



SCIENTIFIC RESEARCH METHODOLOGIES AND TECHNIQUES

Unit 13: ROADMAPPING AND FUTURE PLANNING (II)

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PHD PROGRAM IN ELECTRICAL AND COMPUTER ENGINEERING

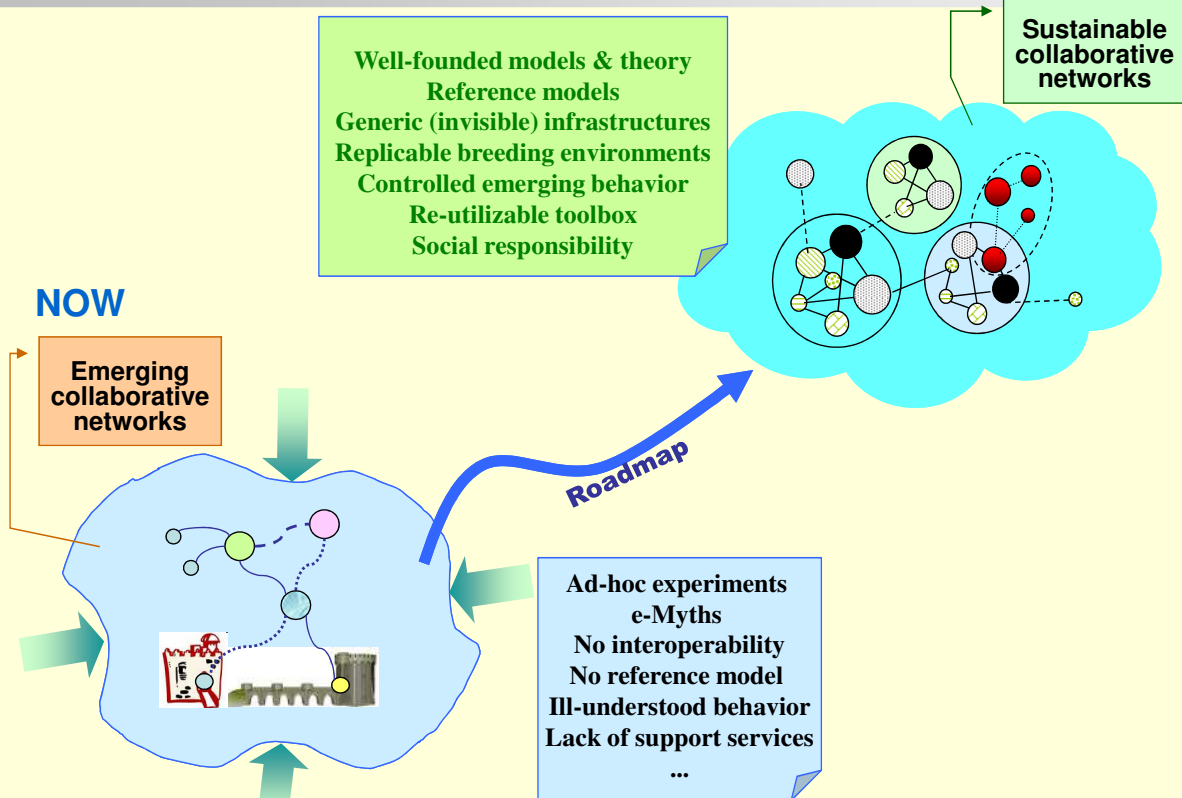
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Example: Roadmap for collaborative networks

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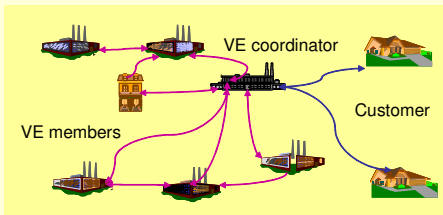
NOW



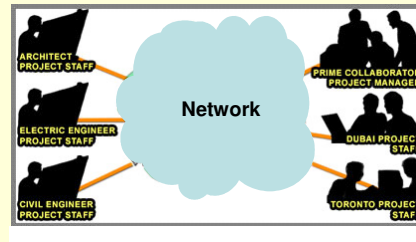


What is a collaborative network ?

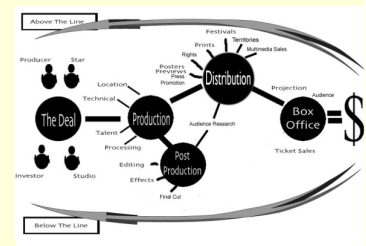
Industrial Virtual Enterprises



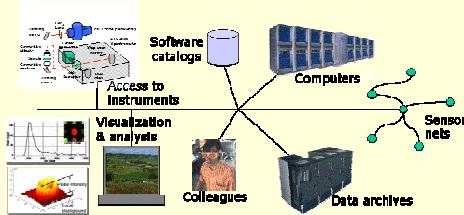
Professional Virtual Communities



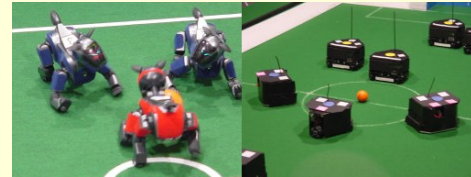
Movie industry networks



Virtual Labs

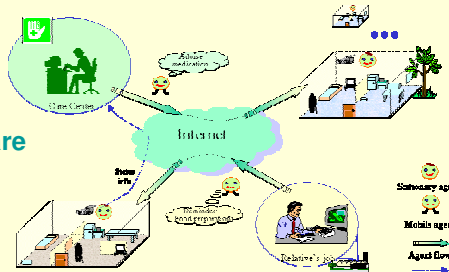


Networks of machines



Examples

Elderly care networks



- Tourism
- Insurance
- Consultation
- Disaster rescue
- e-Government
- Virtual institutes
- European borders protection
- ...

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#8



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**.

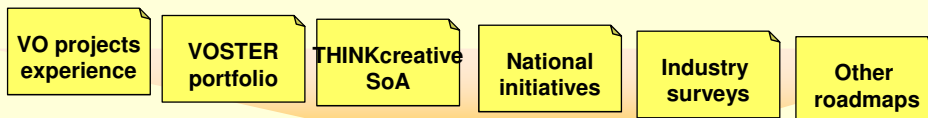
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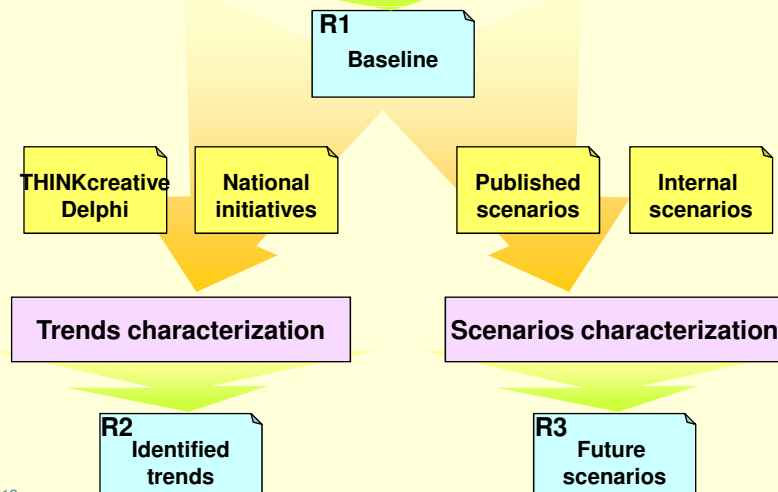
1. BASELINE

First steps

1 Characterize and consolidate baseline



2 Perceive trends and design scenarios



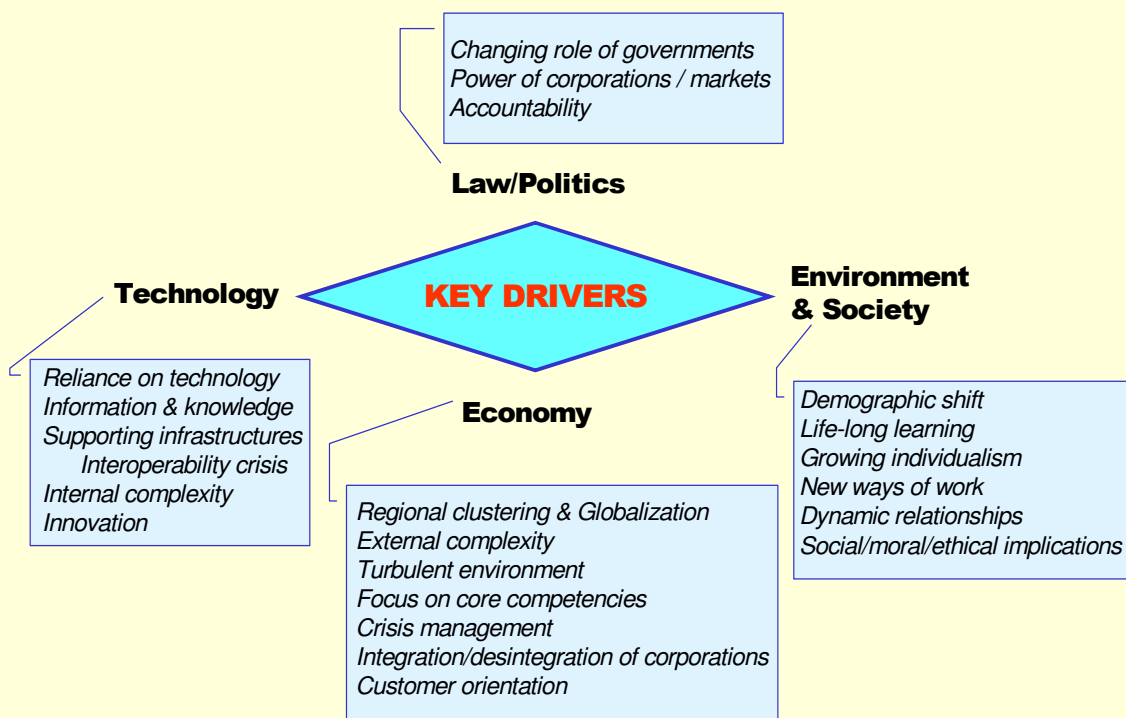


Baseline

- 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



Key drivers



Delphi survey (THINKcreative project)

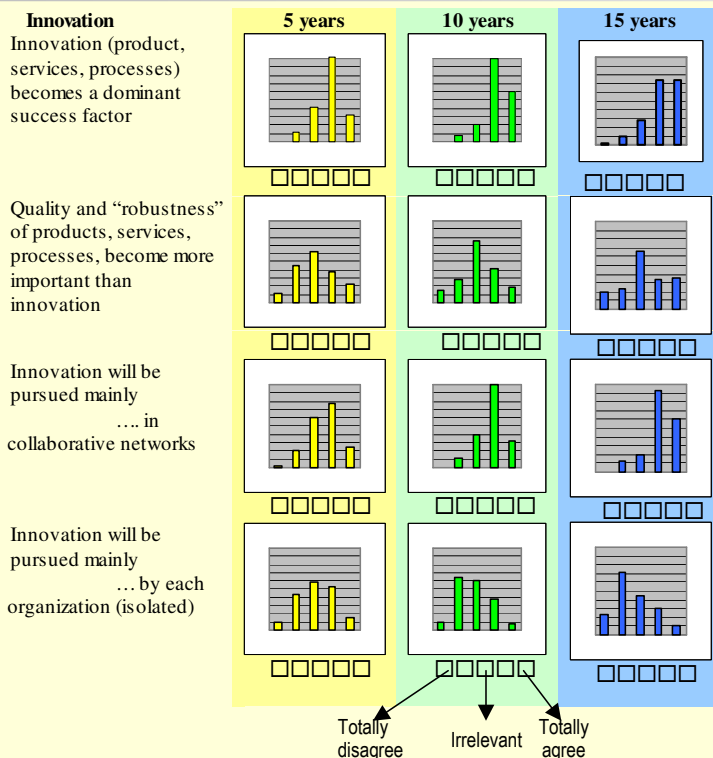


FUTURE SCENARIOS IN COLLABORATIVE NETWORKS for the next 5, 10, to 15 years

	Totally disagree			Irrelevant			Totally agree		
	□	□	□	□	□	□	□	□	□
	5 years	10 years	15 years	5 years	10 years	15 years	5 years	10 years	15 years
Regional clustering and Globalization									
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	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Globalization will definitely erode "geographical competitive advantages" and borders	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Customer orientation									
Trends in products / services point to mass customization	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
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	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Products become increasingly complex (internal structure)	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
External complexity									
Business processes tend to be supported on a lean, stable and simple supply chain	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Business processes tend to be supported on highly dynamic and increasingly complex networks of collaborative entities	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Turbulent environment									
The speed of change in business environments is likely to increase	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
The amount of change in business environments is likely to continue growing	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

135 experts
- 69% industry
- 31% academia

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.



Delphi survey – Identified trends

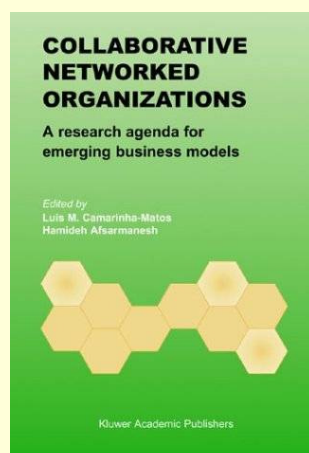
THINKcreative Delphi Survey

➤ 100 experts *identifying the trends*

Key drivers	Trend
Economy	
Regional clustering and globalization	Although regional clusters, by reinforcing long-term relationships and leveraging local “culture”, local specificities, and proximity to customers, might have in the short term some effects against the threats of globalization, the trends in the medium and long term are unclear.
External complexity	Business processes tend to be supported on highly dynamic and increasingly complex networks of collaborative entities, a trend particularly expected in the medium and long term, but not a so clear reality in the short term.
Turbulent environment	The speed of change in business environments is likely to increase, even in the short term, and a definitive expectation for the long term. The amount of change in business environments is likely to continue growing, as a moderate expectation for the short term and a clear trend in the long term.
Focus on core competencies	In order to remain lean and highly efficient in competing markets, organizations progressively trend to focus on their core competencies.
Crisis management	There is a moderate expectation that, in the medium and long term, crisis management will become a standard “capability” in organizations. At the same time, crisis management might become a specialized activity (market niche) for some specific entities.
Integration / disintegration of corporations	The structure of large organizations is likely to evolve, in the medium and long term, namely in the form of organized disintegration (forming complex networks of interacting units).



THINKcreative book



INTRODUCTION

Motivation, Base concepts

NEW COLLABORATIVE FORMS

SoA, Scenarios, Examples

GLOBAL & REGIONAL RESEARCH AGENDAS

Delphi, Workshops, Non-EU views

HUMAN, SOCIETAL, AND ORGANIZATIONAL ASPECTS

ICT FACTORS
Infrastructures, MAS,
Emerging technologies

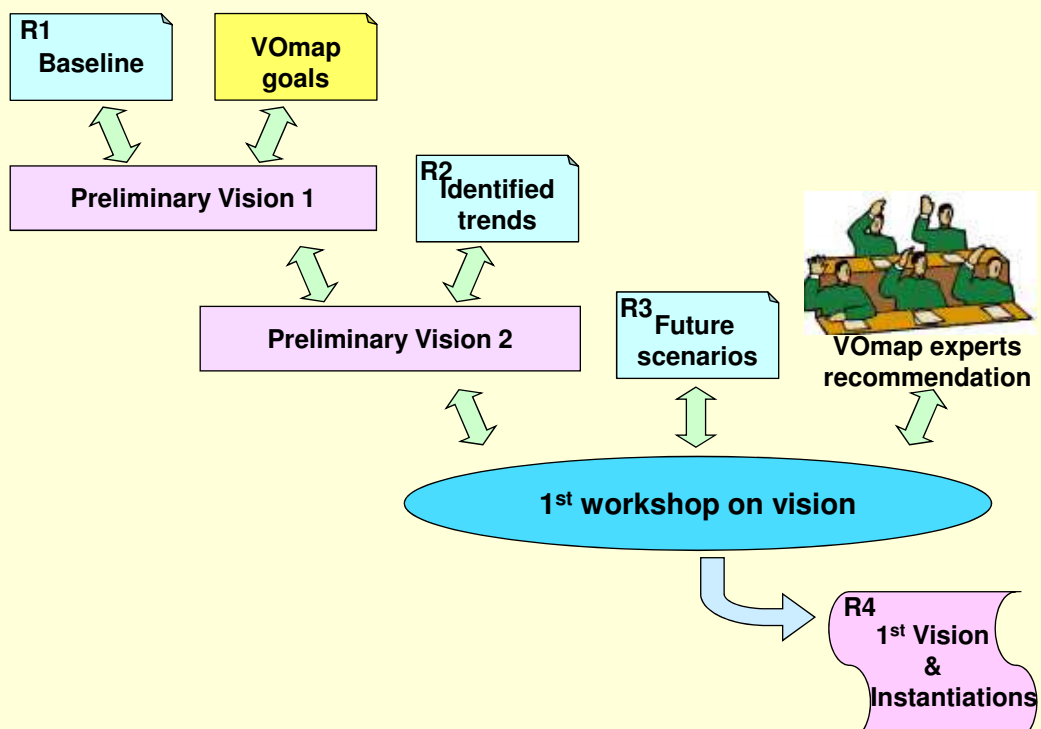
FOUNDATIONS AND MODELING
Models, theories, MAS modeling,
soft modeling, logic of obligations

ROADMAP EXAMPLE
Research agenda for advanced CNs

2. VISION STATEMENT

Towards the vision

3 Elaborate first vision statement and instantiations





Plausible scenarios of future

- Forecasting techniques have become a prerequisite for investments
- A widely recognized & frequently used technique is **scenario building**

Scenarios provide guidelines on:

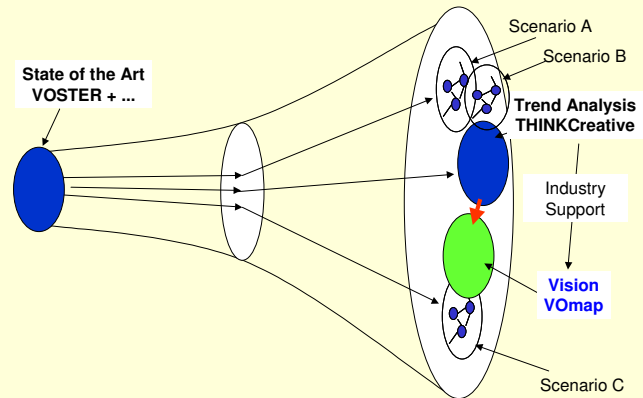
- *which directions are more probable for future*
- *estimation of future results*

