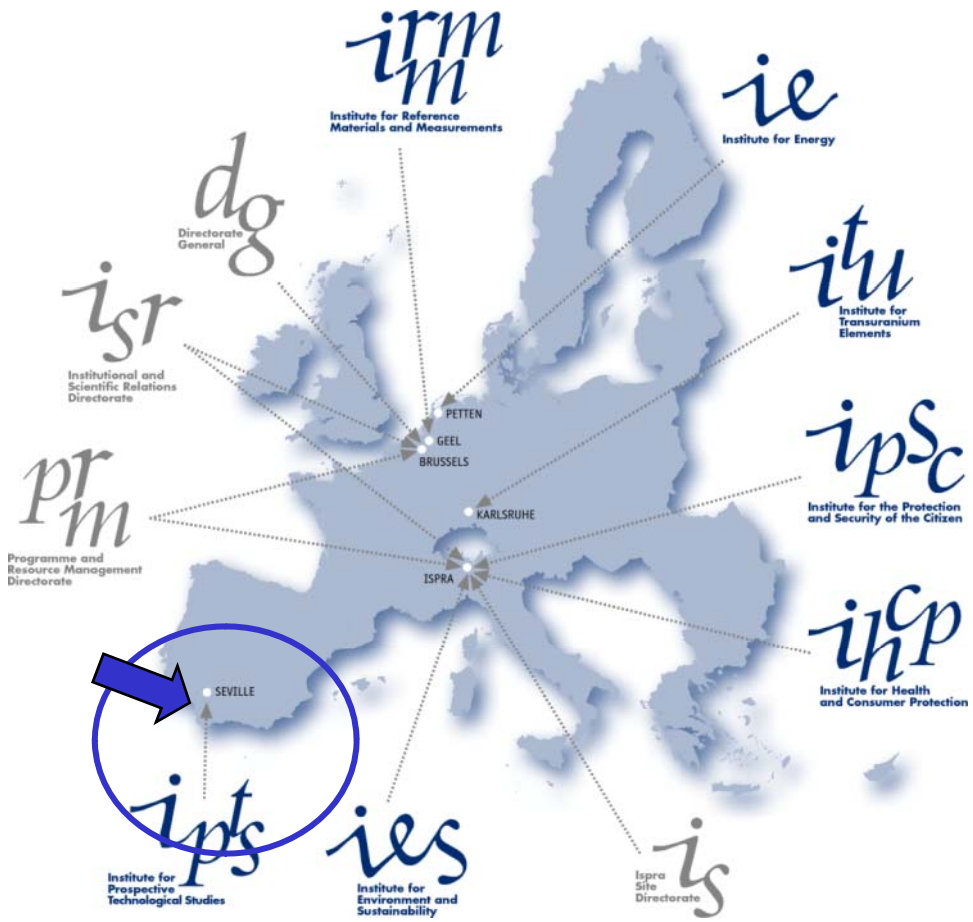
# EHRA SUMMIT 2010

## eHealth and personalised health care in arrhythmias

## Personal Health Systems: a roadmap to 2020

## 22-23 March 2010 – European Heart House Sophia Antipolis

**IPTS – IS Unit**
**Cristiano Codagnone**




IPTS: Part of DG JRC of the EC:
7 Research Institutes across Europe

**Mission**: "to provide customer-driven support to the EU policy-making process by researching science-based responses to policy challenges that have both a socio-economic as well as a scientific / technological dimension"

**Modus operandi:** desk research, expert groups, modelling, centres of Expertise, foresight

# PHS definition

- ***Personal Health Systems (PHS) assist in the provision of continuous, quality controlled, and personalized health services to empowered individuals regardless of location. They consist of:***
  - *Ambient and/or body (wearable, portable or implantable) devices, which acquire, monitor and communicate physiological parameters and other health related context of an individual (e.g. , vital body signs, biochemical markers, activity, emotional and social state, environment);*
  - *Intelligent processing of the acquired information and coupling of it with expert biomedical knowledge to derive important new insights about individual's health status;*
  - *Active feedback based on such new insights, either from health professionals or directly from the devices to the individuals, assisting in diagnosis, treatment and rehabilitation as well as in disease prevention and lifestyle management.*

# visionary thinking from the past …

ipts Institute for Prospective Technological Studies

## 1627: Francis Bacon, *The New Atlantis*

science and technology to delay ageing, heal incurable diseases, relieve pain, change the temper and psychology of individuals, in short maximize human beings intellectual, physical and psychological capacities

