be able to contribute at an appropriate level for a longer period of time;

IMPACT

	FACTOR	EXPECTED GOAL	IMPACT
Users	Design phase	Number of users during the design phase	30 users participating on the design phase (Wizard of Oz tests)
	Validation phase	Nber of users during the validation phase	60 users validating the system
	Testing phase	Number of users during the testing phase	90 users testing the system
Intuitiveness	Past knowledge	Known similar devices to the ones used	All WA parts commercially available 1Y prior to project start
	Tech. familiarity	Perception of familiarity	WA developed software running on smartphones and tablets (android)
	Training	Nbr of training sessions required to use devices	80% of users able to use the solution after a 30 minutes tutorial
		Usefulness of the training provided	Persistence of training continuously received after 4 month. User has not require re-training from the initial session. Users
Acceptances	Social support	Support from family, peers, and community	Methods to allow senior adults to contact their social networks
	Emotion	Perception of emotional and psychological benefits	Questionnaires reflect improve overall emotional state in the senior adults in more than 60% of the cases
	Social projection	Perception of social visibility or how a technology makes them look to others	Perceived aesthetic of the system is positive
	Experience	Relevance with prior experiences/ interactions	Improved
	Confidence	Empowerment without anxiety/intimidation	Makes them fill confident.
	Independence	Perception of autonomy given to the user	Questionnaires reflect improve overall self-perceived independence state in the senior adults in > 60% of the cases. Improved level of IAL(Independent activity levels).

Evidence of **user-centred** design and innovation, new **intuitive** ways of human-computer interaction, and user **acceptance**

IMPACT

Potential **cost-effectiveness** due to enhanced self-care, life-style, age-friendly and skills conducive work environments and socio-economic benefits

Considering a constant budget allocation; which has been seen as not real and is supposed to increase by 70% in 2060, the potential room for saving is 3.712 M€ thanks to ICT solutions like **WA**. Considering a market introduction of 75.000 units; 0, 388% of the population by 2022 (2 years after the project completion), this means a reduction in savings of up to 144 M€. This translate to an impressive ROI **for each euro invested in the project** from an investment from a 4 M€ investment to a ROI of **potentially 144M€.**

Competitive advantage for European industry through **flexible and sustainable work arrangements** for an ageing workforce

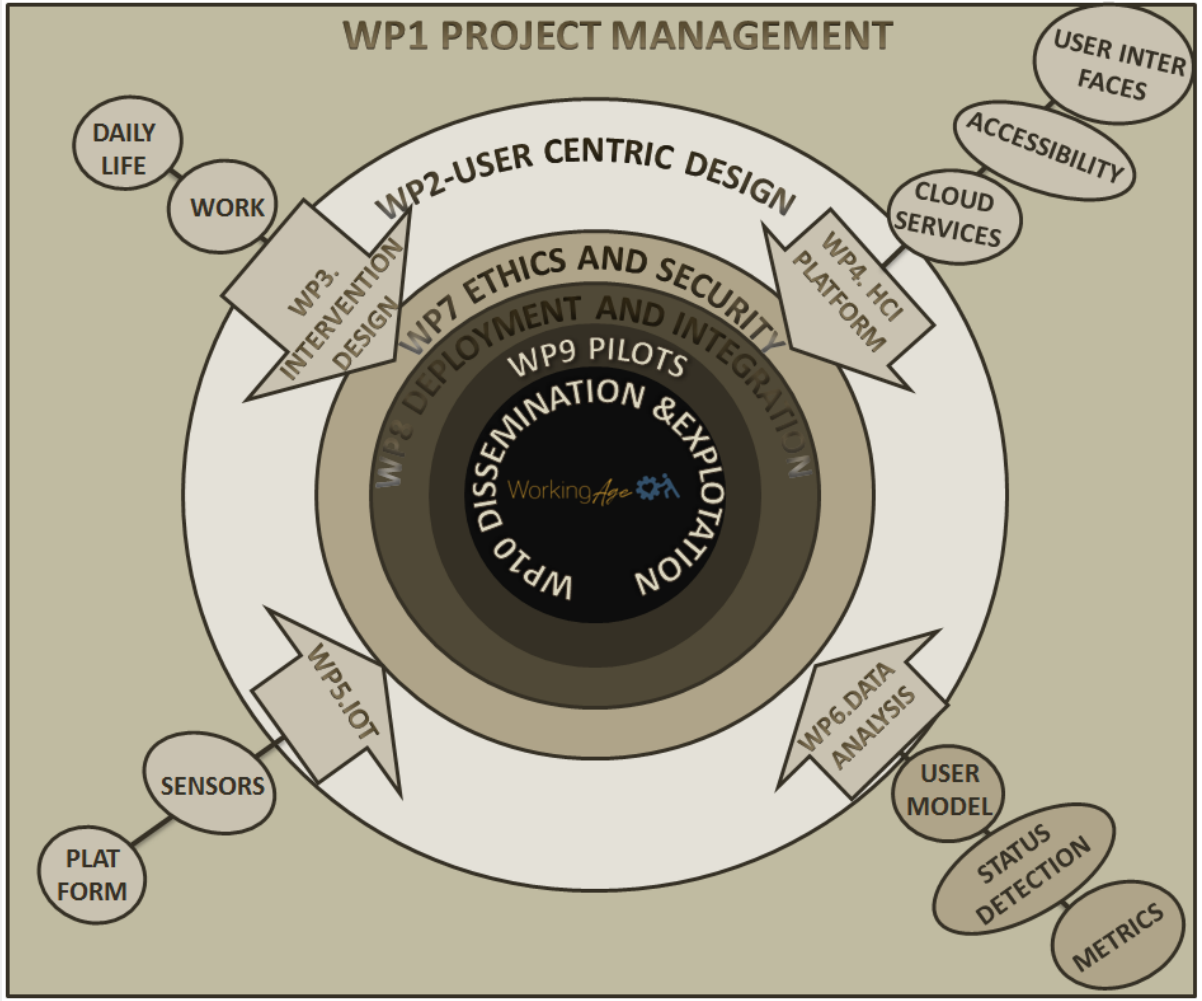
WA aims at retaining employment of elderly workers, providing them alternative working schemes. WA Tool will consider their desire of working time and free time and the search for reconciling occupational and private obligations. This may lead to a decrease of the number of elderly leaving their work.

