



# SCIENTIFIC RESEARCH METHODOLOGIES AND TECHNIQUES

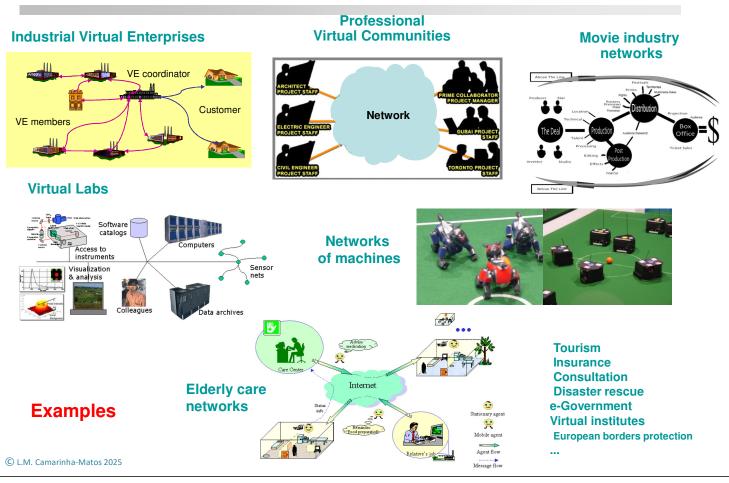
# Unit 13: ROADMAPPING AND FUTURE PLANNING (II)

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#### **Example: Roadmap for collaborative networks** NOVA SCHOOL OF SCIENCE & TECHNOLOGY THEN Sustainable collaborative Well-founded models & theory networks Reference models Generic (invisible) infrastructures Replicable breeding environments Controlled emerging behavior Re-utilizable toolbox Social responsibility NOW -@ Emerging collaborative networks Roadmap Ad-hoc experiments e-Myths No interoperability No reference model Ill-understood behavior Lack of support services ••• © L.M. Camarinha-Matos 2025

#### N VA NOVA SCHOOL OF SCIENCE & TECHNICLOGY What is a collaborative network ?





### WHAT IS IN A CN ?

Variety of entities - organizations and people ... even machines

- largely autonomous
- geographically distributed
- heterogeneous in terms of their: operating environment, culture, social capital and goals

Collaborate to (better) achieve common or compatible goals

Interactions are supported by computer networks.



# **0. Assemble "roadmap coordination team"**



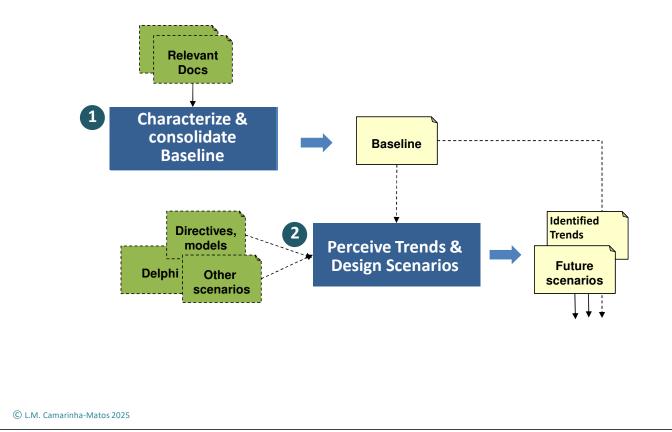
Multi-disciplinary team

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### **1. BASELINE**

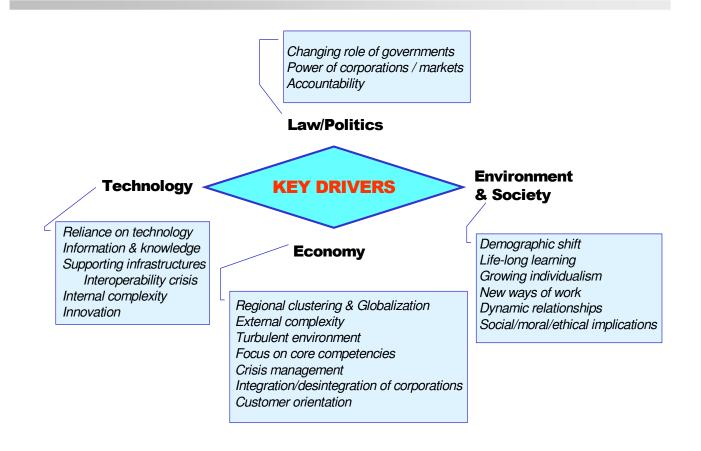






- Research on VO has created a critical mass and European-wide *intuitive* understanding of the area.
- Basic supporting infrastructures and relevant technologies are well represented, but the developments are often focused on particular needs and based on ad-hoc experiments, hardly re-utilizable.
- Generic functions or harmonization of achievements are addressed only in a few projects.
- Efforts on general plug-and-play architecture and interoperability are also to a large extent missing.
  - Consequently, no generally accepted reference model or interoperability base are available.
- Although several disciplines are concerned, the main focus has been on the ICT infrastructure. Research on social/organizational, including management, is mainly focused on best practice. Integration with technological development and impacts on structures are not covered. In addition little research is focused on the social and organizational issues created by VOs





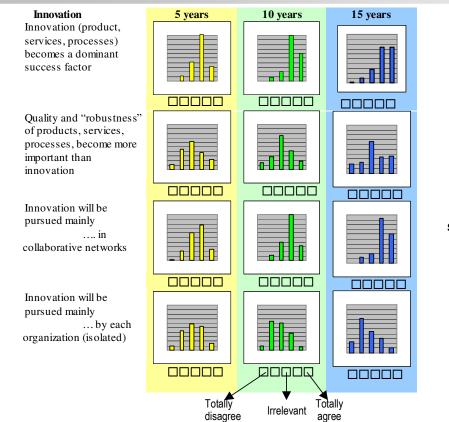
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ľ	FUTURE SCENARIOS IN CO			TWORKS		
		ratally designed		falsiy agan		
	Regional clustering and Globalization	5 years	10 years	15 years		
	Regional clustering, reinforcing long-term relationships and leveraging local "business culture", local specificities, and proximity to customers					
	will be a major trend against threats of globalization will play only a complementary role in the global economy					135 experts
	Globalization will definitely erode "geographical competitive advantages" and borders					
	Customer orientation	I			1	- <mark>69</mark> % indu
Γ	Trends in products / services point to mass customization					- 31% acad
	Guaranteeing customer loyalty becomes a determining competitive advantage					
	Customer satisfaction in networked organizations is the responsibility of the customer interface node a diluted responsibility among network members					
	Internal complexity					
	Systems (e.g. manufacturing, service provision) become increasingly complex	00000	00000	00000		
	Products become increasingly complex (internal structure)					
	External complexity					
Γ	Business processes tend to be supported on a lean, stable and simple supply chain		00000	00000		
	Business processes tend to be supported on highly dynamic and increasingly complex networks of collaborative entities					
	Turbulent environment					
Γ	The speed of change in business environments is likely to increase					
	The amount of change in business environments is likely to continue growing					

III.

#### N VA NOVA SCHOOL OF SCIENCE & TECHNOLOGY Delphi survey – Example results



Innovation on products, services, and processes will clearly become a dominant success factor.

Innovation will be pursued mainly in collaborative networks, especially in the medium and long term.

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# **THINKcreative book**

INTRODUCTION Motivation, Base concepts

NEW COLLABOARTIVE FORMS SoA, Scenarios, Examples

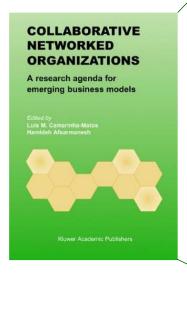
> GLOBAL & REGIONAL RESEARCH AGENDAS Delphi, Workshops, Non-EU views

> > HUMAN, SOCIETAL, AND ORGANIZATIONAL ASPECTS

> > > ICT FACTORS Infrastructures, MAS, Emerging technologies

> > > > FOUNDATIONS AND MODELING Models, theories, MAS modeling, soft modeling, logic of obligations

> > > > > **ROADMAP EXAMPLE** Research agenda for advanced CNs

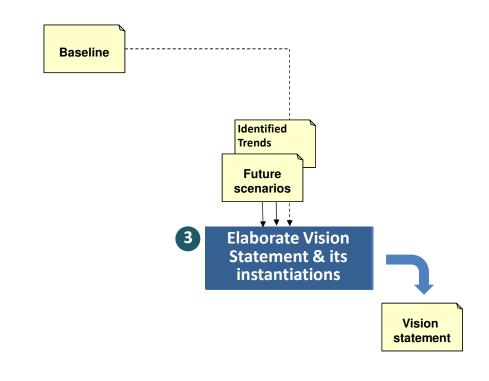




# **2. VISION STATEMENT**

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Plausible scenarios of future

A widely recognized & frequently used technique is scenario building

#### Scenarios provide guidelines on:

Based on:

**Requires:** 

future

driving forces

- which directions are more probable for future
- estimation of future results

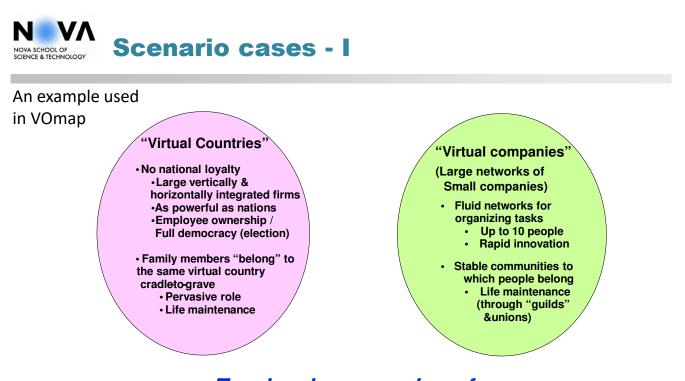
Scenario A Scenario B State of the Art VOSTER + ... Trend Analysis THINKCreative possible trends opposing factors Industry Support significant amount of time and resources to Vision estimate the future, specially for developing VOmap X large-scale scenarios as required for VOs of Scenario C

Important to identify existing

scenarios in literature

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### Two border scenarios of Laubacher & Malone, 1997

3 years > 650 experts and > 300 executives

(Robert J. Laubacher, Thomas W. Malone, and the MIT Scenario Working Group. Two Scenarios for 21st Century Organizations: Shifting "Networks of Small Firms" or All-Encompassing "Virtual Countries" http://ccs.mit.edu/21c/21CWP001.html )

Scenario cases - II

### NOVA SCHOOL OF SCIENCE & TECHNOLOGY

# Other examples used in VOmap

# Regional clusters and enterprise networks:

provide very powerful and flexible ways to support SMEs.

# Professional (virtual) communities:

provide specialized skills and flexible, but secure working conditions for members.

#### Global networked firms:

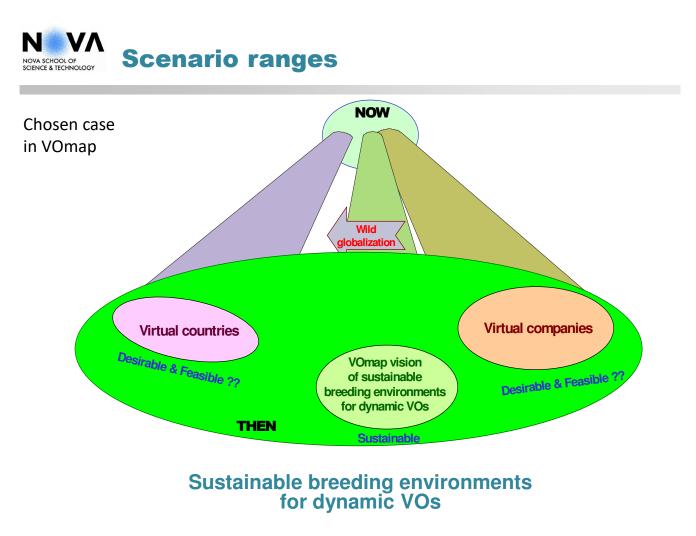
provide flexible usage of regional networks and knowledge workers through a very flexible project-oriented team organization.

# PLAYERS IN A DYNAMIC ECONOMY Global Networked Firm Professional networks Service prosessional s 50 experts from > 25 organizations

# Three potential players in a future

economy scenario

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• Identifies required areas for research and development

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 Identifies the needs form other social bodies (government and regulatory bodies

•Creates new opportunities for businesses large and small

In 2015 most enterprises will be part of some sustainable collaborative networks that will act as breeding environments for the formation of dynamic virtual organizations in response to fast changing market opportunities and conditions.

#### Main mechanisms:

- · Well founded models of collaboration
- Management systems for breeding environments replicable to a large variety of sectors
- Generic and invisible infrastructure and re-utilizable service toolbox, based on interoperability standardization
- Extensive use of pervasive computing
- VO management principles adapted to emerging behavior in complex networks
- Active innovation and new value systems management in networks
- Support of social responsibility, including "life maintenance", based on a suitable ethical code

"

· Comprehensive (international) legal frameworks for VOs

As a result, a strong and cohesive social fabric is built in response to turbulence and uncertainty.