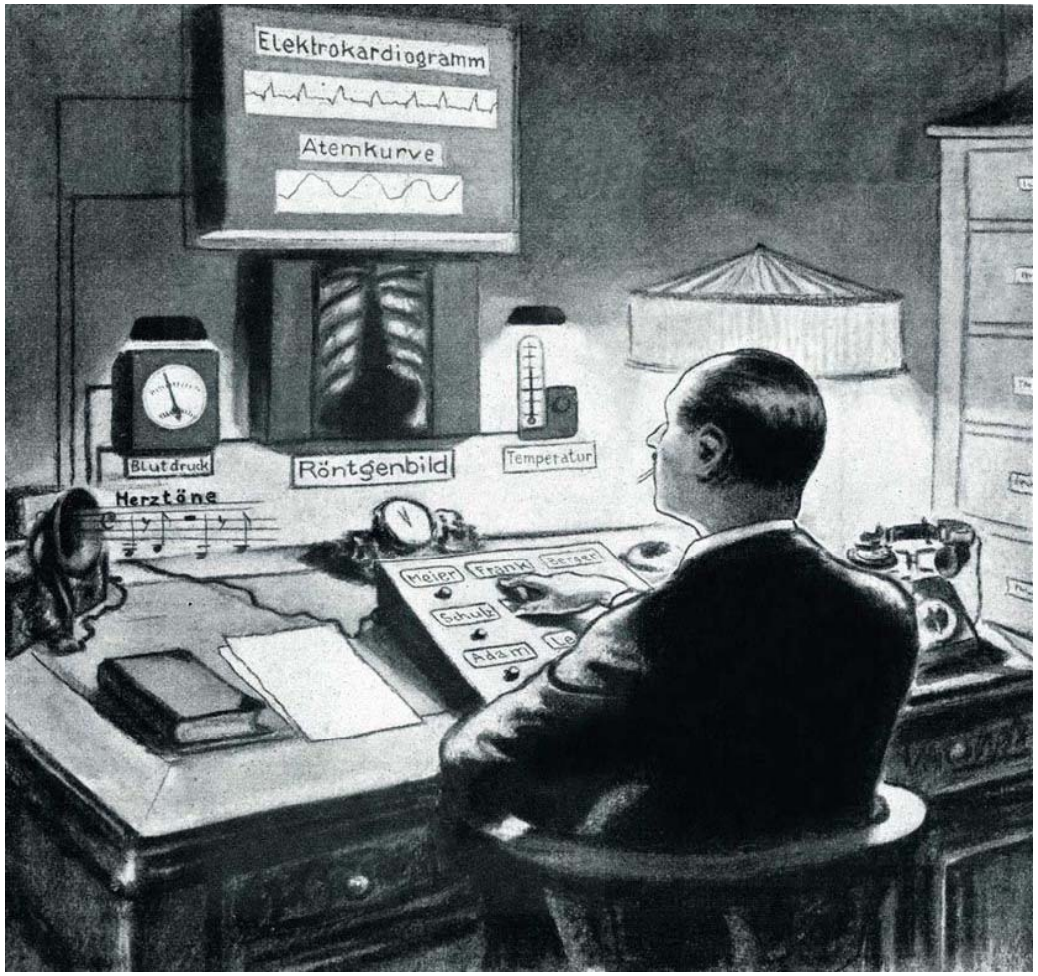
## But today :

**We can** move closer to the New Atlantis utopia (nano-, bio-, info-, technologies)

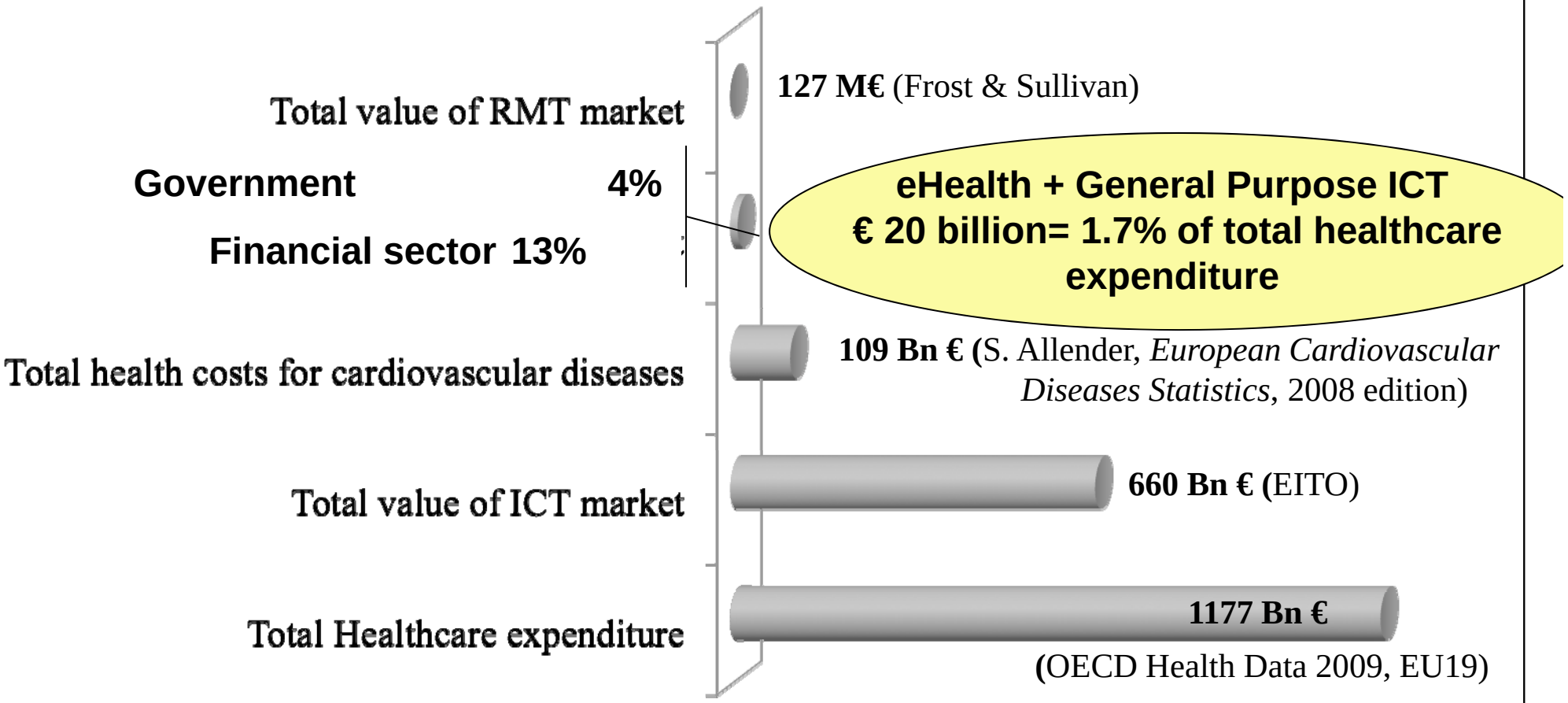
**We must** find ways to do more and better with the same (sustainability of health and social care)