Based on:

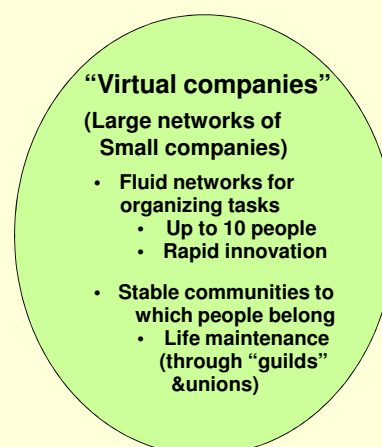
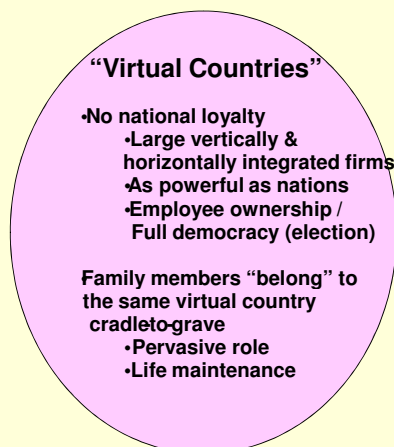
- *driving forces*
- *possible trends*
- *opposing factors*

Requires:

- *significant amount of time and resources to estimate the future, specially for developing large-scale scenarios as required for VOs of future*



Scenario cases - I



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

Regional clusters and enterprise networks:

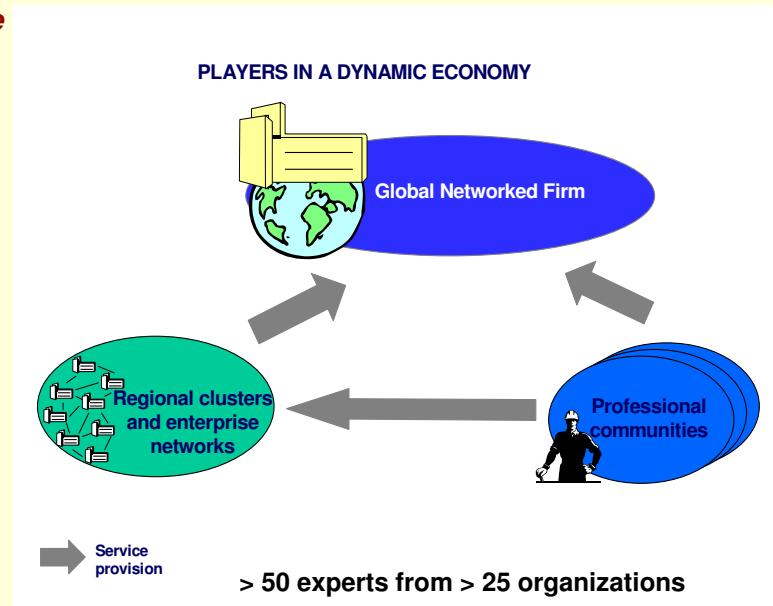
provide very powerful and flexible ways to support SMEs.

Professional (virtual) communities:

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

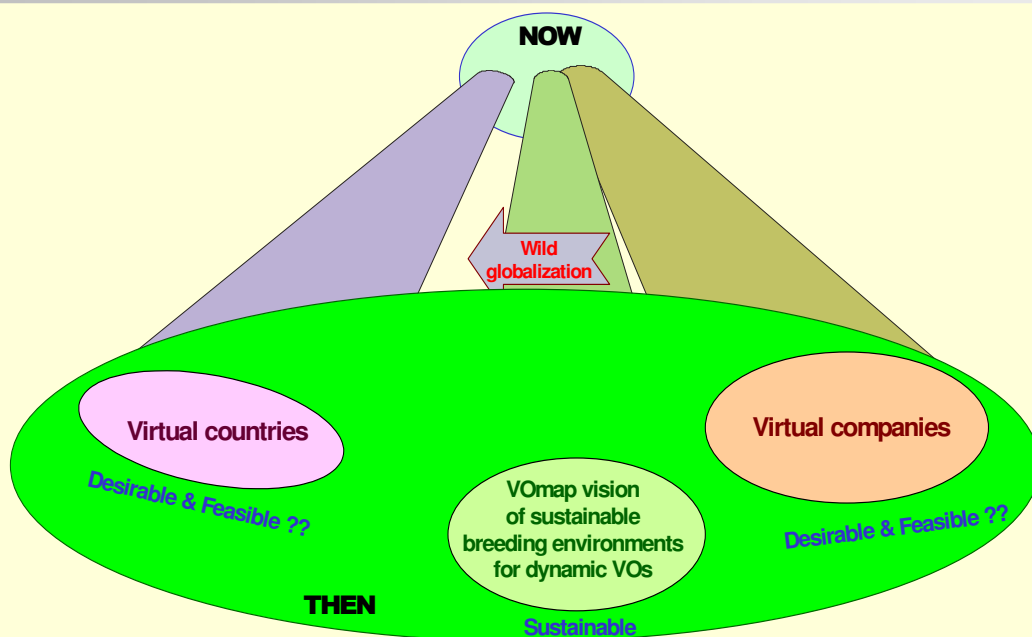
Global networked firms:

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



Three potential players in a future economy scenario

Scenario ranges



Sustainable breeding environments for dynamic VOs



1st Vision statement

• Identifies required areas for research and development

• 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.

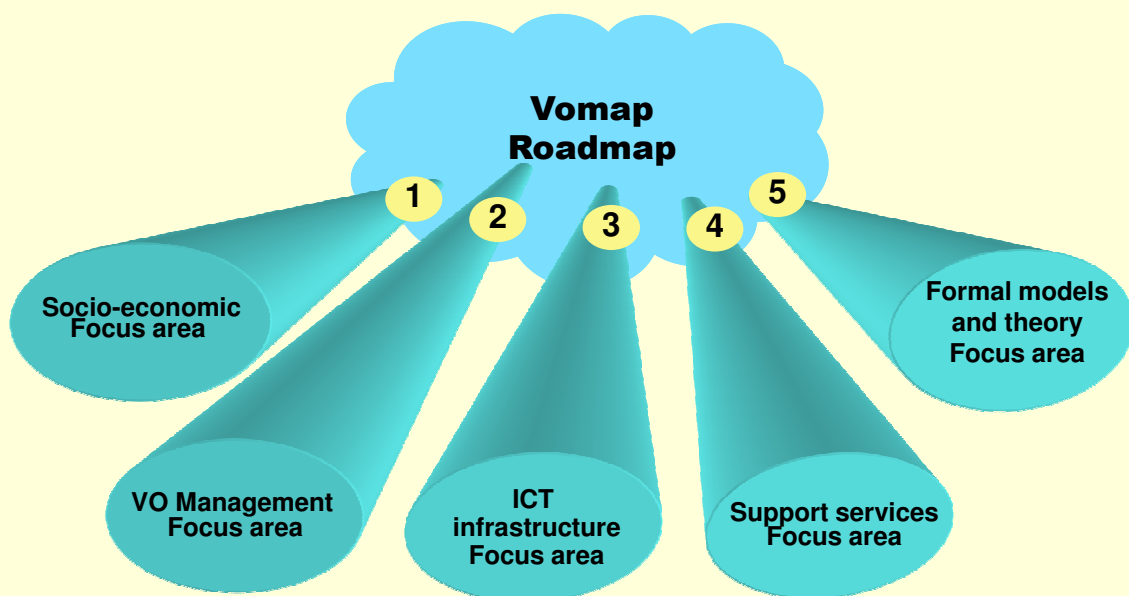
Main mechanisms:

- 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.



VOmap focus areas



Multi-disciplinary contributions



Vision instantiation for socio-economic area

The socio-economic environment will be fully developed to support virtual organizations, stressing the importance of human-related issues at the individual and organizational level, in enabling institutions and in a transparent regulatory environment.

- 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



Vision instantiation for 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 “multiple-objective” 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



Vision instantiation for ICT infrastructures

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)



Vision instantiation for support services

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 / semi-automatic 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 post-cooperation IPRs and liabilities



Vision instantiation for formal models and theories

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 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
- 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

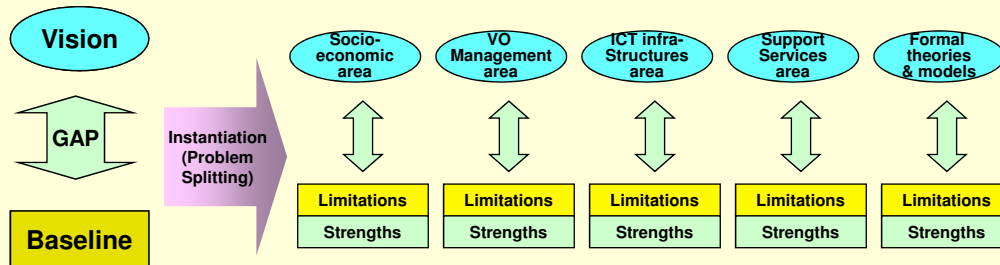


3. GAP ANALYSIS

Gap analysis step

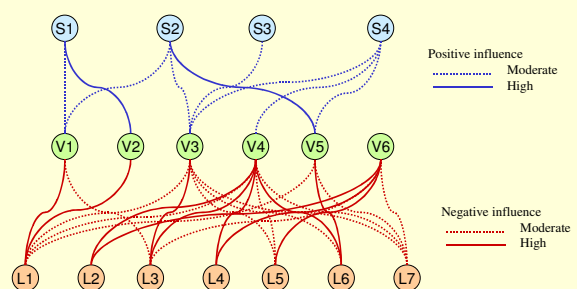
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Filling the GAP: "Where we are" - to - "Where we go"



Influence maps

	V1	V2	V3	V4	V5	V6
S1						
S2						
S3						
S4						
L1						
L2						
L3						
L4						
L5						
L6						
L7						



GAP - Formal models and theories

VISION

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, as well as the base for education, training, and active operation of VOs.

Mechanisms:

- V₁ Established formal foundation to guarantee VOs effectiveness (performance management), better decision-making, incremental learning from past experience, and minimized operating problems via clear commitments
- V₂ The VO research area is recognized (and respected) as a scientific discipline
- V₃ 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
- V₄ Generic modeling of VO members' behavior as a bottom-up approach addresses e.g. contributed assets, accepted responsibilities, acquired rights, individual commitments and contract
- V₅ Discipline-specific formal models are defined
- V₆ Models interoperability (generic and discipline-specific) are defined

BASELINE

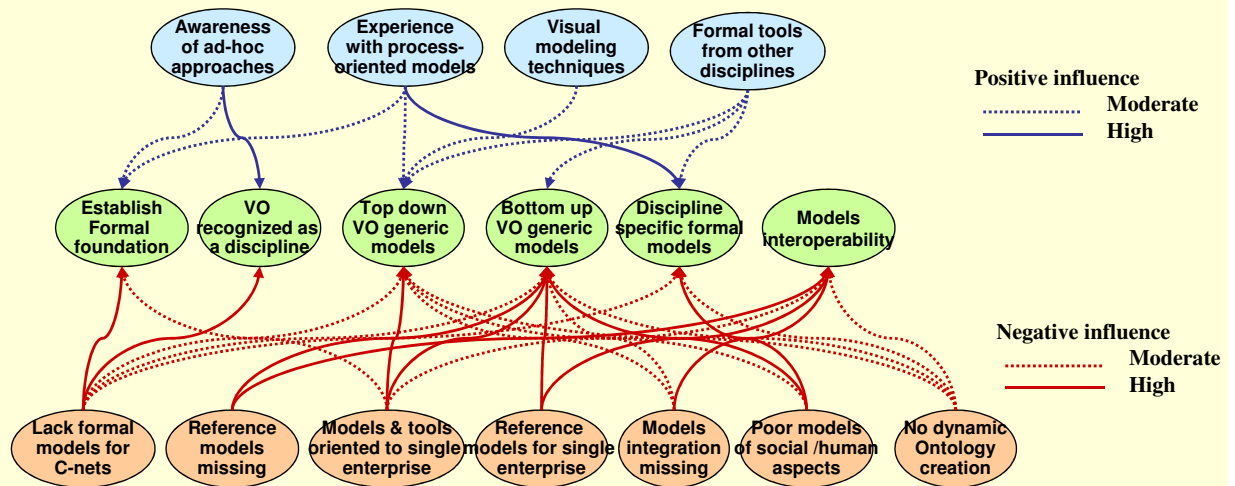


Strengths	
+	S ₁ Increased awareness of limitations of current ad-hoc approaches
	S ₂ Wide experience with process-oriented businesses
	S ₃ Visual modelling techniques facilitate the comprehension of linkages and can be used as communication tools
	S ₄ Variety of tools that can be "borrowed" from other disciplines, as starting basis (e.g. theory, agent-base modelling, complexity theory, game theory, Knowledge management, etc)
	S ₅
Limitations	
-	L ₁ Lack of formal methods for collaborative networks, collaborative decision-making and collaborative behaviour modelling: <ul style="list-style-type: none"> • 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.
	L ₂ Difficult to guarantee VO effectiveness. Reference models are missing
	L ₃ Most available modelling methods and tools were developed for single enterprises, not suitable for VO
	L ₄ Enterprise reference models previously developed are also too focused on the single enterprise
	L ₅ Models integration (models interoperability) missing
	L ₆ Poor approaches to model the social and human aspects in collaborative networks (soft modelling)
	L ₇ Poor support for dynamic Ontology creation and maintenance in a networked environment.



GAP – Formal models and theories ...

	V1	V2	V3	V4	V5	V6		
S1								Positive influence
S2								Moderate
S3								High
S4								
L1								Negative influence
L2								Moderate
L3								High
L4								
L5								
L6								
L7								

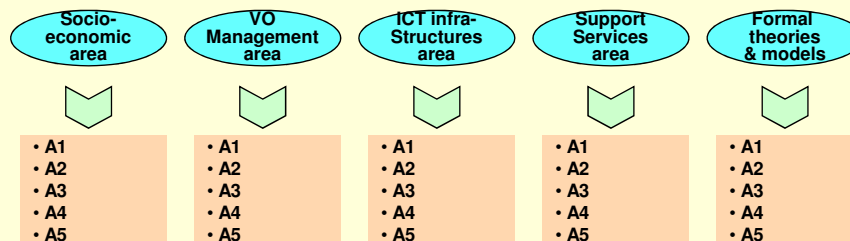


4. PLAN OF ACTIONS

Next steps

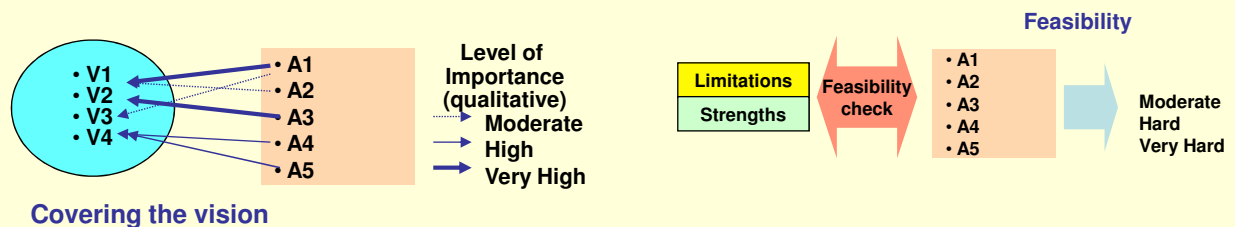
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Propose a plan of actions (a set of unordered transition steps)



6

Verify the planned actions



Actions – Focus on formal models & theories

Vision:

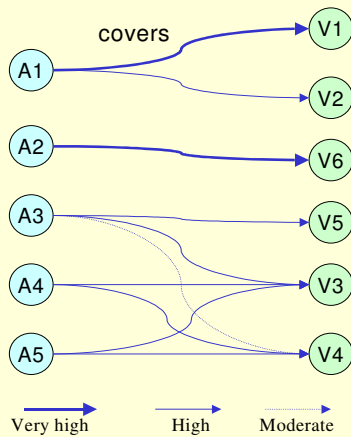
- V₁ Established formal foundation to guarantee VOs effectiveness (performance management), better decision-making, incremental learning from past experience, and minimized operating problems via clear commitments
- V₂ The VO research area is recognized (and respected) as a scientific discipline
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- V₅ Discipline-specific formal models are defined
- V₆ Models interoperability (generic and discipline-specific) are defined



- A1 ■ Establish a **formal theoretical foundation** for modeling dynamic collaborative networks
- A2 ■ Elaborate approaches for **models interoperability**, supporting multiple modeling perspectives (e.g. structure, behavior) at generic and focused area levels
- A3 ■ Define basic **formal reference models** (including ontologies) for collaborative networks at general and focused-area levels
- A4 ■ Elaborate **soft modeling approaches** and soft models to both handle incomplete / imprecise knowledge and capture the social/human aspects in collaborative networks
- A5 ■ Devise mechanisms for **evolution** and maintenance of reference models for collaborative networks



Verification – Focus on formal models & theories



Covering the vision ?