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#### **VOmap focus areas** NOVA SCHOOL OF SCIENCE & TECHNOLOGY The vision (and roadmap in In Vomap we general) can be instantiated considered 5 focus according to different focus areas Vomap areas Roadmap 5 1 2 3 4 **Formal models** Socio-economic Focus area and theory Focus area ICT VO Management Support services infrastructure Focus area Focus area **Focus area**

### **Multi-disciplinary contributions**



#### In 2015 most enterprises will be part of some sustainable tworks that will act as breeding environments for the formation of dynamic virtual organizations in response to fast changing market opportunities and conditions. Main mechanisms: Well founded models of collaboration Management systems for breeding environments replicable to a large variety of sectors Generic and invisible infrastructure and re-utilizable service toolbox, based on interoperability standardization Extensive use of pervasive computing VO management principles adapted to emerging behavior in complex Instantiation of the vision statement for the socio-economic area networks Active innovation and new value systems management in networks Support of social responsibility, including "life maintenance", based on a suitable ethical code The socio-economic environment will be fully developed to support virtual organizations, stressing the importance of human-related issues at the ensive (international) legal fram orks for VOs individual and organizational level, in enabling institutions and in a transparent As a result, a strong and cohesive social fabric is built in response to regulatory environment. General vision statement People being prepared and supported to work as employees or professionals



### in enterprise networks or other virtual organisation settings

- New mechanisms and institutions to provide for human sense of belonging, long-lasting relationships and stability (social responsibility)
- New institutions and models to support "life maintenance", e.g. social security and personal training and development
- Support for companies by enabling institutions and services to set-up, enter and develop virtual organisations regionally and internationally
- Transparent legal framework, specially in the case of institutional collaboration
- Regional assets and identity leveraged and preserved
- Well founded understanding of social and socio-economic processes and developments in the context of networked economies

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#### N VA NOVA SCHOOL OF SCIENCE & TECHNOLOGY And ICT infrastructures

# Instantiation of the vision statement for the VO management area

Well-defined business models will be developed to allow the systematic VO management, namely to act in regards to planning, control, organization and leadership, taking into account the importance of social mechanisms in multi-interest collaboration networks, as well as the transitional nature of VO.

- Wide understanding of brokerage and pro-active approach to VO formation
- VO planning and performance assessment mechanisms
- Clear mechanisms for leadership and participation in shared decision-making
- Defined principles for sharing responsibility and benefits
  Established mechanisms for conflict management in "multipleobjective" collaboration spaces
- Schema of incentives for long/short term collaboration
- Mechanisms, code of ethics, and institutions for trust-building
- support and guarantee of customers' confidence

  Supporting mechanisms for co-evolution and knowledge
- management and ownership
- Seamless flow of knowledge and responsibility among various VOs along the full life cycle of products/services

# Instantiation of the vision statement for the ICT infrastructures area

The ICT infrastructure will be developed as an invisible, affordable, and easy to use enabler of collaborative behaviors in networked organizations.

- Technology-independent reference architecture for the horizontal infrastructure
- Provide support for federated information and resources
   management
- Flexible control mechanisms supporting the
- implementation of a large variety of behaviors
- Plug-and-play concept extended to inter-organizational
- services
- Full e-transaction security is guaranteed
- "Configure yourself" philosophy (user "programmable" infrastructure)



# Instantiation of the vision statement for the support services area

IT support services will be developed to assist VO brokers, management and employees with their tasks for setting-up, operating, and dissolving virtual organizations. The tools are embedded in flexible architectures suited for different types of virtual organizations; driven by business, social, legal, etc. needs and are easy to use and provide a well balanced approach between human support and business process automation.

- Management of breeding environment (e.g. definition, behaviour,
- membership, rules, rights, responsibilities, business interoperability)
- VO creation framework (choices of automatic / semiautomatic or search assisted by the breeding environment's manager)
- Coordination/management of highly distributed activities
   (human assisted)
- Risk management, assessment tools, performance measuring and mechanisms for learning and experience collection
- Mechanisms for traceability and for handling postcooperation IPRs and liabilities

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# Instantiation of the vision statement for the formal models and theories area

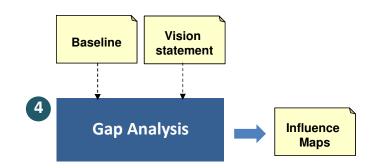
Decision-making in all phases of the VO life cycle is based on well argued and verified models and methodologies, which are the basis for the ICT-based support for business and organizational development and operation:

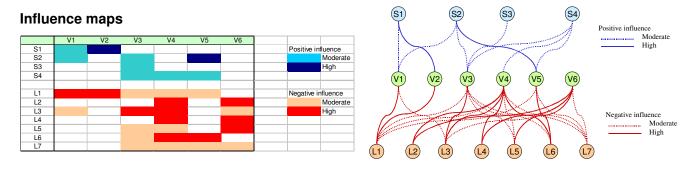
- Established formal foundation to guarantee VOs effectiveness (performance management), better decisionmaking, incremental learning from past experience, and minimized operating problems via clear commitments
- The VO research area is recognized (and respected) as a scientific discipline
- Generic modeling of the VO (structure and behavior) as a top-down approach addresses e.g. VO configuration, roles and responsibilities, coordination,
- distributed process management, general agreements and contract
- Generic modeling of VO members' behavior as a bottom-up approach addresses e.g. contributed assets, accepted responsibilities, acquired rights, individual commitments and contract
- Discipline-specific formal models are defined
- Models interoperability (generic and discipline-specific) are defined

### **3. GAP ANALYSIS**



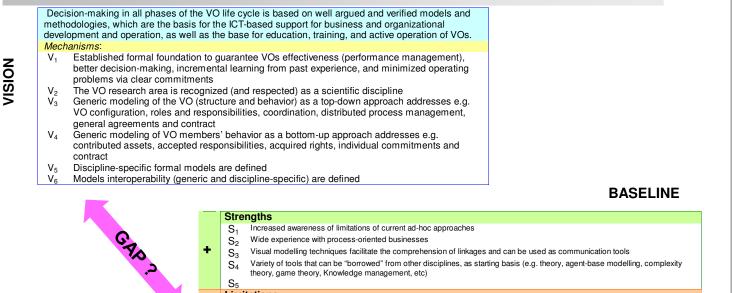
### **Gap analysis step**





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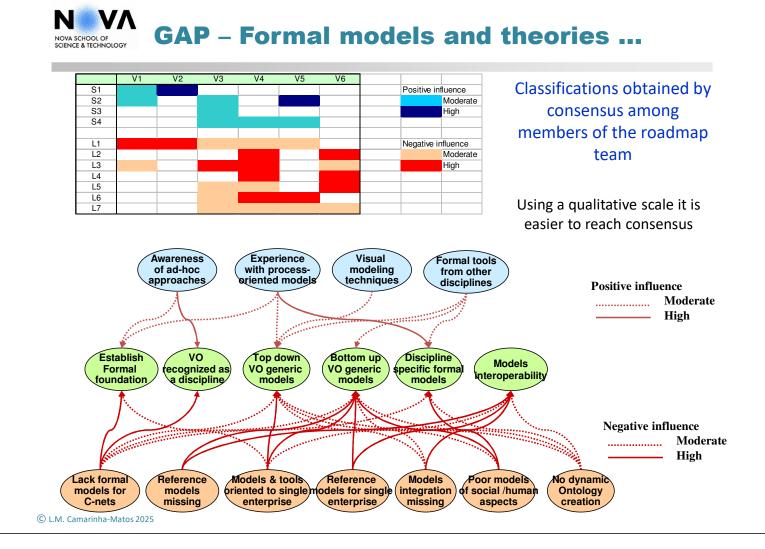




#### Limitations

- L Lack of formal methods for collaborative networks, collaborative decision-making and collaborative behaviour modelling:
  - Ad-hoc modelling techniques have become too pragmatic in recent years focusing on short-term results.
  - •VO areas not recognized as a scientific discipline yet.

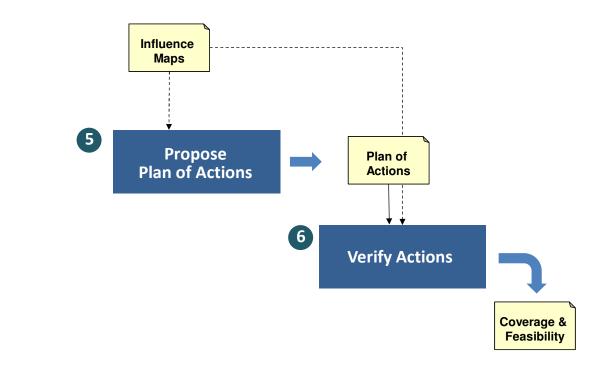
  - Difficult to guarantee VO effectiveness. Reference models are missing
- $L_2$  $L_3$ Most available modelling methods and tools were developed for single enterprises, not suitable for VO
- Enterprise reference models previously developed are also too focused on the single enterprise  $L_4$
- Models integration (models interoperability) missing  $L_5$
- Poor approaches to model the social and human aspects in collaborative networks (soft modelling)  $L_6$
- Poor support for dynamic Ontology creation and maintenance in a networked environment. L<sub>7</sub>





# 4. PLAN OF ACTIONS





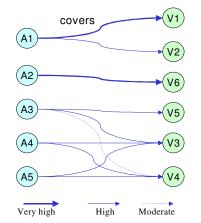
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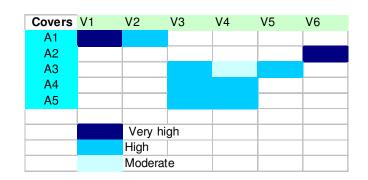
#### N VA NOVA SCHOOL OF SCIENCE & TECHNICIOGY Actions – Focus on formal models & theories

<i>n</i> :		
management), b minimized opera The VO research Generic modelin e.g. VO configur management, ge Generic modelin contributed asse contract Discipline-specif	etter decision-making, incremental learning from past experience, and titing problems via clear commitments in area is recognized (and respected) as a scientific discipline g of the VO (structure and behavior) as a top-down approach addresses ation, roles and responsibilities, coordination, distributed process eneral agreements and contract g of VO members' behavior as a bottom-up approach addresses e.g. ts, accepted responsibilities, acquired rights, individual commitments and ic formal models are defined	A small set of actions (small projects) that are likely to (help) reach the vision
Models interope	ability (generic and discipline-specific) are defined	
A1	Establish a formal theoretical foundation for modeling dynamics	
A2	Elaborate approaches for models interoperability, suppor perspectives (e.g. structure, behavior) at generic and focus	
A3	Define basic formal reference models (including ontologination networks at general and focused-area levels	es) for collaborative
A4	Elaborate soft modeling approaches and soft models to be imprecise knowledge and capture the social/human aspect networks	•
A5	Devise mechanisms for evolution and maintenance of reacollaborative networks	ference models for
	management), b minimized opera The VO research Generic modelin e.g. VO configur management, ge Generic modelin contributed asse contract Discipline-specif Models interoper A1 A2 A3 A4	<ul> <li>Established formal foundation to guarantee VOs effectiveness (performance management), better decision-making, incremental learning from past experience, and minimized operating problems via clear commitments         The VO research area is recognized (and respected) as a scientific discipline Generic modeling of the VO (structure and behavior) as a top-down approach addresses e.g. VO configuration, roles and responsibilities, coordination, distributed process management, general agreements and contract     </li> <li>Generic modeling of VO members' behavior as a bottom-up approach addresses e.g. contributed assets, accepted responsibilities, acquired rights, individual commitments and contract</li> <li>Discipline-specific formal models are defined</li> <li>Models interoperability (generic and discipline-specific) are defined</li> <li>Models interoperability (generic and discipline-specific) are defined</li> <li>A1</li> <li>Establish a formal theoretical foundation for modeling dy networks</li> <li>A2</li> <li>Elaborate approaches for models interoperability, suppor perspectives (e.g. structure, behavior) at generic and focus</li> <li>A3</li> <li>Define basic formal reference models (including ontologi networks at general and focused-area levels</li> <li>A4</li> <li>Elaborate soft modeling approaches and soft models to the imprecise knowledge and capture the social/human aspect networks</li> <li>A5</li> </ul>

#### N VA NOVA SCHOOL OF SCIENCE & TECHNICLOGY Verification – Focus on formal models & theories

### Do proposed actions cove the vision ?





### Are proposed actions feasible ?



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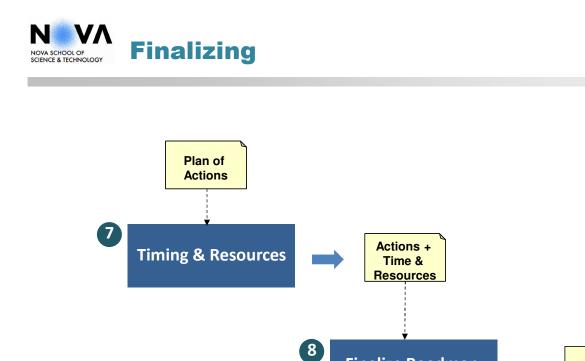
**Timing** – Focus on formal models & theories