Bearing in mind that **everything is connected to everything else** and it is time to reconstruct the "whole": integrated care of individuals not fragmented treatment of diseases

## 1925: Fritz Kahn, Doctor / artist, Berlin



# The obvious is not happening?



# Filling in the missing pieces

- **FP7 PHS2020: RTD roadmap (completed)**
  - C. Codagnone, *Reconstructing the Whole: Present and Future of Personal Health Systems* (http://ec.europa.eu/information_society/newsroom/cf/itemlongdetail.cfm?item_id=5555)


- **IPTS SIMPHS: socio-economic analysis of innovation dynamics (2009-2011)**
  - Preliminary outputs: http://is.jrc.es/pages/TFS/sps.html

# PHS2020: The Gaps



| Domain | Identified Gaps |
|---|---|
| Infusion of biomedical knowledge | • PHS not integrated with clinical evidence, biomedical and genetic information<br>• Data from uncontrolled conditions in need of validation<br>• PHS not integrated with clinical guidelines and pathways |
| Data processing | • Inefficient integration and processing of multimodal data<br>• Need to treat and correct data from uncontrolled conditions<br>• Lack of self-adaptive algorithms for automatic and personalised data processing<br>• Lack of personalised aid decision tools for users |
| Sensors | • Lack of context awareness capacities (emotion, location, activity, environment)<br>• Need to go beyond the “one sensor- one signal” and “one sensor- one disease”<br>• Need to simplify and reduce the amount of data transfers (on board processing)<br>• Need to increase flexibility and better adapt the sensors to individual characteristics<br>• Lack of knowledge on the long term effect of sensors on human body;<br>• Need of more actuation capabilities ( for diagnosis and treatment ) |
| Interfacing and interaction | • Lack of multi-channel delivery and inter-action creating risk of exclusion due to lack of access to, or confidence in, PHS typical interaction channels<br>• Need of more understandable and easy to interpret input and guidance to users;<br>• Need to better inform and educate PHS users |

# PHS2020: roadmap in a nutshell



- **Infuse biomedicine into technology;**
- **More intelligent data processing: from personal to personalised;**
- **New generation sensors: self-calibrating, with on board-processing, multi-signs/multi-diseases, non invasive, energy efficient, plug and play into BAN;**
- **More inclusive and user-friendly interfaces and interaction channels;**
- **Move from remote monitoring to diagnosis, treatment and prevention;**

# PHS of the future



- ***In the future truly personalised and efficient PHS will function***
  - *Capturing the very peculiar characteristics of individuals (vital and physiological signs, but also their genetic outlook, as well as their clinical history, and their socio-demographic and socio-economic conditions);*
  - *Ensuring awareness of very punctual contextual conditions (location, activity being performed, emotional status, physical and chemical conditions in the environment, etc);*
  - *Intelligently processing such information to support traditional action and automatic actuation, thus, enabling new applications and services going beyond monitoring;*
  - *Using devices as minimally invasive and constraining of normal life as possible, adaptable to the very personal specificities and needs of each single individuals (i.e. avoiding materials to which one may be allergic)*
  - *Optimising energy and bandwidth consumption and minimising waste disposal*
  - *Providing 'front-end' fruition modalities that respond to different attitudes and needs of different typology of users;*

- **IPTS: Strategic Intelligent Monitor of Personal Health Systems, SIMPHS, (2009-2011)**
  - Is there a need and how can PHS help?
  - How much PHS deployment so far and how this compare with the potential?
  - Is there evidence that PHS work? Is it sufficient to convince stakeholders?
  - What is blocking us from realising the potential? What must be done to overcome barriers and what we stand to loose if we do not act?