Covers	V1	V2	V3	V4	V5	V6
A1	Very high	High				
A2						Very high
A3			High	High	High	
A4			High	High		
A5				High		
	Very high					
	High					
	Moderate					

Feasibility check

	S1	S2	S3	S4	L1	L2	L3	L4	L5	L6	L7	Difficulty
A1	Strong help from			Strong help from	Partially limited by							Moderate
A2									Strongly limited by			Moderate
A3		Strong help from				Partially limited by	Strongly limited by					Mod/hard
A4			Moderate help from									Hard
A5				Moderate help from								Hard
	Strong help from						Strongly limited by					
	Moderate help from						Moderately limited by					
	Limited help from						Partially limited by					



Timing – Focus on formal models & theories

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



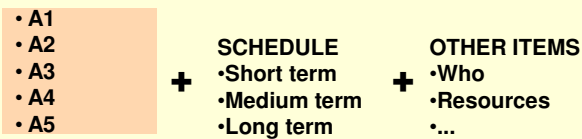
5. FINALIZATION



Finalizing

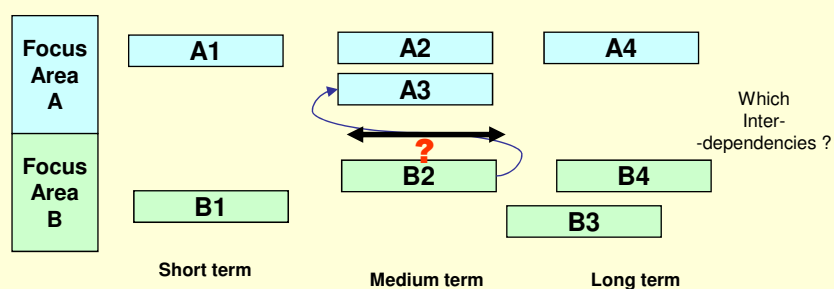
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Plan the timing and other characterization of actions



8

Finalize the definition of the roadmap chart





Suggested actions

1

Socio-economic area:

- A₁ Develop and establish **education and training schemes** for **VO working** on different professional levels
- A₂ Elaborate and pilot **regional and professional communities** as “social homes” for people
- A₃ **Define life maintenance schemes** and related business models with different stakeholders (providers, customers, public bodies)
- A₄ Develop **institutions and services for VO support**, and establish them regionally; **network regional** bodies and developments on **European** level
- A₅ Elaborate and implement transparent **legal frameworks and ethical code** at the company/VO and societal level
- A₆ Support integrated **socio-economic research** in networked economies



Suggested actions

2

VO Management area:

- A₁ Provision of **business models and financing schemes** for VO set up
- A₂ Provision of **planning and performance measurement** concepts and tools
- A₃ Provision of **concepts and practical guidelines** for **organizational design** and implementation of VO
- A₄ Provision of methods for the **application of new value paradigms** addressing critical “soft” issues in VO collaboration
- A₅ Ongoing **evaluation, improvement and individualization** of VO concepts to a fully integrated level



Suggested actions

3

ICT Infrastructure area:

- A₁ Establish the principles of **reference architecture**, interoperability, and security
- A₂ Establish foundation for systems evolution, software technology **migration and systems integration**
- A₃ Develop generic, user-friendly (**invisible!**), and **affordable** (free!) **ICT infrastructure** (user programmable, plug&play, technology independent, and based on emerging open tools/standards)
- A₄ Develop a **“do it yourself” framework** to assist the development of VO support services
- A₅ Define **business models** for developers, suppliers, and buyers of the **ICT infrastructure** developments
- A₆ Elaborate **approaches** to handle **reliability** and **responsibility**, when using multi-supplier building blocks



Suggested actions

4

Support services area:

- A₁ Elaborate **business models** for support service systems and tools
- A₂ Develop mechanisms and tools for **management of breeding environment** systems
- A₃ Identify and develop generic **services for VO life cycle support** (e.g. distributed Business Process management, e-contracting, VO configuration, e-training)
- A₄ Elaborate mechanisms and tools to support **VO’s “inheritance” management**
- A₅ Develop mechanisms and tools for **traceability**, knowledge exchange and **inter-VO transactions** (supporting products and services life cycle)



Suggested actions

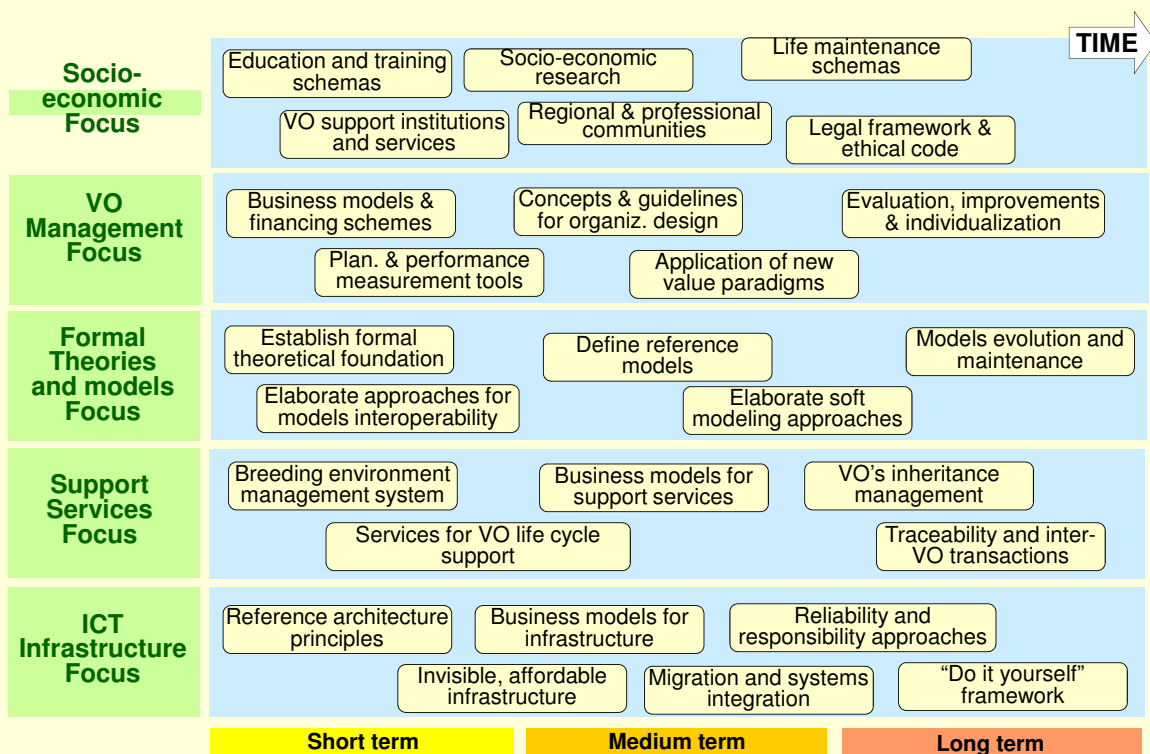
5

Formal theories and models area:

- A₁ Establish a formal theoretical foundation for modeling dynamic collaborative networks
- A₂ Elaborate approaches for models interoperability, supporting multiple modeling perspectives (e.g. structure, behavior) at generic and focused area levels
- A₃ Define basic formal reference models (including ontologies) for collaborative networks at general and focused-area levels
- A₄ Elaborate soft modeling approaches and soft models to both handle incomplete / imprecise knowledge and capture the social/human aspects in collaborative networks
- A₅ Devise mechanisms for evolution and maintenance of reference models for collaborative networks



Roadmap – 1st attempt



6. VERIFICATION

Regional workshops – Part 1

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 post-its onto the current state poster and briefly explains his thought and reason for amendments





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

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networks that will act as breeding environments for the formation of dynamic virtual organizations in response to fast changing market opportunities and conditions.

- 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
- Social responsibility, including "life maintenance", based on a suitable et code
- Comprehensive (international) legal frameworks for VOs

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

How important is achievement of the vision as a whole? Little Very

<10% ~50% >90%

What proportion of SMEs will be working in Virtual Organisations by 2020?

What proportion of large organisations will be working in Virtual Organisations by 2020?

What proportion of potential know-ledge workers will work independent or a small, independent teams by 2020?

Predom. regional Regional with intern. partners Fully international/global

Will there be more regional networks or more international/global ones?

SME networks Balanced Large corporations

Who will have more power (and profit share) in an economy of VOs?

Individuals SME networks Large corporations

Who will mainly drive innovation in the future?

VISION FOR FORMAL MODELS AND THEORIES FOCUS ARE

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, as well as the base for education, training, and active operation of VOs.

V₁ Established formal foundation to guarantee VOs effectiveness (performa management), better decision-making, incremental learning from past experience, and minimized operating problems via clear commitments

V₂ The VO research area is recognized as a scientific discipline

V₃ 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

V₄ Generic modeling of VO members' behavior as a bottom-up approach addresses e.g. contributed assets, accepted responsibilities, acquired rights, individual commitments and contract

V₅ Discipline-specific formal models are defined

V₆ Models interoperability (generic and discipline-specific) are defined

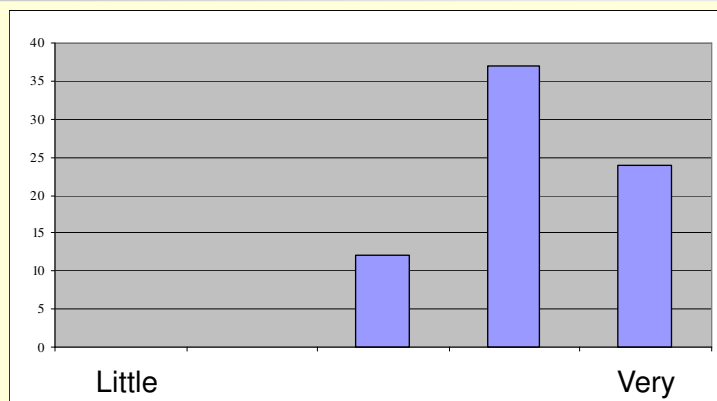
Amendments:

45

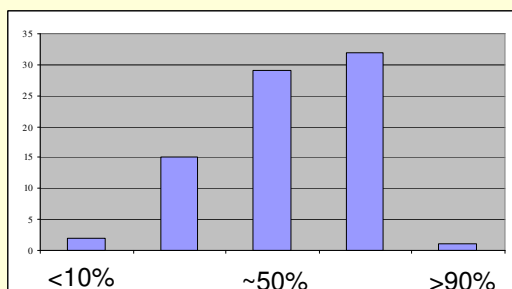


Relevance of vision statement

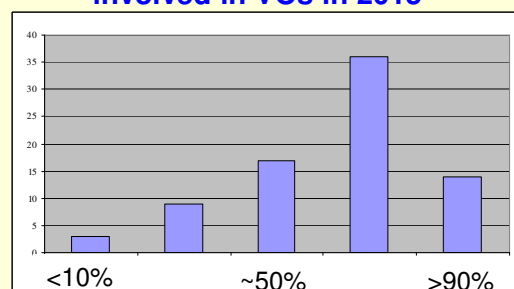
How relevant is the vision statement as a whole?



Proportion of SMEs involved in VOs in 2015



Proportion of large organizations involved in VOs in 2015



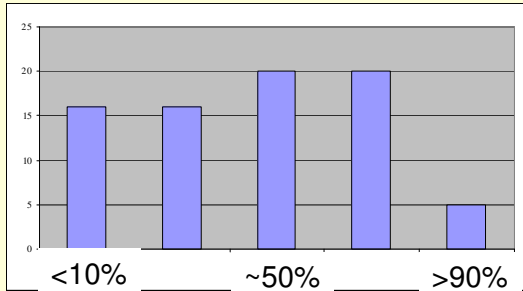
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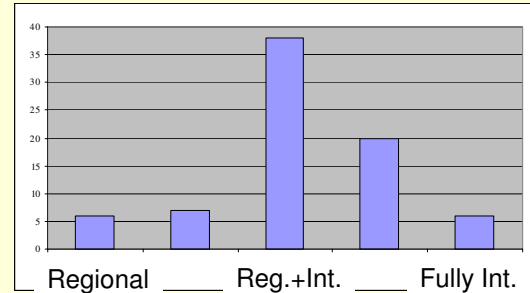


Relevance of vision statement – in 2015

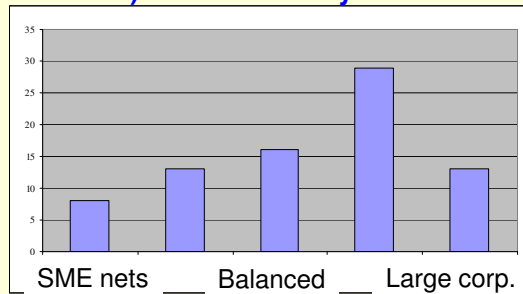
Proportion of knowledge workers as independent or as small teams



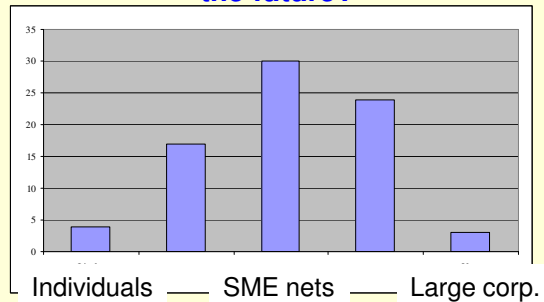
More regional or more international/global networks



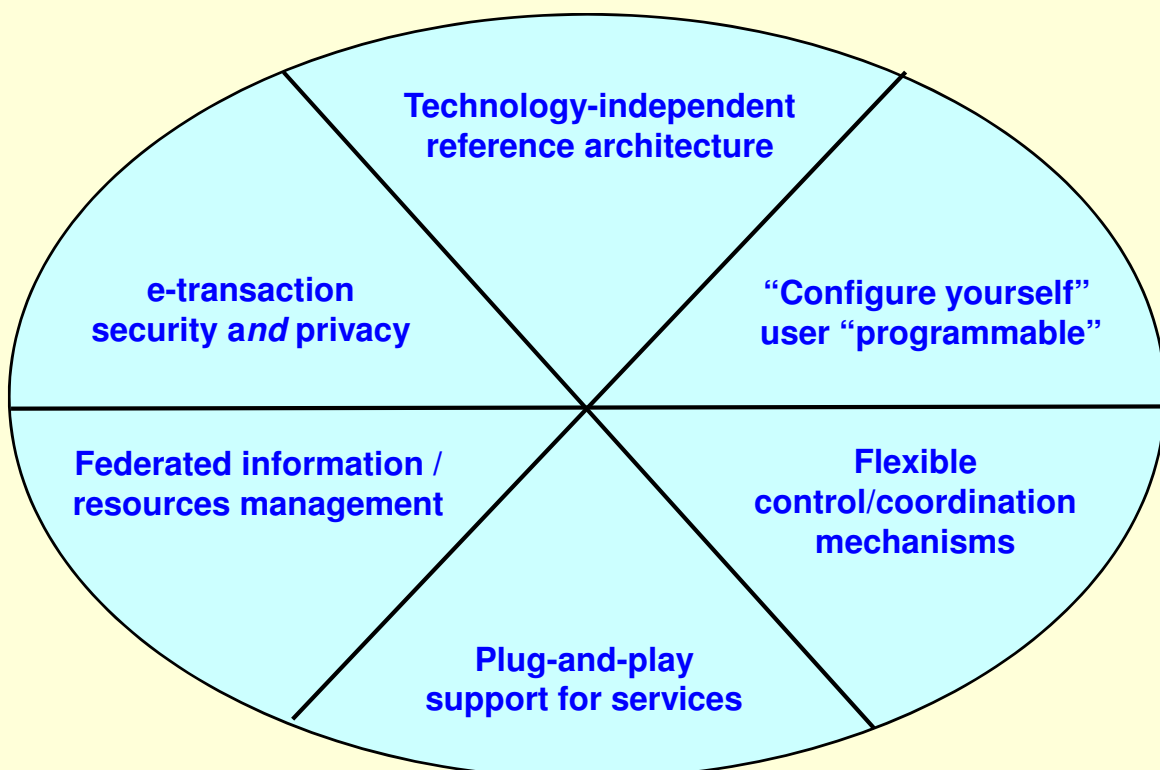
Who will have more power (and profit share) in an economy of VOs?



Who will mainly drive innovation in the future?



Focus ICT infrastructure – Key elements





ICT infrastructure – Vision instantiation

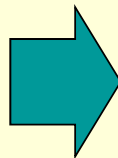
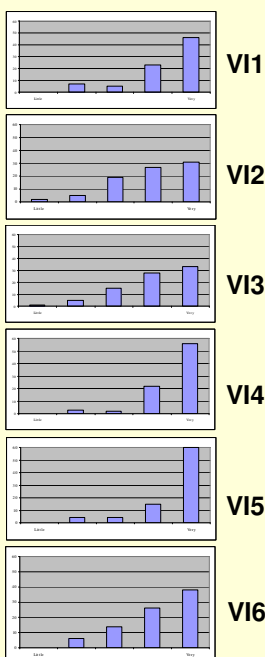
The ICT infrastructure will be developed as a transparent, low-cost, and easy to use enabler of collaborative behaviors in networked organizations.

Mechanisms:

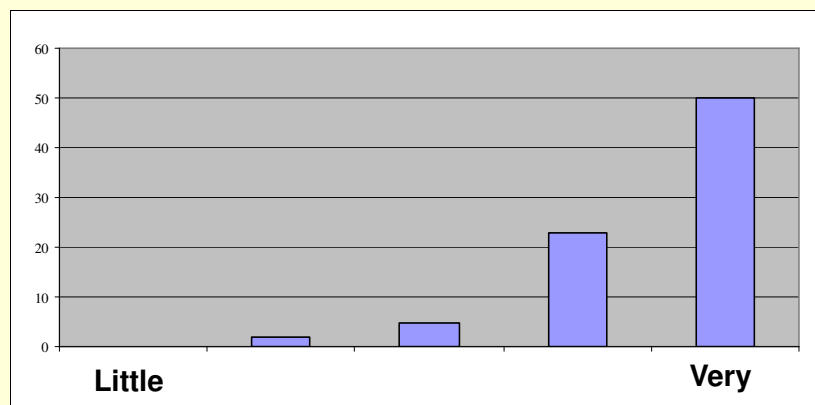
VI ₁	Technology-independent reference architecture for the horizontal infrastructure
VI ₂	Provide support for federated information and resources management
VI ₃	Flexible control mechanisms supporting the implementation of a large variety of behaviors
VI ₄	Plug-and-play concept extended to inter-organizational services
VI ₅	Full e-transaction security and privacy is guaranteed
VI ₆	“Configure yourself” philosophy (user “programmable” infrastructure)



ICT infrastructure – Votes on relevance of vision



How relevant is the ICT Vision as a whole?
Consolidated results from local workshops:



High Acceptance of ICT Vision statement



Consolidated vision



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.

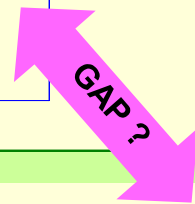


ICT infrastructure – Gap analysis

The ICT infrastructure will be developed as a transparent, low-cost, and easy to use enabler of collaborative behaviors in networked organizations.

