Project Acronym:	**MovingLife**
Project Full Title:	**MObile eHealth for the VINdication of Global LIFEstyle change and disease management solutions**
Grant Agreement #:	**287352**
Funding Scheme:	**FP7-ICT-2011-7**
Project website:	**www.moving-life.eu**

D3.2 Vision scenarios in mobile healthcare

Deliverable:	D3.2
Title:	Vision scenarios in mobile healthcare
Due date:	31 March 2012
Actual submission date:	30 March 2012
Lead contractor for this deliverable:	IN-JET
Contact:	Jesper Thestrup
Dissemination Level:	PU

Abstract

This deliverable describes the methodology used to develop vision scenarios, giving the reader an understanding of this process. Applying this method, four distinct but equally plausible vision scenarios for mobile health have been developed. The result is presented in this document.

Document History

Version	Issue Date	Stage	Content and changes
0.1	17-03-2012	First draft	Trine F. Sørensen, IN-JET
0.2	23-03-2012	Second draft with scenarios	Trine F. Sørensen & Helene Udsen, IN-JET
0.3	27-03-2012	Final version ready for internal review	Trine F. Sørensen, Helene Udsen & Louise B. Riley, IN-JET
	28-03-2012	Reviewed with minor comments	Ann-Katrin Habbig, VUB
	30-03-2012	Reviewed with minor comments	M. Soner Calis, ATOS
	30-03-2012	Reviewed with suggestions for structural change	Jesper Thestrup, IN-JET
1.0	30-03-2012	Final version for submission to EC	Reviewer comments addressed, structure changed

List of Participants

No.	Participant organisation name	Participant short name	Country
1	Atos Research and Innovation	ATOS	ES
2	Innova S.p.A.	INN	IT
3	In-JeT ApS	IN-JET	DK
4	Global Security Intelligence	GSI	UK
5	Vrije Universiteit Brussels	VUB	BE
6	Herlev Hospital, Center for Sundhedsinnovation	CSI	DK

Contents

1 Executive Summary

The MovingLife project will deliver roadmaps for technological research, implementation practice and policy support with the aim of accelerating the establishment, acceptance and wide use of mobile eHealth solutions. As a result, the project will provide better understanding of the technology options for defining research policies and of the business and regulatory aspects for both private sector-driven and publicly-funded mHealth services through the thematic roadmaps in socio-economic developments and policy frameworks.

To provide input to the work in *WP4 Development of Roadmaps* and *WP5 Impact Assessment*, a Vision Scenario Workshop was held in Brussels on 27 January 2012. This deliverable presents the results of the workshop in terms of four equally plausible visions about the future, based on the discussions and issues raised at the scenario workshop and further developed using the IDON scenario method. It also builds on the deliverable *D3.1 Workshop Report*. The MovingLife consortium will choose to focus on one of the four scenarios in the forthcoming gap analysis and definition of the roadmaps.

The core of the IDON technique is to examine a set of wider environmental factors, ambiguities and uncertainties in order to resolve which role they are likely to play in the unfolding of a variety of scenarios.

The initial phase involves steps to identify, evaluate and rank a variety of environmental factors in response to a trigger question given to the workshop participants.

The IDON methodology is described in detail in Appendix A.

The complete list of topics and issues discussed is available in Appendix B.

The primary target audience for this deliverable is the members of the MovingLife consortium, but the content may also be useful and inspirational for other stakeholders in mHealth in relation to future technological research, healthcare delivery strategies, policy recommendations etc.

1.1 MovingLife Vision Scenarios

The **Trigger Question** selected for MovingLife is: *How will mHealth applications and solutions be used in chronic disease management in 2025?*

The following **environmental factors** have been taken into account:

- Technology trends
- Medical trends
- Management of clinical pathways
- Trends in healthcare provisioning
- Economic influence and reimbursements
- Social values and lifestyles
- Ethical and privacy questions
- Regulatory framework
- Policies and political influences

The derived **pivotal uncertainties** have been grouped in two **clusters**:

mHealth Trust, with flips being **mHealth Empowerment** and flops **mHealth Disempowerment**

and

Care models with flips being **Innovative Care Models** and flops **Static Care Models.**

These four cluster subplots (flips and flops) can be combined in four different ways, leading to four very different future scenarios as outlined below.

1) mHealth empowerment + Innovative care models

There must be an app for that!

Healthcare delivery has become digital and mobile; eHealth and mHealth technologies and applications are vital tools for how, when, where and by whom healthcare is delivered.

Trustworthy certifications and data protection and data management regulations have been adopted, and clearly defined mHealth payment models are in place, combined with a "pay for performance" scheme, embedding patient-centred disease management and flexible care models.

For patients living in remote areas mHealth is the only option.

2) mHealth empowerment + Static care models

Aaarrgh!

This scenario describes a situation where the healthcare system is conservative, neither adapting to patients' individual health needs nor the technological possibilities. Care models have to fit existing care spaces and healthcare systems, and patients are not actively involved in any decision-making processes regarding their own care.

Patients become frustrated by higher co-payments without the benefit of the instant medical attention that is technologically achievable. The combination of traditional care models in traditional healthcare systems funded by the traditional stakeholders persists.

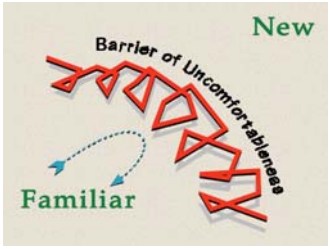
3) mHealth disempowerment + Innovative care models

Something's missing

This scenario reflects a situation where the foundation has been laid for a widespread implementation of mHealth solutions together with innovative care models based on continuity of care and an active patient role. However, technological restraints in terms of privacy, trust and interoperability remain unsolved and therefore the use of mHealth is free of choice instead of the only choice.

In theory the care models are based on the premise that mHealth services and solutions should always be offered and if remote care is possible, then face-to-face care is considered obsolete. In practice, however, patients are free to choose if they want remote care and other mHealth services. Moreover, some regulatory and technical issues, such as lack of interoperability and data protection issues, are still unresolved.

4) mHealth disempowerment + Static care models



No one likes change

In this scenario mobile technologies and applications have not yet met the criteria which need to be fulfilled for a widespread, acceptable and formal use of the technologies in healthcare delivery. As a result it has not been possible to implement the technological developments and potentials with healthcare systems in a revolutionary way. This is due to technological restrictions as well as societal hesitation. Society has not been able to adapt to the changes mHealth represents for all the stakeholders in the healthcare system and there is an unwillingness to implement technological progress and change healthcare models accordingly.

The distrust in mHealth technologies is reflected in the lack of use by doctors as well as patients, but the most influential barrier to the deployment and implementation of mHealth services and applications is basically the question of money! Doctors are expected to adopt mHealth but as these services do not fall into any existing category, there is simply no way of claiming payment for offering mHealth services.

2 Target audiences

This deliverable is first and foremost targeted at the MovingLife consortium as it provides vital input to the work in *WP4 Development of Roadmaps* and *WP5 Impact Assessment*. Secondly, all stakeholders in mHealth may find inspiration and use of the vision scenarios presented here in relation to future technological research, healthcare delivery strategies, policy recommendations etc.

3 Introduction

The MovingLife project will deliver roadmaps for technological research, implementation practice and policy support with the aim of accelerating the establishment, acceptance and wide use of mobile eHealth solutions.

The roadmaps will address a broad group of fundamental issues such as: technology options for applications and services; options for new and improved medical guidelines; user empowerment, acceptance, ethics and privacy; socio-economic environments and policy and regulatory frameworks. The combined roadmaps will address a range of fundamental issues that are related to the vision of massive deployment and use of mHealth solutions to support lifestyle changes among citizens and improve disease management.

The project will thus provide better understanding of the technology options for defining research policies and of the business and regulatory aspects for both private sector-driven and publicly-funded mHealth services through the thematic roadmaps in socio-economic developments and policy frameworks.