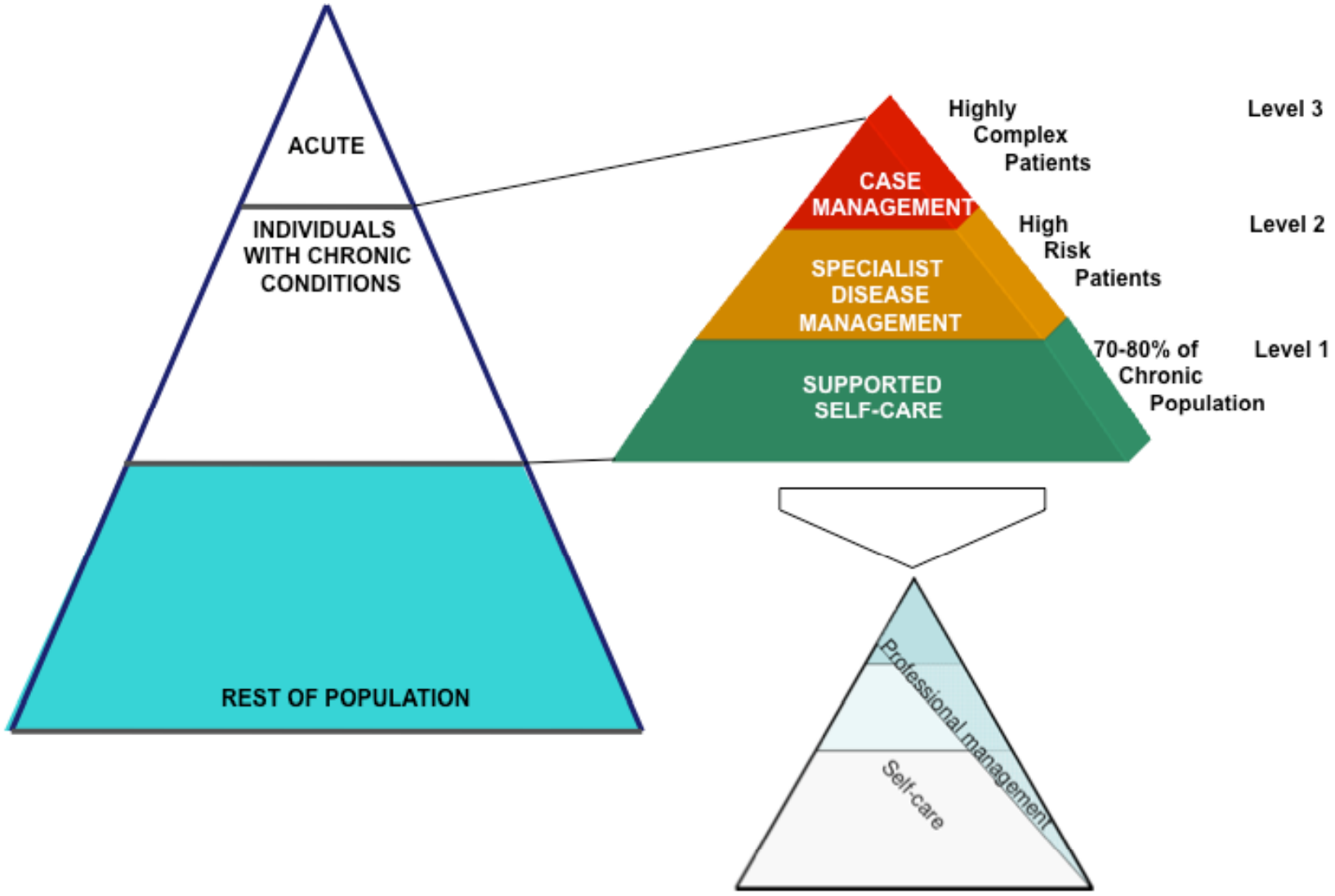
# Chronic diseases drivers



| Diseases | Prevalence | Costs |
|---|---|---|
| Diabetes<br>(IDF Diabetes Atlas, plus several sources) | • 6.6% of total population<br>• 2.2 million DALYs lost yearly | • Type II: € 29 bln per year in 8 countries (Jönsson and Jönsson 2002), |
| COPD<br>(Several sources) | • Range from 4% to 11%<br>• 2 mllion DALY lost yearly | • No aggregate data found<br>• cost per patient per year: from € 400 up to € 2.100 (several studies) |
| CVD in general<br>(S. Allender, ed. 2008) | • 12 million DALYs lost yearly | • EU27 € 109 bln direct costs= 10% of expenditure<br>• Indirect costs: € 83 bln (41 of lost productivity and 42 for informal care) |
| CHF<br>(several sources, OECD 2009 Health Data) | • Between 1% and 3% of general population<br>• 10% among the very elderly | • Up to 2% of total health expenditure (23 Bln €)<br>• Up to 5% of all hospital admissions<br>• CHF patients average bed occupancy: 10,2 days<br>• Up to 45% re-hospitalisation after 6 months of discharge<br>• Mortality rate at one year 25%-40% (at 5 year up to 75% |

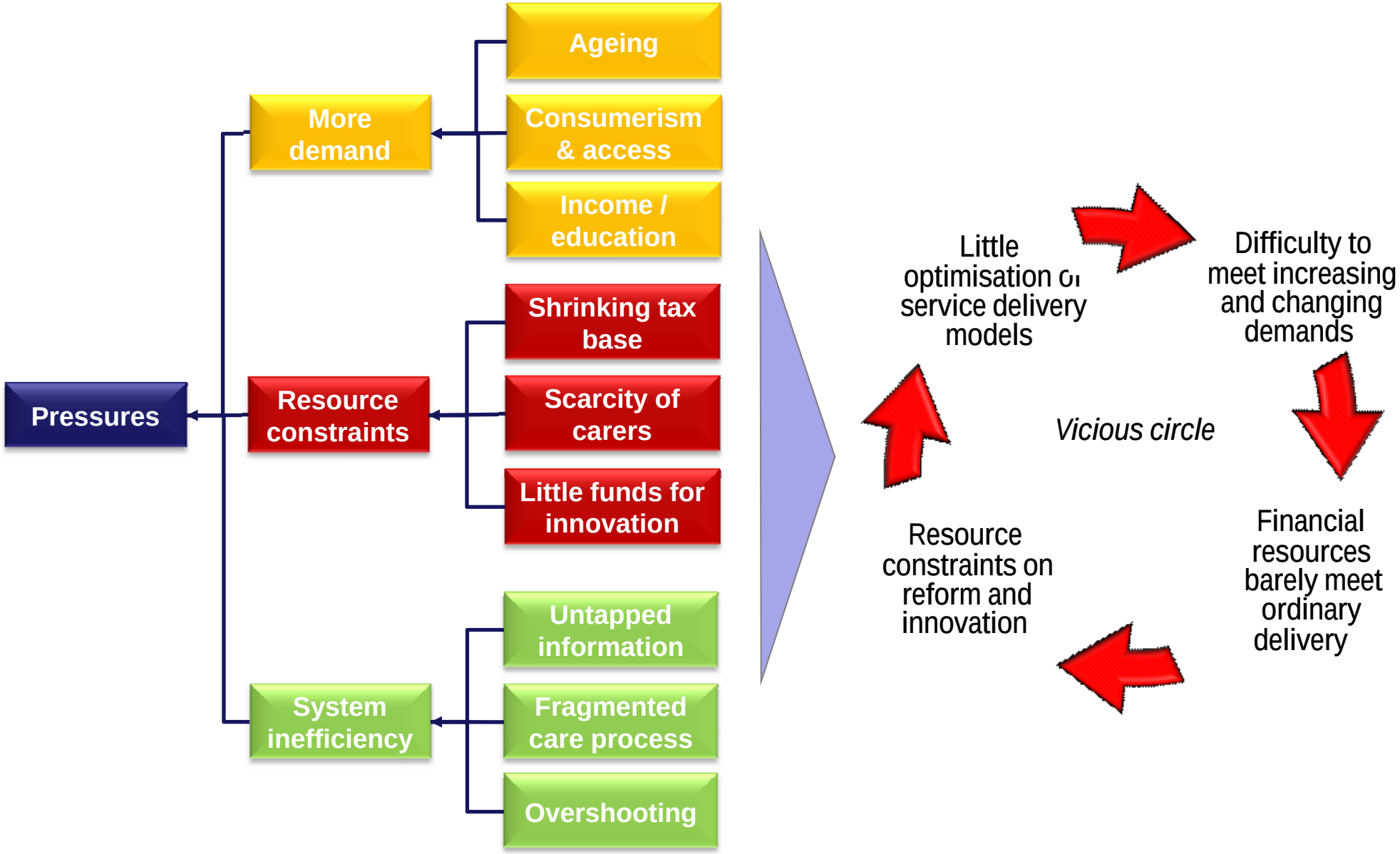
# Addressability: a good pool for PHS?