Global **leadership** in ICT based innovation for active and healthy ageing including the occupational environment

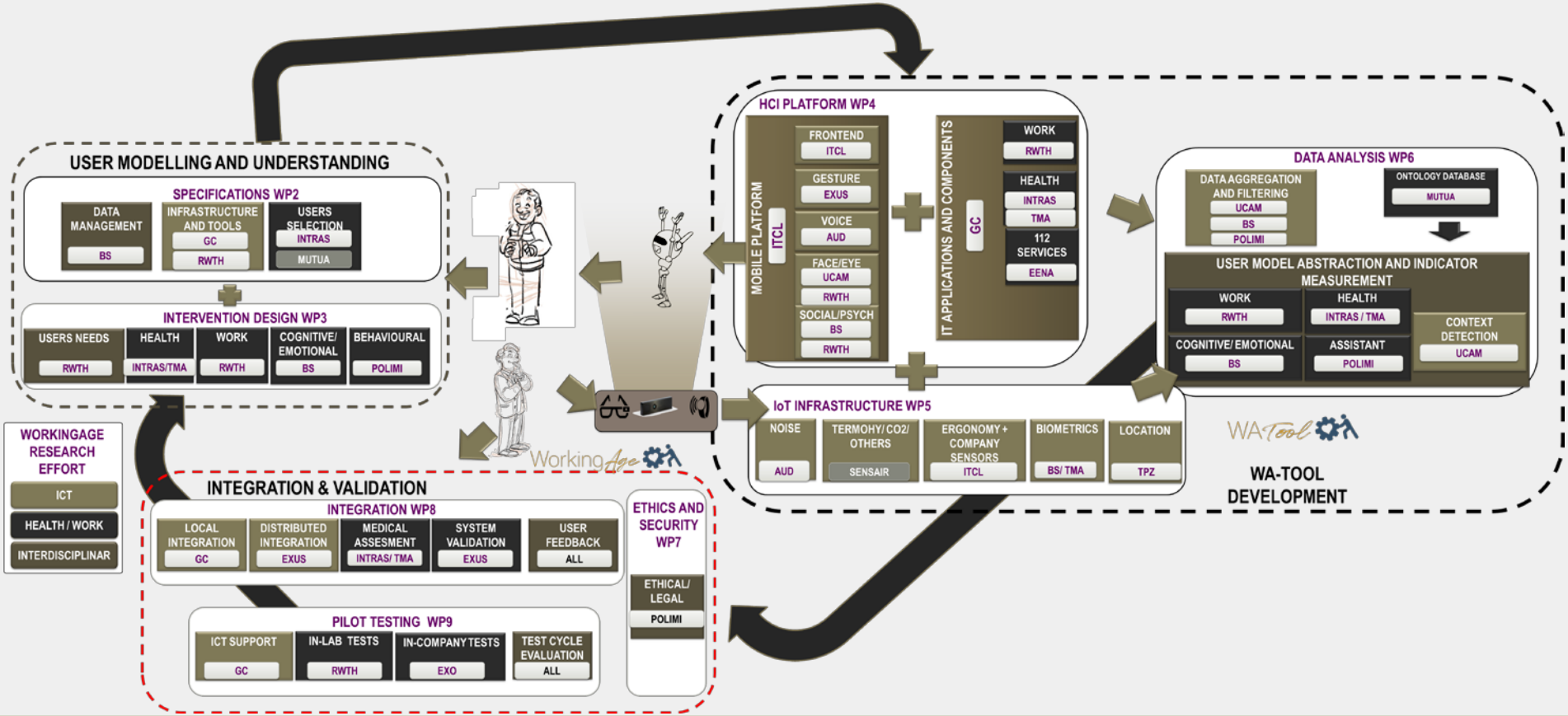
WA will contribute to the European Global leadership in ICT as its research will influence and will benefit from many of the points addressed by the Mid-Term Review on the implementation of the Digital Single Market Strategy.