Ac	tions:	Time	Other aspects
$A_1$		Short	
	modeling dynamic collaborative networks	term	
$A_2$	Elaborate approaches for models	Short	
	interoperability, supporting multiple modeling perspectives (e.g. structure, behavior) at generic and focused area levels	term	
$A_3$		Medium	
Ŭ	ontologies) for collaborative networks at general and focused-area levels	term	
$A_4$	Elaborate soft modeling approaches and soft	Medium	
	models to both handle incomplete / imprecise	/ Long	
	knowledge and capture the social/human	term	
	aspects in collaborative networks		
$A_5$	Devise mechanisms for evolution and	Long	
	maintenance of reference models for	term	
	collaborative networks		



# **5. FINALIZATION**

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Finalize Roadmap Chart

Roadmap

chart



Small set – no more than 6 actions – per focus area

L'	
Soc	cio-economic area:
A <sub>1</sub>	Develop and establish education and training schemes for VO working on different professional levels
A <sub>2</sub>	Elaborate and pilot regional and professional communities as "social homes" for people
A <sub>3</sub>	Define life maintenance schemes and related business models with different stakeholders (providers, customers, public bodies)
A <sub>4</sub>	Develop institutions and services for VO support, and establish them regionally; network regional bodies and developments on European level
<b>A</b> <sub>5</sub>	Elaborate and implement transparent legal frameworks and ethical code at the company/VO and societal level
A <sub>6</sub>	Support integrated socio-economic research in networked economies

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(1)



### **Suggested actions**



#### VO Management area:

- A1 Provision of business models and financing schemes for VO set up
- A<sub>2</sub> Provision of planning and performance measurement concepts and tools
- A<sub>3</sub> Provision of concepts and practical guidelines for organizational design and implementation of VO
- A<sub>4</sub> Provision of methods for the application of new value
- $\begin{array}{l} \mbox{paradigms addressing critical "soft" issues in VO collaboration} \\ A_5 & Ongoing evaluation, improvement and individualization of VO \end{array}$
- concepts to a fully integrated level

#### ICT Infrastructure area:

A<sub>1</sub> Establish the principles of reference architecture, interoperability, and security

3

- A<sub>2</sub> Establish foundation for systems evolution, software technology migration and systems integration
- A<sub>3</sub> Develop generic, user-friendly (invisible!), and affordable (free!) ICT infrastructure (user programmable, plug&play, technology independent, and based on emerging open tools/standards)
- A<sub>4</sub> Develop a "do it yourself" framework to assist the development of VO support services
- A<sub>5</sub> Define business models for developers, suppliers, and buyers of the ICT infrastructure developments
- A<sub>6</sub> Elaborate approaches to handle reliability and responsibility, when using multi-supplier building blocks



**Suggested actions** 



#### Support services area:

- A<sub>1</sub> Elaborate business models for support service systems and tools A<sub>2</sub> Develop mechanisms and tools for management of breeding
- A2 Develop mechanisms and tools for management of breeding environment systems
   A3 Identify and develop generic services for VO life cycle support
- A3 Identify and develop generic services for VO life cycle support (e.g. distributed Business Process management, e-contracting, VO configuration, e-training)
- A<sub>4</sub> Elaborate mechanisms and tools to support VO's "inheritance" management
- A<sub>5</sub> Develop mechanisms and tools for traceability, knowledge exchange and inter-VO transactions (supporting products and services life cycle)

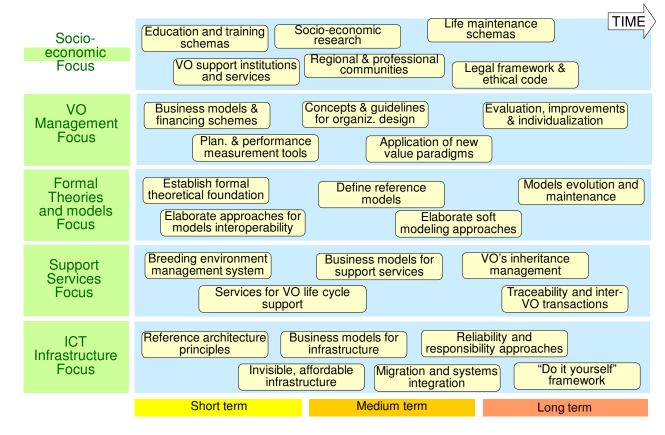
#### Formal theories and models area:

- A<sub>1</sub> Establish a formal theoretical foundation for modeling dynamic collaborative networks
- A<sub>2</sub> Elaborate approaches for models interoperability, supporting multiple modeling perspectives (e.g. structure, behavior) at generic and focused area levels
- A<sub>3</sub> Define basic formal reference models (including ontologies) for collaborative networks at general and focused-area levels
- A<sub>4</sub> Elaborate soft modeling approaches and soft models to both handle incomplete / imprecise knowledge and capture the social/human aspects in collaborative networks
- A<sub>5</sub> Devise mechanisms for evolution and maintenance of reference models for collaborative networks

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# Roadmap – 1st attempt

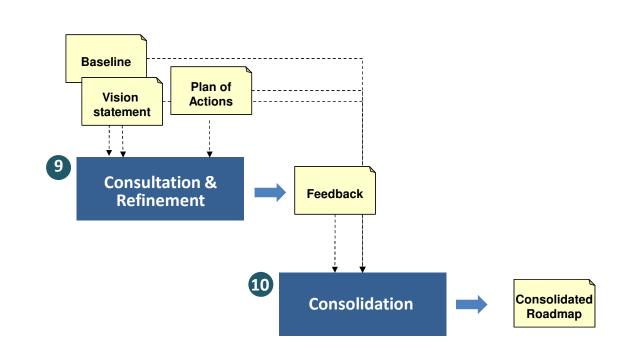




### **6. VERIFICATION**

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### **Regional workshops – Part 1**

# Consultation of external experts

#### Core workshop format

Groups of about 6-10 people (including facilitator).

The task of the workshop should consist of three elements:

- Current state of Virtual Organisations: Participants' perspectives
  - ~15 Min. Short mutual introduction of group members (2 Min for everybody, name, company, position, relationship to VO topic)
  - ~10 Min. Participants write key issues of their perspectives on the current state in VO on post-its.
  - ~20 Min: In turns, everybody places his postits onto the current state poster and briefly explains his thought and reason for amendments



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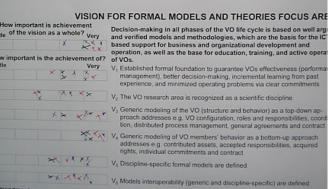


# Regional workshops - Part 2

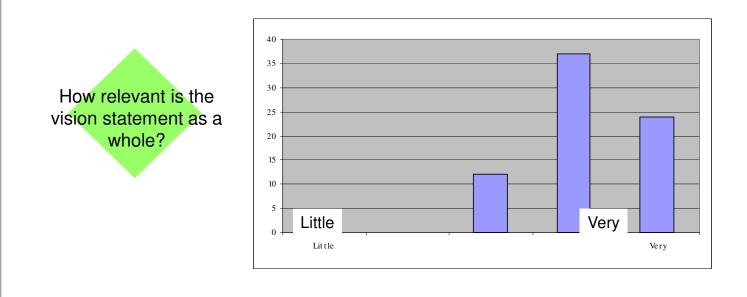
#### Opinion poll on vision: Relevance and amendment

- ~15 Min. Walk through the current vision drafts. VOmap project member explains the vision elements and the main thoughts behind it and links the key issues of the participants to the vision drafts.
- ~10 Min: Every team member votes on relevance of vision elements (scale of 1-5). Individual brainstorming: everybody gets pack of Post-its (size ~76\*127 mm) and writes amendments to current vision on them.
- ~20 Min: In turns, everybody places his post-its onto the vision posters and briefly explains his thought and reason for amendments

	opportunities and conditions.
How important is achievement Little of the vision as a whole?	<ul> <li>Management systems for preeding environments replicable to a targe var Very of sectors</li> </ul>
X XX	Generic and invisible infrastructure and re-utilizable service toolbox, base interoperability standardization
	Extensive use of pervasive computing     VO management principles adapted to emerging behavior in complex
	networks
	<ul> <li>Active innovation and new value systems management in networks</li> <li>Social responsibility, including "life maintenance", based on a suitable eti code</li> <li>Comprehensive (international) legal frameworks for VOs</li> </ul>
	As a result, a strong and cohesive social fabric is built in response to turbulence and uncertainty.
	>90%
× × +× × * *	What proportion of SMEs will be working in Virtual Organisations by 2020?
x × ×*X	X X What proportion of large organisations will be working in Virtual Organisation by 2020?
A 1	
x X+x x	What proportion of potential know-ledge workers will work independent or a small, independent teams by 2020?
Predom. Regional with Full	What proportion of potential know-ledge workers will work independent or a
Predom. Regional with Full	What proportion of potential know-ledge workers will work independent or a small, independent teams by 2020?
Predom. Regional with Full regional intern. partners Full X X X X X SME	What proportion of potential know-ledge workers will work independent or a small, independent teams by 2020? aligibatian alignment and alignment of the second se
Predom. Regional with Full regional intern. partners Full X X X X X SME	What proportion of potential know-ledge workers will work independent or a small, independent teams by 2020? ty interna- atiglobal Will there be more regional networks or more international/global ones? Large
Predom Regional with Full intern.partners Since	What proportion of potential know-ledge workers will work independent or a small, independent teams by 2020? ty interna- aligibaal Will there be more regional networks or more international/global ones? Large portations







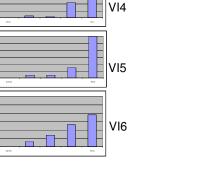
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### **NVAICT infrastructure** – Vision instantiation NOVA SCHOOL OF SCIENCE & TECHNOLOGY

trans	ICT infrastructure will be developed as a sparent, low-cost, and easy to use enabler of aborative behaviors in networked organizations.	VI1	Consolidated results from local worksho
М	lechanisms:		
VI <sub>1</sub>	Technology-independent reference architecture for the horizontal infrastructure	VI2	Little Very
VI <sub>2</sub>	Provide support for federated information and resources management	VI3	
VI <sub>3</sub>	Flexible control mechanisms supporting the implementation of a large variety of behaviors	VI4	High Acceptance of ICT
VI <sub>4</sub>	Plug-and-play concept extended to inter- organizational services	VI5	Vision statement
VI <sub>5</sub>	Full e-transaction security and privacy is guaranteed		
VI <sub>6</sub>	"Configure yourself" philosophy (user "programmable" infrastructure)	VI6	

How relevant is the ICT Vision as a whole? al workshops:

Very



Consolidated vision NOVA SCHOOL OF SCIENCE & TECHNOLOGY

### After taking into account received feedback from the workshops

" In 2015 the majority of organizations and individuals will be part of sustainable collaborative networks that will act as breeding environments for the formation of dynamic virtual organizations, in response to fast changing economic and social conditions.

- Well founded models of collaboration
- Management systems for breeding environments replicable to a large variety of sectors
- Generic and transparent infrastructure and re-utilizable service toolbox, based on interoperability standardization
- Extensive use of pervasive computing
- · VO management principles adapted to emerging behavior in complex networks
- Accepted mechanisms to handle innovation and new value systems
- Social responsibility, including "life maintenance"
- · Better understanding and handling of VO-related cultural/regional issues
- Definition of moral / ethical code for VOs
- Comprehensive (international) legal frameworks for VOs

As a result, a strong and cohesive social fabric is built in response to turbulence and uncertainty.