**Source: Adapted from UK Department of Health, *Supporting People with Long Term Conditions*, 2007, (http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/Browsable/DH_4100317 );**

# HealthCare Challenges



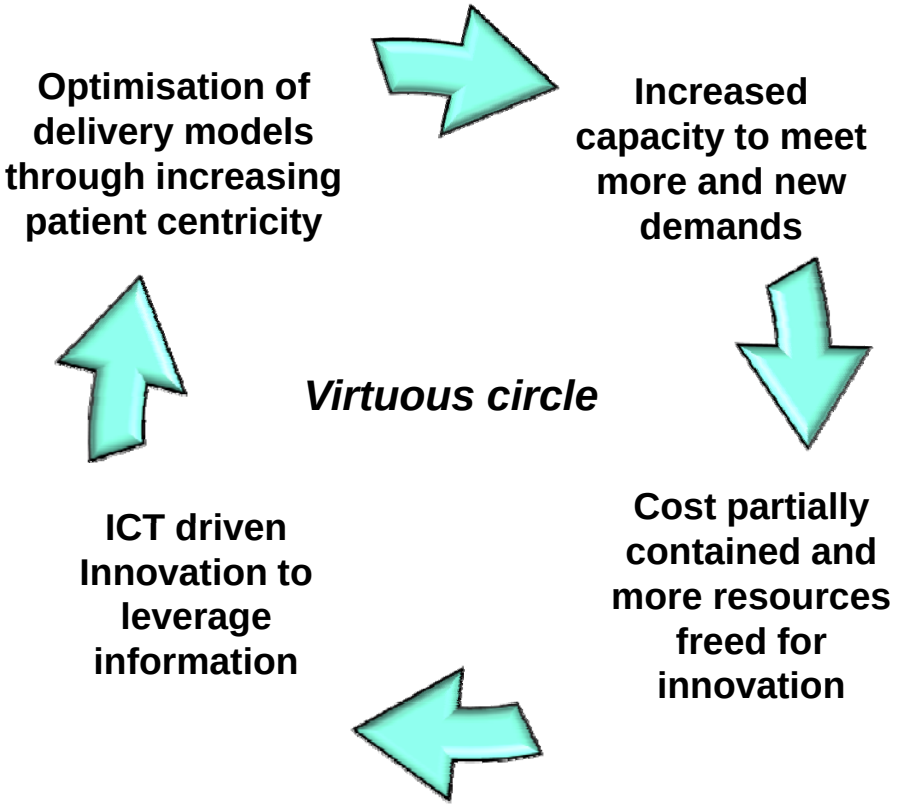
# What can we ask of PHS/eHealth?



PHS help produce more and better output with almost the same

Increase quantity and quality of care, while ensuring financial sustainability and coping with decreasing pool of carers

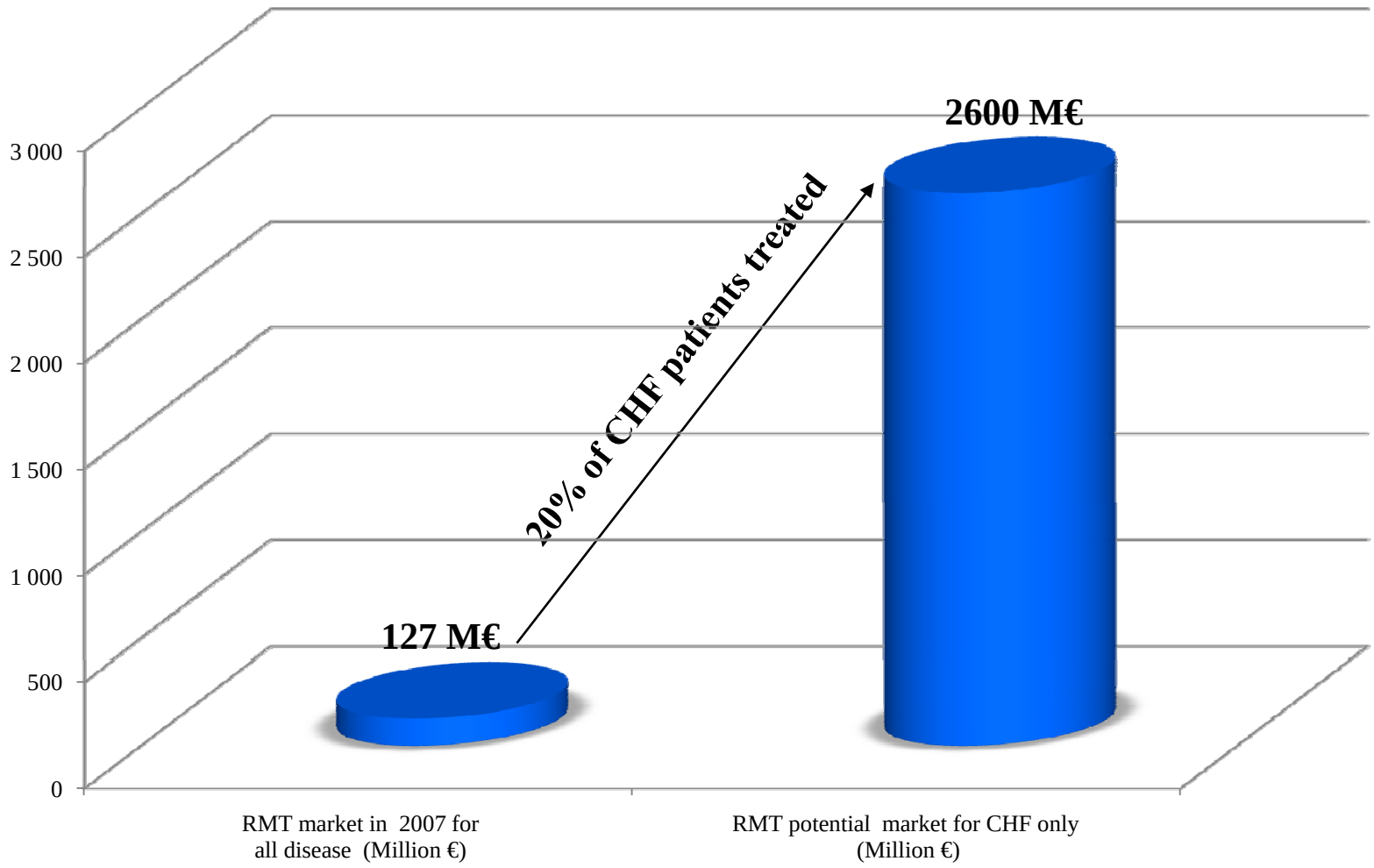
PHS can also boost the economy creating new market opportunity