Mechanisms:

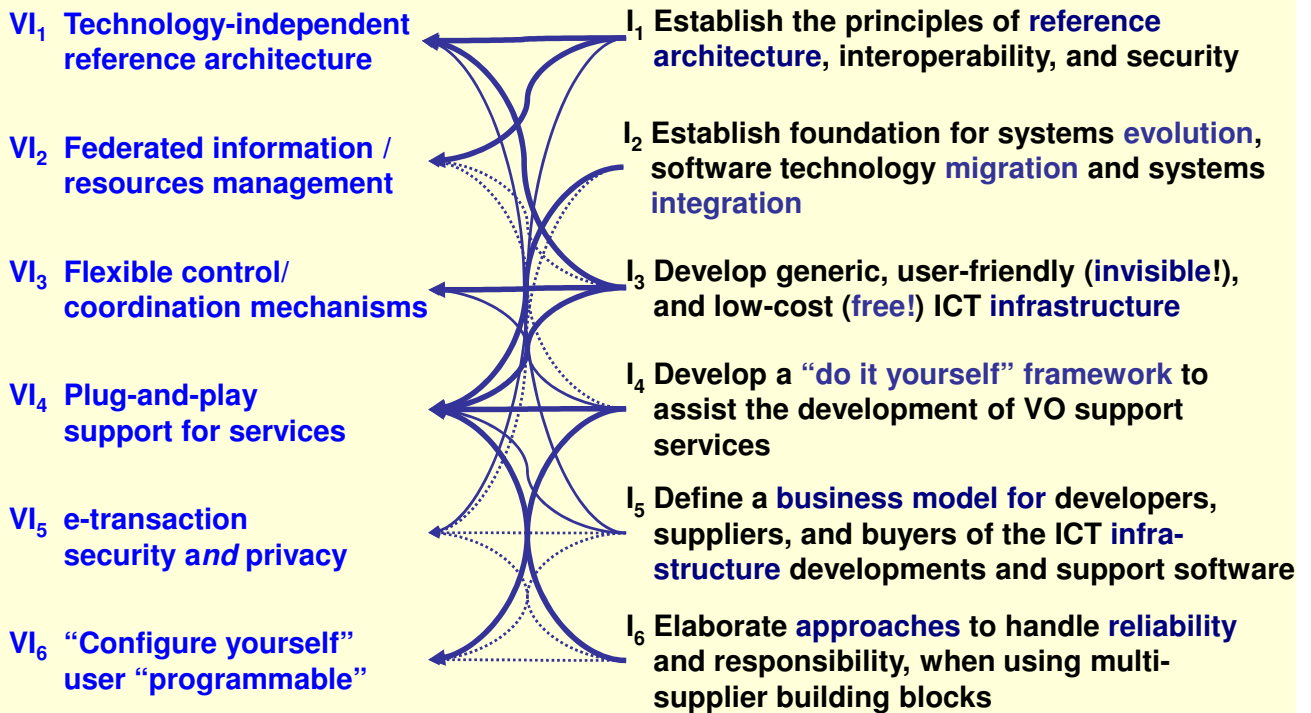
- V₁ Technology-independent reference architecture for the horizontal infrastructure
- V₂ Provide support for federated information and resources management
- V₃ Flexible control mechanisms supporting the implementation of a large variety of behaviors
- V₄ Plug-and-play concept extended to inter-organizational services
- V₅ Full e-transaction security is guaranteed
- V₆ “Configure yourself” philosophy (user “programmable” infrastructure)



Strengths	
+	S ₁ Basic building blocks for support infrastructures and technologies are well represented
	S ₂ Recent research achievement on supporting IT-technologies and human/IT interaction for knowledge, management, e-learning etc.
	S ₃ Internet access being offered by a wide variety of communication channels
	S ₄ Fast growing basis of ubiquitous computing and people able to use/exploit internet technologies.
Limitations	
-	L ₁ Lack of generic infrastructure – Developments rather focused on particular needs, requiring repeated reengineering.
	L ₂ Missing clarification of practical implantation models.
	L ₃ No general plug-and-play architecture
	L ₄ Interoperability still a major difficulty
	L ₅ Missing consolidation of current research results
	L ₆ Lack of proper business model for ICT infrastructures (who supplies, who pays)
	L ₇ Although basic mechanisms are available, there is a lack of an integrated perspective to handle security.
	L ₈ Current ICT infrastructure hard to adapt to new conditions/new organizational forms.
	L ₉ Coping with a too fast evolution of systems versions
	L ₁₀ Reliability and responsibility issues when using multi-supplier building blocks still open
	L ₁₁ Research infrastructures still “not transparent” and “not user-friendly”

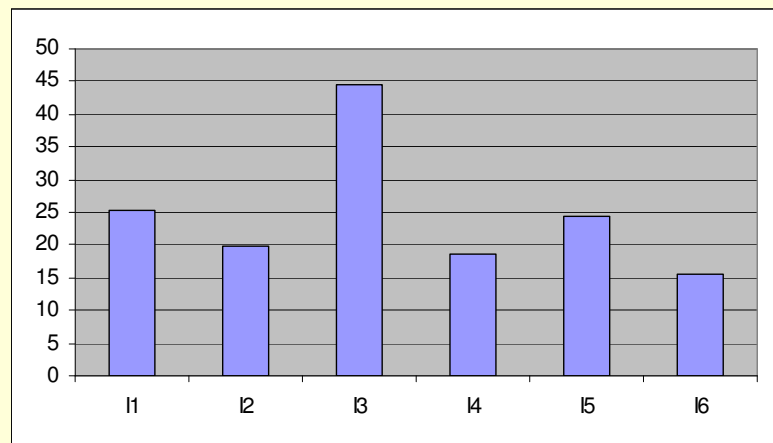


ICT infrastructure – Actions



ICT infrastructure – Priority / Importance of Actions

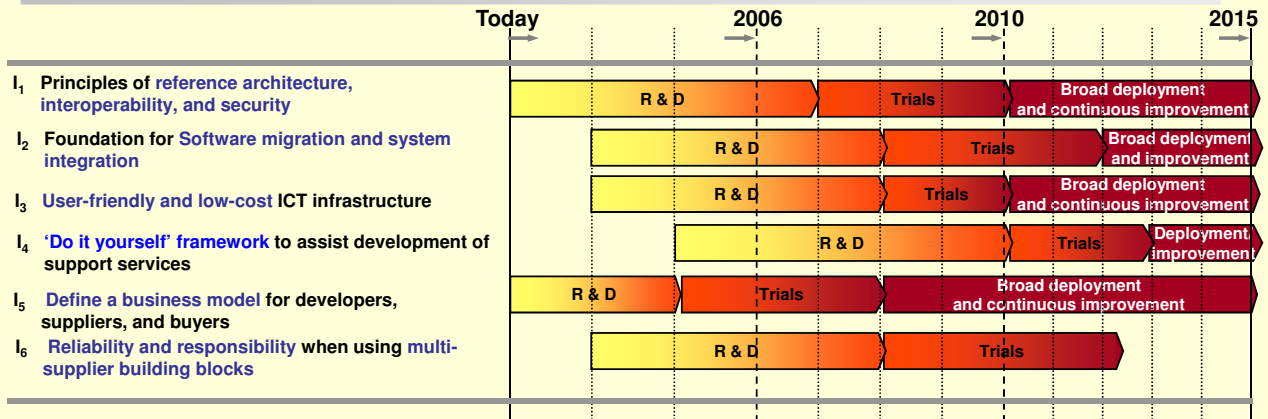
- I₁ Principles of reference architecture, interoperability, and security**
- I₂ Foundation for Software migration and system integration**
- I₃ User-friendly and low-cost ICT infrastructure**
- I₄ ‘Do it yourself’ framework to assist development of support services**
- I₅ Define a business model for developers, suppliers, and buyers**
- I₆ Reliability and responsibility when using multi-supplier building blocks**



- 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



ICT infrastructure – Implementation plan



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

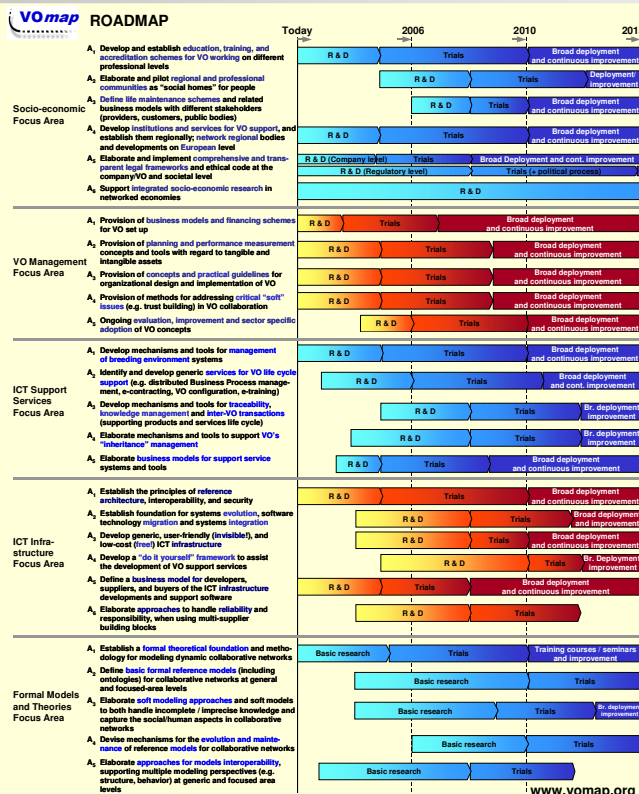


Towards the roadmap ...

2nd attempt

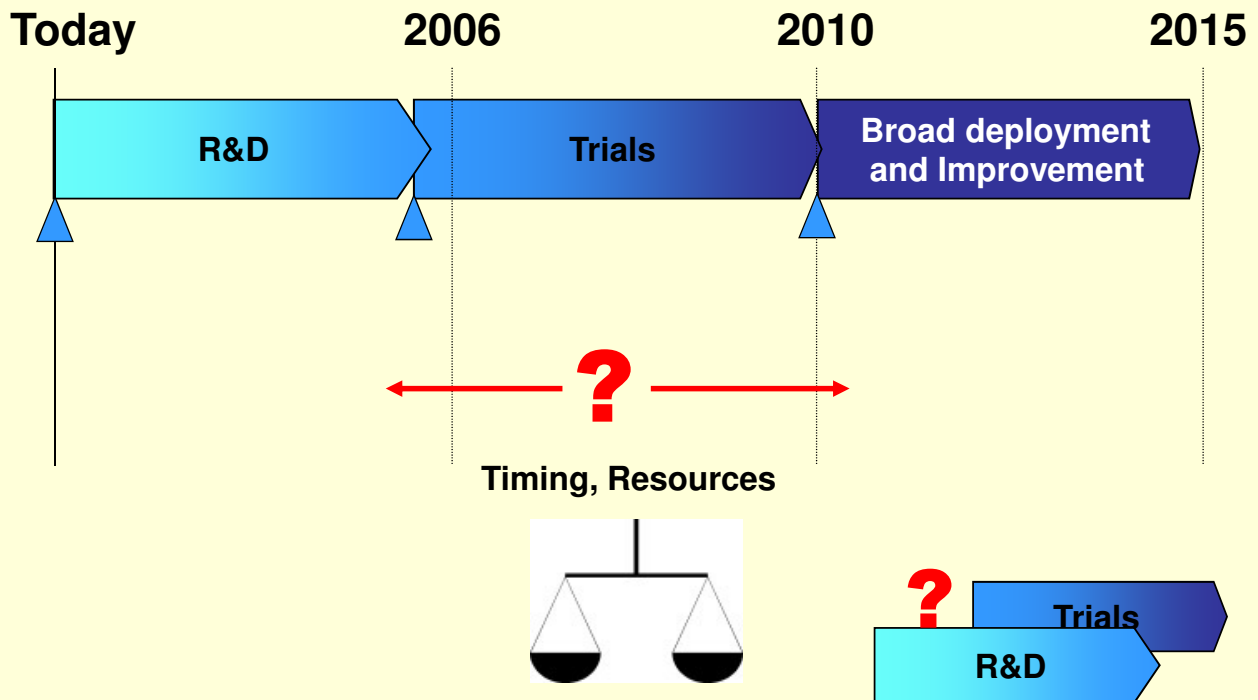
Implementation Mechanisms

**R&D
Trials
Deployment & improvement**





Towards the roadmap - Efforts



Towards the roadmap - consolidation

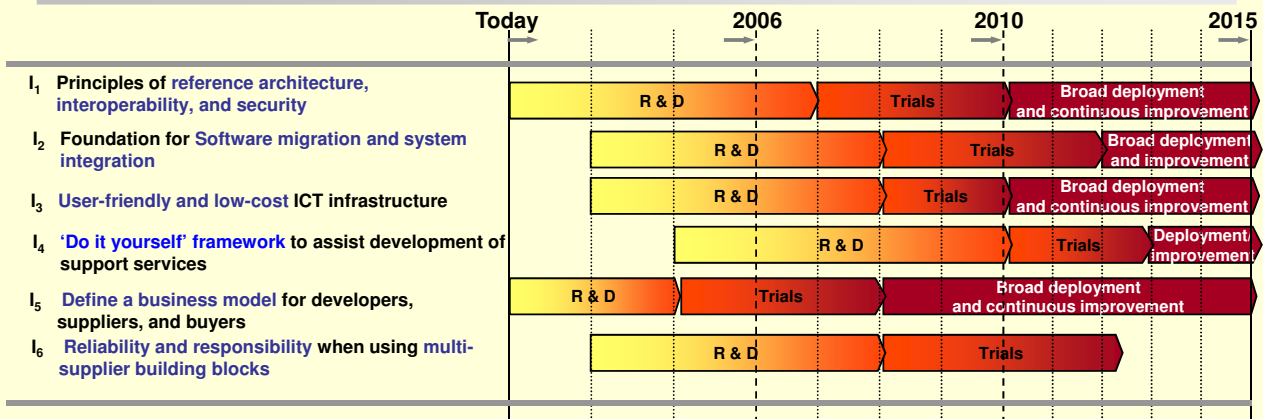
Consolidation workshop

28 participants (22+6)

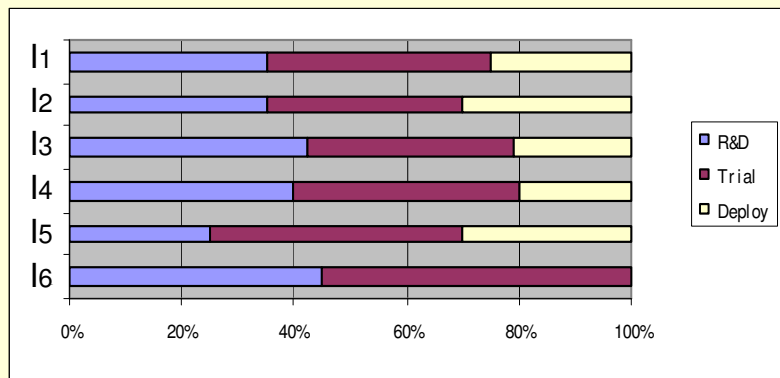




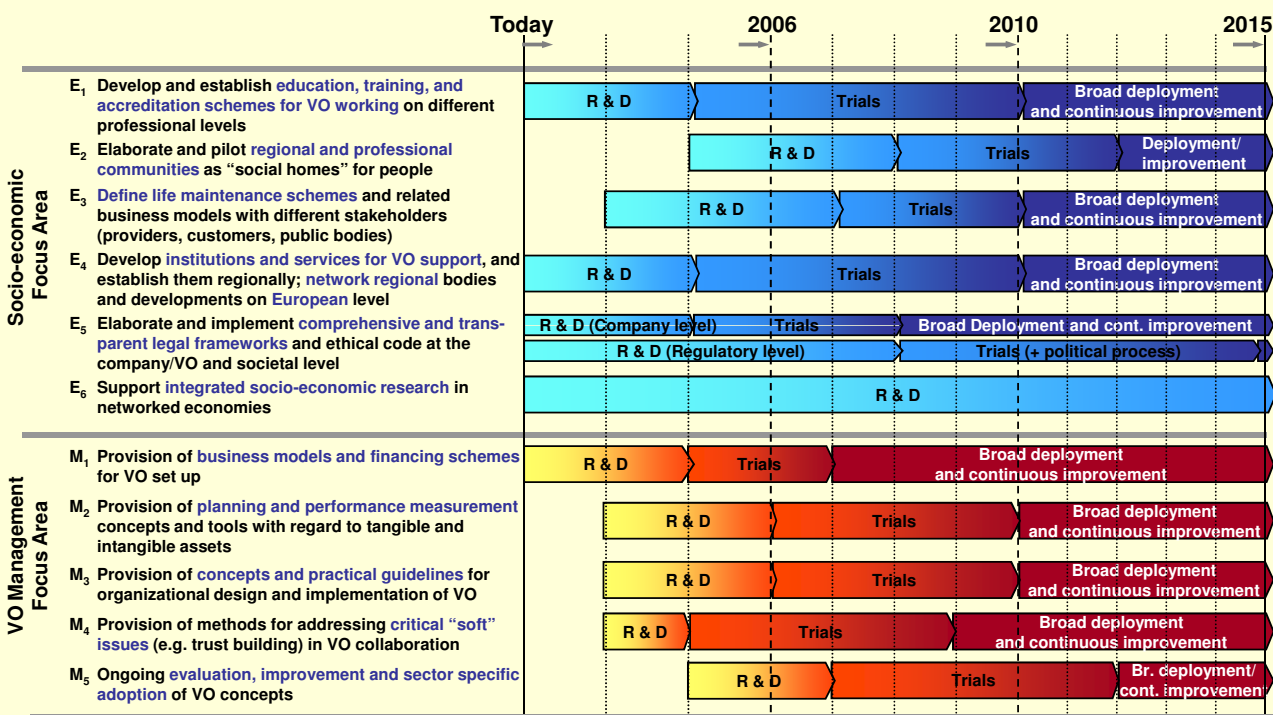
ICT infrastructure – Distribution of efforts