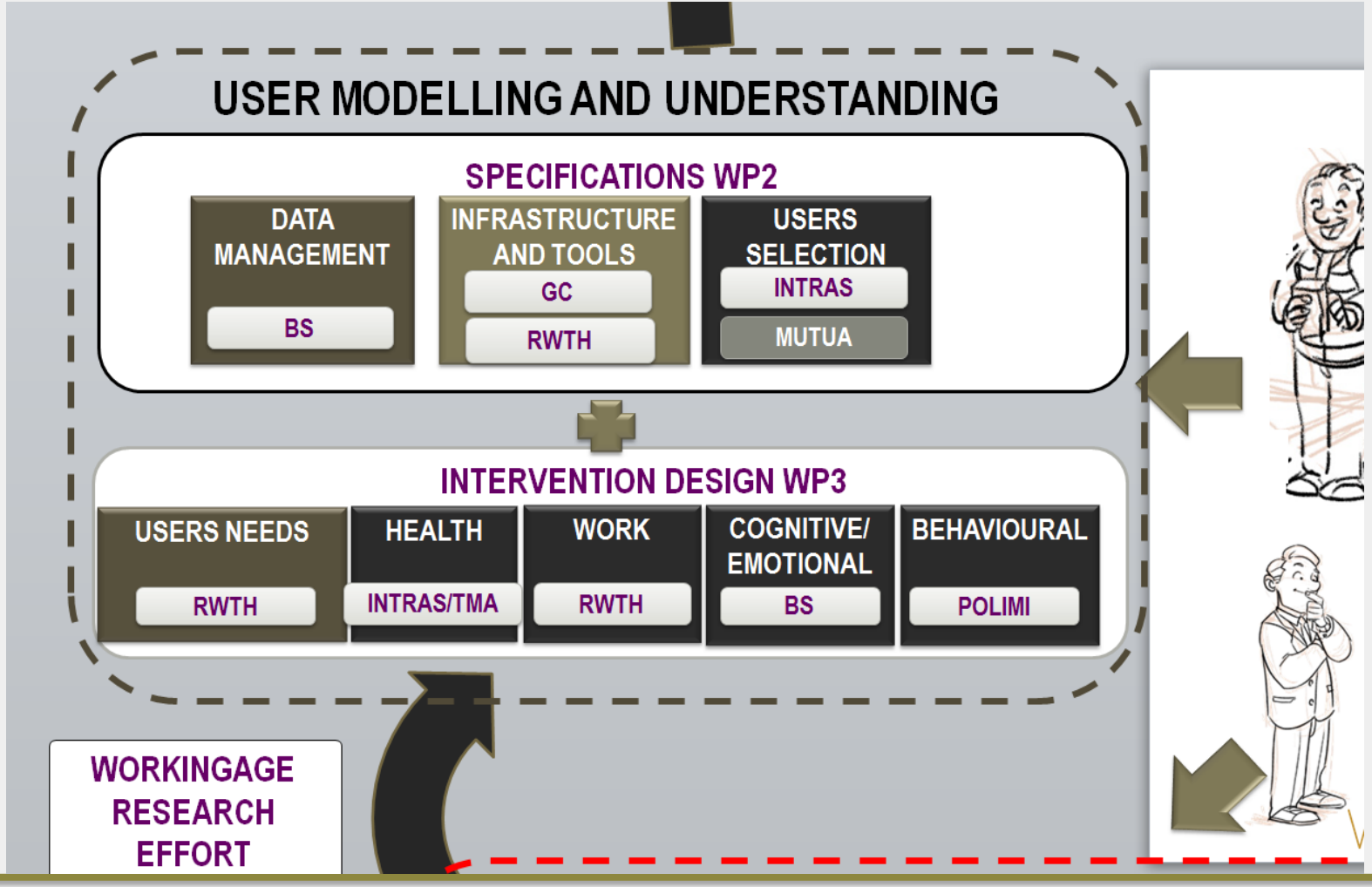
METHODOLOGY

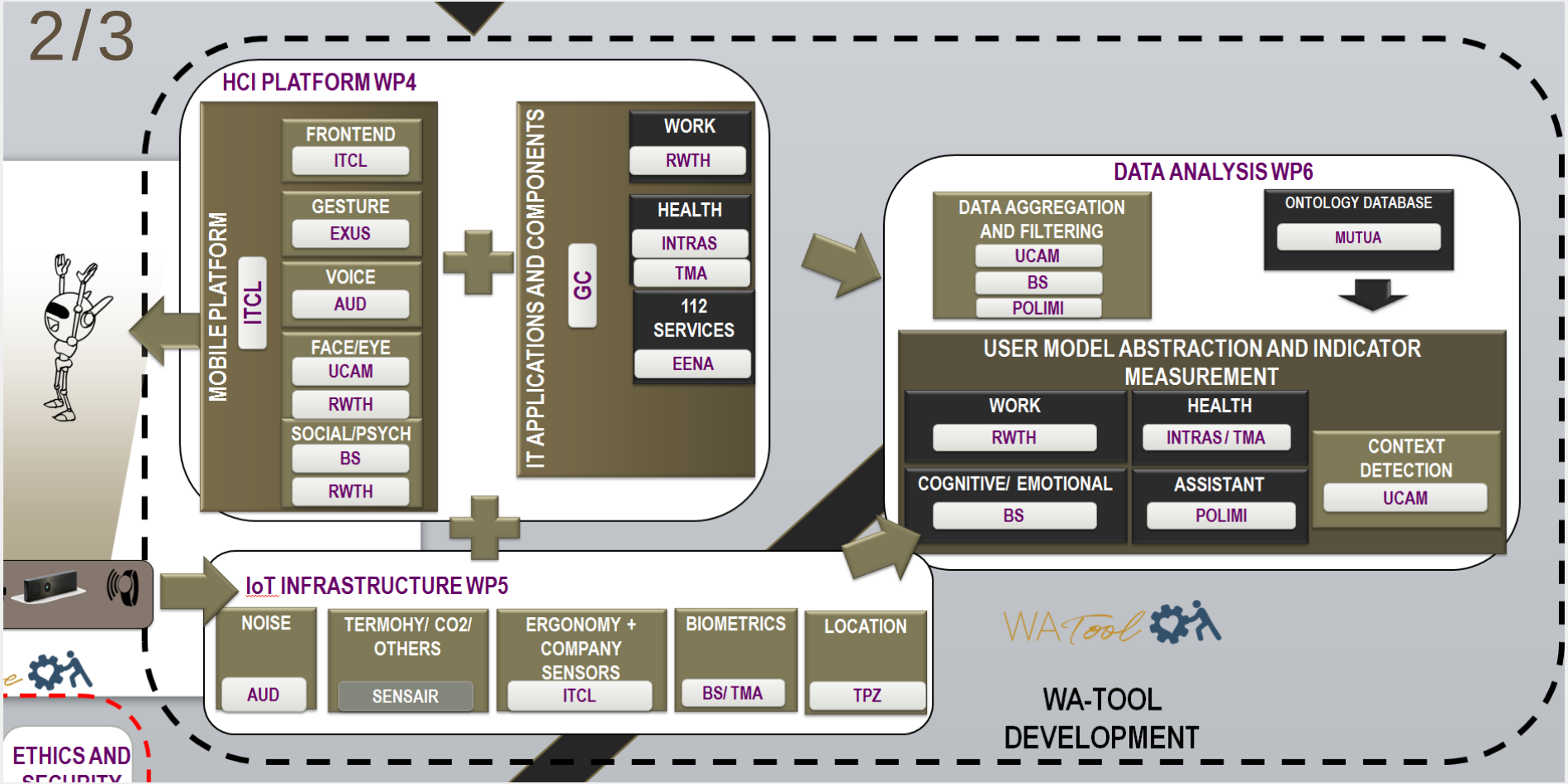
WP Interrelation



METHODOLOGY




USER MODELLING AND UNDERSTANDING
SPECIFICATIONS WP2
DATA MANAGEMENT
BS
INFRASTRUCTURE AND TOOLS
GC
RWTH
USERS SELECTION
INTRAS
MUTUA
INTERVENTION DESIGN WP3
USERS NEEDS
RWTH
HEALTH
INTRAS/TMA
WORK
RWTH
COGNITIVE/ EMOTIONAL
BS
BEHAVIOURAL
POLIMI
WORKINGAGE RESEARCH EFFORT


HCI PLATFORM WP4
MOBILE PLATFORM
ITCL
FRONTEND
ITCL
GESTURE
EXUS
VOICE
AUD
FACE/EYE
UCAM
RWTH
SOCIAL/PSYCH
BS
RWTH
IT APPLICATIONS AND COMPONENTS
GC
WORK
RWTH
HEALTH
INTRAS
TMA
112 SERVICES
EENA
DATA ANALYSIS WP6
DATA AGGREGATION AND FILTERING
UCAM
BS
POLIMI
ONTOLOGY DATABASE
MUTUA
USER MODEL ABSTRACTION AND INDICATOR MEASUREMENT
WORK
RWTH
HEALTH
INTRAS / TMA
COGNITIVE/ EMOTIONAL
BS
ASSISTANT
POLIMI
CONTEXT DETECTION
UCAM
IoT INFRASTRUCTURE WP5
NOISE
AUD
TERMOHY/ CO2/ OTHERS
SENSAIR
ERGONOMY + COMPANY SENSORS
ITCL
BIOMETRICS
BS/ TMA
LOCATION
TPZ
WA-TOOL DEVELOPMENT
ETHICS AND