Technology roadmapping is a needs-driven technology planning process to help identify, select, and develop technology alternatives to satisfy a set of product needs. It is a plan that applies to a new product or process, or to an emerging technology. The two key products in technology roadmapping are Scenarios (our vision of what may happen) and the Roadmap itself (what needs to be researched/put in place to realise the vision).

This deliverable is based on the discussion and issues raised at the Vision Scenario Workshop held in Brussels on 27 January 2012 and thus also builds on the deliverable *D3.1 Workshop Report*.

Scenarios help identify threats, recognise opportunities and make choices about strategically important issues. A scenario illuminates the possible, what might be. Visions scenarios present snapshots of possible futures that help us plumb the uncertainty about the future.

The four vision scenarios presented in this deliverable represent four alternative but equally plausible visions about the future. Each scenario is presented in the form of a detailed description of the contextual environment in which the scenario unfolds. The MovingLife consortium will choose to focus on one of the four scenarios in the forthcoming gap analysis and definition of the roadmaps.

4 Overview of the Methodology

The result of applying the IDON[1] method is a set of scenarios that all point to alternative use cases within a given user domain and at a given point in time. All scenarios will have the same frame of reference and – ideally – be equally likely to happen.

The method consists of two parts: Scenario Development and Scenario Deployment. The scenarios are developed in the Scenario Development part by drawing on a diverse group of experts and applying a systematic analysis. In the MovingLife project, the Scenario Deployment part has the very specific purpose of analysing the gaps between the "as is" (state of play) with the alternative "to be" states (the scenarios). Connecting the "as is" with the "to be" is an integral part in developing the roadmaps, thus feeding directly into the work to be carried out in *WP4 Development of Roadmaps*.

The core of the IDON technique is to examine a set of wider environmental factors, ambiguities and uncertainties in order to resolve which role they are likely to play in the unfolding of a variety of scenarios.

The initial phase involves steps to identify, evaluate and rank a variety of environmental factors in response to a trigger question given to the workshop participants. The results are then categorised according to their degree of uncertainty and how direct their impact is likely to be on the user domains.

The prototype scenarios are built around the pivotal uncertainties, i.e. the factors that are likely to have direct impact on the use cases, but whose outcome is uncertain.

Creating the scenarios involves rephrasing the uncertain factors as uncertainty questions for which there are two possible outcomes and grouping them according to how they are connected and how they influence each other. After that subplots are named based on whether the questions resolve to one side or the other (flip or flop).

When the subplots have been generated they are combined to form scenario structures.

A detailed description of the IDON methodology, including an example, can be found in Appendix A.

[1] The method is named after the use of 'idons' in the process of mapping future domain factors to uncertainties. Hexagon Mapping is part of a visual facilitation approach, which combines dynamic representation with creativity using visual idea representing units, called idons.

5 MovingLife Vision Scenarios

In this chapter, the steps involved in developing the four vision scenarios are described, thus giving the reader an insight into the entire scenario building process and how the vision scenarios came to life. The time horizon was set to 2025.

5.1 Trigger Question

The Trigger Question must be an open question about the future in order to trigger creative thoughts about the subject. Its purpose is to identify and group the environmental factors. We decided on the following Trigger Question:

> How will mHealth applications and solutions be used in chronic disease management in 2025?

The Trigger Question is important because it helps us identify clusters among the uncertain factors in the next steps.

5.2 Identification of environmental factors

Identifying the environmental factors is a key step and it is important that the Trigger Question is considered in terms of all the defined environmental factors because it allows us to think about the Trigger Question – and the future – from a variety of perspectives.

Factors were identified from among all the possible environments that could influence mHealth in 2025:

- Technology trends
- Medical trends
- Management of clinical pathways
- Trends in healthcare provisioning
- Economic influence and reimbursements
- Social values and lifestyles
- Ethical and privacy questions
- Regulatory framework
- Policies and political influences.

As reported in *D3.1 Workshop Report*, the presentations and discussions during the Vision Scenario Workshop allowed us to take notes on the many issues and topics raised. These notes have since been divided into four groups:

1. High uncertainty and indirect influence
2. High uncertainty and direct influence
3. High certainty and indirect influence
4. High certainty and direct influence

The workshop moderator was responsible for ensuring that the discussion touched on all the various environmental factors that may affect the future of mHealth. A full list of the issues and topics discussed can be found in Appendix A. The environmental factors were then grouped according to the certainty and impact criteria, which yielded the following matrix:

High UNCERTAINTY

Joker

Health data for patients

Liability regulations

Telecare improves care

Innovation requirements

Re-admission penalty

Advertisements pays for mHealth

3rd party buys data

Selling/donating health data

Basic and premium version of Apps

Importance of privacy

Mobile devices intervene

Security and health

Trustworthy certification

Pay for performance

mHealth payment model

Flexible care models

Patient-doctor sharing of data

Care process fragmentation

Face-to-face replaced

Doctors trust patients

Responsibility and liability

Flexibility and freedom

General data protection regulation

Geographical divide

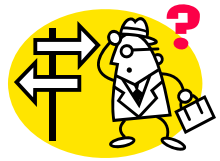
New stakeholders

Forced use of mHealth applications

Technological interoperability

Involved patients

Apps motivate



Either/or

Indirect

Direct Impact

Patients co-responsible

mHealth support unskilled health staff

Informal carers

Healthcare changes

Regulation regarding technological standards

Explicit consent

Informed patients

Patient acceptance

Technology extends warm hands

Demanding patients

Patients develop mHealth apps

Technological standard compliance

Mobile Apps for research & policy

Mobile Apps

Mobile device dependency

Influential patient organisations

Reliability

Correct data management

Increased surveillance

Risk prevention

Co-payments

eHealth & mHealth reimbursement schemes

Patient-centred disease management

Patients book appointments

Demand for health Apps

Scene

Trends

High CERTAINTY

5.3 Flip-Flopping the Pivotal Uncertainties

Looking at the marked factors in the "Either/Or" quadrant we group them in clusters. Each of the clusters will form different scripts in our scenarios. We now consider the uncertainties as a question, for which there are two possible outcomes: the "flip" (+) and the "flop" (-) outcome. When the factor in question has either "flipped" or "flopped", the uncertainty is resolved. The following table presents all the uncertainties (20 in total) in the Either/Or quadrant and the related flip-flow questions.

Importance of privacy Will privacy issues have a low priority for users in the future?	+	Privacy issues will have a low priority for especially the younger generation of users
	-	Privacy issues will have a high priority for all users
Mobile devices intervene Will mobile devices be used to intervene in patients' self-management thus overriding patient liberty?	+	Mobile devices will be used to intervene to ensure patient compliance
	-	Mobile devices will not be used to intervene to ensure patient compliance
Security and health Is eHealth embedded in security issues by using eHealth technologies and applications for public health warnings	+	eHealth technologies and applications are used for public health warnings regarding e.g. communicable diseases
	-	eHealth technologies and applications are not used for public health warnings regarding e.g. communicable diseases
Trustworthy certification Will trustworthy certification for mobile health services and applications be in place?	+	Trustworthy certification for mobile health services and applications is in place
	-	Trustworthy certification for mobile health services and applications is not in place
Pay for performance Are doctors paid on the basis of "pay for performance"?	+	Doctors are paid on the basis of "pay for performance"
	-	Doctors are not paid on the basis of "pay for performance"
mHealth payment model Is a clearly defined mHealth payment model implemented?	+	A clearly defined mHealth payment model has been implemented
	-	A clearly defined mHealth payment model has not been implemented
Patient-doctor sharing of data Will patients want to continuously share their health data with doctors?	+	Patients want to share their health data with doctors
	-	Patients do not want to share their health data with doctors
Flexible care models Are care models flexible and with a holistic approach?	+	Care models are flexible and holistic
	-	Care models are not flexible and holistic
Face-to-face replaced Will remote care begin to replace face-to-face care?	+	Remote care has begun to replace face-to-face care
	-	Remote care has not begun to replace face-to-face care
Doctors trust patients Will doctors trust that patients' own measurements of health data are accurate?	+	Doctors trust that patients' own measurements are accurate
	-	Doctors do not trust that patients' own measurements are accurate