**But expecting costs cutting is simply unrealistic**

# Deployment scenario CHF: a market opportunity





# RMT outcomes



- **RMT proven outcomes**
  - Clinical outcomes: robust evidence
  - Cost-effectiveness: inconclusive?
  - CHF:
    - Re-hospitalisation due to CHF reduced
    - All cause re-hospitalisation not?
- **US VHA study:**
  - Diabetes: 20.4% utilisation decrease;
  - CHF: 25.9% utilisation decrease
  - COPD: 20.7% utilisation decrease
- **Other Studies:**
  - RCT for HBT in Italy (↓ hospitalisation readmission, ↓mortality)
  - Similar outcomes with diabetes/ COPD in other studies

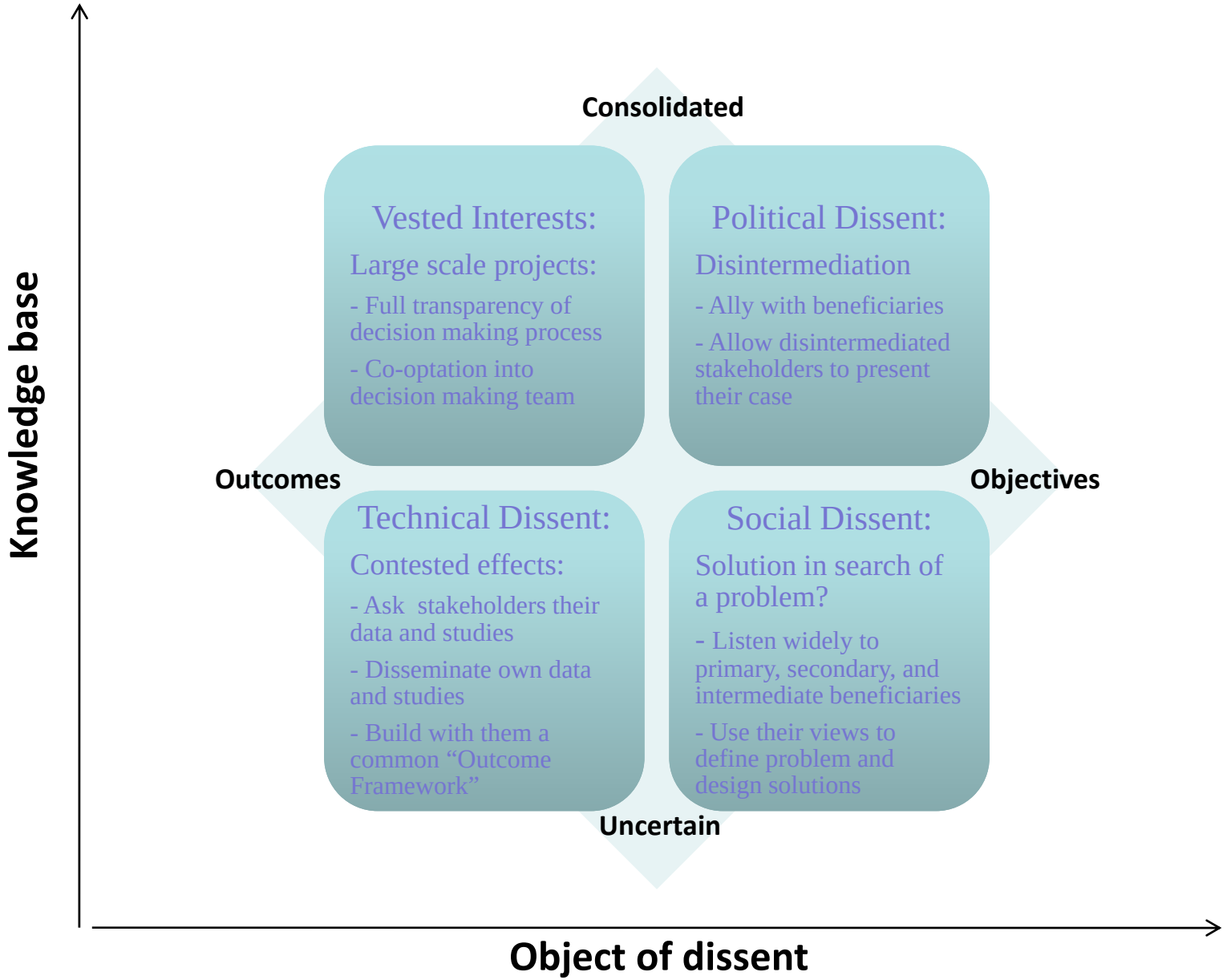
**Reducing diabetic death**
11,000 deaths caused by complication ensuing from diabetes could be reduced in the six Member States through the combined applications of EMR and disease management