WORKINGAGE RESEARCH EFFORT

- ICT
- HEALTH / WORK
- INTERDISCIPLINAR

INTEGRATION & VALIDATION

INTEGRATION WP8

LOCAL INTEGRATION	DISTRIBUTED INTEGRATION	MEDICAL ASSESEMENT	SYSTEM VALIDATION	USER FEEDBACK
GC	EXUS	INTRAS/TMA	EXUS	ALL

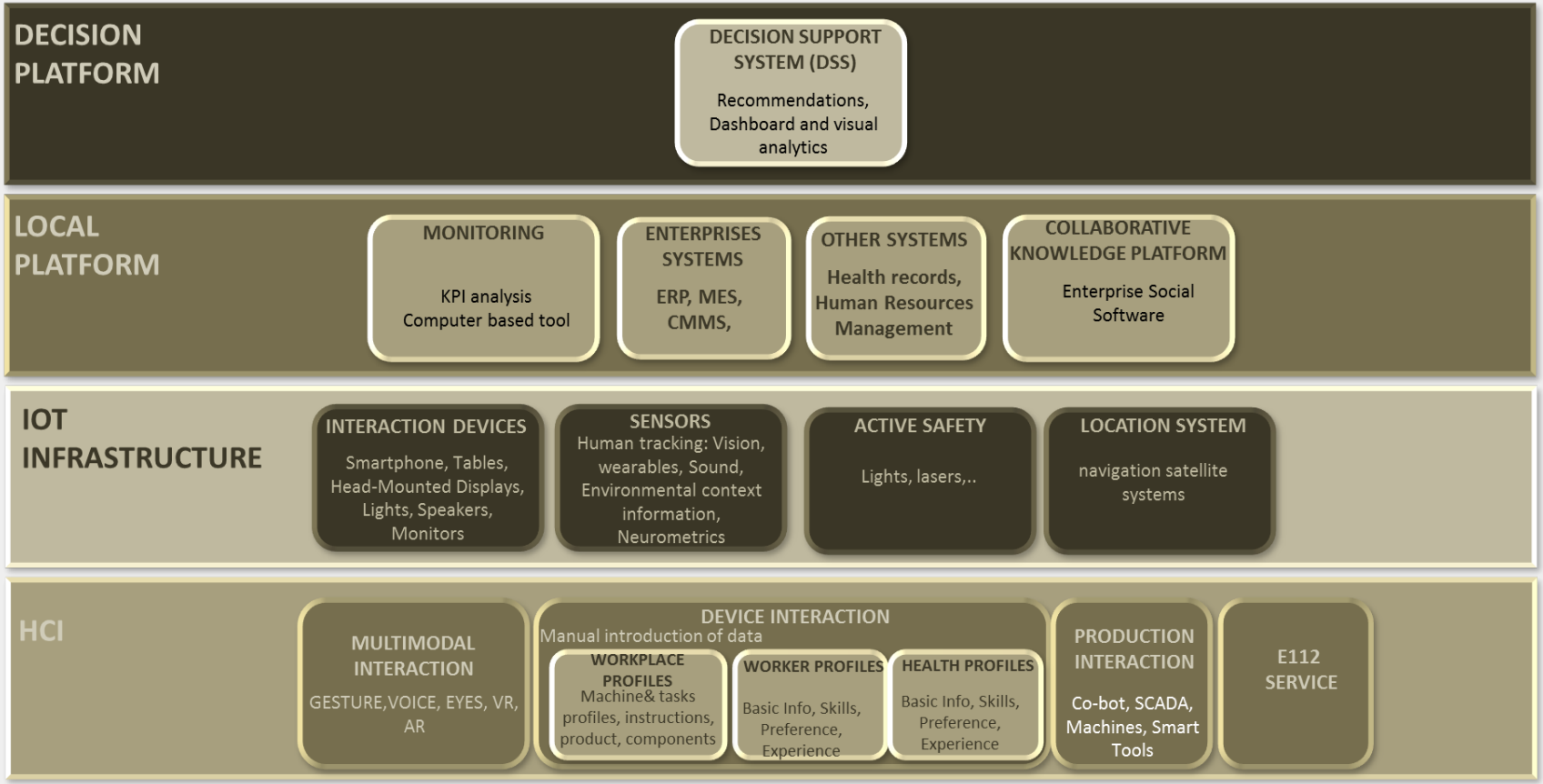
PILOT TESTING WP9

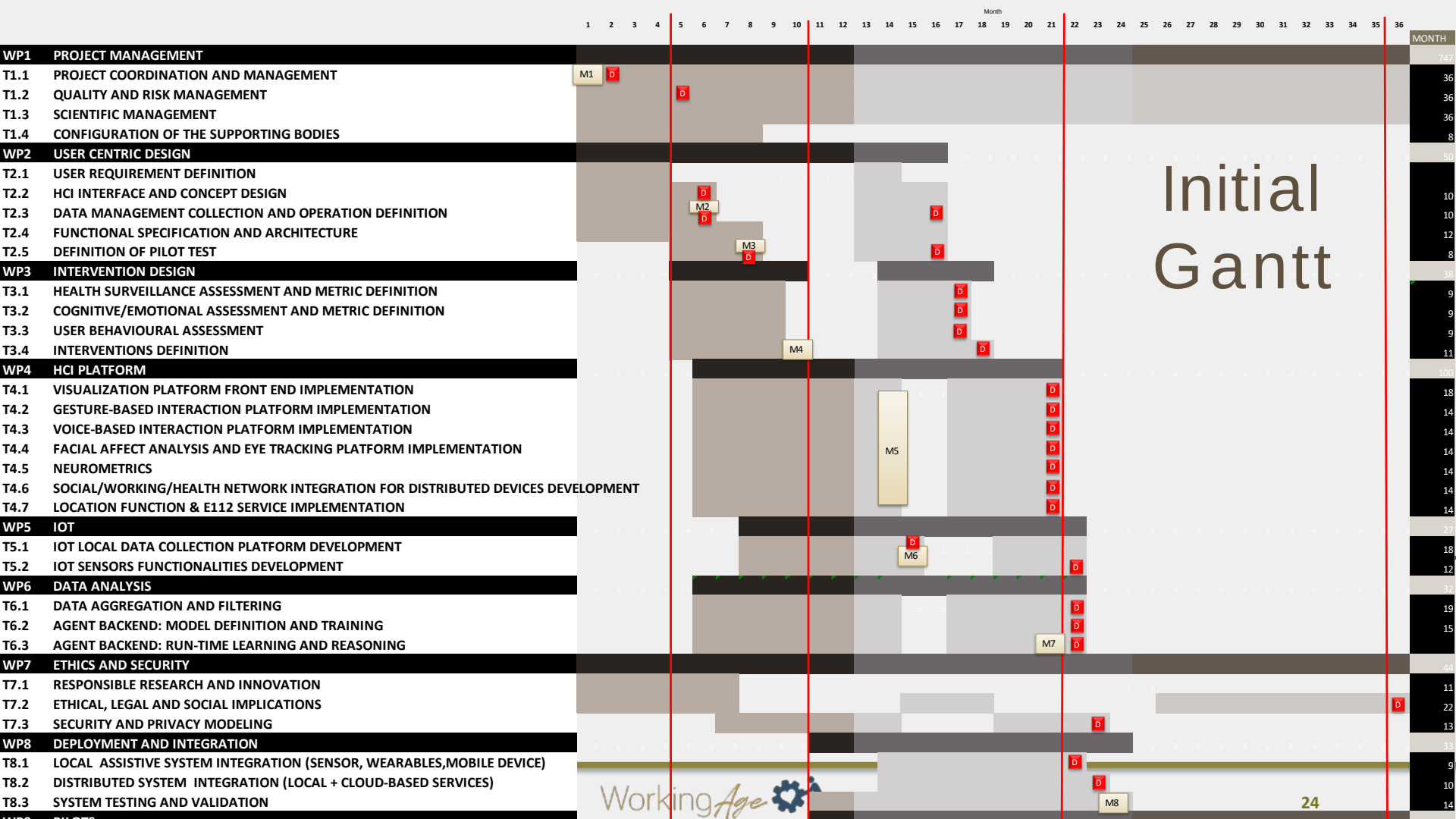
ICT SUPPORT	IN-LAB TESTS	IN-COMPANY TESTS	TEST CYCLE EVALUATION
GC	RWTH	EXO	ALL

ETHICS AND SECURITY WP7

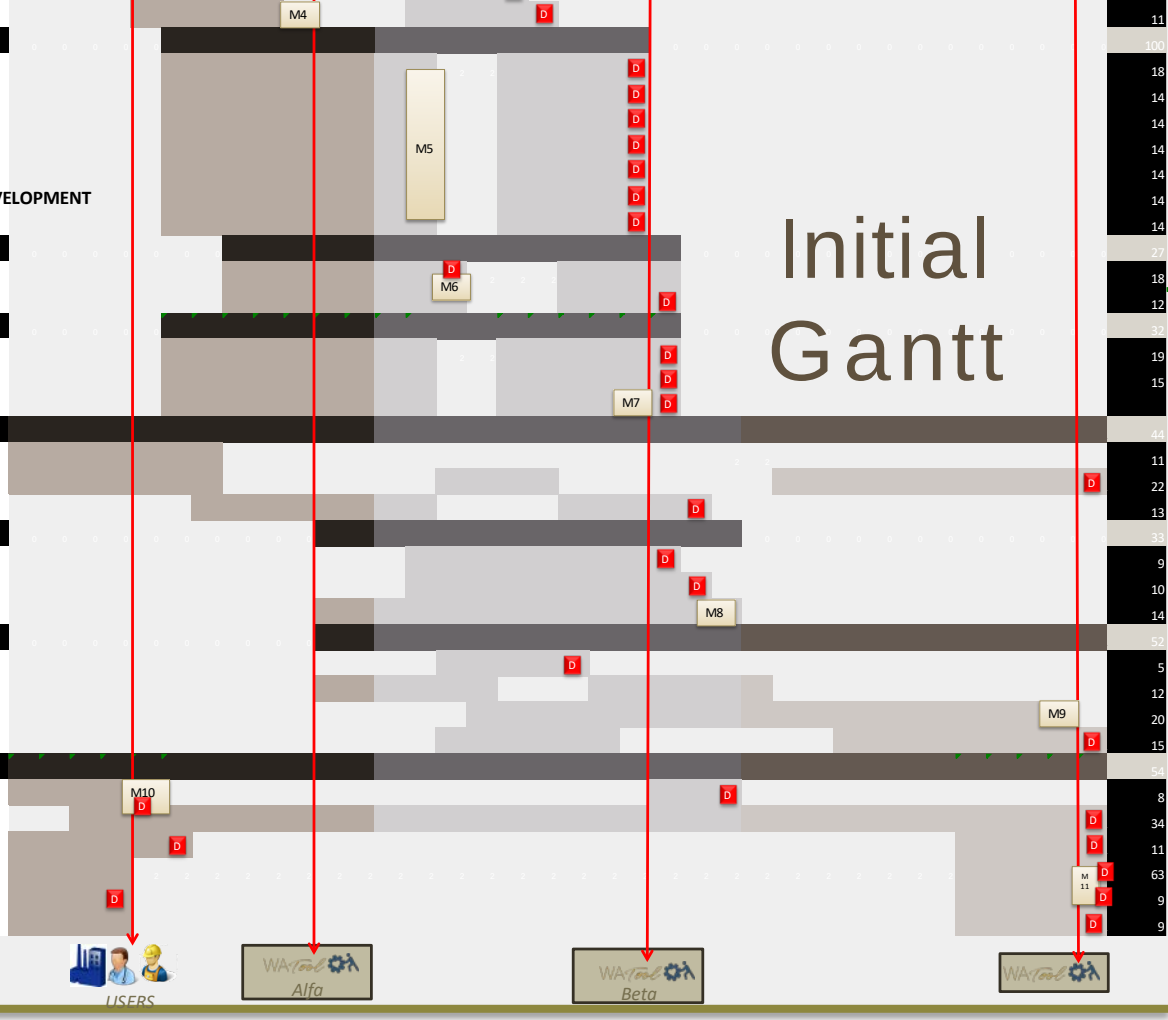
ETHICAL/ LEGAL — POLIMI

WA TOOL


DECISION PLATFORM
DECISION SUPPORT SYSTEM (DSS)
Recommendations, Dashboard and visual analytics
LOCAL PLATFORM
MONITORING
KPI analysis Computer based tool
ENTERPRISES SYSTEMS
ERP, MES, CMMS,
OTHER SYSTEMS
Health records, Human Resources Management
COLLABORATIVE KNOWLEDGE PLATFORM
Enterprise Social Software
IOT INFRASTRUCTURE
INTERACTION DEVICES
Smartphone, Tables, Head-Mounted Displays, Lights, Speakers, Monitors
SENSORS
Human tracking: Vision, wearables, Sound, Environmental context information, Neurometrics
ACTIVE SAFETY
Lights, lasers,..
LOCATION SYSTEM
navigation satellite systems
HCI
MULTIMODAL INTERACTION
GESTURE,VOICE, EYES, VR, AR
DEVICE INTERACTION
Manual introduction of data
WORKPLACE PROFILES
Machine& tasks profiles, instructions, product, components
WORKER PROFILES
Basic Info, Skills, Preference, Experience
HEALTH PROFILES
Basic Info, Skills, Preference, Experience
PRODUCTION INTERACTION
Co-bot, SCADA, Machines, Smart Tools
E112 SERVICE