Care process fragmentation Will the care process become more and more fragmented?	+	The care process is continuous
	-	The care process is fragmented
Flexibility and freedom Is mHealth giving all stakeholders more flexibility and freedom?	+	mHealth is giving all stakeholders more flexibility and freedom
	-	mHealth is not giving all stakeholders more flexibility and freedom
General data protection regulation Will a uniform general data protection regulation be in place in European member states	+	A uniform general data protection regulation is in place in European member states
	-	A uniform general data protection regulation is not in place in European member states
Responsibility and liability Will patients, doctors and developers be held equally liable?	+	Patients, doctors and developers are equally liable
	-	Patients, doctors and developers are not equally liable
Geographical divide Will geographical location determine the extent of patients' freedom of use?	+	Geographical location will determine the extent of patients' freedom of use
	-	Geographical location will not determine the extent of patients' freedom of use
New stakeholders Will mHealth projects be funded by entirely new stakeholders?	+	mHealth projects will increasingly be funded by a new type of stakeholder
	-	mHealth projects continue to be funded by the traditional stakeholders
Forced use of mHealth applications Are patients forced to use mHealth applications?	+	Patients are forced to use mHealth applications
	-	Patients are free to decide if they want to use mHealth applications
Apps motivate Will Apps motivate patients to be more active in their own healthcare?	+	Apps motivate people to be active in their own healthcare
	-	Apps do not motivate people to be more active in their own healthcare
Involved patients Are patients more involved and active in their own healthcare due to mHealth solutions and services?	+	Patients are much more involved and active in their own healthcare due to mHealth solutions and services
	-	Patients do not become more involved and active in their own healthcare due to mHealth solutions and services
Technical interoperability Is full technical interoperability a reality?	+	Full technical interoperability is now a reality
	-	Full technical interoperability is still not a reality

5.4 Clustering the uncertainties

We now group the pivotal uncertainties into two groups, or clusters, by searching for connections and associations between the various uncertainties. Within a cluster, uncertainties tend to counter-align in flip-flop questions so that if one flips, the other will flop.

In inspecting all 20 uncertainties it becomes obvious that they can be separated into two distinct groups. One group of uncertainties is related to use of mobile technologies, e.g. how mobile healthcare technologies and applications are used, the context in which they are used and technological capabilities. This cluster of uncertainties has been named "mHealth Trust".

The other group of uncertainties is related to healthcare and care models, e.g. patient/doctor relationship, healthcare payment models and the care process. This cluster has been named “Care Models”.

mHealth Trust	**Care Models**
Importance of privacy	Doctors trust patients
Mobile devices intervene	Care process fragmentation
Security and health	Responsibility and liability
Trustworthy certification	Pay for performance
Flexibility and freedom	mHealth payment model
General data protection regulation	Patient-doctor sharing of data
Forced use of mHealth applications	Flexible care models
Geographical divide	Face-to-face replaced
Apps motivate	New stakeholders
Technical interoperability	Involved patients

5.5 Naming the Subplots

Having identified all the flip-flop questions and grouped the uncertainties in two clusters, we are now ready to perform the last step before scenario write-up, i.e. naming the different subplots that will define the scripts.

In the clusters we now deploy the flip-flop questions from Chapter 5.3. We analyse and group the responses thus resolving one entire cluster into a large-scale flip or a large-scale flop. We do this for both clusters.

In the **mHealth Trust** cluster we arrive at the following large-scale flips and flops:

Flips for mHealth Trust	**Flops for mHealth Trust**
• Privacy issues will have a low priority for especially the younger generation of users • Mobile devices will be used to intervene to ensure patient compliance • eHealth technologies and applications are used for public health warnings regarding e.g. communicable diseases • Trustworthy certification for mobile health services and applications is in place • mHealth is giving all stakeholders more flexibility and freedom • Geographical location will determine the extent of patients' freedom of use • Patients are forced to use mHealth applications • Apps motivate people to be active in their own healthcare • A uniform general data protection regulation is in place in European member states • Full technical interoperability is now a reality *which leads to the name* **mHealth empowerment**	• Privacy issues will have a high priority for all users • Mobile devices will not be used to intervene to ensure patient compliance • eHealth technologies and applications are not used for public health warnings regarding e.g. communicable diseases • Trustworthy certification for mobile health services and applications is not in place • mHealth is not giving all stakeholders more flexibility and freedom • Geographical location will not determine the extent of patients' freedom of use • Patients are free to decide if they want to use mHealth applications • Apps do not motivate people to be more active in their own healthcare • A uniform general data protection regulation is not in place in European member states • Full technical interoperability is still not a reality *which leads to the name* **mHealth disempowerment**

In the "big flip" mHealth Trust cluster, mHealth technologies and applications are pervasive and incorporated in healthcare delivery. The technological and regulatory context supports the wide use of mobile health technologies. Mobile healthcare applications have become an integral part of healthcare management and self-management of chronic diseases. This cluster facilitates scenarios where the medical and regulatory context empowers the implementation of mHealth solutions. We can therefore name this subplot "mHealth empowerment".

In the "big-flop" cluster, mHealth applications and services are available, but several issues, e.g. a lagging regulatory framework, technological challenges, patient attitude, and ethical concerns, hinder their full implementation into healthcare delivery models and self-management of chronic diseases. This cluster points towards scenarios where the full potential of mHealth is disempowered by various issues and challenges. We name this subplot "mHealth disempowerment".

In a similar way we create two clusters in the Care Models cluster using the flip/flop questions:

Flips for Care Models	**Flops for Care Models**
• Doctors are paid on the basis of "pay for performance" • A clearly defined mHealth payment model has been implemented • Patients want to share their health data with doctors • Care models are flexible and holistic • Remote care has begun to replace face-to-face care • Doctors trust that patients' own measurements are accurate • The care process is continuous • Patients, doctors and developers are equally liable • mHealth projects will increasingly be funded by a new type of stakeholder • Patients are more involved and active in their own healthcare due to mHealth solutions and services	• Doctors are not paid on the basis of "pay for performance" • A clearly defined mHealth payment model has not been implemented • Patients do not want to share their health data with doctors • Care models are not flexible and holistic • Remote care has not begun to replace face-to-face care • Doctors do not trust that patients' own measurements are accurate • The care process is not continuous • Patients, doctors and developers are not equally liable • mHealth projects continue to be funded by the traditional stakeholders • Patient are not becoming more involved and active in their own healthcare due to mHealth solutions and services
which leads to the name **Innovative care models**	*which leads to the name* **Static care models**

The "big flip" Care Models cluster has care models that are supported by mHealth solutions and which actively engage the patient in his/her own healthcare and disease management. The patient is in the centre and care models are adapted to personal needs. The economic and liability framework for care models and healthcare delivery has been adapted to the new forms of healthcare delivery which mobile technologies offer. We call this subplot "Innovative care models".

By contrast, the "big flop" Care Models cluster describes a situation where the availability of Health solutions and services has not enabled a reformation of existing fragmented care models. The non-existence of appropriate payment models for mHealth services and the existence of a general clinical scepticism towards giving patients more responsibility and liability means that there is no real incentive for adopting and implementing mHealth in care models. This subplot has been named "Static care models" because the care models are inflexible and the clinical and economic context makes it impossible to use mHealth as a way to develop new and different care models.

5.6 Multiple Images of mHealth in 2025

We are now able to define the structure of the scenarios by looking at all the environmental factors in the matrix.