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#### **Regional workshops – Part 3** NOVA SCHOOL OF SCIENCE & TECHNOLOGY

VI <sub>1</sub>	Technology-independent reference architecture	<ul> <li>I<sub>1</sub> Establish the principles of reference architecture, interoperability, and security</li> </ul>	
VI <sub>2</sub>	Federated information / resources management	<ul> <li>I<sub>2</sub> Establish foundation for systems</li> <li>evolution, software technology migration and systems integration</li> </ul>	ICT infrastructur Actions
VI <sub>3</sub>	Flexible control/ coordination mechanisms	<ul> <li>I<sub>3</sub> Develop generic, user-friendly</li> <li>(invisible!), and low-cost (free!) ICT infrastructure</li> </ul>	<ul> <li>Analysis of coverability</li> <li>Analysis of description text</li> </ul>
VI <sub>4</sub>	Plug-and-play support for services	<ul> <li>I<sub>4</sub> Develop a "do it yourself" framework</li> <li>to assist the development of VO support services</li> </ul>	<ul> <li>Proposals for change</li> <li>Voting relative importance</li> </ul>
$VI_5$	e-transaction security and privacy	I <sub>5</sub> Define a business model for developers, suppliers, and buyers of the ICT infra- structure developments and support software	again in small groups of invited external experts
VI <sub>6</sub>	"Configure yourself" user "programmable"	I <sub>6</sub> Elaborate approaches to handle reliability and responsibility, when using multi-supplier building blocks	

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ICT infrastructure – Priority / Importance of Actions

I<sub>1</sub> Principles of reference architecture, interoperability, and security

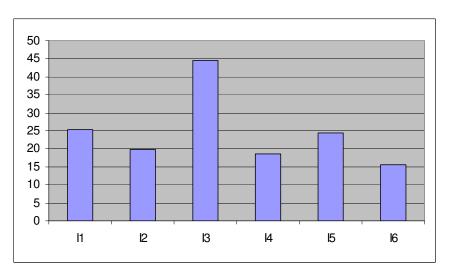
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- I<sub>2</sub> Foundation for Software migration and system integration
- I<sub>3</sub> User-friendly and low-cost ICT infrastructure
- I<sub>4</sub> 'Do it yourself' framework to assist development of support services
- I<sub>5</sub> Define a business model for developers, suppliers, and buyers
- I<sub>6</sub> Reliability and responsibility when using multi-supplier building blocks

**Based on aggregated** 

votes from the various

workshops

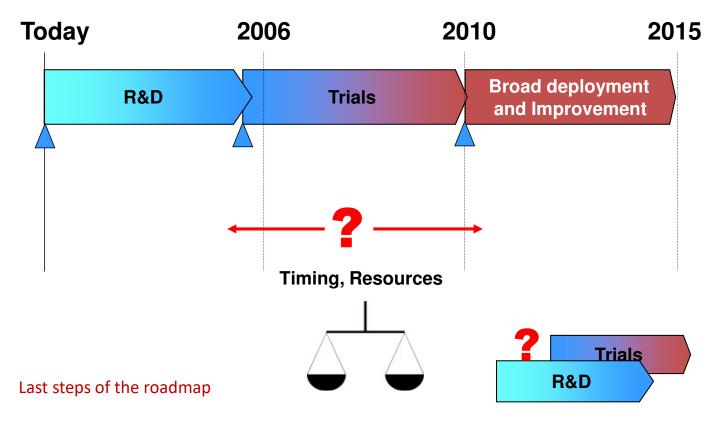


- A3 is the most prioritised action
- A1 and A5 are prioritized next, to reach the vision
- A2, A4, and A6 are required important actions to follow
- Priority was mostly given to the immediate needs

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# **Towards the roadmap - Efforts**



# ICT infrastructure – Implementation plan

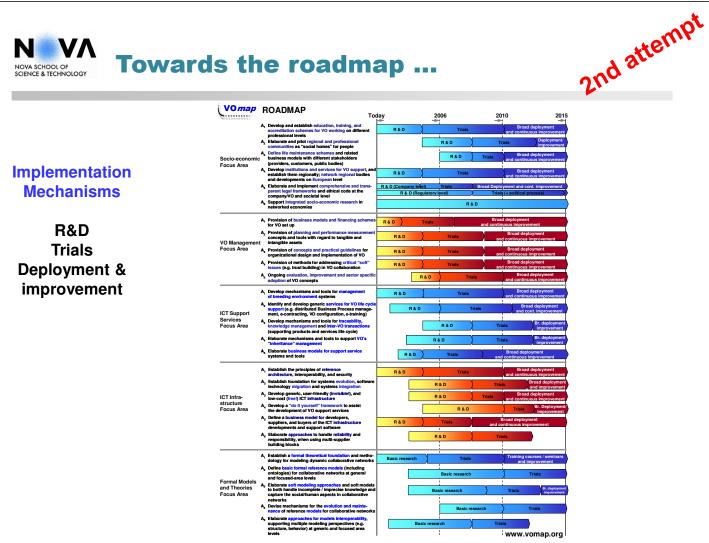
Тс	oday		20	06			2010			2015
I <sub>1</sub> Principles of reference architecture, interoperability, and security		R &	D			Trials	an		id deploy nuous im	ment provement
I <sub>2</sub> Foundation for Software migration and system integration			R & C				Trials			deployment provement
I <sub>3</sub> User-friendly and low-cost ICT infrastructure			R & D			Tria	als / an		id deploy nuous im	rment provement
I <sub>4</sub> 'Do it yourself' framework to assist development of support services					R & D			Trials	S: 2	eployment/ nprovement
<ul> <li>I<sub>5</sub> Define a business model for developers, suppliers, and buyers</li> </ul>	R	& D		Trials			Broa and contin	d deploy nuous im		ent
I <sub>6</sub> Reliability and responsibility when using multi- supplier building blocks			R & D				Trials			
		•			•		, i			

#### Why this sequence?

- Basic reference architecture principles (I1) are required before I2, I3 and I6 can start with their necessary R&D
- Business model for ICT (I5) can start immediately, and has a shorter R&D
- R&D for the development of ``Do-it-yourself`` framework (I4) requires some input from all other actions
- Responsibility when using multi-supplier building blocks generates results that can be used by the business model and other actions for ICT, so it does not seem to have independent broad deployment

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### **Consolidation workshop**

To verify / validate the  $2^{nd}$  iteration of the roadmap



VOmap example: 28 participants



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# ICT infrastructure – Distribution of efforts

	Today	20	006	2010	2015
Principles of reference architecture, interoperat and security	pility,	R & D			Broad deployment ontinuous improvement
Foundation for Software migration and system integration		R & [		Trials	Broad deployment and improvement
User-friendly and low-cost ICT infrastructure		R & [	1		Broad deployment ontinuous improvement
'Do it yourself' framework to assist developmer support services	nt of		R & D	N	ials Deployment/ improvement
Define a business model for developers, suppl and buyers	iers, R&D		Trials	Broad de and continuous	
Reliability and responsibility when using multi- building blocks	supplier	R & E			
- E.g. Business model (I5) has smaller research period	1  2  3  4  5  6				R&D Trial Deploy



### After consolidation workshop

	Тос	lay		20	06		20	)10	2015
	E <sub>1</sub> Develop and establish education, training, and accreditation schemes for VO working on different professional levels	R	& D			Trials			deployment ous improvement
Socio-economic Focus Area	E <sub>2</sub> Elaborate and pilot regional and professional communities as "social homes" for people				R&D	<u>}</u>	Tri	als	Deployment/ improvement
	E <sub>3</sub> Define life maintenance schemes and related business models with different stakeholders (providers, customers, public bodies)			R & D	-       		Trials		deployment ous improvement
	E <sub>4</sub> Develop institutions and services for VO support, and establish them regionally; network regional bodies and developments on European level	R	& D	}		Trials			deplcyment ous improvement
	E <sub>5</sub> Elaborate and implement comprehensive and trans- parent legal frameworks and ethical code at the company/VO and societal level	R & D (C	ompany lev R & D (R	el) egulatory le	Trials vel)			loyment and cor als (+ political pro	
	E <sub>6</sub> Support integrated socio-economic research in networked economies					R & I	D		
±	M <sub>1</sub> Provision of business models and financing schemes for VO set up	R 8	2 D	> Tria	s			ad deployment inuous improven	nent
VO Management Focus Area	M <sub>2</sub> Provision of planning and performance measurement concepts and tools with regard to tangible and intangible assets	[	R٤	D		Trials	<b>3</b>		deployment ous improvement
) Manaç Focus /	M <sub>3</sub> Provision of concepts and practical guidelines for organizational design and implementation of VO		R٤	k D		Trials	s		deployment ous improvement
22	$\rm M_4$ Provision of methods for addressing critical "soft" issues (e.g. trust building) in VO collaboration		R & D		Trial			Brcad deplo and continuous in	oyment
	$\rm M_5$ Ongoing evaluation, improvement and sector specific adoption of VO concepts			R &	Ь		Trials		Br. deployment/ cont. improvement
					1	. :	:	, ; ;	

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# Roadmap ...

### After consolidation workshop

_		Тос	lay		2006		2010	2015
~	S <sub>1</sub>	Develop mechanisms and tools for management of breeding environment systems	R٤	& D		Trials	a	Broad deployment ind continuous improvement
: Services Area	S <sub>2</sub>	Identify and develop generic services for VO life cycle support (e.g. distributed Business Process manage-ment, e-contracting, VO configuration, e-training)			R&D		rials	Broad deployment and cont. improvement
Support Serv Focus Area	S <sub>3</sub>	Develop mechanisms and tools for traceability, knowledge management and inter-VO transactions (supporting products and services life cycle)			и R & D		Trials	Br. deployment improvement
ICT SI	S <sub>4</sub>	Elaborate mechanisms and tools to support VO's "inheritance" management			R & D		Trials	Br. deployment improvement
	S <sub>5</sub>	S <sub>5</sub> Elaborate business models for support service systems and tools		R & D	Trials			ad deployment nuous improvement
	I <sub>1</sub>	Establish the principles of reference architecture, interoperability, and security		R &	D	Tria	als a	Broad deployment Ind continuous improvement
ture a	l <sub>2</sub>	Establish foundation for systems evolution, software technology migration and systems integration			R & D		Trials	Broad deployment and improvement
<sup>-</sup> Infrastructure Focus Area	I <sub>3</sub>	Develop generic, user-friendly (invisible!), and low- cost (free!) ICT infrastructure	ĺ		R & D			Broad deployment and continuous improvement
- Infra Focu	$I_4$	Develop a "do it yourself" framework to assist the development of VO support services				R&D		Trials Deployment/ improvement
ICT F	Ι <sub>5</sub>	Define a business model for developers, suppliers, and buyers of the ICT infrastructure developments and support software	R 8	& D	Trials			nd deployment nuous improvement
_	I <sub>6</sub>	Elaborate approaches to handle reliability and responsibility, when using multi-supplier building blocks			R & D		Trials	



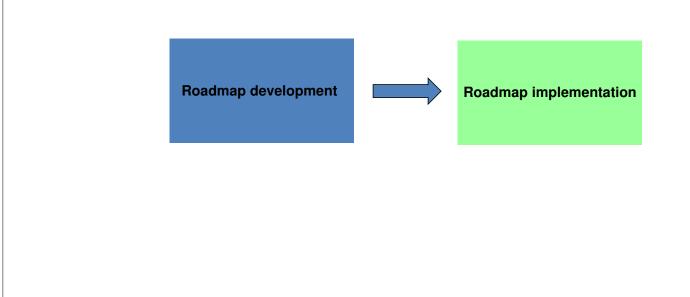
### After consolidation workshop

		Τος	lay		20 →	06			201 —	0				2015
ies		Establish a formal theoretical foundation and metho- dology for modeling dynamic collaborative networks	Basic	research			Trials			Tra		ourses mprove		hars
Theories	-	Define basic formal reference models (including ontologies) for collaborative networks at general and focused-area levels			В	asic rese	earch					Trials	/ seminar ment Br. deploym improveme	
	Focus Area	Elaborate soft modeling approaches and soft models to both handle incomplete / imprecise knowledge and capture the social/human aspects in collaborative networks			Basic	research				Tria	ls			
	ĕ F₄					Basi	e researe	h		>		Trials		
Formal	F <sub>5</sub>	Elaborate approaches for models interoperability, supporting multiple modeling perspectives (e.g. structure, behavior) at generic and focused area levels			Basic rese	arch			Tria	s		)		
-														