- Business model (I5) has smaller research

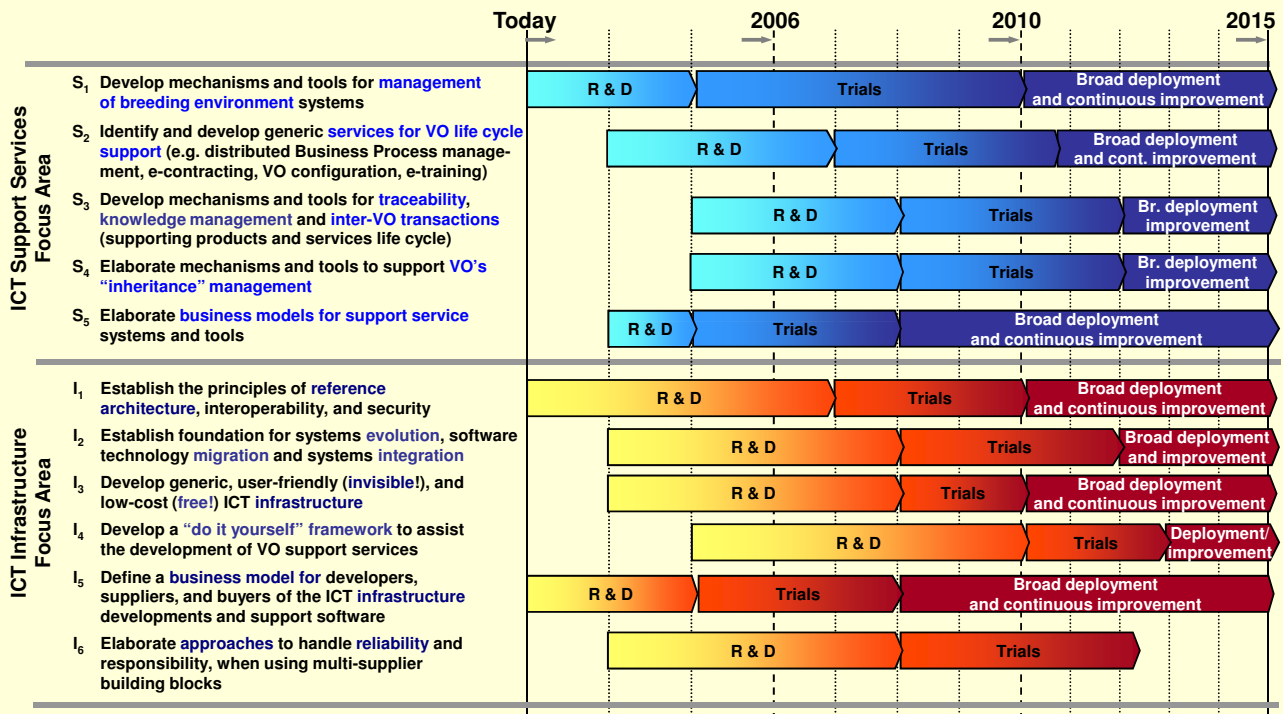


Roadmap ...

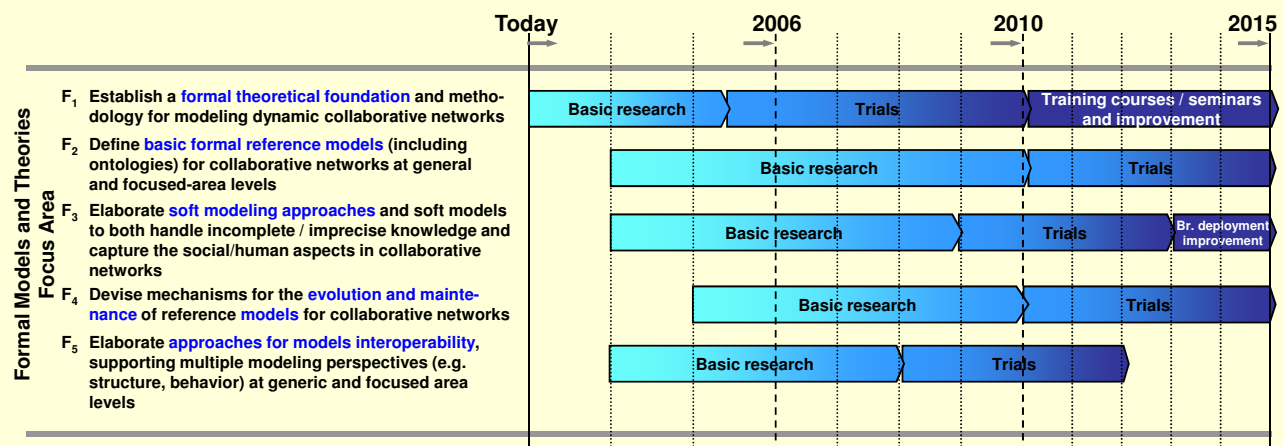




Roadmap ...



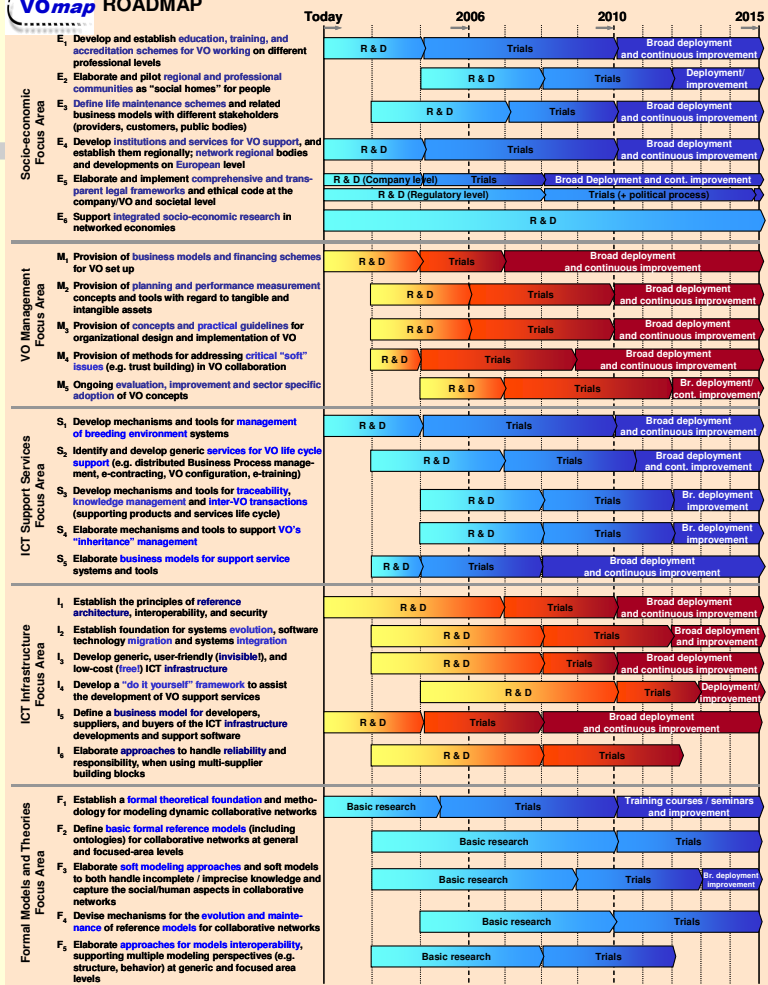
Roadmap ...





Roadmap

VOmap ROADMAP



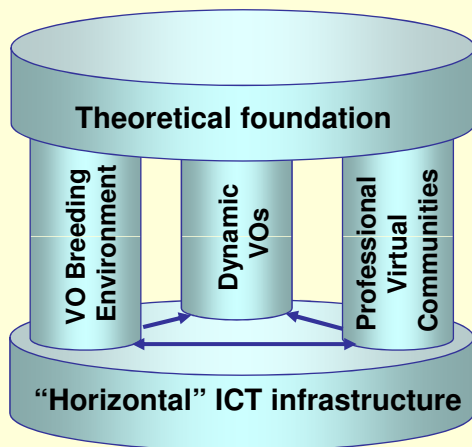
Camarinha-Matos, L.M.; Afsarmanesh, H. (2004), A roadmapping methodology for strategic research on VO, in *Collaborative Networked Organizations – A research agenda for emerging business models*, cap. 7.1, Kluwer Academic Publishers.

Camarinha-Matos, L.M.; Afsarmanesh, H. ; Loeh, H.; Sturm, F.; Ollus, M. (2004), A strategic roadmap for advanced virtual organizations, in *Collaborative Networked Organizations – A research agenda for emerging business models*, cap. 7.2, Kluwer Academic Publishers.

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One implementation – ECOLEAD project



A holistic approach combining:

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

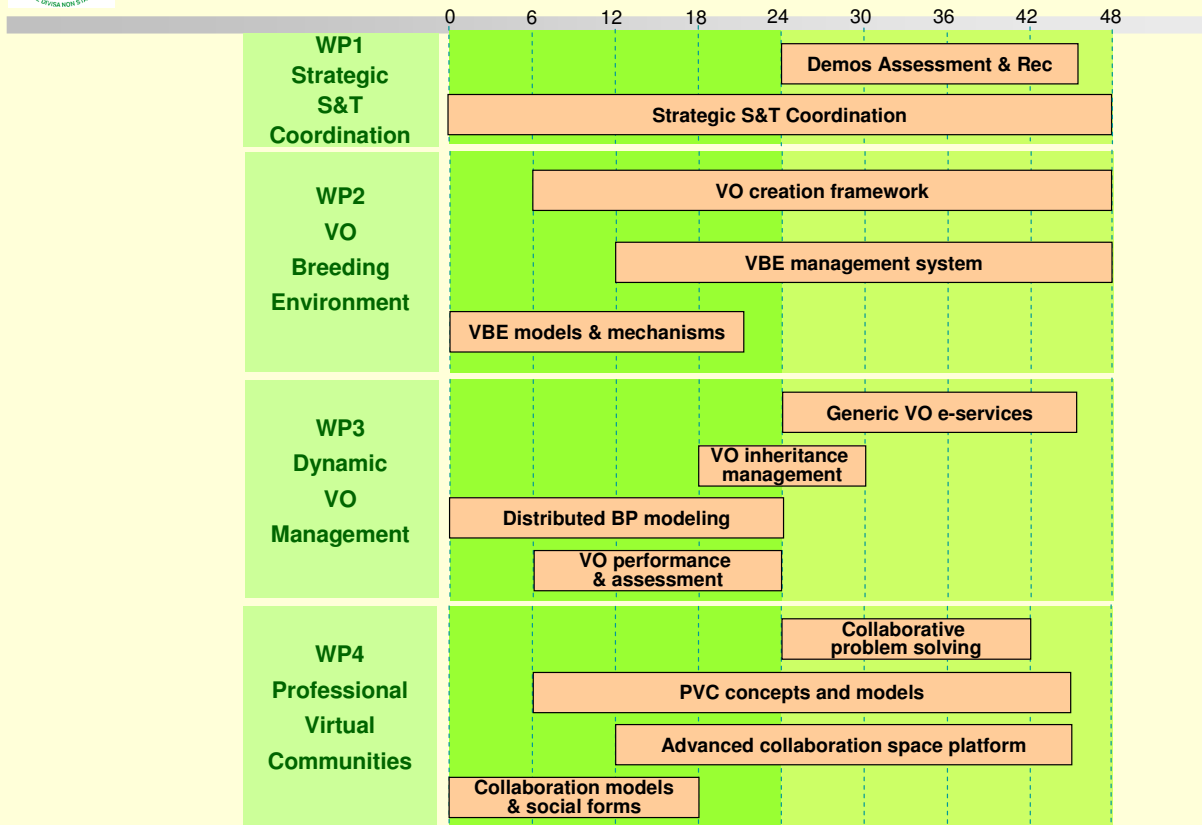
towards the establishment of collaborative networks as a new scientific discipline

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

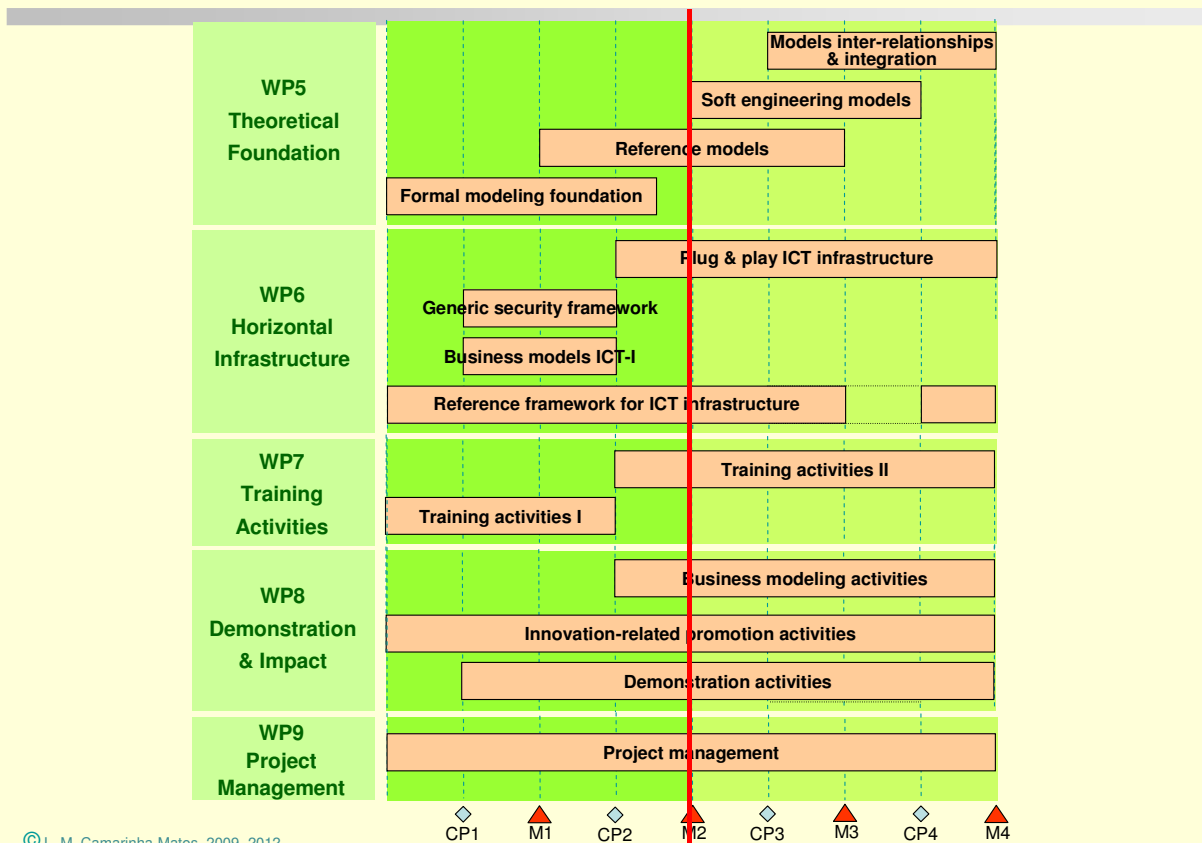
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ECOLEAD activities

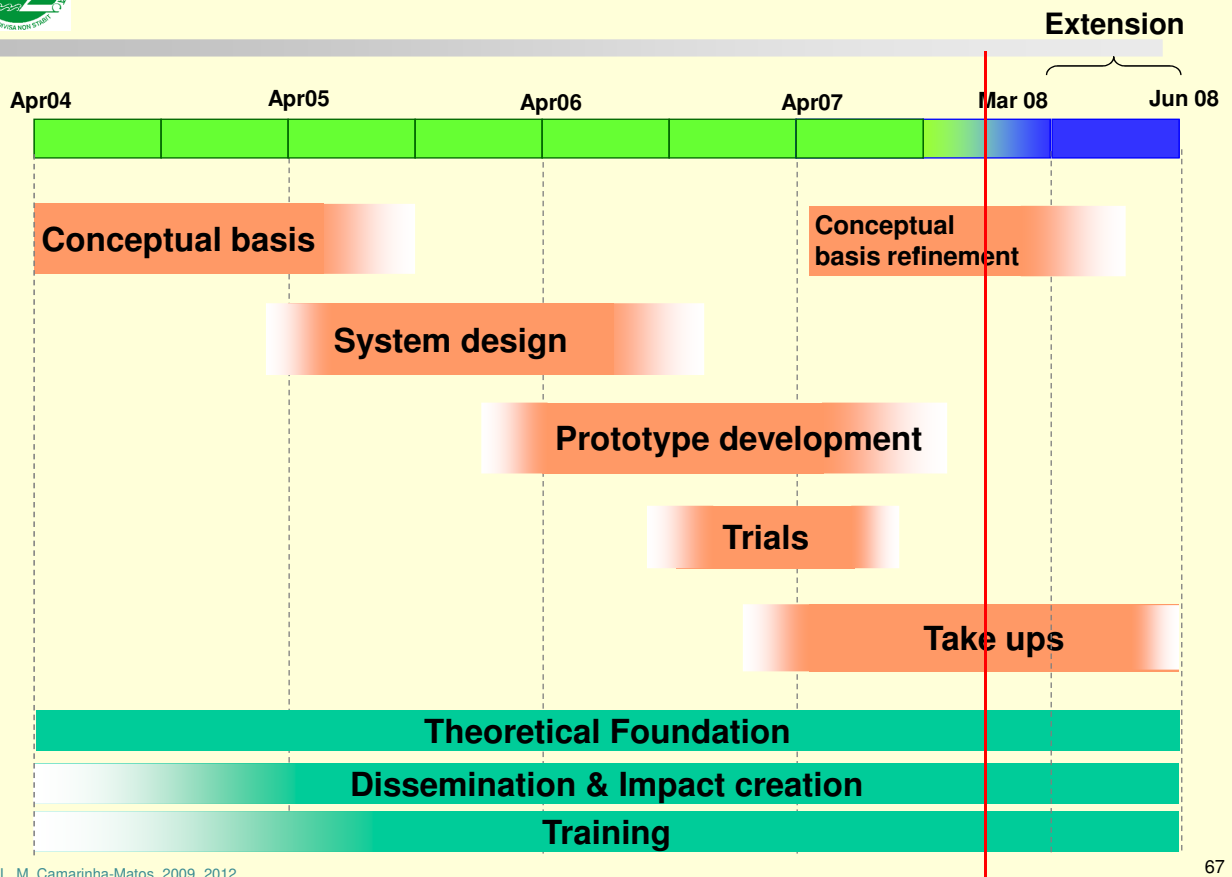


ECOLEAD activities ...