5.6.1 Developing the Scene

We find the environmental factors that make up the scene in the lower left quadrant of the grid. These factors are considered to be fairly certain and are thus common for all the scenarios.

mHealth solutions are available and have influenced changes in the structure and organisation of healthcare. Due to the lack of medical professionals, mHealth solutions have been implemented to support unskilled healthcare workers in the field, particularly in remote areas. Using a mobile device,

unskilled health workers have instant online access to health information databases and/or possibility of real-time communication with a medical expert. This support makes it possible for unskilled health workers to give a diagnosis and thus decide on the recommended treatment in consultation with experts.

Another consequence of the lack of medical professionals is that the number of informal carers has increased and is now playing a significant role in healthcare delivery. Informal carers are first and foremost family members. Both informal carers and the patients themselves are well informed about their condition, symptoms and available treatments due to the vast amount of health information that is available online and via health related apps.

Patients play an active role in their healthcare and have become co-responsible for their health and for managing their condition. Doctors no longer carry the sole responsibility when patients use a mobile health application to support them in managing their condition; the patient is responsible for the prescribed correct and proper use of the mobile health application. The advantages of mobile health applications, e.g. improved and constant monitoring, access to health data etc., have eased patient acceptance significantly.

Ethical concerns about privacy and protection of data have meant that explicit consent must be collected from patients repeatedly to use the data collected, transmitted, analysed and stored by mobile devices.

Technological standards regulations have been defined and are likely to have an effect on future mHealth developments and implementations.

5.6.2 Building the Sets

The environmental factors in the lower right quadrant, the Trends, constitute the changing sets that are built into the scene for each scenario. Several trends were identified by experts during the vision scenario workshop. Trends do not necessarily form a cohesive, single targeted trend for the future.

1) One trend has to do with patients' role in and experiences of the mHealth services and applications. Patients expect instant medical attention as mHealth applications and technologies enable them to interact with their doctors in new ways, i.e. through text messaging, access to medical data, etc. Patients are not only embracing mHealth Apps, they are also developing mobile health related applications based on their personal experience and needs in dealing with their medical condition. In addition, patient organisations have become very influential thus giving patients, and especially groups of patients with specific conditions, a unified voice in promoting patients' needs and rights.

2) Another trend points in the direction of medical professionals' increased use of mobile applications and technologies. Mobile devices have become a necessary tool for professionals for access to health information, medical data, symptoms and treatment guidelines when attending patients. mHealth applications and services are used to support and improve patient-centred disease management.

3) The third trend is related to healthcare provision and costs. Rising healthcare costs have meant that co-payments have been adopted for most healthcare services. At the same time, specific reimbursement schemes for eHealth and mHealth are being implemented which motivates both doctors and patients to use eHealth services and applications but which also eases the integrating of these technologies into healthcare delivery strategies and care models.

4) A fourth trend concerns the technological developments in relation to healthcare. In order for mHealth to be adopted some basic issues have had to be resolved. Thus, compliance with technological standards has been made mandatory, there are fixed guidelines for how data should be managed, and information, system and connection reliability has been established.

5.6.3 Jokers

The top left quadrant, the Jokers, are used to add an extra dimension or twist to the four scenarios. This way we avoid that the scenarios become too uniform.

5.6.4 Defining the Script

In the final step, the four scenarios come to life as imaginative plays defined by scripts. In writing the scripts, it is useful to let the environmental factors enter according to a simple grouping: What is happening, how is it happening and why is it happening?

What is happening?

Mobile technologies and application related to healthcare are changing the ways healthcare is being delivered. Instant and mobile access to medical information and expert knowledge and advice has enabled unskilled health workers to deliver care and treatment previously limited to doctors and nurses. In a similar vein, patients themselves and informal carers are better informed due to both the use of health related mobile apps and online access to the established health portals that provide public health information and education.

How is it happening?

The general push towards "everything mobile" has also affected healthcare delivery, and mobile devices such as the smartphone are becoming more and more reliable and sophisticated. The existing infrastructure networks for mobile phones are used to provide mHealth solutions and services.

Why is it happening?

The combination of a shortage of medical professionals and available mHealth applications and services has necessitated the development of new ways of providing care and of improving existing care to patients. The popularity of off-the-shelf mobile health apps has eased patient acceptance of mHealth.

5.7 Writing up the scenarios

We are now going to define four scenario structures generated from the two clusters "mHealth Trust" and "Care Models" each of which has two states or sub-plots. The possible combinations are as follows:

1. mHealth empowerment + Innovative care models
2. mHealth empowerment + Static care models
3. mHealth disempowerment + Innovative care models
4. mHealth disempowerment + Static care models

1. There must be an app for that!

Healthcare delivery has become digital and mobile; eHealth and mHealth technologies and applications are vital tools for how, when, where and by whom healthcare is delivered.

mHealth is enabled by the existence of wireless networks and mobile platforms that support full interoperability of all mobile technological solutions that fulfil European standard requirements.

Another important hurdle, namely how doctors are reimbursed, has been overcome by the implementation of clearly defined mHealth payment models combined with a "pay for performance" model. Doctors get paid based on the number of different mHealth services they offer and on the basis of how on the number of patients treated using mHealth solutions and/or applications. While there is a distinction between apps prescribed by the doctors and apps that patients download privately, this payment model also compensates doctors when patients present data from their non-prescribed apps during the consultation.

The overall saturation of smartphone and off-the-shelf apps for everything and anything imaginable has also reached the healthcare system and how patients themselves deal with their medical condition. Using health related apps has become a way of life and patients want apps that respond precisely to their individual needs. Mobile apps developers have now become important stakeholders in the healthcare eco-system.

mHealth is not only used to support and improve the care for the individual, it is also employed for public health purposes. Traditional direct targeted Text Messaging for the purpose of general health education and information has been taken a step further. Today, anyone who has downloaded the public health service app on their smartphone will receive an automatic text message informing them of the presence of communicable diseases in the area. The same app allows public health authorities to receive data from users' smartphone every time the user enters or leaves an affected area.

Patient and clinician reservations and concerns towards the use of mHealth services and application have been overcome by the implementation of trustworthy certifications which are in place across Europe. This makes it simple and easy to verify, even for the patient, whether an application has been approved for medical use. In addition, data protection and data management regulations have been adopted, enabling the use of mHealth services and applications without jeopardizing the protection of personal and medical data.

In medical practice, mobile technologies and applications have become embedded in patient-centred disease management and flexible care models, which have been able to compensate for the diminishing clinical personnel resources. In fact, patients, especially chronic patients who have particularly high needs and requirements concerning continuous care, hardly even perceive or experience the lack of medical staff. On the contrary, patients feel more connected to their doctor and more actively involved in managing their condition when they have to actively use mobile applications to monitor, record, and transmit medical and personal data.

In addition, simple mobile apps make it possible to collect and record other data than simply those directly connected to the condition in question which strengthen the holistic care model approach. The patient's experience, lifestyle and well-being are all taken under consideration and different apps can provide support for any of these issue. This could be air pollution data for asthmatic patients carrying a GPS-enabled device which records where and when they use their inhaler. The data can then be shared with other users and a map showing "polluted areas" can be generated. In this way, asthmatic patients can either avoid those particular areas or take their precautions if they have to enter them. In many ways, these types of applications enable citizen-centred surveillance of health risk factors similar to that employed by the state for public health warnings.

While the vast majority of patients readily embrace mHealth services and applications, patients living in remote areas actually do not have a choice. The scarcity of human resources, the deployment of mobile platforms, wireless networks and technological solutions make mHealth the obvious solution to improve the provision of care for people in remote areas. In addition to the traditional features of remote care and monitoring, an increasing number of unskilled health workers cover health needs in remote areas. Mobile applications and platforms support these workers in making skilled decisions and providing treatment and care.

2. Aaarrgh!

This scenario describes a situation where the healthcare system is conservative, neither adapting to patients' individual health needs nor the technological possibilities.