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	VOmap ROADMAP	lay	2006	2010	2015
	E, Develop and establish education, training, and accreditation schemes for VO working on different	R & D	<u>т</u>	rials	Broad deployment continuous improvement
	professional levels E <sub>2</sub> Elaborate and pilot regional and professional		R & D	Trials	Deployment/
NOVA SCHOOL OF SCIENCE & TECHNOLOGY	Communities as "social homes" for people E G E Define life maintenance schemes and related business models with different stakeholders (providers, customers, public bodies) E Develop institutions and services for VO support, and establish them regionally; network regional bodies and developments on European level D E, Elaborate and Implement comprehensive and trans-		R&D	Trials	Broad deployment
	business models with different stakeholders (providers, customers, public bodies)			and	continuous improvement
	<ul> <li>E<sub>4</sub> Develop institutions and services for VO support, and establish them regionally; network regional bodies and developments on European level</li> </ul>	R & D	Т	rials and	Broad deployment continuous improvement
	<ul> <li>Elaborate and implements on European even</li> <li>Es Elaborate and implement comprehensive and transparent legal frameworks and ethical code at the</li> </ul>	R & D (Company I			t and cont. improvement
Final version	company/VO and societal level E <sub>s</sub> Support integrated socio-economic research in	R & D (F	Regulatory level)		olitical process)
FILIAL VEISION	networked economies			R & D	· · · · · · · · · · · · · · · · · · ·
	M, Provision of business models and financing schemes for VO set up	R & D	Trials	Broad dep and continuous	ployment improvement
	ଥିଷ୍ଣ M, Provision of planning and performance measurement	B	& D	Trials	Broad deployment
	Concepts and tools with regard to tangible and intangible assets			and	Continuous improvement
	Image: Second state state         Mage: Second state state         Mage: Second state state         Mage: Second state state         Second state	R	&D		Broad deployment continuous improvement
	M <sub>4</sub> Provision of methods for addressing critical "soft" issues (e.g. trust building) in VO collaboration	R & D	Trials	Br and con	oad deployment ttinuous improvement
Camarinha-Matos, L.M.; Afsarmanesh, H.	M <sub>5</sub> Ongoing evaluation, improvement and sector specific adoption of VO concepts		R & D	Trials	Br. deployment/ cont. improvement
(2004), A roadmapping methodology for	S <sub>1</sub> Develop mechanisms and tools for management	R&D		rials	Broad deployment
strategic research on VO, in Collaborative	of breeding environment systems S, Identify and develop generic services for VO life cycle		1	/ and	Broad deployment
Networked Organizations – A research	<ul> <li>S. Identify and develop generic services for VO life cycle support (e.g. distributed Business Process manage- ent, e-contracting, VO configuration, e-training)</li> <li>S. Develop mechanisms and tools for traceability, howidege management and inter-VO transactions (supporting products and services life cycle)</li> <li>S. Elaborate mechanisms and tools to support VO's</li> </ul>		R&D	Trials	and cont. improvement
agenda for emerging business models, cap.	S a Develop mechanisms and tools for traceability, knowledge management and inter-VO transactions		R & D	Trials	Br. deployment
7.1, Kluwer Academic Publishers.	G (supporting products and services life cycle) S Elaborate mechanisms and tools to support VO's		R&D	Trials	Br. deployment
https://www.researchgate.net/publication/22	S. Elaborate business models for support service		1 1		deployment
6937637 A Roadmapping Methodology f	systems and tools	R & D	Trials		ious improvement
or Strategic Research on VO	I, Establish the principles of reference architecture, interoperability, and security	Rå	D	Trials	Broad deployment continuous improvement
			R&D	Trials	Broad deployment
	S S Is Develop generic, user-friendly (invisible!), and		R&D	Trials	and improvement Broad deployment
Camarinha-Matos, L.M.; Afsarmanesh, H.;	low-cost (free!) ICT infrastructure		i	& D	Continuous improvement
Loeh, H.; Sturm, F.; Ollus, M. (2004), <u>A</u>	E       Č       the development of VO support services         D       Is       Define a business model for developers,		i 1		deployment
strategic roadmap for advanced virtual	<ul> <li>suppliers, and buyers of the ICT infrastructure developments and support software</li> </ul>	R & D	Trials		ious improvement
organizations, in Collaborative Networked	I <sub>6</sub> Elaborate approaches to handle reliability and responsibility, when using multi-supplier building black		R & D	Trials	
Organizations – A research agenda for	building blocks				
emerging business models, cap. 7.2,	F. Establish a formal theoretical foundation and metho- dology for modeling dynamic collaborative networks	Basic research		Trials	aining courses / seminars and improvement
Kluwer Academic Publishers.	<ul> <li>F<sub>2</sub> Define basic formal reference models (including ontologies) for collaborative networks at general and focused-area levels</li> </ul>		Basic resea	rch	Trials
https://www.researchgate.net/publication/22	F <sub>3</sub> Elaborate soft modeling approaches and soft models to both handle incomplete / Imprecise knowledge and		Basic research		als Br. deployment
6527248 A Strategic Roadmap for Adva	<ul> <li>F. Establish a formal molecule obligation and instruc- ology for modeling dynamic collaborative networks F. Define basic formal reference models (including ontologies) for collaborative networks at general and focused-area levels E. Eliborate soft modeling appraches and soft models to both handle incomplete / imprecise knowledge and aptrue the social/human aspects in collaborative networks E. Devise mechanisms for the evolution and mainte- </li> </ul>		basic research		improvement
nced Virtual Organizations	E F <sub>4</sub> Devise mechanisms for the evolution and mainte- nance of reference models for collaborative networks		Basic r	research	Trials
	<ul> <li>nance of reference models for collaborative networks</li> <li>F<sub>5</sub> Elaborate approaches for models interoperability, supporting multiple modeling perspectives (e.g.</li> </ul>		Basic research	Trials	
C) L.M. Camarinha-Matos 2025	structure, behavior) at generic and focused area		Lasic research		



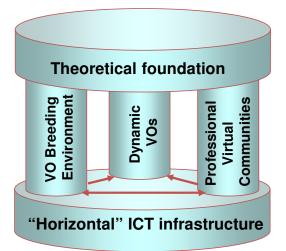


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### NOVA SCHOOL OF SCIENCE & TECHNOLOGY

# **One implementation – ECOLEAD project**

A project proposal developed based on the VOmap roadmap



#### A holistic approach combining:

- Breeding environments
- Management of (dynamic) VOs
- Professional Virtual Communities
- Horizontal Infrastructures for collaboration
- Theoretical foundation

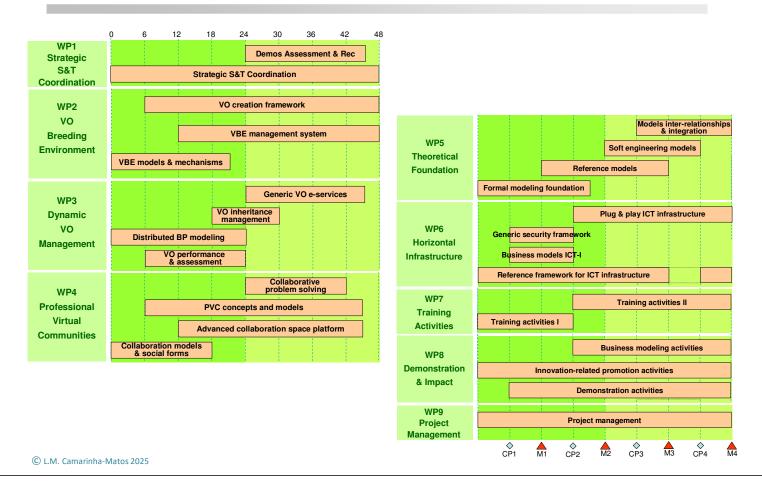
towards the establishment of collaborative networks as a new scientific discipline

The proposal was accepted and funded by the European Commission

"Creating the foundations and mechanisms for establishing an advanced collaborative, network-based industry society"



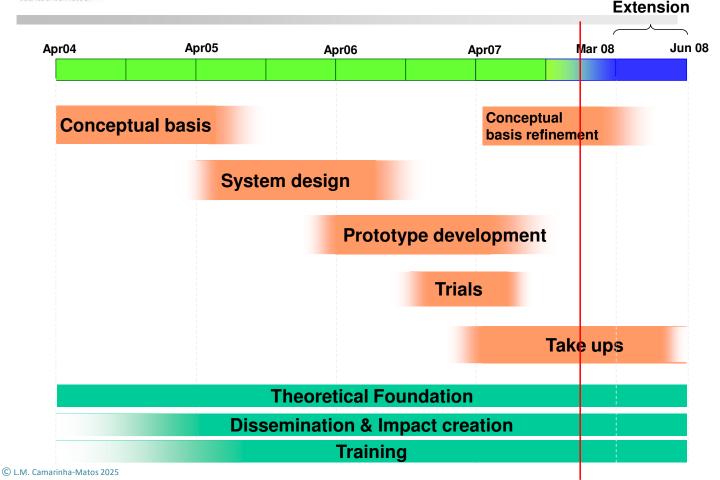
**ECOLEAD** activities

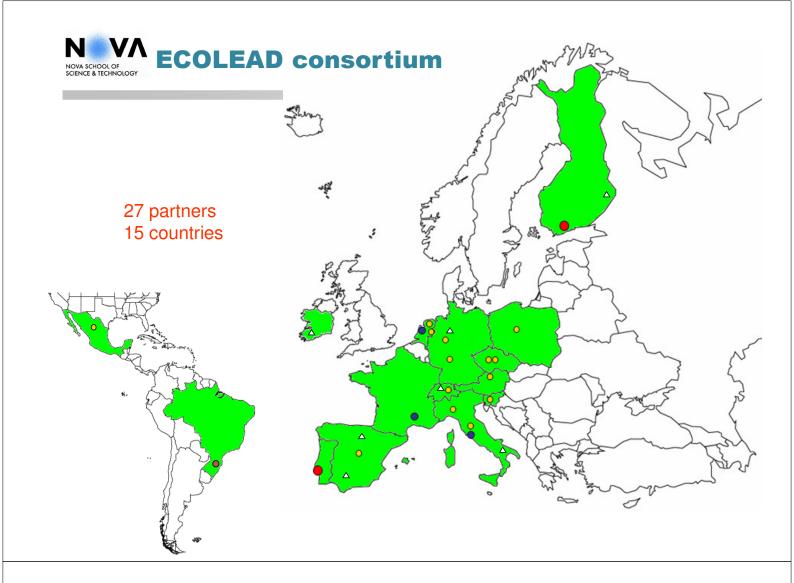


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NOVA SCHOOL OF SCIENCE & TECHNOLOGY

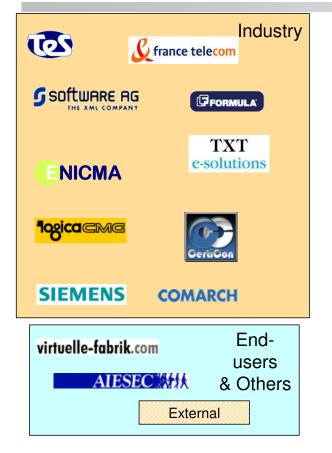
# **ECOLEAD** schedule







# **ECOLEAD** consortium ...



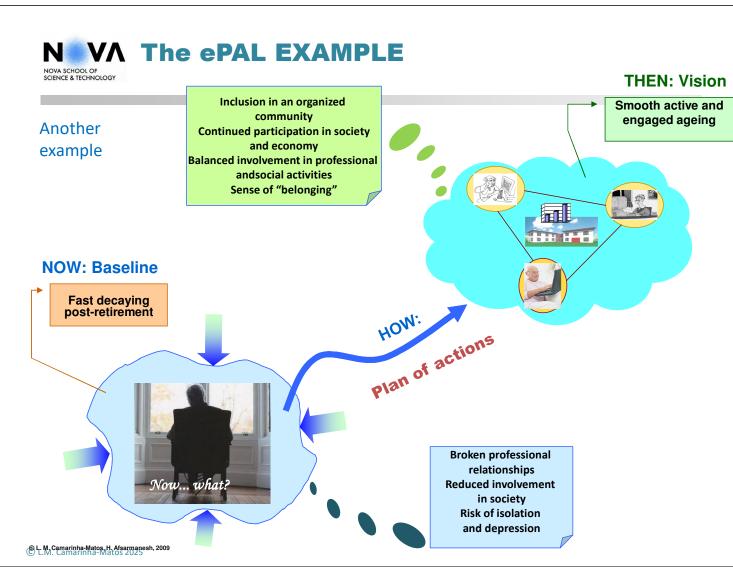






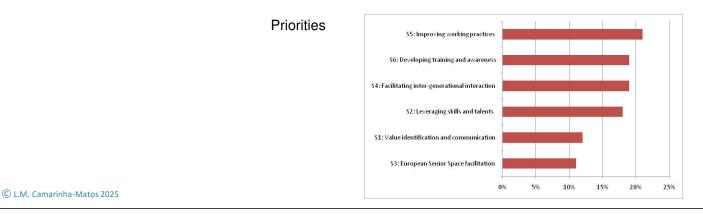
These books strongly contributed to the consolidation of the area of Collaborative Networks

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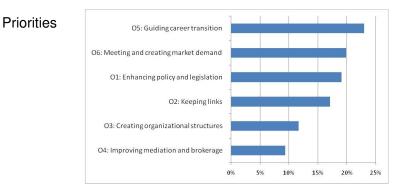
#### NOVA SCHOOL OF SCIENCE & TECHNOLOGY BENER & TECHNOLOGY BOLL ACTIONS – SOCIAL PERSPECTIVE

	2010	)		20	13		20	16		20	020
S1: Value identification and communication			Rð	D		Trials			oyment ous improv	ement	
S2: Leveraging skills and talents		ĺ		R&D			Trials			deployment provement	
S3: European Senior Space facilitation		R 8	D			Trials			ad deploym continuous	ient s improvemer	nt
S4: Facilitating inter-generational interaction				R	& D		Trial	Ş		oyment/ ovement	
S5: Improving working practices			R & D			Trials			d deploym continuous	ent improvemen	nt
S6: Developing training and awareness		R &	D		Trials				oyment ous improv	ement	
								 			_



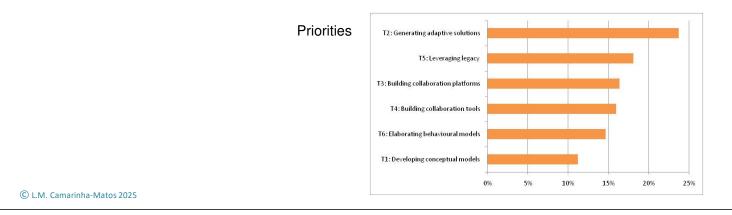
#### N VA NOVA SCHOOL OF SCIENCE & TECHNOLOGY B PAL ACTIONS - ORGANIZATIONAL PERSPECTIVE

2	2010		20	13		2016	2020
O1: Enhancing policy and legislation		R٤	D		Trials		Broad deployment and improvement
O2: Keeping links		R & [			Trials		Broad deployment and improvement
O3: Creating organizational structures		R & I	2		Trials		ed deployment continuous improvement
O4: Improving mediation and brokerage			R & [	}		Trials	Deployment/ improvement
O5: Guiding career transition	R	& D		Trials		Broad depl and continu	cyment ious improvement
O6: Meeting and creating market demand			R&D		т	rials	Deployment/ improvement