ECOLEAD schedule



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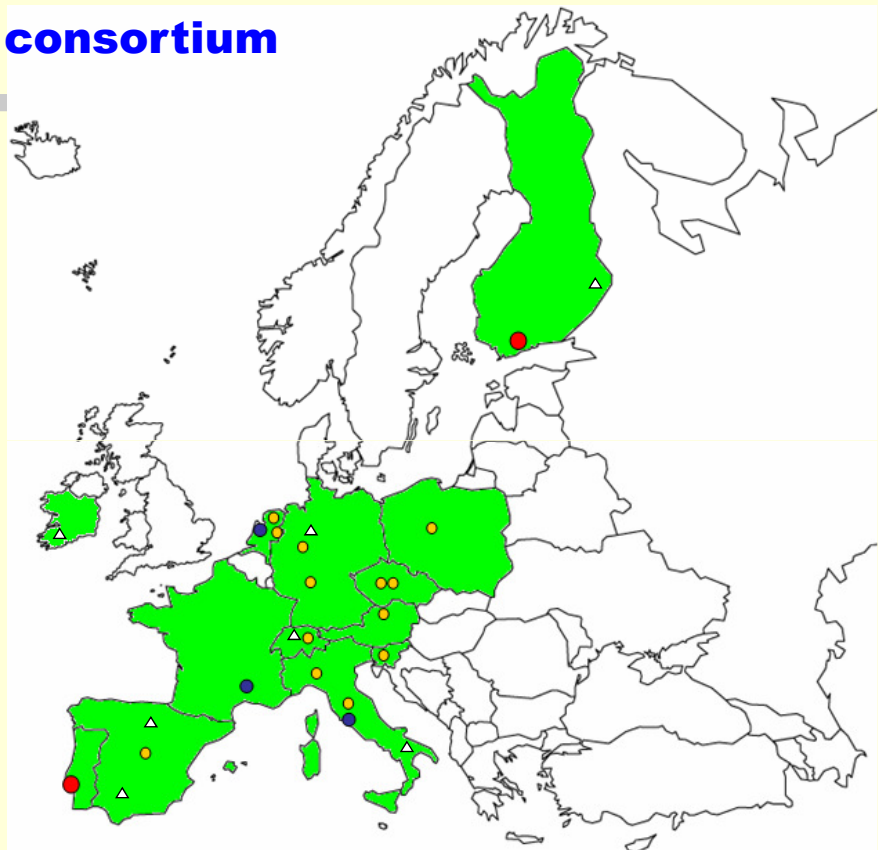
67



ECOLEAD consortium

www.ecolead.org

27 partners
15 countries



68



ECOLEAD consortium ...

Industry

Research

End-users & Others

+ New SME networks

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ECOLEAD books

Methods and Tools for Collaborative Networked Organizations

Edited by
Luis M. Camarinha-Matos
Hamideh Afsarmanesh
and
Martin Ollus

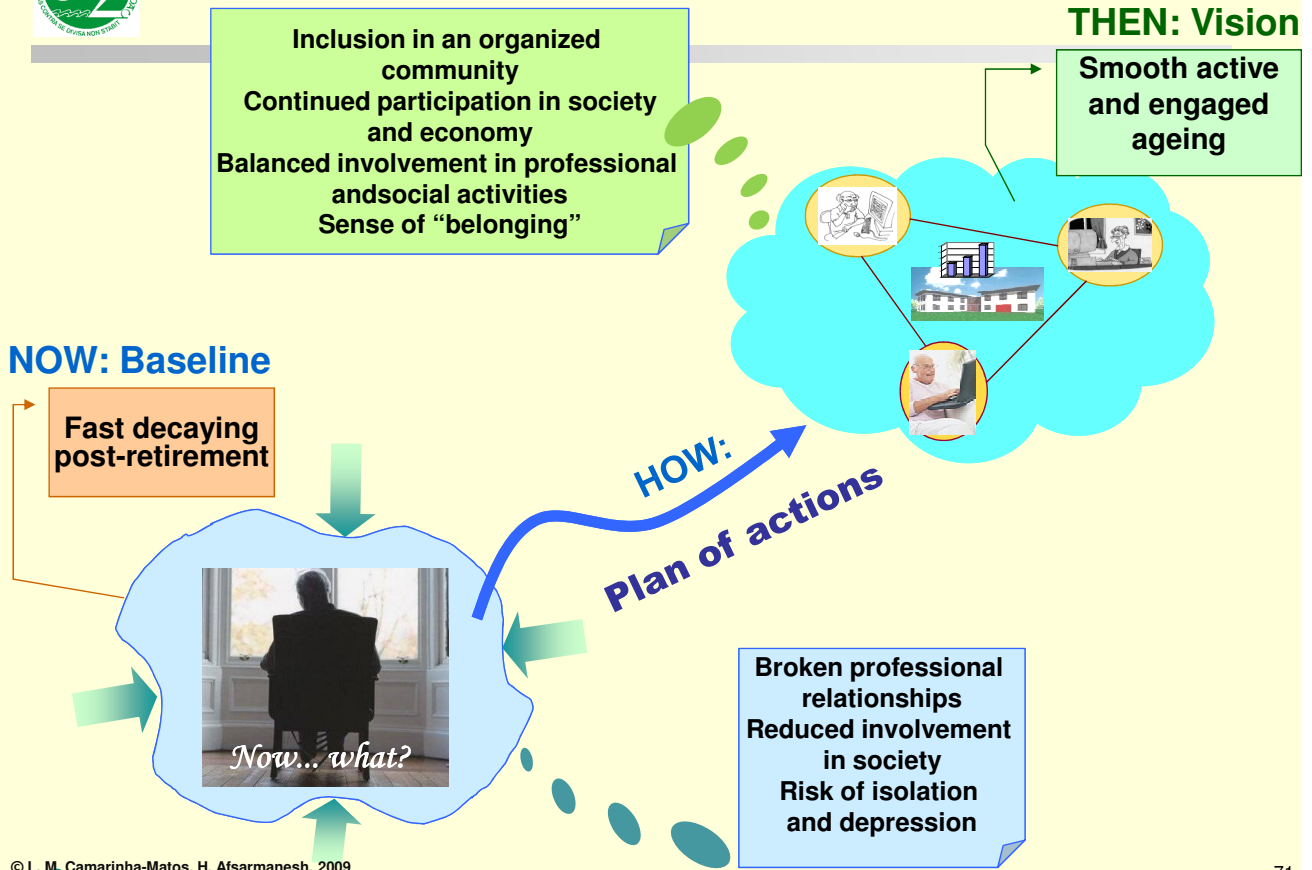
Collaborative Networks Reference Modeling

Luis M. Camarinha-Matos
Hamideh Afsarmanesh

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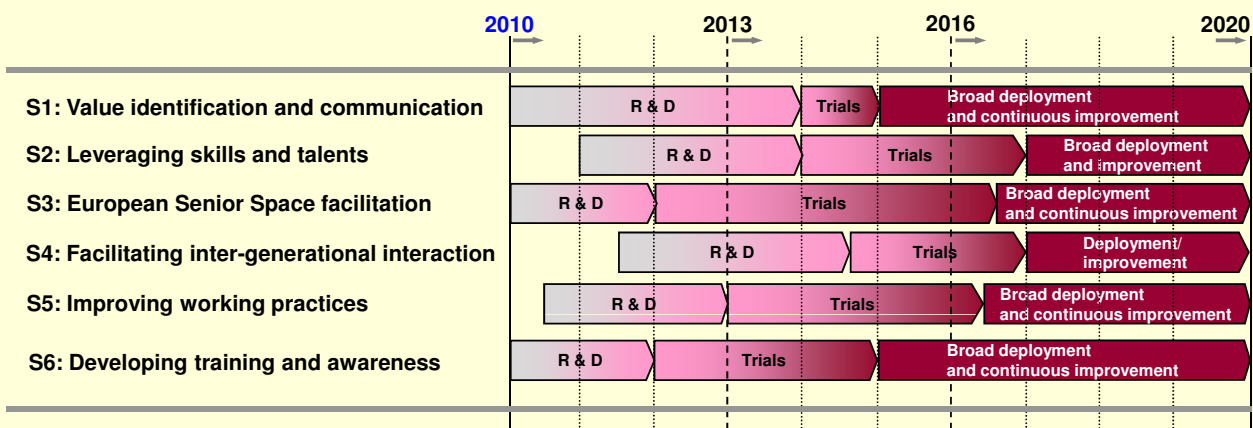
The ePAL EXAMPLE



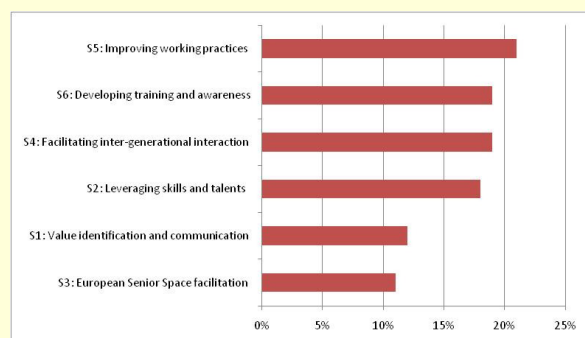
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ePAL ACTIONS – SOCIAL PERSPECTIVE



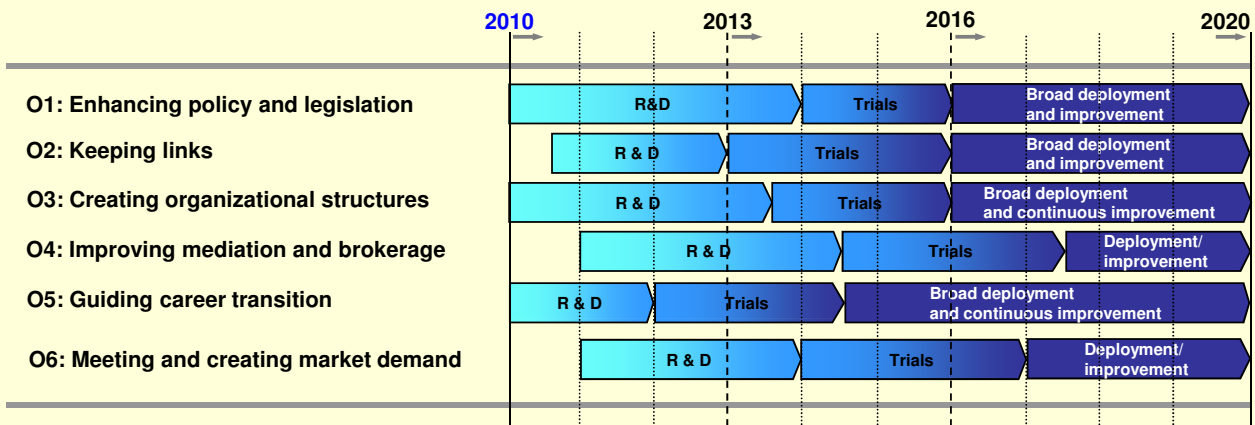
Priorities



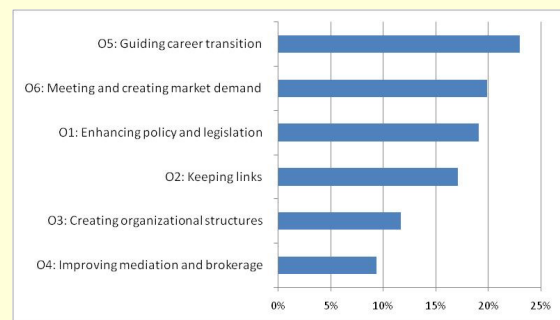
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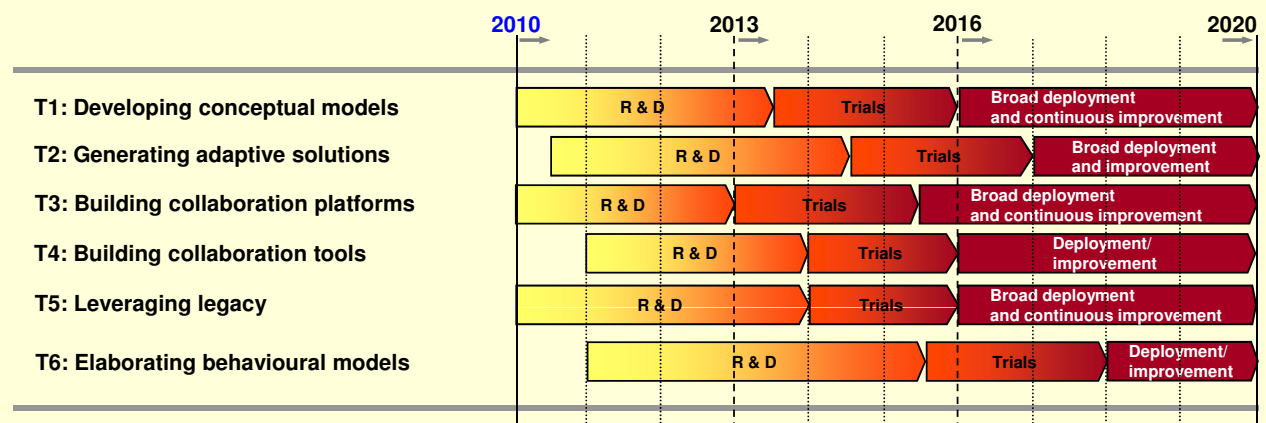
ePAL ACTIONS – ORGANIZATIONAL PERSPECTIVE



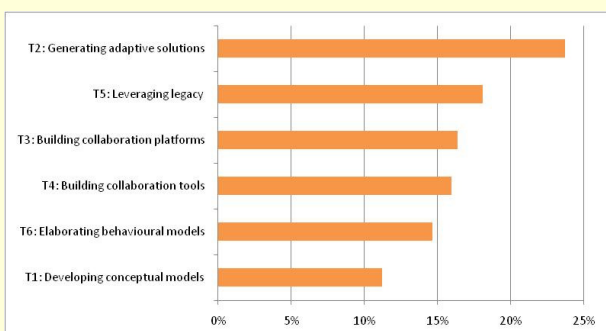
Priorities



ePAL ACTIONS – TECHNOLOGICAL PERSPECTIVE

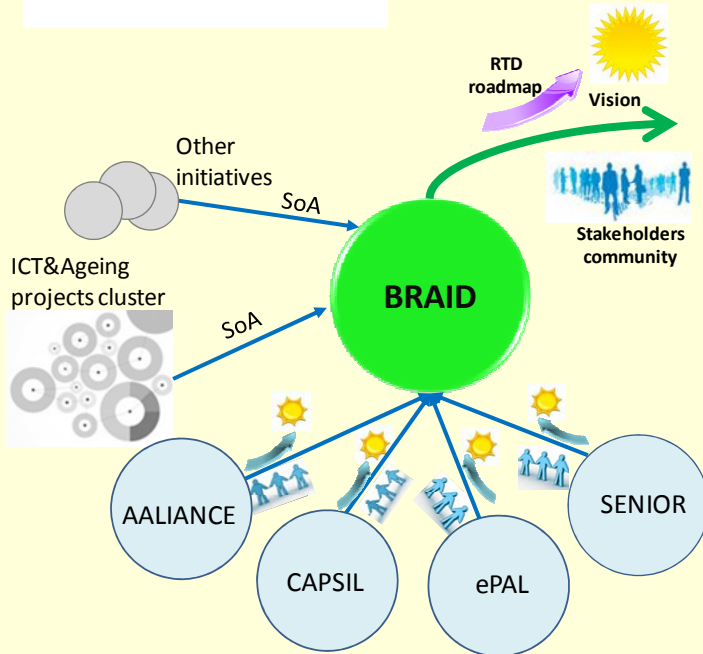


Priorities





The BRAID EXAMPLE

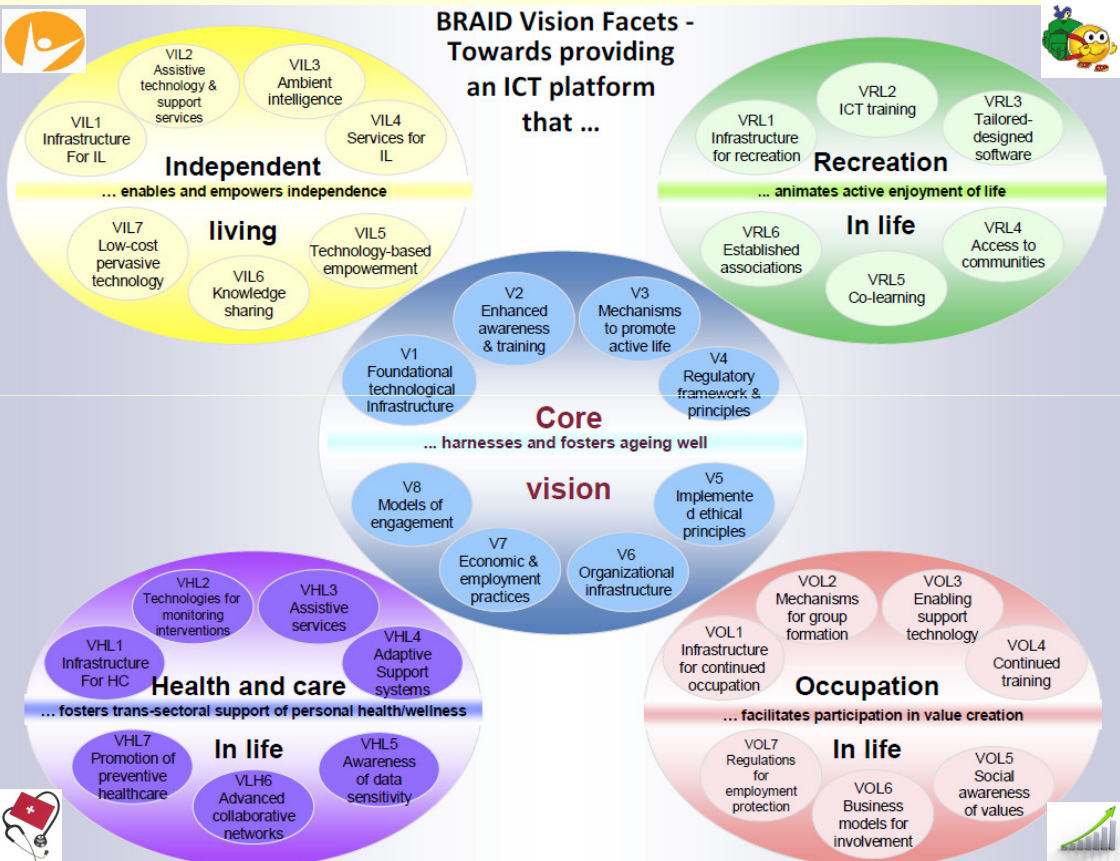


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OBJECTIVES

- 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.