If new care models are even considered they have to be adapted to existing care spaces and healthcare systems, and though numerous eHealth and mHealth technologies and applications are available and interoperable, patients are not actively involved in any decision-making processes regarding their own care.

EU data protection regulations have been put in place as has reliable certification for mobile health services, but a clearly defined payment model for mHealth services is yet to be implemented. Doctors are still typically reimbursed per patient and per visit, and independent of performance and outcomes. Because of this very traditional set-up, face-to-face visits in the doctor's office are still the norm in spite of the abounding opportunities for remote care and communication.

Another reason for this state of affairs is the lack of trust by doctors in measurements taken by the patients themselves, mainly due to the fact that liability remains with the doctors. This again puts a considerable damper on patients' incentive to play an active role in their own healthcare, even though the technology is there to support it, e.g. by the use of mobile devices for ensuring compliance. Patients feel that the motivation they experience when using the many available apps which can often be tailor-made to fit their particular situation perfectly meets with the brick wall of traditional care models in traditional healthcare systems funded by the traditional stakeholders. Regardless of the considerable influence and pressure from patient organisations, new types of stakeholders interested in funding mHealth solutions have met great resistance from a conservative market.

The frustration of higher co-payments without the benefit of the instant medical attention that is technologically achievable is the basis for a less-than-ideal doctor-patient relationship.

3. Something's missing

This scenario reflects a situation where the foundation has been laid for a widespread implementation of mHealth solutions together with innovative care models based on continuity of care and an active patient role. However, technological restraints in terms of privacy, trust and interoperability remain unsolved and therefore the use of mHealth is free of choice instead of the only choice.

The existing mobile platforms and infrastructure networks for mobile phones are capable of fully supporting mHealth solutions and services. Mobile devices that can support health related applications and service are reliable and numerous pilot projects have demonstrated that mHealth services and applications can improve the efficiency and quality of healthcare delivery. However, there are still some of the more complicated regulatory, technological and end user issues to be resolved before the potential of mHealth can truly benefit medical professionals, patients and society at large.

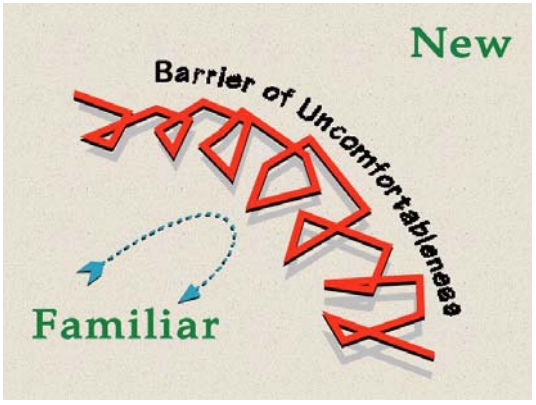
The healthcare eco-system is based on providing holistic and continuous care to patients. Care models are based on patient-centred disease management and on substituting as much as possible with mHealth solutions and services. Patients with chronic conditions are a particular target group for mHealth because mHealth technologies offer various ways of improving and intensifying the

monitoring of these patients. One of the main problems with this group is compliance; patients either simply forget to take their medication or they neglect to do so if they "feel fine". This patient behaviour is responsible for many serious, but actually avoidable, complications that often require hospitalization.

In theory the care models are based on the premise that mHealth services and solutions should always be offered and if remote care is possible, then face-to-face care is considered obsolete. In practice, however, patients are free to choose if they want remote care and other mHealth services. Moreover, some regulatory and technical issues, such as lack of interoperability and data protection issues, are still unresolved which limits the full potential of mHealth. The result is that the technological possibilities that could greatly improve disease management, including patient compliance, are not being used consistently.

Doctors have also observed that most patients have downloaded health related apps prior to their diagnosis, but that the idea of using these apps as an integral part of their disease management makes many patients worry about protection of privacy. While patients want to share their data with their doctor, they also want to be fully in control as to when, why and how to do so. The lack of data and privacy regulations and policies to cover the new ways of collecting, transferring and storing data in the context of eHealth and mHealth means that patients have no legally recognised guarantee that their personal data will be fully protected, and therefore many opt out of mHealth services.

Medical staff has used mobile devices as a tool for years and having wireless online access to health portals and databases, electronic patient records, medical data etc. is taken for granted. Now that payment models for mHealth services are in place, most medical professionals are very eager to take full advantage of the potentials of mHealth and to offer these services to diminish the burden of increasing numbers of chronic patients. While this group of medical professionals is concerned about the lack of trustworthy certification of mHealth services and applications, those clinicians that are more sceptical use this to blankly refuse to incorporate mHealth in their practice.



4. No one likes change

In this scenario mobile technologies and applications have not yet met the criteria which need to be fulfilled for a widespread, acceptable and formal use of the technologies in healthcare delivery. As a result it has not been possible to implement the technological developments and potentials with healthcare systems in a revolutionary way. This is due to technological restrictions as well as societal hesitation. Society has not been able to adapt to the changes mHealth represents for all the stakeholders in the healthcare system and there is an unwillingness to implement technological progress and change healthcare models accordingly.

The use of smartphone and apps is widespread and the mobile networks are reliable and able to support the steady increased traffic and transmission of data. However, privacy and data protection issues prevent authorities and governments from using the data constructively. One example is the recent global bird flu outbreak which led to an EU proposal to use eHealth technologies for monitoring of communicable diseases and use mobile applications to map the movement of persons who have been in contact with infected areas. The proposal was rejected on grounds of privacy and data protection issues, particularly in the light of recent incidents where medical data was bought by a 3rd party and used for commercial purposes.

The distrust in mHealth technologies is also reflected in the lack of use by doctors as well as patients.

Despite the popularity of off-the-shelf apps including health related apps, trial pilots using these applications have shown that patients do not become more actively engaged in their own healthcare. Part of the explanation for this is that doctors do not trust the measurements that patients do at home using mobile applications. In addition, doctors especially do not want to rely or base their treatment on patients' readings because they are still ultimately liable if something goes wrong due to incorrect data. Another reason is that many patients have experienced problems with connecting their device or application to the healthcare platform because of the lack of full interoperability problems. Basically, each different service would require a specific device thus making it impossible to change service provider or service type without also changing the device.

But perhaps the most influential barrier to the deployment and implementation of mHealth services and applications is quite simply the question of money! Doctors are expected to adopt mHealth but as these services do not fall into any existing category, there is simply no way of claiming payment for offering mHealth services. Assumptions that the steady increase of the number of chronic patients GPs must provide care for would encourage the uptake of eHealth and mHealth technologies to provide better and remote monitoring, support medical compliance and self-management have simply proved wrong because of the lack of payment models and other incentives such as payment for performance where keeping a chronic patient out of hospital would activate a bonus to the GP while re-admission would result in a reduction in fee.

While there is an overall demand for flexible and holistic care models and a continuous care process, the demand remains unmet. The potential of mHealth to set new standards for care has been deflated by arguments that mHealth services and application defragment the care process because they change the traditional care delivery path.

6 Appendix A – Description of the IDON methodology

Using the IDON method step by step will result in a set of scenarios that all point to alternative use cases within a given user domain and at a given point in time. All scenarios will have the same frame of reference and – ideally – be equally likely to happen.

IDON Scenario Thinking is based on the logical intuitive story-and-simulation approach to scenario thinking and was originally developed in consultation with Arie de Geus, author of "The Living Company" while head planning coordinator of Shell International.

The IDON method consists of two parts: Scenario Development and Scenario Deployment. The scenarios are developed in the Scenario Development part using experts and based on knowledge and systematic analysis. The aim is to develop four mind-challenging scenarios by mixing inevitable trends with creative fiction.

In the MovingLife project, the Scenario Deployment part has the very specific purpose of helping us analyse the gaps between the "as is" (state of play) with the alternative "to be" states (the scenarios).[2] Connecting the "as is" with the "to be" is an integral part in developing the roadmaps. The scenarios thus feed directly into the work to be carried out in *WP4 Development of Roadmaps*.