#### N VA NOVA SCHOOL OF SCIENCE & TECHNOLOGICAL PERSPECTIVE

	2010		20	)13	20	2	2020
T1: Developing conceptual models		R & I	)		Trials	Broad deployment and continuous improvement	
T2: Generating adaptive solutions			R&D		Trials	Broad deployment and improvement	
T3: Building collaboration platforms		R & D			Trials	Broad deployment and continuous improvement	
T4: Building collaboration tools			R&D		Trials	Deployment/ improvement	
T5: Leveraging legacy		Ra	& D		Trials	Broad deployment and continuous improvement	
T6: Elaborating behavioural models				R & D		Trials Deployment improvement	
				1			

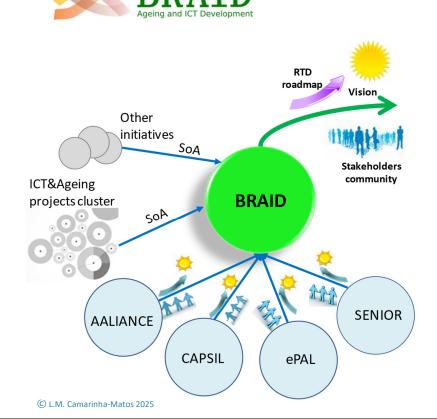




Bridaina

Research in



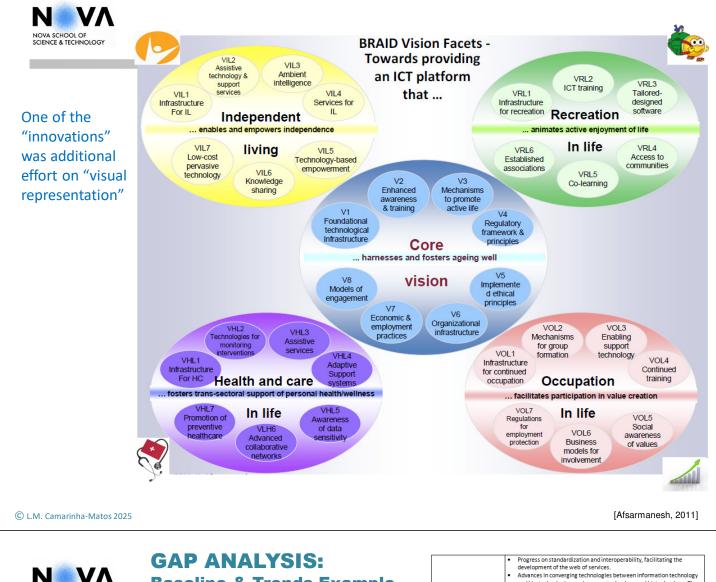


### **OBJECTIVES**

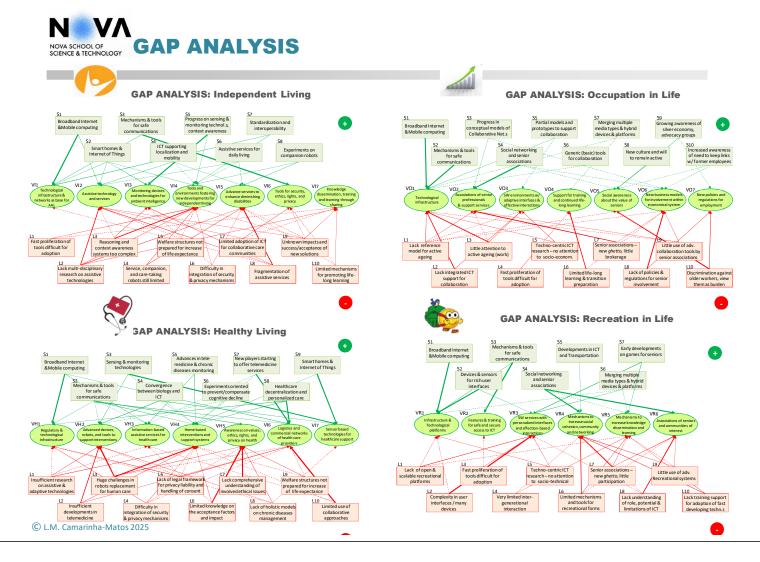
Integrate and consolidate current roadmaps, leading to a more holistic approach to ICT and Ageing development.

Elaborate a strategic research agenda that builds upon existing, emerging and disruptive technologies and that responds to the needs of senior citizens in a context of rapidly changing socio-economic conditions.

• Devise implementation approaches for the strategic research agenda.



NOVA SCHOOL OF SCIENCE & TECHNOLOGY	Baseline Life Setting: Independent living Vision facet: Established infrastructure and networks as the base for the support of independent living by technology	A Creasing availability of Internet and speed of broadband access.     Increasing availability of Internet and speed of broadband access covers less than half of the rural population and, ageing people, this access is lagging behind.     Market trend towards mobile broadband access at a decreasing price.     Increasing availability and power of mobile computing.     Mobile phones with built-in GPS, facilitating context aware applications.     More applications running on Cloud Computing.     Progress on standardization and interoperability, facilitating the development of the web of services.     Progress on standardization and interoperability, facilitating the development of the web of services.     Increasing the possibility of having more devices in the environment.     Large panoply of mechanisms and tools for safe communications, although still difficult to integrete and configure.	Sup envin the te	Life Setting: lependent living Vision facet: porting tools and onment that foster development of technologies for lependent living	<ul> <li>Advances in converging technologies between information technology and bio-technologies, such as nanotechnology and biotechnology. The reciprocal combination of areas allow collecting information related to the living body and elderly environment (such as blood pressure, facial expression, smell, air temperature, pos), enabling for instance networking biological components with technology fixes through external machines.</li> <li>Emergence of design for all.</li> <li>Early attempts on a "configure yourself" based systems design philosophy.</li> <li>Trend towards easily adaptable and customizable user interfaces, notion of skins and themes, adaptation to different output channels (PCs, mobile phones, PDAs, etc.), but not yet very smoothly.</li> <li>Personalization and profiling support is increasing, also opening new opportunities for applying data mining techniques.</li> </ul>
	technology	artnougn still attricuit to integrate and comgure. Technological convergence continues to merge multiple media types onto new hybrid devices. Progress on systems integration around the concept of smart home. Fast development of ICT represents a barrier for seniors, but broadband access also creates new opportunities for distance learning.		Life Setting: lependent living	<ul> <li>Progress on standardization and interoperability, facilitating the development of the web of services.</li> <li>Emergence of social welfare mechanisms, varying from public to private social security systems.</li> <li>Changes in organization of healthcare towards a more decentralized care models, namely localized care centers and at home. There is also a rising importance of self-managed care.</li> </ul>
	Life Setting: Independent living Vision facet: Assistive technology and support services that	<ul> <li>Advances in assistive/adaptive technologies for augmenting the capabilities of individuals, such as cognitive assistance, daily Living assistance, wellness monitoring, and health monitoring.</li> <li>Progress in robotics, which may act as replacement for human care, including service and companion robots, and able to monitor and assist elderly people suffering both from cognitive disorders and physical disabilities. However, developments in this field encounter both scientific and economic challenges.</li> <li>Progress in assistive communication technologies, which allows enhancing the communication abilities of the elderly to engage in desired person-to-person communications and person-to-machine communications.</li> <li>Customizable user interfaces allow the usage optimization of screen company in the provident of and the provident desire in the former desired in the communication.</li> </ul>	Advanc and co aim diminis seniors	Vision facet: ced set of organized mmercial services ning to enhance shing disabilities of s and caring so that they can live ndependently	In importance of service and a service and individualized services from several suppliers in order to address new customer groups, allowing reduce the complexity for the end user and creating custom-tailored services.     Offering services are becoming more important than equipment, and results in a B2B or even collaborative business model.     Telemedicine companies are evolving as new players that complement existing stationary and ambulant treatment, offering a broader portfolio which is more tailored to individual customer needs.     Technological convergence continues to merge multiple media types onto new hybrid devices.     Increasing economic pressure on social care systems.     Improvements on consumer protection and a coherent regulatory framework for grivacy liability are needed.
	facilitate independent living	space with adaptive interfaces, for different output channels (PCs, mobile phones, PAos, etc.), and the inclusion of translation engines. Experiments on preventing cognitive decline, focused on developments to compensate cognitive loss through assistive technologies. Growing convergence between biology and (CT tools (e.g., ICT implants that enhance brain/cognitive function, genetic screening, DNA tests). But the use of biometric systems has not yet been fully explored, and ethical issues are likely. Progress on assistive services for daily living assistance, driving assistance, cognitive assistance, etc.	Ind Tools	Life Setting: ependent living Vision facet: to ensure security,	<ul> <li>Large panoply of mechanisms and tools for safe communications, although still difficult to integrate and configure.</li> <li>Europe lacks a coherent legal framework for privary liability. Law currently guarantees neither the establishment nor the protection of an online private space in the same way as the private space in the physical world is protected.</li> <li>Emerging undir commercial practices. Elderly people are particularly more sensitive to unfair commercial practices and unfair contractual terms.</li> </ul>
	Life Setting:	<ul> <li>Progress in sensing technologies, creating the possibility of having more effective monitoring and context awareness reasoning functionalities.</li> <li>Some developments applying reasoning and context awareness.</li> <li>Extraction of knowledge about the activities of the user and the current situation in this environment from low-level sensor data to plan the appropriate short-term and long-term reaction.</li> </ul>		rights, and privacy a and used services	<ul> <li>Consent plays a key role in social relations, but modern ICT processing activities remain opaque to most users. Even when consent is given, the user might not be able to use his or her data protection rights. Personal data, including health data or even genetic data, can be used without consideration to user protection and rights.</li> </ul>
	Vision facet: Monitoring devices and technologies supporting ambient intelligence solutions	<ul> <li>Bergerick and section biologic generation of the section of the sect</li></ul>	Ind Mecha knowle train throug seni	Life Setting: lependent living Vision facet: anisms to increase edge dissemination, ning and learning th sharing both for iors and all other stakeholders	Training on new ICT should be available even before retirement. Seniors should also be involved in the process of tools development. Difficulty in coping with advances in technology. ICT is still a barrier for seniors because some show reluctance to accept new technologies. Expanding Accessibility of Life-Long Learning Technologies. New tools for user-generated content, if properly integrated in a collaborative community context, are likely to provide the opportunity for a great increase in knowledge dissemination, training and learning.



### PRELIMINARY VERIFICATION: COVERING THE VISION

#### Independent Living

AIZ

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A15

(A16

(RI1)

(RI2)

AH1

AH2

АНЗ

AH4

AHS

AH6

RH1

(RH2)

(RH3)

Vision facets

N V/

NOVA SCH

VI1: Established infrastructure and networ as the base for the support of independent living by technology

VI2: Assistive technology and support set that facilitate independent living

VI3: Monitoring devices and technologies supporting ambient intelligence solutions

VI4: Supporting tools and environment that foster the development of technologies for independent living

VI5: Advanced set of organised and nmercial services aiming to enhance inishing abilities of seniors and cari iors so that they can live independe ng for

VI6: Tools to ensure security, ethics, rights, and privacy on data and used services

VI7: Mechanisms to increase knowledge dissemination, training and learning thre sharing both for seniors and all other stakeholder



Living

E. Vision facets VH1: Regulatory and technological infrastructure to support consumer driven healthcare (supporting data privacy, standards)

VH2: Advanced devices, robots, and tools supporting interventions for monitoring and provision of health care

VH3: Information based assistive services supporting the health care of seniors and involvement of other stakeholders VH4: Appropriately designed home based interventions and support systems, based on seniors' cognitive and emotional status, which adapt whilst they age

VH5: Mechanisms to raise awareness on the formation of values, ethics, rights, and privacy on health related data and advanced ICT tools to ensure data security

VH6: Organised logistics and commercial networks of health care providers in the society, adapted to demographic change VH7: Sensor based technologies, which are context aware, for healthcare support

Actions Monitor Well-Being. Design, develop and integrate open and scalable sensor network environments both home-centered and human-centered, with intelligent monitoring, including new levels of security, safety, and privacy.

Action

of security, safety and privacy. Extend capabilities. Investigate, develop and integrate intelligent functionalities to compensate diminishing cognitive and physical capabilities and to design and develop intelligent, context-aware and self-adapting to tools for personal assistance in planning and performingdaily activities and facilitating societal participation.

Build supportive environments. Design, develop, and validate preventative and responsive interventions based on situational

awareness. Establish collaborative environments. Design and develop novel collaborative environments, combining social networking and collaborative networks of care provision stakeholders to facilitate support, companionship, and community participation.

Assist mobility. Integrate and customize methods and tools to assist mobility. Integrate and customize methods and tools to assist mobility, including services for localization, trip planning, navigation, orientation in complex environments, driving assistance, and inter-modal transportation, focusing elderlyneeds. Align independent and sustainable living. Explore the alignment of ICT for Independent Living with smart grid and sustainable development technologies.

Assess impacts. Promote integrative studies on the sociological, economic, Assekial, and quality of life impacts of introducing services and technologies for independent living.

Train for new environments. Define new community-based training programs leveraging the potential of new technology-based assistive environments.