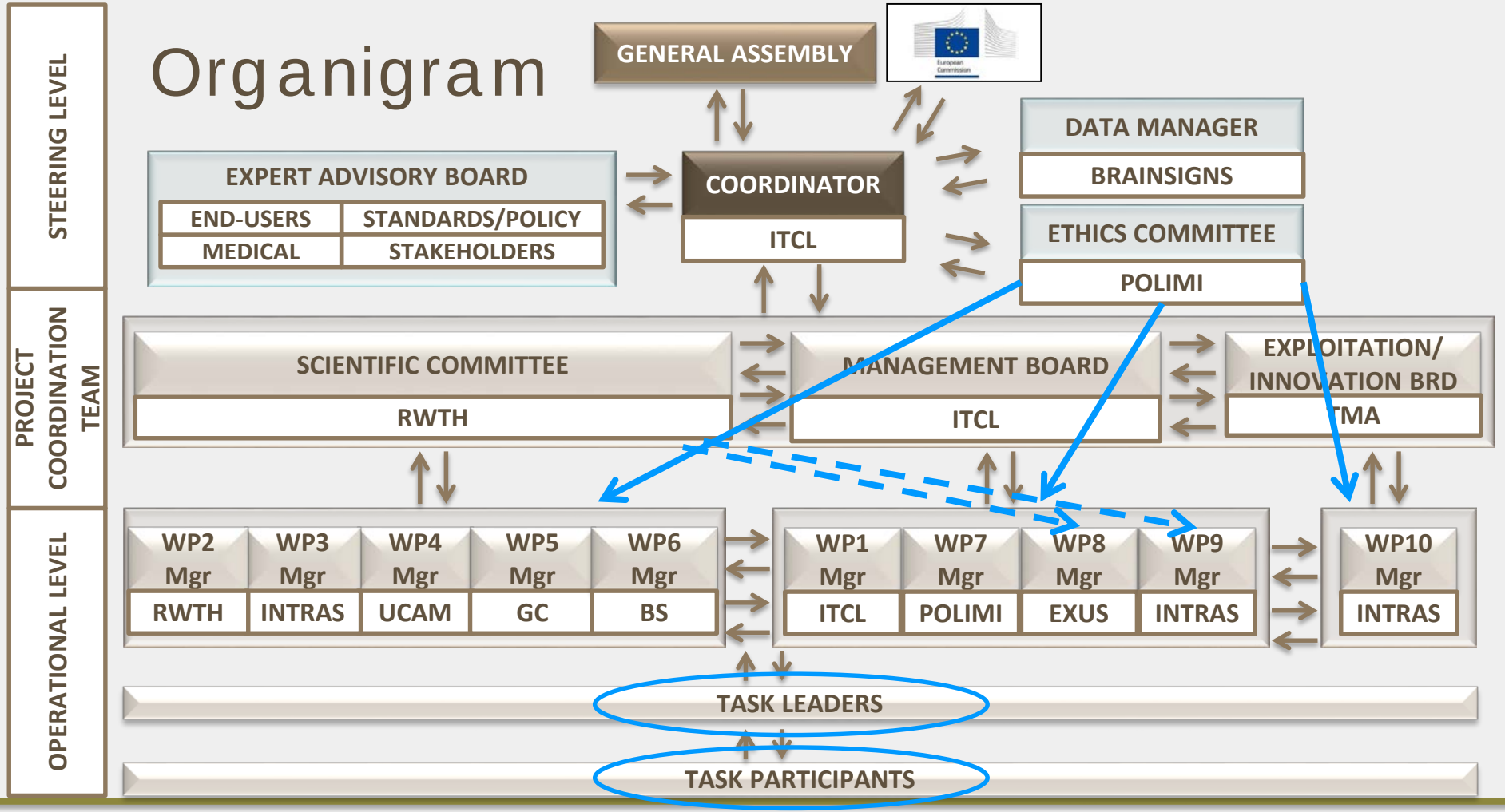

Month
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
MONTH
WP1 PROJECT MANAGEMENT 747
T1.1 PROJECT COORDINATION AND MANAGEMENT 36
T1.2 QUALITY AND RISK MANAGEMENT 36
T1.3 SCIENTIFIC MANAGEMENT 36
T1.4 CONFIGURATION OF THE SUPPORTING BODIES 8
WP2 USER CENTRIC DESIGN 50
T2.1 USER REQUIREMENT DEFINITION 10
T2.2 HCI INTERFACE AND CONCEPT DESIGN 10
T2.3 DATA MANAGEMENT COLLECTION AND OPERATION DEFINITION 12
T2.4 FUNCTIONAL SPECIFICATION AND ARCHITECTURE 8
T2.5 DEFINITION OF PILOT TEST
WP3 INTERVENTION DESIGN 38
T3.1 HEALTH SURVEILLANCE ASSESSMENT AND METRIC DEFINITION 9
T3.2 COGNITIVE/EMOTIONAL ASSESSMENT AND METRIC DEFINITION 9
T3.3 USER BEHAVIOURAL ASSESSMENT 9
T3.4 INTERVENTIONS DEFINITION 11
WP4 HCI PLATFORM 100
T4.1 VISUALIZATION PLATFORM FRONT END IMPLEMENTATION 18
T4.2 GESTURE-BASED INTERACTION PLATFORM IMPLEMENTATION 14
T4.3 VOICE-BASED INTERACTION PLATFORM IMPLEMENTATION 14
T4.4 FACIAL AFFECT ANALYSIS AND EYE TRACKING PLATFORM IMPLEMENTATION 14
T4.5 NEUROMETRICS 14
T4.6 SOCIAL/WORKING/HEALTH NETWORK INTEGRATION FOR DISTRIBUTED DEVICES DEVELOPMENT 14
T4.7 LOCATION FUNCTION & E112 SERVICE IMPLEMENTATION 14
WP5 IOT 27
T5.1 IOT LOCAL DATA COLLECTION PLATFORM DEVELOPMENT 18
T5.2 IOT SENSORS FUNCTIONALITIES DEVELOPMENT 12
WP6 DATA ANALYSIS 32
T6.1 DATA AGGREGATION AND FILTERING 19
T6.2 AGENT BACKEND: MODEL DEFINITION AND TRAINING 15
T6.3 AGENT BACKEND: RUN-TIME LEARNING AND REASONING
WP7 ETHICS AND SECURITY 44
T7.1 RESPONSIBLE RESEARCH AND INNOVATION 11
T7.2 ETHICAL, LEGAL AND SOCIAL IMPLICATIONS 22
T7.3 SECURITY AND PRIVACY MODELING 13
WP8 DEPLOYMENT AND INTEGRATION 33
T8.1 LOCAL ASSISTIVE SYSTEM INTEGRATION (SENSOR, WEARABLES,MOBILE DEVICE) 9
T8.2 DISTRIBUTED SYSTEM INTEGRATION (LOCAL + CLOUD-BASED SERVICES) 10
T8.3 SYSTEM TESTING AND VALIDATION 14
M1
M2
M3
M4
M5
M6
M7
M8
Initial Gantt
WorkingAge
24

T3.4	INTERVENTIONS DEFINITION
WP4	**HCI PLATFORM**