6.1 Creating and Writing Scenarios with a Group

Scenarios are constructed from a varied background of knowledge and guesswork about the relevant environment and the trends and discontinuities likely to happen in the future and affecting the users' business and way of work. The scenarios will draw on both available research and application knowledge in the consortium and on the opinion of a diverse group of experts from different parts of the domain.

The process and group dynamics is managed by a group facilitator, who is also responsible for the final documentation and write-up of the scenarios.

The entire IDON process can be illustrated graphically as in Figure 1.

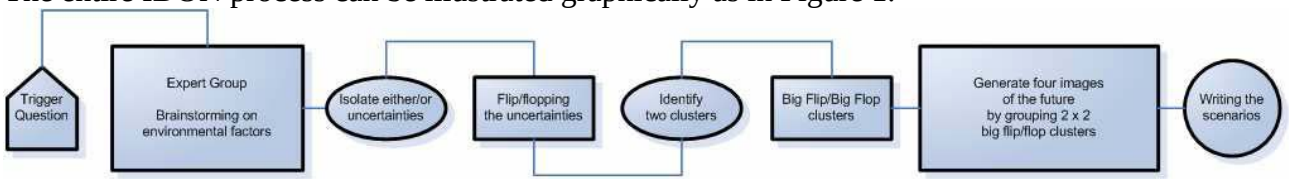


Figure 1: The IDON process

6.2 Environmental Factors

The core of the IDON technique is to examine a set of wider environmental factors, ambiguities and uncertainties identified by the group, in order to resolve which role they are likely to play in the unfolding of a variety of scenarios. The precise definition of environmental factors depends on which domain we are dealing with.

Some of the environmental factors that might be covered in the discussion process are:

- Research and technology trends
- Institutional and market trends
- Social values and lifestyles

[2] In RTD projects, in the Scenario Deployment part, technical experts and project decision makers interpret the scenarios and extract a framework for the functional and trust and security requirement specifications.

- Economic futures
- Management and delivery systems
- Ethics and values questions
- Global political influences
- Ecological and environmental issues

It can be difficult to move from such a set of factors to actually construct scenarios, but the IDON method and its systematic approach is a good way to do it and has proven its usefulness in many other projects.

6.3 The "Trigger Question"

The initial phase of the IDON method involves three steps. After this phase, a variety of environmental factors will have been identified, evaluated and ranked.

Step 1 – Gathering environmental factors

The facilitator formulates a question designed to elicit responses from participants, which will cover the subject under investigation. This is called the "Trigger Question" because it triggers a whole range of creative thoughts about the subject.

Step 2 – Positioning on the grid

The next step is to group factors according to their degree of uncertainty and how direct their impact is likely to be on the user domains.

The method is visualised using a conventional two-dimensional grid:

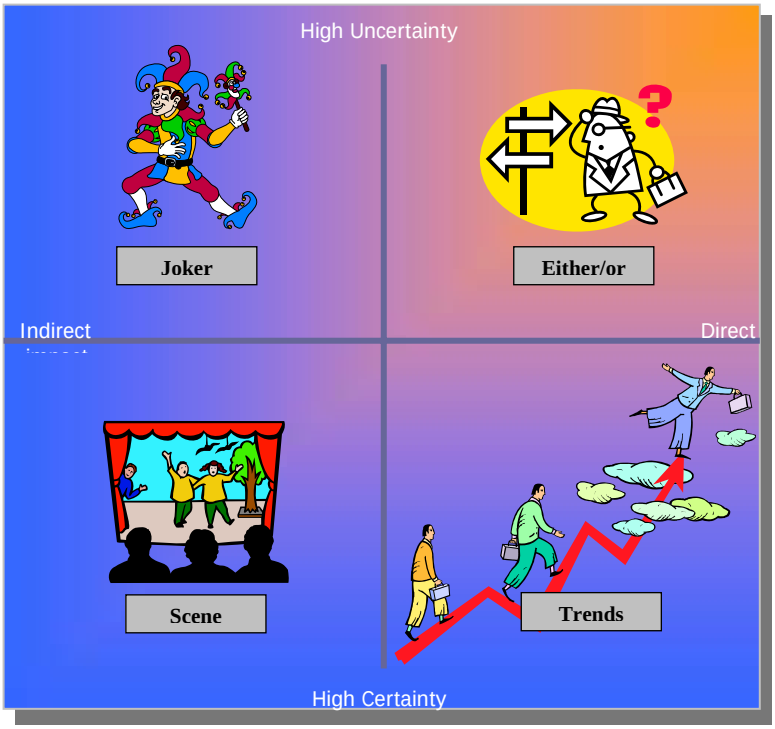


Figure 2: Two-dimensional grid

The dimensions of the grid are introduced, without interpretation at this point. The idea here is to begin to categorise the different factors, placing them on the grid, where the participants feel they best belong. Each factor is taken in turn and its position discussed and provisionally fixed according to its perceived "Higher" or "Lower" degree of uncertainty and "Indirect" and "Direct" impact in the use cases. Note that absolute positioning is not the point; it is the relative positioning that is important.

Step 3 – Survey all factors

When all the factors have been placed in position, the whole set is reviewed by the group and fine adjustments are made in relative positioning.

6.4 Characterisation of the Quadrants

Each quadrant has a different interpretation, but there is no sharp line of distinction either vertical or horizontal. The behaviour of each group of factors in broad terms is as follows:

Top - right: Pivotal uncertainties (Either/or)

These factors are likely to have a direct impact on the use cases, but their outcome is uncertain. They are pivotal in the sense that the way they turn out may have strong directional consequences. These factors will determine the shape of the different scenarios.

Top - left: Potential jokers (Joker)

These factors are rather uncertain as to their outcome and maybe also less relevant to the use cases. However, it could be dangerous to treat them as merely noise. They represent factors that should be monitored in case they move strongly to the right, i.e. develops a direct impact on the use cases.

Bottom - right: Significant trends (Trends)

These factors impact more directly on the use cases and it should be possible to anticipate their effect.

Bottom - left: Context shapers (Scene)

These are relatively certain factors and are bound to shape the future context

6.5 Use of the Quadrants

In the scenario building we are going to explore the uncertainties from the "Either/or" quadrant to derive a set of different scenarios for the use cases. Each scenario will thus reflect the uncertainties attached to the environmental factors grouped in this quadrant.

The environmental factors grouped in the other quadrants will be retained for reference and inclusion in the final stage of writing up the scenarios in the following ways:

- The factors in the context shapers quadrant are those that should be woven into every scenario, if it is written up fully. These factors will be used to describe a common scene for all scenarios.
- The significant trends will also be found in each scenario, but the manner in which they manifest themselves will be different. The factors in this quadrant can be said to constitute different sets placed on the scene.
- The potential jokers are useful factors to bring into the scenarios during the process, if the scenarios are starting to become too uniform.

6.6 Creating Prototype Scenarios

Scenarios can be thought of simply as having three levels. At base level there are the context shapers, which seem fairly inevitable and will tend to underpin all scenarios at a given time – these are changes that are common throughout, like the stage in a theatre.

At the intermediate level there are trends, which can be quite complex because of the variety of ways they can interact with each other. These will be modified from scenario to scenario, but still retain their basic condition. These can be likened to the changing scenery in a play.

At the differentiated level each scenario has some unique variances. These differences arise from the uncertainties we perceive. An uncertainty about something means that at least things could go this way or go the other way. Uncertainties may be mainline or they may be jokers.

As these uncertainties interact in different ways that affect how things turn out, the number of combinations of even twenty variables is enormous. We need a way to simplify this information, without diluting its impact, into different emergent stories of the future. These may be perceived as the different dramas that might be put on in a theatre. In order to do this we go through the following stages in creating prototype scenarios from which a full set of scenarios can be developed.