Establish safe infrastructure. Develop a safe and adaptable infrastructure, aligned with relevant standards in e-health, to support the provision of consume-driven healthcare services. Develop intervention tools. Design, develop and adapt advanced devices, intelligent robots, and intelligent tools to support interventions regarding seniors healthcare. Design integrated adsistive services. Create a framework for the emergence of integrated information-based assistive services for health care of seniors, with particular emphasis on quality of service? quality of information, and based on a multi-stakeholder collaboration model. Develop health monitoring systems. Design, develop and integrate and other context factors, and smoothy adaptable to the needs of each senior individual.

senior individual. Establish healthcare ecosystem. Define new organizational and business models and develop support tools for the establishment of collaborative healthcare ecosystems involving healthcare providers, social security and regulatory authorities, forming the backbone for the emergence of new services for healthryliving support. Support home-based interventions. Identify, develop and assess novel experiments on home-based interventions and associated support systems, which are selfadapting to the cognitive, emotional, and physical status of the senior and respect the established safety and ethical principles.

copies: lop regulatory framework. Promote studies to elaborate and assess new initiational forms and business models for healthcare provision to ageing alation under a community and multi-stakeholder collaboration perspective.

Establish organisational and business models. Lefting and regulate critical elements in ICI-based support services for healthy living. Raise awareness on healthy living. Launch actions and develop mechanisms to raise awareness on healthy living. Launch actions and develop mechanisms to raise awareness on healthy living. Launch actions and develop mechanisms to raise awareness on the living living. Launch actions and develop mechanisms to raise to be adopted in actional to the mechanisms of the available awareness on the living living.

#### Occupation in Life

Vision facets Vol:Established technological infrastructure (including support for connectivity, mobility cloud computing) as the base for seniors professional activities VO2: Mechanisms to build associations of senior professionals and actively engage them, and support services for formation / management of teams of professionals

VO3: Advanced software environments to support seniors with adaptive personalized interfaces and affective interactions (within a context-aware and configure-yourself enviched environment)

#### VO4: Organized support for training and continued life-long learning for seniors

VO5:Increased social awareness about the value of senior professionals and their social coehsion and knowledge transfer (facilitating active involvement through networking, with emphasis on cross-generational and gender issues)

#### VO6: New business models for inv seniors within existing economical



Recreation in Life

(40

RO2

RRZ

(RR3

### Vision facets VR1: Infrastructure and required technologica platforms (connectivity, communications and networking infrastructures and pervasive applications and services that are universally accessible.

VR2: Adequate features and training support to enable seniors to access and use ICT safely (free from harm) and with security (free from threat or intrusion)

VR3: Appropriately designed software services to support seniors with personalized interfaces and affection-based interactions, that can adapt to users' sensory, cognitive and physical capabilities (within a context-aware and configure-yourself enriched environment)

VR4: Mechanisms to increase social cohession, access to community and networking of seniors (including support for transport and mobility)

VR5: Growth and development mechanisms to increase knowledge dissemination and learning through sharing

VR6: Established associations of seniors and communities of interest, allowing active engagement (physically and virtually)

Actions Build collaboration platforms and systems. Design and develop open creation, addressing the specific needs of communities of senior professionals, and which promote htter-generational interaction and oscialazidon, which are enhanced by affective computing, context awareness, and trust setablishment. Generate adaptive solutions and services. Develop and integrate self-adaptive and configurable technology solutions and services in ICT environments, apphying principles of e-accessibility, design for all, and usability in order to facilitate technology acceptance and enable sustomization for/byseniors. Use organe legacy. Develop environments that empower and enables seniors to create a legacy capakiling on their invaluable and transferable personal / professional knowledge and experience. Create a model framework. Develop aproaches, models, and reasoning methods related to older people's occupation life cycle and their participation

(A03

Create a model framework. Develop approaches, models, and reasoning methods related to older people's couption life cycle and their participation in the economic system, including value systems, behaviors, and issues of physical, cultural and emotional health. Create trusted knowledge network. Create a trusted knowledge network that provides an integrative framework to enable seniors within their occupation in life, whether professional or voluntary. Join online and offline collaboration. Develop integrative framework for identity management which effectively and seamless/pions online and offline collaboration, for seniors, to create invaluable connections between virtual and real-word aspects of their occupation in life. AO

- (A05
- $\langle RO1 \rangle$

Virtual and real-works a spects orther or accupation in itre-Improve working practices, investigate new models of working practices and related rework and taxation models for senions, taking account of working branches and provide the senior of the senior of the senior of the senior is the Enhance poly, and agalantion, identify and assess current rational and European poly. Indiginities upstem and incomments to active participation of seniors in the protone and upport active aging. Guide carrier transitions. Define new He-long taking uppgrammes and realistic gradies for an equilation of the successful transition of senior knowle dge bolders from full employment to accupation in life.

RO3

Actions Build recreational platforms, solutions and services. Design and develop open, secure, interoperable, flexible, customizable and affordable ICT recreational platforms, solutions and services for senior citizens.

Semior rucens. Build novel interfaces. Develop novel human-machine interfaces with high quality of usability and applying design for all principles, oriented towards seniors' active engagement in recreational activities, considering their cognitive and physical capabilities, and including augmented reality, affective computing, companion artifacts, pervasiveness, etc.

Find new recreational channels. Elaborate innovation portfolio of new ICT-supported recreational activities for seniors, exploring tele-presence, remote participation in cultural events, collaborative gaming, intelligent urban environments, etc.

gamm; intelligent urban environments, etc. Build participatory communities. Design, develop and implement local and regional participatory communities that combine online and offline participation through social networking, inter-generational interaction, and local government involvement, focusing participatory recreational life and wellbeing.

Create and promote gaming. Design, develop and promote novel physical, recreational and cognitive games for seniors, with a holistic focus on recreation, wellbeing, socialization, and inter-generational collaboration.

Assess recreation impact. Promote multi-disciplinary studies on the impact of physical and cognitive recreational activities for seniors.

provide and cognitive recreational activities or sensors. Train for digital infersive, Create and deploy training programs and mechanisms oriented to help senior citizens enter and explore new lifestyles in the digital age, with parkular attention to rural areas. Promote studies in recreation. Promote studies on all aspects of ICT-enabled/induced social innovation oriented to participatory involvement of elderly in recreational, cutural and social life.



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### **VALIDATION WORKSHOPS**



Group discussion Argumentation Amendment



Voting

### Summarizing conclusions



#### NOVA SCHOOL OF SCIENCE & TECHNOLOGY FEEDBACK: Prioritization of actions

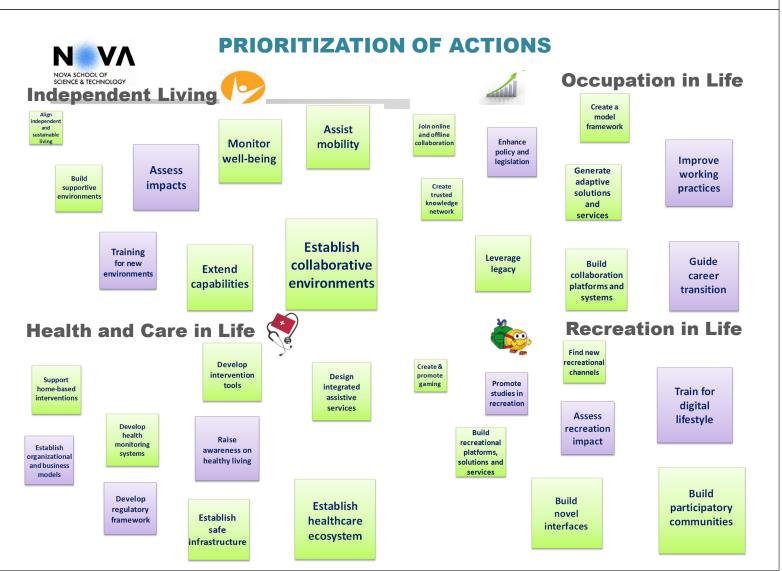
**Independent Living** 30.00% 25.00% 20.00% 15.00% 10.00% 5.00% 0.00% RI1 RI2 AI1 AI2 AI5 AI6 AI3 AI4