*Source*: EU Swedish Presidency, (2009) ***eHealth for a Healthier Europe!*** , p. 34

**Reduce hospitalisation**
Application of telemedicine and home health monitoring could avoid 5.6 million admissions to hospitals for chronically ill patients in the six Member States

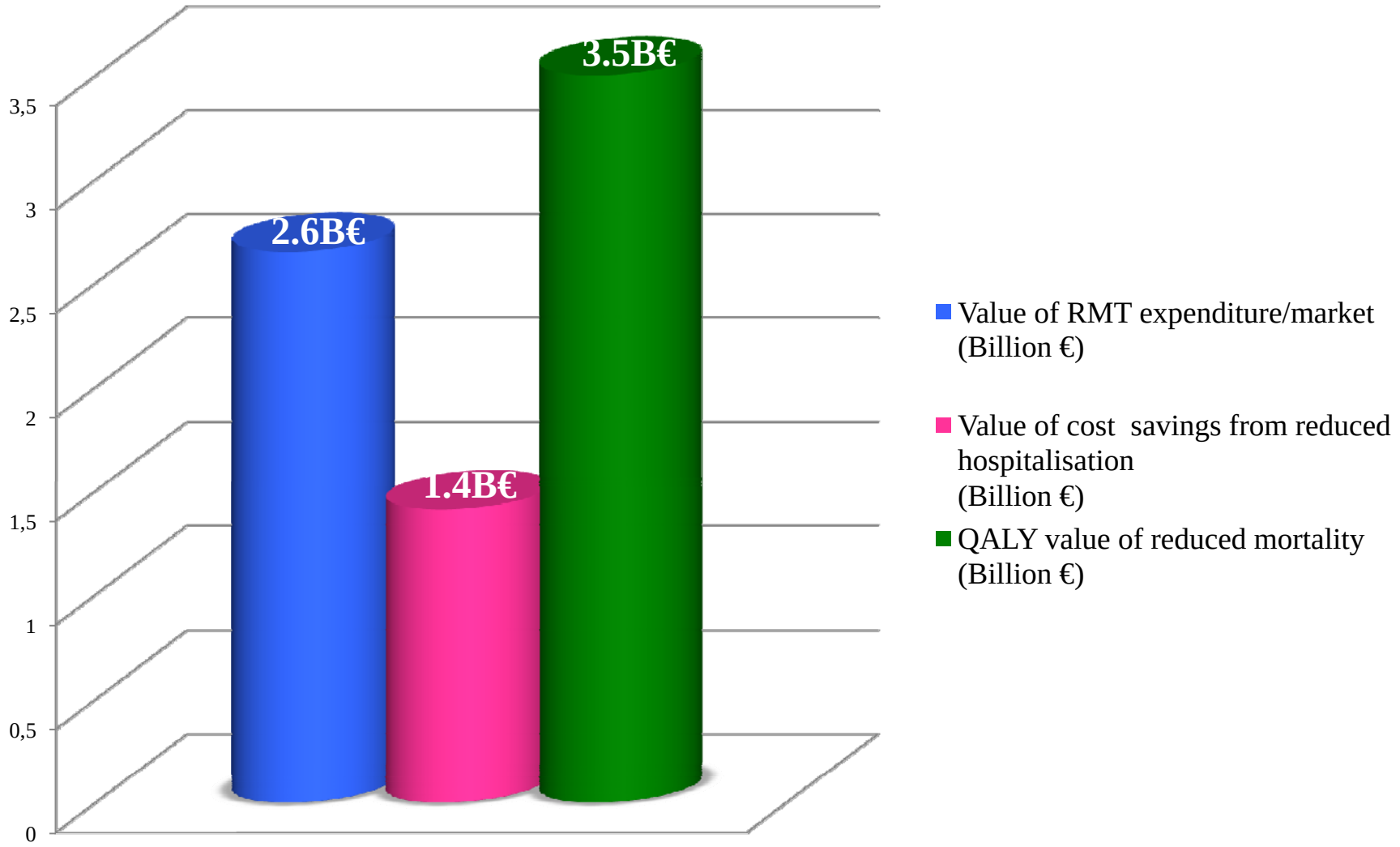
*Source*: EU Swedish Presidency, (2009) ***eHealth for a Healthier Europe!*** , p. 36