Arriving at the prototype scenarios involves three steps:

Step 1 – Rephrasing the Pivotal Uncertainties as Questions

Looking at the factors in the quadrant marked "Either/or", participants are invited to think of each one as an uncertainty question for which there are two possible outcomes. We will call one outcome state the "flip" (e.g. Yes, education will be affordable) and the other contrasting outcome state the "flop" (e.g. No, education will not be affordable). When the factor in question has either "flipped" or "flopped", the uncertainty is resolved.

An example may illustrate the technique. Assume that the group is working on writing scenarios in a teaching environment. The left-hand column lists the questions/factors that were phrased based on the environmental factors (as written on the note cards that were positioned in the quadrant "Either/Or"). The right-hand column then lists the "flipping/flopping" of each environmental question.

Price of education How will the price of education develop in the future?	+	Education will continue to be affordable
	-	Education will become relatively more expensive than today
Access to information How accessible will information be?	+	Easy access to information
	-	Difficult to get access to information
Media types Which media type will proliferate?	+	Electronic media dominates
	-	Traditional media will be retained
Mobility How will people move around?	+	Commuting will be increasingly difficult
	-	Mobility will increase
Equipment Will people have access to the necessary equipment?	+	Access to learning equipment is facilitated
	-	Equipment is only available to few
Learning method What will be the dominant leaning method?	+	Emphasis on individual learning
	-	Emphasis on shared learning

Organizational How will organizational learning evolve?	+	No take-up of organizational learning
	-	Adoption of organizational learning
Collaboration Will people collaborate with co-workers?	+	Minimal collaboration
	-	Collaborative thinking at work
Feedback What kind of feedback is available?	+	Poor feedback systems
	-	Effective feedback systems
Global pressure How will the pressure for better education develop?	+	Global pressure will be reducing
	-	Global pressure for "best in class"

Step 2 – Grouping the factors

We will now search for connections and associations between the various factors (uncertainties). Uncertainty areas connect because of the impact of their influence on each other, either because if one "flips" the other will "flop" or because they are likely to align by association.

This is a kind of domino effect. The group will continue to work with the associations, until there are two main clusters or at least two priority clusters out of a set. In the example above there are 10 environmental factors (uncertainties) of which the first 5 have to do with how people will approach learning ("Learning Location"). The remaining five can be said to relate to the "Learning Culture". It is thus possible to set up the two main clusters as follows:

Cluster One: Learning Location	**Cluster Two: Learning Culture**
• Price of education • Access to information • Media types • Mobility • Equipment	• Learning method • Organizational • Collaboration • Feedback • Global pressure

Step 3 – Naming the subplots

In the clusters we now have groups of questions. When one of the uncertainty questions resolves to, say, a "flip" side, it will tend to correlate with the "flip" side of all the other uncertainties in that cluster. This will end up resolving the entire cluster as a large scale "flip" or "flop". It is rather like a group of little magnets organizing themselves to a main north pole and south pole. The two outcomes of the whole cluster are called subplots, which will combine in different ways according to the "flip/flop" questions to give us different scenarios.

In the example we can now group the uncertainties in the "Learning Location" cluster as big "flips" and "flops":

Big Flip Cluster "Learning Location"	**Big Flop Cluster "Learning Location"**
• Education affordable • Easy access to information • Electronic media dominates • Commuting increasingly difficult • Access to learning equipment leads to the name: **REMOTE LEARNING**	• Education will be expensive • Difficult to access information • Traditional media retained • Mobility will increase • Equipment only for the few leads to the name: **LOCAL LEARNING**

In a similar way we can group the "learning culture" cluster:

Big Flip Cluster "Learning Culture"	**Big Flop Cluster "Learning Culture"**
• Emphasis on individual learning • No up-take of organizational learning • Minimal collaboration • Poor feedback system • Global pressure reducing leads to the name: **INDIVIDUALISM DOMINATES**	• Emphasis on shared learning • Adoption of organizational learning • Collaborative thinking at work • Effective feedback system • Global pressure for best in class leads to the name: **CORPORATISM DOMINATES**

Each name needs to express a coherent alternative view of the combined uncertainties – more than simply "good" or "bad" but suggestive of how things might develop. They should be imaginative and evocative, like good chapter headings of a novel, and easy to remember, because throughout the project, the names will be used to quickly identify a tremendously complex set of future uncertainties in a large number of environmental factors.

6.7 Generating Multiple Images of the Future

When the subplots have been generated using the "flip-flop" method, they need to be combined to form scenario structures. On the one hand this is a logical process in which there are a set number of combinations statistically. On the other hand it is an intense exercise of imagination and judgment, where the participants are challenged to synthesize each set of combinations to formulate scenario stories, which are stimulating and relevant to the thinking task.

The purpose of this is to arrive at creating four scenarios generated from the two clusters, each of which has two states or subplots. The titles of these scenarios will represent four distinct possible futures extrapolated from the thinking done by the group and will hold rich meanings, which can be further fleshed out when the scenarios are written up after the exercise is completed.

The four outcomes from the two clusters can be combined in four different ways to form images of the future. In our example the possible combinations are as follows:

1. Remote Learning + Individualism Dominates

2. Remote Learning + Corporatism Dominates
3. Local Learning + Individualism Dominates
4. Local Learning + Corporatism Dominates

The group members now use their imagination to form a mental picture of the world that emerges within each of the four combinations and formulate a provisional title for that world. The result will be presented in a two-dimensional grid like this:

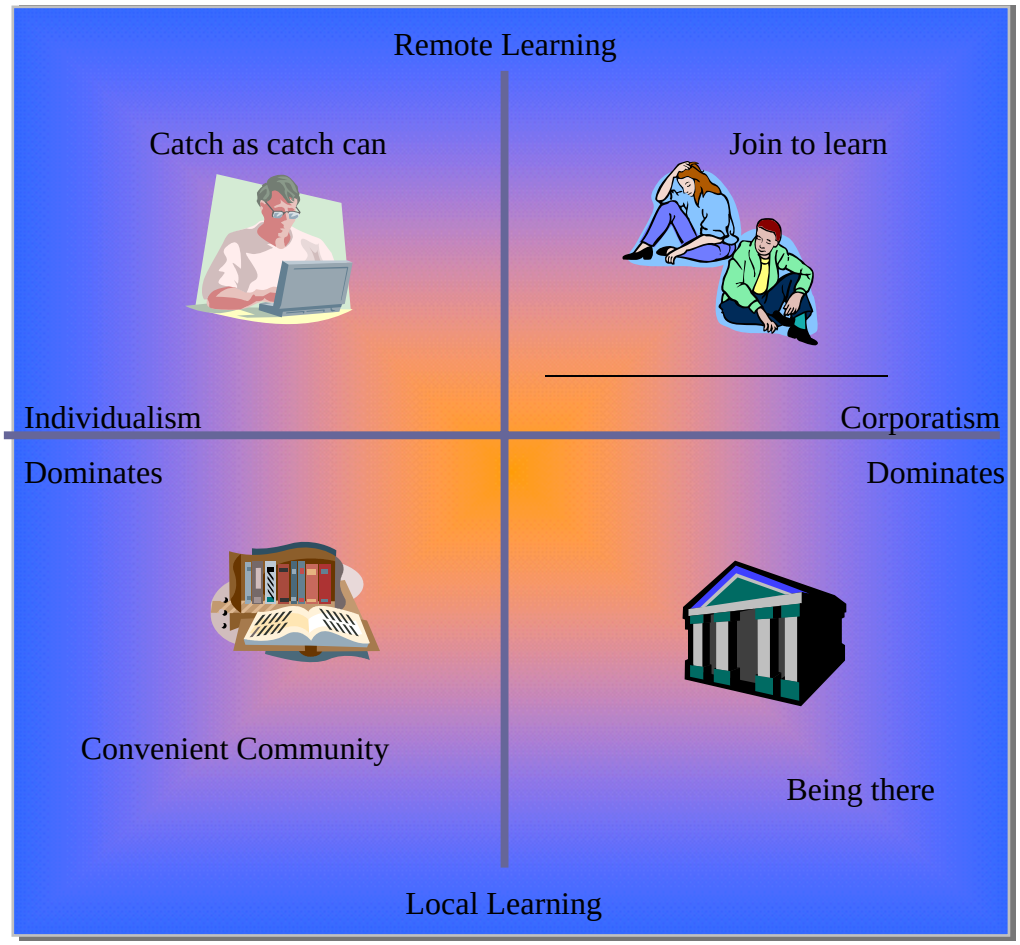


Figure 3: Four scenarios

6.8 Writing up Scenarios

At the end of the exercise the scenarios are written based on the group discussions and the imaginations and visions created during the workshop. Group members usually perform the writing up of the stories after the workshop.