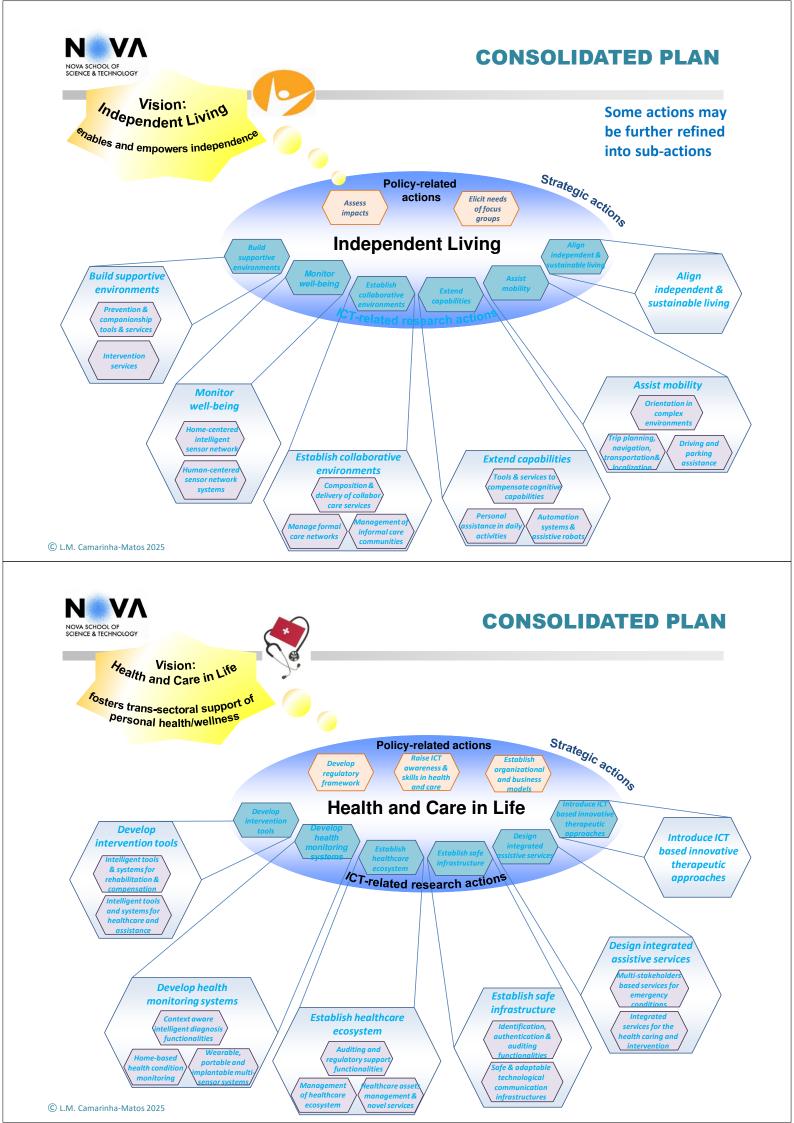


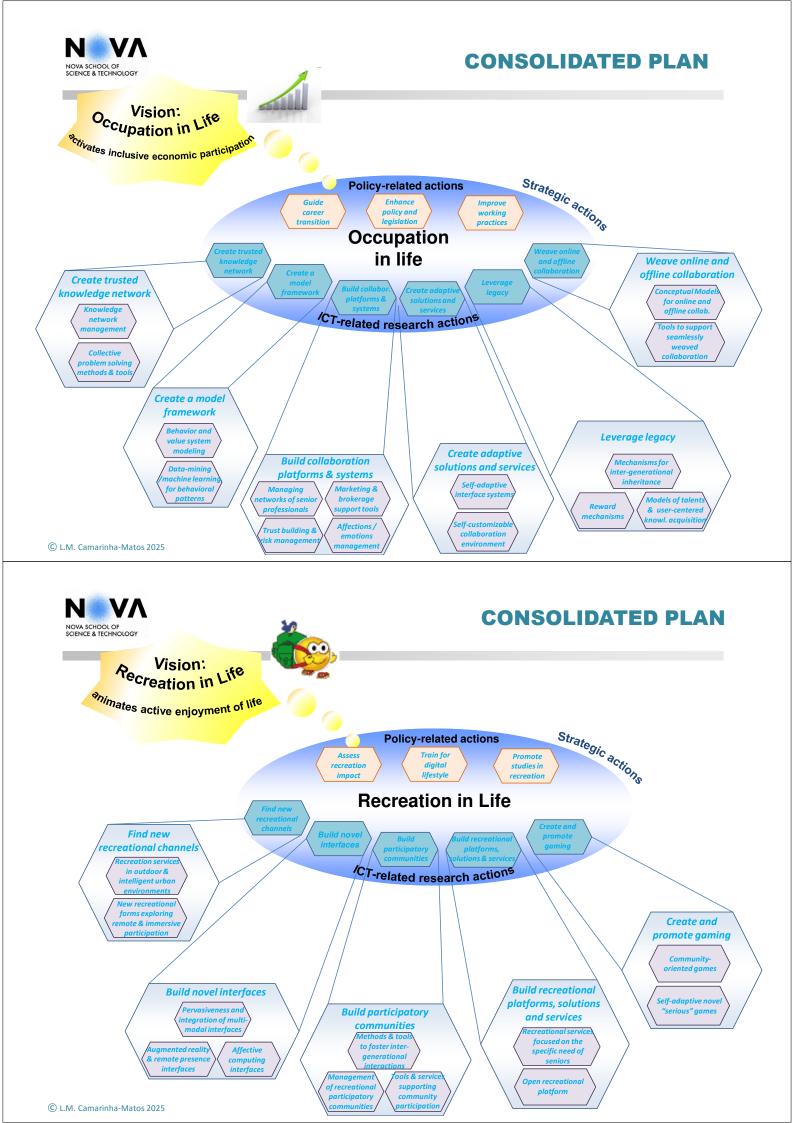


#### Recreation in Life 30.00% 25.00% 20.00% 15.00% 10.00% 5.00% 0.00% AR1 AR2 AR3 AR4 AR5 RR1 RR2 RR3

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### NOVA SCHOOL OF SCIENCE & TECHNOLOGY BRAID: SCEHDULE OF ACTIONS

All Establish collaborative environments		2013		2016		2019		2021	AH	Establish healthcare ecosystem	_							
	840						1				RAD							
Al1.1 – Plan, organize and support	Plat						-		Life	AH1.1 Plan, organize and support management of the healthcare ecosystem.	Plat							
management of formal care networks.	Tale-up								<u>+</u>	management of the nearthcare ecosystem.	Take-up							
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Al1.3 - Design and develop tools for	RAD					_	_		3	AH1.3 Develop auditing and regulatory	RaD							-
composition of collaborative care services.	Plot					_	_		~~	support functionalities.	Pliat Take-up						_	_
	Tale-up								0	2 Develop health monitoring systems	Take-up			_				_
AI2 Extend capabilities						_	_		AH	2 Develop health monitoring systems		_	_			-		-
AI2.1 - Development of intelligent tools and	RAD	(							pu	AH2.1 Develop and integrate home-based	RaD			_	_			
services for personal assistance in daily	Plat									health condition monitoring systems.	Pliot							
activities.	Tale-up								ສ		Take-up							
	RaD										RaD							
Al2.2 - Development of automation systems and assistive robots.	Plot								÷	AH2.2 Develop wearable, portable and implantable multi-sensor systems	Plint							
una usals uve l'00005.	Tale-up								b	improvidence incruissensor systems	Tako-up							
									Health							-		
AI2.3 - Investigate, develop and integrate	RAD		_		_				*		RAD							
AI2.3 – Investigate, develop and integrate intelligent tools and services to compensate	Plat								I	AH2.3 Design and develop context aware	Plan							
diminishing cognitive capacities.	Taleur									intelligent diagnosis functionalities	Trice up							
Al3 Assist mobility	Carer Sp.									SEstablish safe infrastructure	saver sip	-			-			
		1			_	-	_		An	s establish sale initastructure		_					_	-
AI3.1 – Integrate and customize methods, tools and services for trip planning,	RaD						-			AH3.1 Design and develop safe and adaptable	RAD							
navigation and localization.	Plat									technological communication infrastructures	Pllat	_			_			_
inavigation and rocanzation.	Tale-up										Take-up							
						_	_											
AI3.2 - Develop and customize driving and	RaD				_		_			AH3.2 Design and develop identification,	RaD							
parking assistance.	Plat									authentication and auditing functionalities	Plat							
	Tale-up										Tako-up							
									AH	Design integrated assistive services						1		
AI3.3 – Integrate and customize methods,	RaD										RaD							
tools and services for orientation in "complex	Plat									AH4.1 Develop integrated services for the health caring and intervention	Plot							
environments".	Tale-up									nearth carring and intervention	Take-up							
Al4 Monitor well-being																		
AI4.1 - Design, develop and integrate home-	RAD									AH4.2 Dynamic configuration of multi-	BAD							
centered intelligent sensor network	Plat									stakeholders based services in response to	Plat							
environments.	Take-up									emergency conditions	Triput			_				
									AH	5 Develop intervention tools		_			-	_		_
AI4.2 - Design, develop and integrate human-	RAD																	-
centered intelligent sensor network systems	Plat									AH5.1 Develop intelligent tools and systems	Prince							
development.	Tale-up									for healthcare and assistance	Pliat Take-up							
A15 Build supportive environments	· · · ·										Take-up							
	RAD						1									1		_
AI5.1 - Design and development of prevention	Plat									AH5.2 Develop intelligent tools and systems	RaD							
and companionship tools and services.	Tale-up									for rehabilitation and disability compensation	Pliot							
											Take-up			_				
	840			_						5 Introduce ICT based innovative					-			_
AI5.2 - Design and development of	Plat								the	rapeutic approaches	RaD							
intervention services.	PIDI										Pliot							
Align independent and sustainable living	1 3HP-10										Take-up							
and sustainable living		_							RH	Raise ICT awareness and skills in health								
	RAD								and	care	RaD							
	Pliot										Plat							
	Tale-up				_						Take-up							
R11 Assess impacts							_											
	RaD								RH	Develop regulatory framework	810							-
	Plat										наД							-
	Tale-up								-		Pliat							
RI2 Elicit needs of focus groups										Cotabilistic annual anti-anal and business	Tako-up			_				
	RaD									Establish organizational and business						-		_
	Plot								ma	dels	RaD							
	Tale-up										Tripping	_			-			_

#### N VA NOVA SCHOOL OF SCIENCE & TECHNOLOGY BRAID: SCEHDULE OF ACTIONS

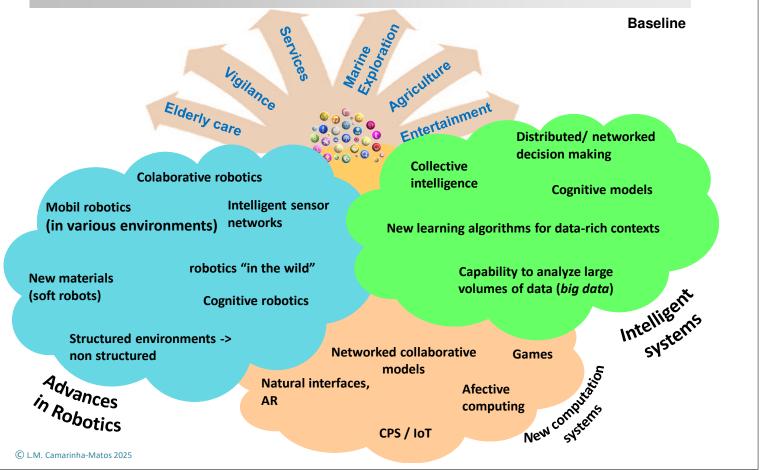
A01	Build collaboration platforms and systems		2013			2016			2019	
	AO1.1 - Develop advanced functionalities and	RAD						1		-
	systems for management of networks of	Pliat								
	senior professionals	Take up								
								_		
	AO1.2 - Develop marketing and brokerage	RAD								
	support tools for communities of senior	Pliat								
	professionals.	Take-up								
	AD1.3 - Develop trust building and risk	RAD		1	1	1		1		-
	management systems for communities of	Plat								
	senior professionals.	Take up						_		
	AD1.4 - Develop affections / emotions	RAD		i i	i i	1		1	i i	1
	management systems for communities of	Pliet								
	senior professionals.	Take-up								
401	Leverage legacy	1 MAP Up			-			-		_
	AD2.1 - Define conceptual models of talents	RAD		1	i i	i i	Ì	i i	i	-
	and develop user-centred knowledge	Plat								
	acquisition tools.	Take up		1	1					
		1.00.07.00								
	AQ2.2 - Create reward mechanic are function	RaD		_	_	_	_			-
	AO2.2 - Create reward mechanisms (system of incentives) to attract user-generated	Pliet								
	knowledge.	Take up	<u> </u>	-						
		RAD		_	_	_	_	_		
	AD2.3 - Mechanisms to promote inter-	Pliet								
	generational inheritance.	Take up								
401	Create adaptive solutions and services									
~~~		RAD		1	1	1				
	AO3.1 - Develop self-adaptive interface	Dist								
	- systems.	Take up								
		RAD		1	1	1		1		
	AO3.2 - Develop self-customizable	Plat								
	collaboration environments and services.	Take up								
AO	Create a model framework							-		
-		RAD								
	AD4.1 – Develop a conceptual base for	Pliat								
	behavioural and value system modelling.	Take-up								
									-	
	AD4.2 - Develop data-mining / machine	RAD								
	learning approaches for behavioural patterns	Pliet								
	di scovery.	Take up								
AOS	Create trusted knowledge networks				· · · · ·	· · · · ·		· · · · · ·		
		RaD								
	AO5.1 – Develop effective knowledge network management systems.	Plat								
	managements youting.	Take up								
		Rid								
	ADS.2 – Develop collective problem solving methods and tools.	Plat								
		Take up								
AOF	Weave online and offline collaboration									
		RaD								
	AD6.1 - Develop conceptual models for online and offline collaboration.	Trial								
	and omme consolitation.	Take-up								
		RAD	_							
	AO6.2 - Develop tools to support seamlessly weaved online/offline collaboration.	Trial								
	weaved on meyon me collaboration.	Take up								
RO1	Guide career transition									
		RaD								
		Plat								
		Take-up								
801	Improve working practices									
		RAD								
NUZ										
NOZ		Plat								

			2013	8		2016			2019		
AR1	Build participatory communities										
	AR1.1 Plan, organize and support	RAD						1	1		Ē
	management of recreational participatory	Pliot									H
	communities.							_			H
		Take-up									-
				1	1	1					÷
	AR1.2 Develop tools and services supporting	RaD									
	community participation.	Pliot									
	commany paracipation.	Take-up									
	AR1.3 Develop methods and tools to foster	RAD									Г
	inter-generational interactions on a	Pliot									
	community basis.	Take-up									
482	Build novel interfaces			-				_			
	band nover meenades	RAD						-	-	-	t
	AR2.1 Explore augmented reality and remote							_			⊢
	presence interfaces.	Trial									H
		Take-up									-
AR2			_						_		H
		RaD									L
	AR2.2 Develop affective computing interfaces.	Trial		-							L
		Take-up									
											Г
	AR2.3 Develop methods to promote	RaD		_							Г
	pervasiveness and integration of multi-modal	Trial									
	interfaces.	Take-up									
AD2	Build recreational platforms, solutions					·					-
	services										
anu	services	RAD									<b>—</b>
	AR3.1 Design and develop an open	Plot									⊢
	recreational platform.										L
		Take-up									
	AR3.2 Customize and integrate recreational	RAD									
	services focused on the specific need of	Pliot									
	seniors.	Take-up									
AR4	Find new recreational channels										
	AR4.1 Design and develop new recreational	RaD									Г
	forms exploring remote and immersive	Pliot									
	participation.	Take-up									
				-							-
		RAD		1				1	1		Ē
	AR4.2 Novel technology assisted recreation services in outdoor and intelligent urban	Plot					_				⊢
	environments.										H
		Take-up		ļ							-
AR5	Create and promote gaming								_		1
	AR5.1 Design and develop self-adaptive novel	RaD									L
	"serious" games	Pilot									L
		Take-up									
											Г
		RaD									Г
	AR5.2 Design and develop community-	Pliot									
	oriented games	Take-up		1							
DD*	Train for digital lifestyle	cand-sp									۳
ran1	nam för ufgital mestyle	RaD	_								
		Pilot									
		Take-up				-					
RR2	Assess recreation impact										
		RaD									
		Pliot									
		Take-up									
RR3	Promote studies in recreation										-
		RAD							-		t
		R&D Pilot									H
		Pilot Take-up									H



### Another example









### **Recriation of professions in traditional sectors**

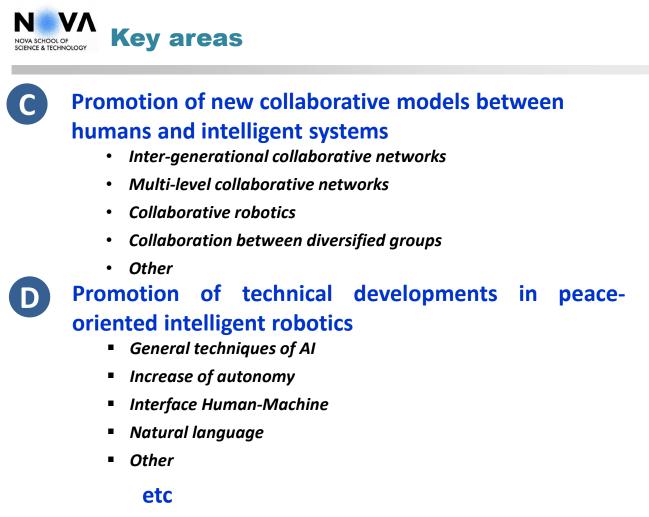
- Agriculture
- Marine exploitation
- Tourism
- Civil construction
- Home tasks
- Other



### **Establishing new professions and functions**

- Security
- Environment monitoring e.g. fires
- Elderly care and active ageing
- Support to children with special needs
- Entertainment and arts
- Education and training
- Healthcare
- Other

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