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[Afsarmanesh, 2011] 76

GAP ANALYSIS: Baseline & Trends Example



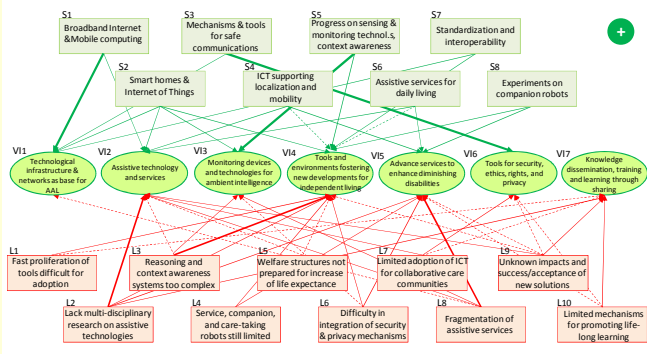
<p>Life Setting: Independent living</p> <p>Vision facet: Established infrastructure and networks as the base for the support of independent living by technology</p>	<ul style="list-style-type: none"> Increasing availability of Internet and speed of broadband access. However, in some countries broadband 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 Internet of Things, new sensorial systems and wireless integration, creating the possibility of having more devices in the environment. Large panoply of mechanisms and tools for safe communications, although still difficult to integrate and configure. 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.
<p>Life Setting: Independent living</p> <p>Vision facet: Assistive technology and support services that facilitate independent living</p>	<ul style="list-style-type: none"> Advances in assistive/adaptive technologies for augmenting the capabilities of individuals, such as cognitive assistance, daily living assistance, wellness monitoring, and health monitoring. 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. 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. Customizable user interfaces allow the usage optimization of screen space with adaptive interfaces, for different output channels (PCs, mobile phones, PDAs, 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 ICT 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.
<p>Life Setting: Independent living</p> <p>Vision facet: Monitoring devices and technologies supporting ambient intelligence solutions</p>	<ul style="list-style-type: none"> Progress in sensing technologies, creating the possibility of having more effective monitoring and context awareness reasoning functionalities. Some developments applying reasoning and context awareness. The elderly behavior can be observed and compared to typical behaviors, issuing alerts when necessary. Assistive robots can act as replacement for human care, including service and companion robots. They can monitor and assist elderly people suffering from cognitive disorders and physical disabilities. Developments in this field encounter both scientific and economic challenges. Early developments on perception / recognition of emotions. Progress on smart homes development opens new opportunities for developing novel monitoring and intelligent assistance services.

<p>Life Setting: Independent living</p> <p>Vision facet: Supporting tools and environment that foster the development of technologies for independent living</p>	<ul style="list-style-type: none"> Progress on standardization and interoperability, facilitating the development of the web of services. 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. Emergence of design for all. Early attempts on a "configure yourself" based systems design philosophy. 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. Personalization and profiling support is increasing, also opening new opportunities for applying data mining techniques.
<p>Life Setting: Independent living</p> <p>Vision facet: Advanced set of organized and commercial services aiming to enhance diminishing disabilities of seniors and caring so that they can live independently</p>	<ul style="list-style-type: none"> Progress on standardization and interoperability, facilitating the development of the web of services. Emergence of social welfare mechanisms, varying from public to private social security systems. 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. Offering of more integrated 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. Offered 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 privacy/liability are needed.
<p>Life Setting: Independent living</p> <p>Vision facet: Tools to ensure security, ethics, rights, and privacy on data and used services</p>	<ul style="list-style-type: none"> Large panoply of mechanisms and tools for safe communications, although still difficult to integrate and configure. Europe lacks a coherent legal framework for privacy/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. Emerging unfair commercial practices. Elderly people are particularly more sensitive to unfair commercial practices and unfair contractual terms. 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.
<p>Life Setting: Independent living</p> <p>Vision facet: Mechanisms to increase knowledge dissemination, training and learning through sharing both for seniors and all other stakeholders</p>	<ul style="list-style-type: none"> 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.

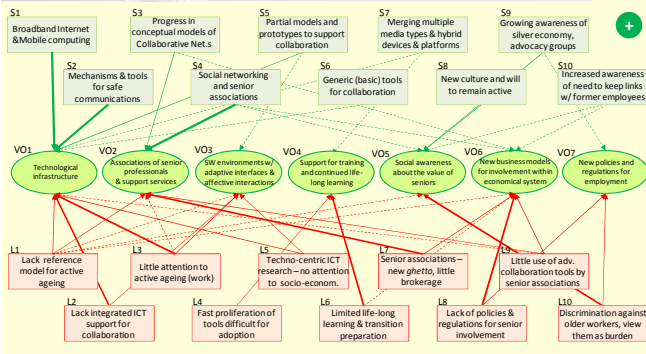
GAP ANALYSIS



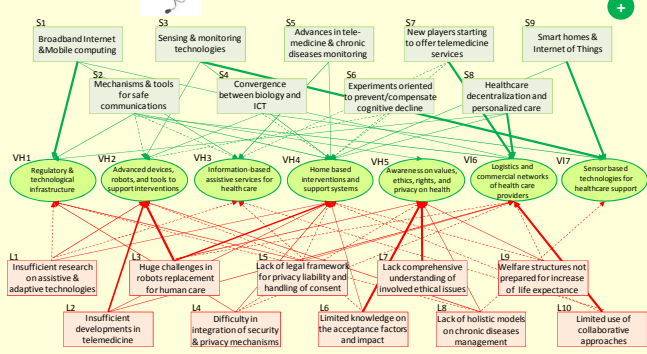
GAP ANALYSIS: Independent Living



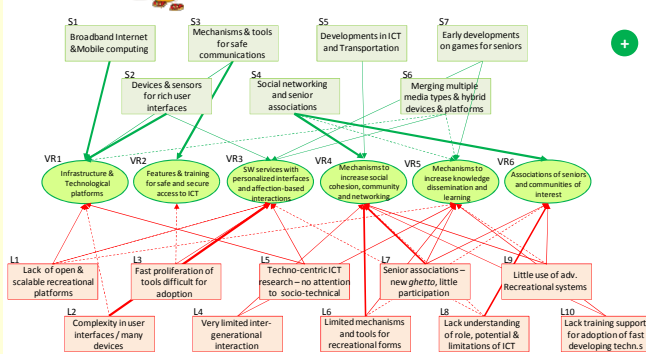
GAP ANALYSIS: Occupation in Life



GAP ANALYSIS: Healthy Living



GAP ANALYSIS: Recreation in Life





PRELIMINARY VERIFICATION: COVERING THE VISION

Occupation in Life

Actions

Independent Living

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.

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 tools for personal assistance in planning and performing daily 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, including services for localization, trip planning, navigation, orientation in complex environments, driving assistance, and inter-modal transportation, focusing elderly needs.

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, ethical, 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.

Occupation in Life

Build collaboration platforms and systems. Design and develop open ICT collaboration platforms, support, and systems aimed at facilitating value creation, addressing the specific needs of communities of senior professionals, and which promote inter-generational interaction and socialization, which are enhanced by affective computing, context awareness, and trust establishment.

Generate adaptive solutions and services. Develop and integrate self-adaptive and configurable technology solutions and services in ICT environments, applying principles of e-accessibility, design for all, and usability in order to facilitate technology acceptance and enable customization for/by seniors.

Leverage legacy. Develop environments that empower and enable seniors to create a legacy capitalizing on their invaluable and transferable personal / professional knowledge and experience.

Create a model framework. Develop approaches, models, and reasoning methods related to older people's occupation 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 seamlessly joins online and offline collaboration, for seniors, to create invaluable connections between virtual and real-world aspects of their occupation in life.

Improve working practices. Investigate new models of working practices and related reward and taxation models for seniors, taking account of work-life balance, aging well and gender, and promote the findings to positively influence societal perception of older workers.

Enhance policy and legislation. Identify and assess current national and European policy, legislation and incentives relevant to active participation of seniors in the socio-economic system and recommend new approaches that lower barriers and promote and support active aging.

Guide career transition. Define new life-long training programmes and realistic practices that prepare for and guide the successful transition of senior knowledge holders from full employment to occupation in life.

Healthy Living

Establish safe infrastructure. Develop a safe and adaptable infrastructure, aligned with relevant standards in e-health, to support the provision of consumer-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 assistive 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 sensorial systems for health conditions monitoring, combined with intelligent diagnosis functionalities, understanding of the environment and other context factors, and smoothly adaptable to the needs of each 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 healthy living support.

Support home-based interventions. Identify, develop and assess novel experiments on home-based interventions and associated support systems, which are self-adapting to the cognitive, emotional, and physical status of the senior and respect the established safety and ethical principles.

Develop regulatory framework. Promote studies to elaborate and assess new organizational forms and business models for healthcare provision to aging population under a community and multi-stakeholder collaboration perspective.

Establish organizational and business models. Identify and regulate critical elements in ICT-based support services for healthy living.

Raise awareness on healthy living. Launch actions and develop mechanisms to raise awareness on the potential of ICT support for "healthy living environments" and the formation of consensus on values, ethical principles, rights, safety and privacy issues to be adopted in such environments.

Recreation in Life

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.

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.

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.

Train for digital lifestyle. Create and deploy training programs and mechanisms oriented to help senior citizens enter and explore new lifestyles in the digital age, with particular 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, cultural and social life.

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PRELIMINARY VERIFICATION: FEASIBILITY

FEASIBILITY: Independent Living

FEASIBILITY: Occupation in Life

Action	U1: Infrastructure	U2: Services	U3: Support	U4: Monitoring	U5: Mobility	U6: Collaboration	U7: Awareness	U8: Regulation	U9: Training	U10: Innovation	U11: Evaluation	U12: Dissemination	U13: Sustainability	U14: Impact	U15: Ethics	U16: Privacy	U17: Security	U18: Usability	U19: Interoperability	U20: Accessibility	U21: Scalability	U22: Flexibility	U23: Customizability	U24: Affordability	U25: Reliability	U26: Maintainability	U27: Reproducibility	U28: Portability	U29: Compatibility	U30: Interoperability	U31: Sustainability	U32: Impact	U33: Ethics	U34: Privacy	U35: Security	U36: Usability	U37: Interoperability	U38: Accessibility	U39: Scalability	U40: Flexibility	U41: Customizability	U42: Affordability	U43: Reliability	U44: Maintainability	U45: Reproducibility	U46: Portability	U47: Compatibility	U48: Interoperability	U49: Sustainability	U50: Impact	U51: Ethics	U52: Privacy	U53: Security	U54: Usability	U55: Interoperability	U56: Accessibility	U57: Scalability	U58: Flexibility	U59: Customizability	U60: Affordability	U61: Reliability	U62: Maintainability	U63: Reproducibility	U64: Portability	U65: Compatibility	U66: Interoperability	U67: Sustainability	U68: Impact	U69: Ethics	U70: Privacy	U71: Security	U72: Usability	U73: Interoperability	U74: Accessibility	U75: Scalability	U76: Flexibility	U77: Customizability	U78: Affordability	U79: Reliability	U80: Maintainability	U81: Reproducibility	U82: Portability	U83: Compatibility	U84: Interoperability	U85: Sustainability	U86: Impact	U87: Ethics	U88: Privacy	U89: Security	U90: Usability	U91: Interoperability	U92: Accessibility	U93: Scalability	U94: Flexibility	U95: Customizability	U96: Affordability	U97: Reliability	U98: Maintainability	U99: Reproducibility	U100: Portability	U101: Compatibility	U102: Interoperability	U103: Sustainability	U104: Impact	U105: Ethics	U106: Privacy	U107: Security	U108: Usability	U109: Interoperability	U110: Accessibility	U111: Scalability	U112: Flexibility	U113: Customizability	U114: 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VALIDATION WORKSHOPS

Barcelona
11 Feb 2011

Pordenone
8 Apr 2011



Group discussion
Argumentation
Amendment



Voting

Summarizing conclusions



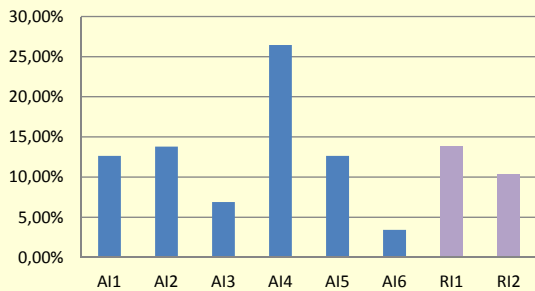
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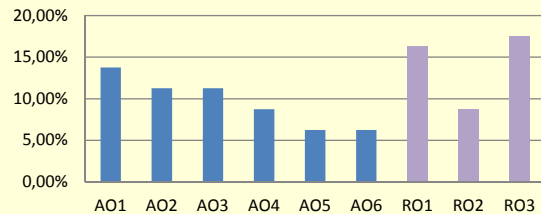
FEEDBACK: Prioritization of actions



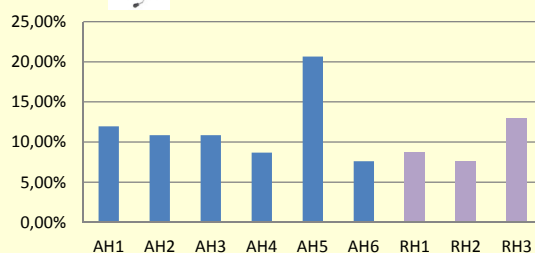
Independent Living



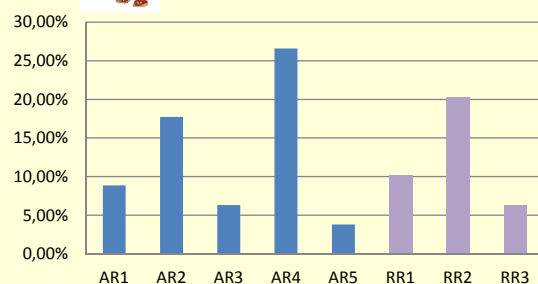
Occupation in Life



Healthy Living



Recreation in Life



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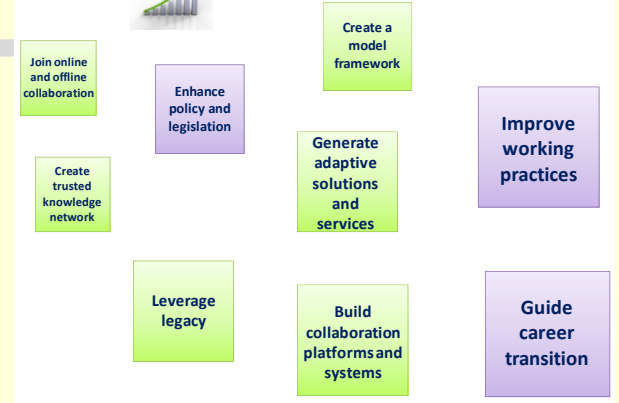