Step 1 – Development of the scene

When a scenario is written, the writers start with the scene, which is common for all scenarios. The elements for defining the scenes are found in the lower left “Scene” quadrant of the original grid of environmental factors. The scene must reflect the basic characteristics of the user area, for which the scenarios have been developed.

Step 2 – Building the set

The environmental factors in the lower right "Trend" quadrant constitute the changing sets that are built on the scene for each scenario. Trends have a direct influence on the story in the scenario, but only the environmental factors relevant to the scenario are used.

Step 3 – Defining the script

In the final step, the story is written from the prototype scenario so that the scenarios come to life as imaginative plays.

In writing the scenarios, it is useful to let the environmental factors enter the scene, set or script according to a simple grouping:

- What is happening?
- How is it happening?
- Why is it happening?

The final scenarios can be illustrated with pictures to stimulate the reader's imagination.

7 Appendix B – List of Topics and Issues Raised

Topic, statement or question	*Explanation and comments*	*Environmental factor*
High uncertainty – indirect influence		
Patients have no inherent interest in health data	Patients have no inherent interest in being informed about all of their own health data	Health data for patients
Is telecare good care	Is telecare improving care	Telecare improves care
Penalty for readmissions and non-compliance	Will more penalties occur if patients do not show/adhere to/ comply and readmission becomes necessary	Readmission penalty
Free and premium versions of Apps	Will a basic version of an Apps be offered for free and then a premium version is only available for a fee/price	Basic and premium version of Apps
Commercial space on Internet sponsors mHealth	Free mHealth services on the Internet is made possible by selling commercial/advertising space on the webpage	Advertisements pays for mHealth
Data sold to 3rd party pays for mHealth services	mHealth services are offered for free to patients but patient data are sold to 3rd party	3rd party buys data
People sell/donate health data	Will people be able to sell and/or donate their health data	Selling / donating health data
Liability regulations	Liability regulations are in place	Liability regulations
Innovation a legal requirement	Doctors will be legally required to be innovative regarding healthcare delivery	Innovation requirements
High uncertainty – direct influence		
Privacy	Privacy issues have low priority for younger generation	Importance of privacy
Mobile device inject medicine	Mobile devices are used to intervene e.g. by injecting medicine	Mobile devices intervene
Health embedded in security	Health will become embedded in security issues as eHealth is used for public warnings of other people's disease	Security and health
Trustworthy certification	There will be trustworthy certification of mobile services and application for medical use	Trustworthy certification
Pay for performance	Doctors are paid based on a pay for performance model	Pay for performance
Who is paying for mHealth	Who is going to pay for mHealth services	mHealth payment model
Patients share data with doctors	Patients wants to share their health data with doctors	Patient-doctor sharing of data
Care models will be more flexible	Care models will be more flexible and have a holistic approach	Flexible care models
Remote care replaces face-2-face	Remote care will replace face-2-face care	Face-2-face replaced
Doctors trust patients' measurements	Doctors trust patients' own measurements of e.g. blood pressure	Doctors trust patients
Increasing fragmentation of the care process	Increasing fragmentation of the care process	Care process fragmentation
Will mHealth provide flexibility and freedom	Will mHealth provide flexibility and freedom for all stakeholders	Flexibility and freedom

Topic, statement or question	*Explanation and comments*	*Environmental factor*
Impact of general data protection regulation	What kind of impact will the forthcoming EU directive have for the regulation of general data protection	General data protection regulation
Patient, doctor and developer share responsibility	Patient, doctor and developer share responsibility regarding liability	Responsibility and liability
Patients in remote areas will not have freedom of use	Patients in remote areas will not have freedom of use; their geographical location decides whether they must have mHealth services	Geographical divide
Will new stakeholders be funding mHealth projects	Will new stakeholders be funding mHealth projects and thus create new business models e.g. combining mHealth with other service	New stakeholders
Are patients forced to use mHealth applications	Are patients forced to use mHealth applications	Forced mHealth application
Apps motivate people	Apps motivate people to be active in their own healthcare	Apps motivate
High certainty – indirect influence		
Acceptance	Patient acceptance of mHealth service represents a problem for its implementation	Patient acceptance
Patients are more informed	Patients become more and more informed and knowledgeable about their condition and healthy lifestyle choice	Informed patients
Implied versus explicit consent	mHealth will require explicit consent from patients	Explicit consent
Unskilled health workers can work in the field	Health workers who work in the field do not need proper skills as they are supported by mHealth services	mHealth support unskilled health staff
Healthcare go through fundamental changes due to mHealth	Healthcare go through fundamental changes due to the implementation of mHealth solutions and services	Healthcare changes
Regulations on technological standards	We need a professional statement and regulations about technological standards to drive real change	Regulation regarding technological standards
There will still be market and commercial barriers to interoperability	There will still be market and commercial barriers to interoperability	Interoperability barriers
There will be more family and informal carers	Shortages of professional healthcare staff means that there will be more family and informal carers	Informal carers
Patients responsible for their own healthcare	Patients responsible for their own healthcare	Patients responsible
High certainty – direct influence		
Patients engaged in developing mHealth	Patients are engaged in developing mHealth solutions and services	Patients develop mHealth
Mobile Apps	Mobile Apps are here to stay	Mobile Apps
Use of mobile Apps	People's use of mobile Apps will provide information for research and policy	Mobile Apps for research & policy
Technical interoperability	Full technical interoperability is made possible	Technical interoperability
Reliability	Information, system and connection reliability will exist	Reliability

Topic, statement or question	*Explanation and comments*	*Environmental factor*
Patients organisations are influential	Patients organisations will have a strong voice in eHealth policy making	Influential patients organisations
Preventing risks	Focus on managing and preventing clinical risks	Risk prevention
Technology increases surveillance	The technology will increase surveillance of patients	Increased surveillance
Reimbursement for mHealth and eHealth	Reimbursement schemes for eHealth and mHealth will be developed	eHealth & mHealth reimbursement schemes
Co-payments	Patients' co-payments of healthcare services will increase	Co-payments
Dependency on mobile devices	Patients and doctors are more dependent on mobile devices	Mobile device dependency
Technology extends warm hands need	Technology supplements and enables delivery of care particularly where there are shortages of healthcare staff	Technology extends warm hands
Patient-centred disease management	Focus is on a more patient-centred disease management, not only at the level of interaction but also at the level of development of services	Patient-centred disease management
Patients book appointments	Patients themselves will book appointments with relevant healthcare professionals	Patients book appointments
Patients more demanding	Patients will demand more from doctors	Demanding patients
Will complying to certain standards be mandatory	Will complying to certain technological standards be mandatory	Technological standard compliance
Correct data management will be defined	Correct data management will be defined	Correct data management
Patients more involved and active due to mHealth	mHealth solutions and services motivates patients to become more involved and engaged in managing their health	Involved patients
Younger generation demands health Apps	The younger generation will demand that health related Apps are available	Demand for health Apps