T4.1	VISUALIZATION PLATFORM FRONT END IMPLEMENTATION
T4.2	GESTURE-BASED INTERACTION PLATFORM IMPLEMENTATION
T4.3	VOICE-BASED INTERACTION PLATFORM IMPLEMENTATION
T4.4	FACIAL AFFECT ANALYSIS AND EYE TRACKING PLATFORM IMPLEMENTATION
T4.5	NEUROMETRICS
T4.6	SOCIAL/WORKING/HEALTH NETWORK INTEGRATION FOR DISTRIBUTED DEVICES DEVELOPMENT
T4.7	LOCATION FUNCTION & E112 SERVICE IMPLEMENTATION
WP5	**IOT**
T5.1	IOT LOCAL DATA COLLECTION PLATFORM DEVELOPMENT
T5.2	IOT SENSORS FUNCTIONALITIES DEVELOPMENT
WP6	**DATA ANALYSIS**
T6.1	DATA AGGREGATION AND FILTERING
T6.2	AGENT BACKEND: MODEL DEFINITION AND TRAINING
T6.3	AGENT BACKEND: RUN-TIME LEARNING AND REASONING
WP7	**ETHICS AND SECURITY**
T7.1	RESPONSIBLE RESEARCH AND INNOVATION
T7.2	ETHICAL, LEGAL AND SOCIAL IMPLICATIONS
T7.3	SECURITY AND PRIVACY MODELING
WP8	**DEPLOYMENT AND INTEGRATION**
T8.1	LOCAL ASSISTIVE SYSTEM INTEGRATION (SENSOR, WEARABLES,MOBILE DEVICE)
T8.2	DISTRIBUTED SYSTEM INTEGRATION (LOCAL + CLOUD-BASED SERVICES)
T8.3	SYSTEM TESTING AND VALIDATION
WP9	**PILOTS**
T9.1	TRAINING AND ICT SUPPORT
T9.2	IN LAB TESTS
T9.3	IN COMPANY TEST
T9.4	TEST CYCLE EVALUATION
WP10	**DISSEMINATION, EXPLOITATION STRATEGY AND VALUE CHAIN MODELLING**
T10.1	COMMUNICATION AND DISSEMINATION STRATEGY
T10.2	COMMUNICATION AND DISSEMINATION MATERIAL
T10.3	EXCHANGE WITH OTHER PROJECTS/COUNTRIES
T10.4	STANDARDIZATION
T10.5	EXPLOITATION STRATEGY AND VALUE CHAIN MODELLING
T10.6	IPR MANAGEMENT



Initial Gantt

Organigram


STEERING LEVEL
PROJECT COORDINATION TEAM
OPERATIONAL LEVEL
GENERAL ASSEMBLY
EXPERT ADVISORY BOARD
END-USERS
STANDARDS/POLICY
MEDICAL
STAKEHOLDERS
COORDINATOR
ITCL
DATA MANAGER
BRAINSIGNS
ETHICS COMMITTEE
POLIMI
SCIENTIFIC COMMITTEE
RWTH
MANAGEMENT BOARD
ITCL
EXPLOITATION/
INNOVATION BRD
TMA
WP2 Mgr
RWTH
WP3 Mgr
INTRAS
WP4 Mgr
UCAM
WP5 Mgr
GC
WP6 Mgr
BS
WP1 Mgr
ITCL
WP7 Mgr
POLIMI
WP8 Mgr
EXUS
WP9 Mgr
INTRAS
WP10 Mgr
INTRAS
TASK LEADERS
TASK PARTICIPANTS

THANK YOU

Agenda