# Contested policy domains: what to do?



# Deployment scenario CHF: costs and benefits





# Barriers : views from the field (1/2)



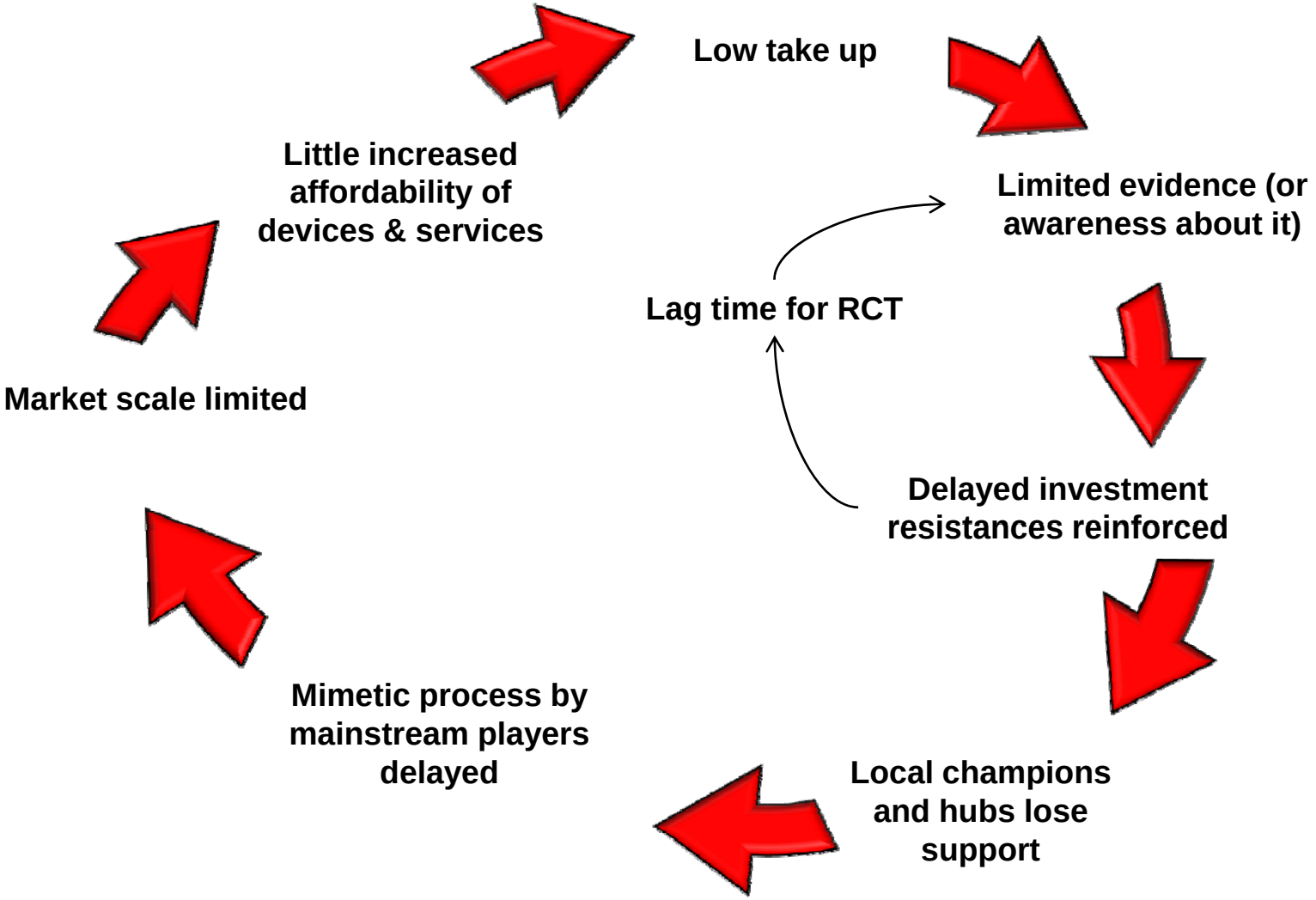
| Domain/perspective | Barriers |
|---|---|
| Unclear business model, shaky revenues, diversification (Industry) | • **Lack of reimbursement**<br>– No unified approach, ad hoc efforts<br>– Unclear revenue streams<br>– No viable as out of pocket market<br>• **Buyers' fragmentation**<br>– Locally based strategies<br>– Looking in to many directions<br>– Institutional and market fragmentation feed each other<br>• **Entry "barriers"**<br>– End-to-end provision by suppliers not easily accepted<br>– Space for local opportunistic initiatives<br>– Need of intermediary between healthcare system and suppliers |
| Lack of strategic vision on organisationally embedded PHS (Healthcare stakeholders and experts) | • **Lack of consolidated and shared evaluation methods and results**<br>• **Unfavourable incentives**<br>– "fee for service" or "capitation" do not work for PHS<br>– Create incentives for HC players<br>• **Missing policy box**<br>– PHS is part of 'territorial' medicine and not always finds clear policy sponsors<br>– Compete for attention and funds with other applications<br>• **Primary, secondary & social care**<br>– Success due to personal commitments or top down decisions<br>– No spontaneous emergence of seamless integrated care |

# Barriers : views from the field (2/2)



| Domain/Perspective | Barriers |
|---|---|
| The Users Dimension (ALL) | • Need of education campaign and integration between eHealth and eInclusion policies<br>• Need of PHS embedded eLearning<br>• Need of quality controlled Web 2.0 tools;<br>• Off and online information on scientific reliability, privacy issue, benefits, etc; |
| Standardisation and interoperability bottlenecks (ALL, but especially industry) | • Lack of bodies setting binding standards at both national and EU level;<br>• Lack of shared infrastructures and standards for data exchange;<br>• Lack PHR inter-operability even at national level (strongly stressed by experts from ICT industry);<br>• Need of citizen owned fully inter-operable Personal Health Records (PHR) integrated with PHS; |
| PHS use for Prevention (Healthcare) | • Lack of consolidated evaluation methods and supporting evidence<br>• Lack of large enough databases for genetic mass screening of population (and of supporting legal framework);<br>• Need of incentives for healthy behaviour backed by sanctions; |
| BODY ADVENTURES (ethical and legal issues) ALL | • Lack of clear legal framework;<br>• Lack of tailoring of security and encryption techniques for healthcare sector application;<br>• Need of data management and mining applications integrated into PHS that embed, support and protect privacy; |

# Need to break the stalemate



# Thank you for your attention!

# Health is Wealth