PRIORITIZATION OF ACTIONS

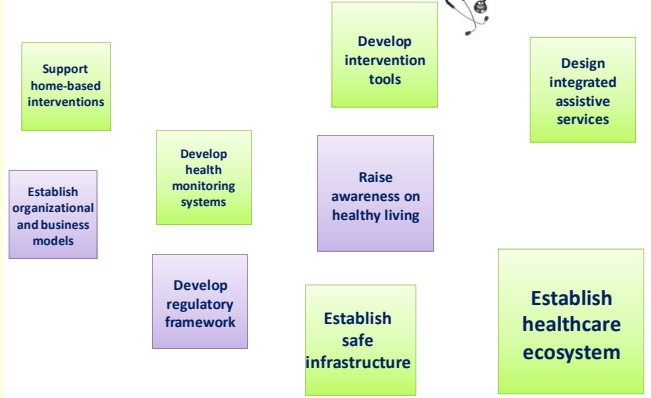
Independent Living



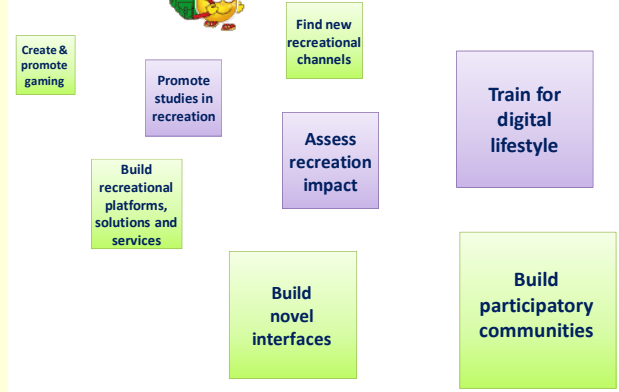
Occupation in Life



Health and Care in Life



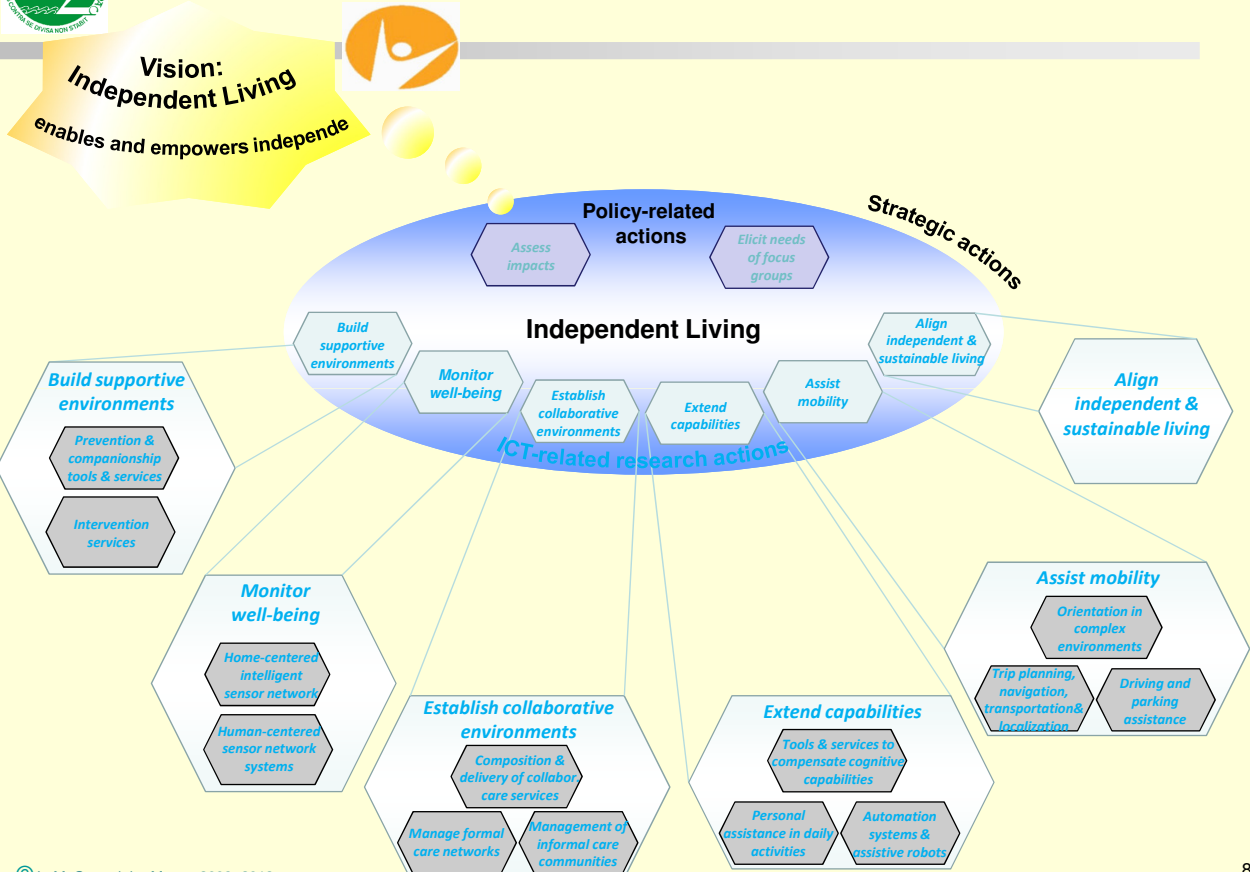
Recreation in Life



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CONSOLIDATED PLAN

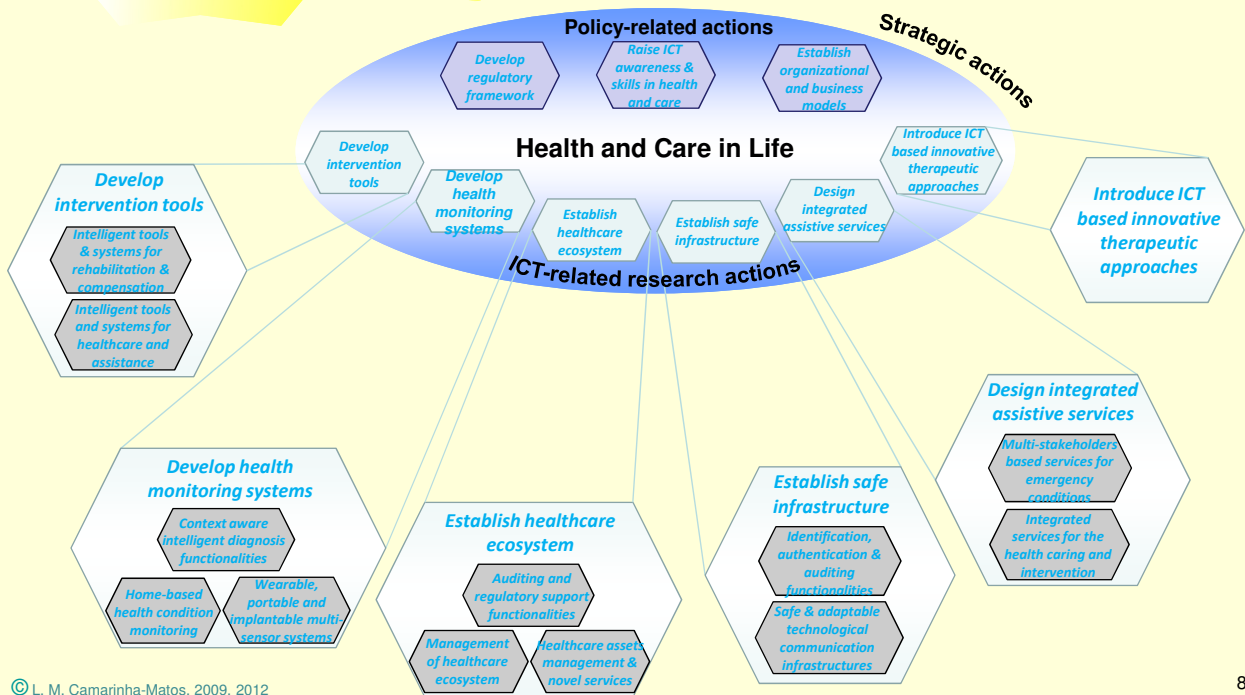


© L. M. Camarinha-Matos, 2009, 2012



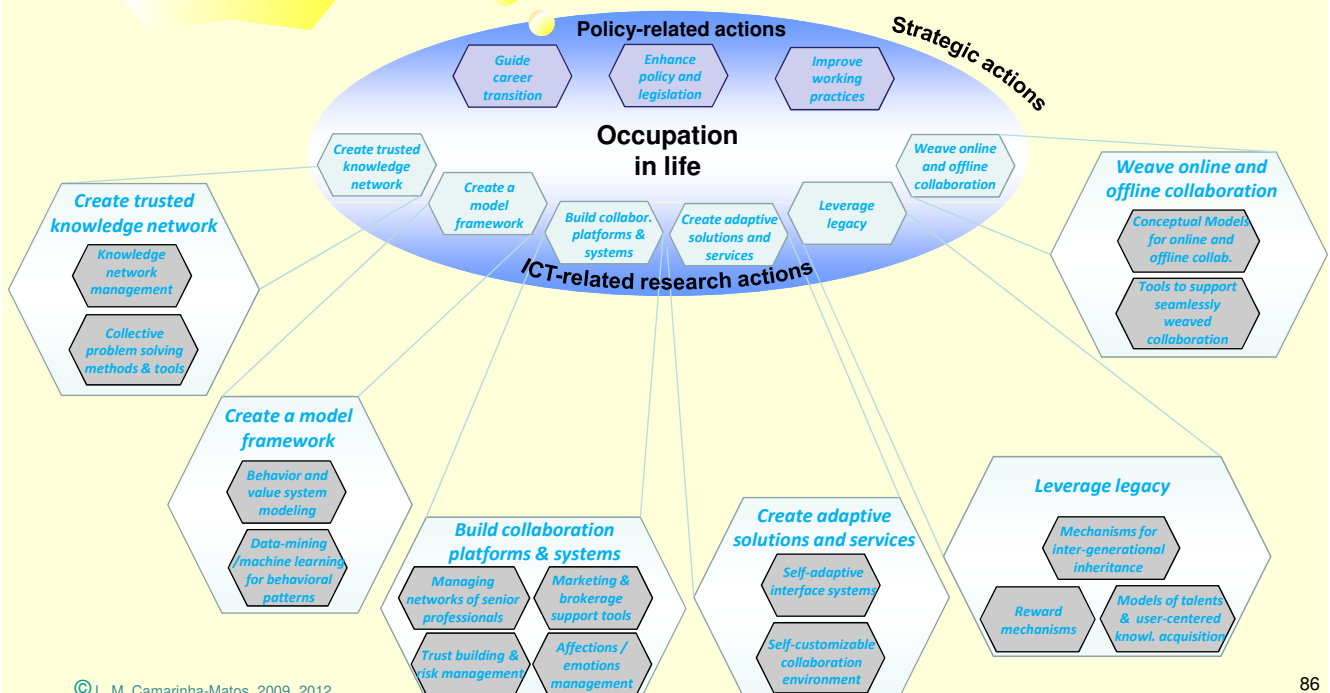
CONSOLIDATED PLAN

Vision:
Health and Care in Life
fosters trans-sectoral support of
personal health/wellness

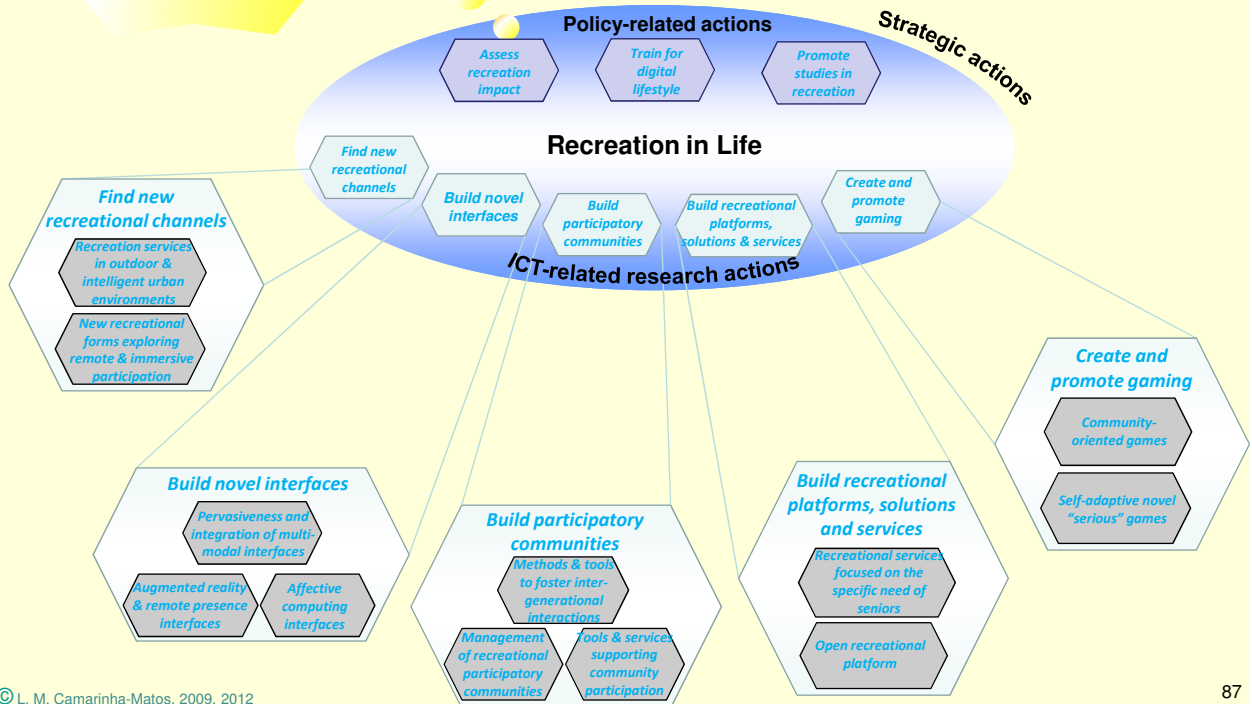


CONSOLIDATED PLAN

Vision:
Occupation in Life
activates inclusive economic particip



Vision:
Recreation in Life
animates active enjoyment of I



BRAID: SCHEDULE OF ACTIONS

Independent Living

	2013	2014	2015	2016	2017	2018	2019	2020	2021
A11 Establish collaborative environments									
A11.1 - Plan, organize and support management of formal care networks.	Res	Res	Res	Res	Res	Res	Res	Res	Res
A11.2 - Plan, organize and support informal care networks.	Res	Res	Res	Res	Res	Res	Res	Res	Res
A11.3 - Design and develop tools for composition of collaborative care services.	Res	Res	Res	Res	Res	Res	Res	Res	Res
A12 Extend capabilities									
A12.1 - Development of intelligent tools and services for personal assistance in daily activities.	Res	Res	Res	Res	Res	Res	Res	Res	Res
A12.2 - Development of automation systems and assistive robots.	Res	Res	Res	Res	Res	Res	Res	Res	Res
A12.3 - Investigate, develop and integrate intelligent tools and services to compensate diminishing cognitive capacities.	Res	Res	Res	Res	Res	Res	Res	Res	Res
A13 Assist mobility									
A13.1 - Integrate and customize methods, tools and services for trip planning, navigation and localization.	Res	Res	Res	Res	Res	Res	Res	Res	Res
A13.2 - Develop and customize driving and parking assistance.	Res	Res	Res	Res	Res	Res	Res	Res	Res
A13.3 - Integrate and customize methods, tools and services for orientation in "complex environments".	Res	Res	Res	Res	Res	Res	Res	Res	Res
A14 Monitor well-being									
A14.1 - Design, develop and integrate home-centered intelligent sensor network environments.	Res	Res	Res	Res	Res	Res	Res	Res	Res
A14.2 - Design, develop and integrate human-centered intelligent sensor network systems development.	Res	Res	Res	Res	Res	Res	Res	Res	Res
A15 Build supportive environments									
A15.1 - Design and development of prevention and companionship tools and services.	Res	Res	Res	Res	Res	Res	Res	Res	Res
A15.2 - Design and development of intervention services.	Res	Res	Res	Res	Res	Res	Res	Res	Res
A16 Align independent and sustainable living									
R1 Assess impacts									
R2 Elicit needs of focus groups									

Health and Care in Life

	2013	2014	2015	2016	2017	2018	2019	2020	2021
AH1 Establish healthcare ecosystem									
AH1.1 Plan, organize and support management of the healthcare ecosystem.	Res	Res	Res	Res	Res	Res	Res	Res	Res
AH1.2 Develop functionalities for healthcare basic management and emergence of novel services.	Res	Res	Res	Res	Res	Res	Res	Res	Res
AH1.3 Develop auditing and regulatory support functionalities.	Res	Res	Res	Res	Res	Res	Res	Res	Res
AH2 Develop health monitoring systems									
AH2.1 Develop and integrate home-based health condition monitoring systems.	Res	Res	Res	Res	Res	Res	Res	Res	Res
AH2.2 Develop wearable, portable and implantable multi-sensor systems.	Res	Res	Res	Res	Res	Res	Res	Res	Res
AH2.3 Design and develop context aware intelligent diagnosis functionalities.	Res	Res	Res	Res	Res	Res	Res	Res	Res
AH3 Establish safe infrastructure									
AH3.1 Design and develop safe and adaptable technological communication infrastructures.	Res	Res	Res	Res	Res	Res	Res	Res	Res
AH3.2 Design and develop identification, authentication and auditing functionalities.	Res	Res	Res	Res	Res	Res	Res	Res	Res
AH4 Design integrated assistive services									
AH4.1 Develop integrated services for the health caring and intervention.	Res	Res	Res	Res	Res	Res	Res	Res	Res
AH4.2 Dynamic configuration of multi-stakeholders based services in response to emergency conditions.	Res	Res	Res	Res	Res	Res	Res	Res	Res
AH5 Develop intervention tools									
AH5.1 Develop intelligent tools and systems for healthcare and assistance.	Res	Res	Res	Res	Res	Res	Res	Res	Res
AH5.2 Develop intelligent tools and systems for rehabilitation and disability compensation.	Res	Res	Res	Res	Res	Res	Res	Res	Res
AH6 Introduce ICT based innovative therapeutic approaches									
RH1 Raise ICT awareness and skills in health and care									
RH2 Develop regulatory framework									
RH3 Establish organizational and business models									



BRAID: SCEHDULE OF ACTIONS

	2013	2016	2019	2021	
Occupation in Life	AD1 Build collaboration platforms and systems				
	AD1.1 - Develop advanced functionalities and systems for management of networks of senior professionals.	AD1.2 - Develop marketing and brokerage support tools for communities of senior professionals.	AD1.3 - Develop trust building and risk management systems for communities of senior professionals.	AD1.4 - Develop affections / emotions management systems for communities of senior professionals.	
	AD2 Leverage legacy				
	AD2.1 - Define conceptual models of talents and develop user-centred knowledge acquisition tools.	AD2.2 - Create reward mechanisms (system of incentives) to attract user generated knowledge.	AD2.3 - Mechanisms to promote inter-generational inheritance.		
	AD3 Create adaptive solutions and services				
	AD3.1 - Develop self-adaptive interface systems.	AD3.2 - Develop self-customizable collaboration environments and services.			
	AD4 Create a model framework				
	AD4.1 - Develop a conceptual base for behavioural and value system modelling.	AD4.2 - Develop data-mining / machine learning approaches for behavioural patterns discovery.			
	AD5 Create trusted knowledge networks				
	AD5.1 - Develop effective knowledge network management systems.	AD5.2 - Develop collective problem solving methods and tools.			
	AD6 Weave online and offline collaboration				
	AD6.1 - Develop conceptual models for online and offline collaboration.	AD6.2 - Develop tools to support seamlessly mixed online/offline collaboration.			
	RD1 Guide career transition				
	RD2 Improve working practices				
	Recreation in Life	AR1 Build participatory communities			
		AR1.1 Plan, organize and support management of recreational participatory communities.	AR1.2 Develop tools and services supporting community participation.	AR1.3 Develop methods and tools to foster inter-generational interactions on a community basis.	
		AR2 Build novel interfaces			
		AR2.1 Explore augmented reality and remote presence interfaces.	AR2.2 Develop affective computing interfaces.	AR2.3 Develop methods to promote pervasiveness and integration of multi-modal interfaces.	
		AR3 Build recreational platforms, solutions and services			
		AR3.1 Design and develop an open recreational platform.	AR3.2 Customize and integrate recreational services focused on the specific need of seniors.		
AR4 Find new recreational channels					
AR4.1 Design and develop new recreational forms exploring remote and immersive participation.		AR4.2 Novel technology assisted recreation services in outdoor and intelligent urban environments.			
ARS Create and promote gaming					
ARS.1 Design and develop self-adaptive novel "serious" games.		ARS.2 Design and develop community-oriented games.			
RR1 Train for digital lifestyle					
RR2 Assess recreation impact					
RR3 Promote studies in recreation					

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