



REPORT

on

The establishment of a platform for the sharing of national eHealth strategies

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1. Executive Summary

This document intends to prepare the establishment of an online platform for the sharing of national eHealth knowledge and experiences between Member States (MS). In order to develop a common language and structure to facilitate this knowledge exchange, it is proposed a conceptual framework for sharing national eHealth experiences. This framework will serve as a starting point to the sharing of national strategies & action plans, and reference cases, for which it is also presented a proposed structure. The framework will also be on the basis of the development of a national eHealth maturity model for measuring the level of national implementation of eHealth based on a final score. The online platform is conceptualized at a high-level, focusing on the characterization of the main goals, platform users, and sections.

2. Introduction

In order to bridge the gaps between the levels of governance, strategy and operation, a dedicated mechanism for eHealth at the European Union (EU) level has been formally established in 2011: the eHealth Network (eHN).

The eHN is a voluntary network composed of high-level representatives from all national health authorities in the EU, and represents the highest decision-making body at the EU political level in the field of eHealth. The main objective of the eHN is to:

“work towards delivering sustainable economic and social benefits of European eHealth systems and services and interoperable applications, with a view to achieving a high level of trust and security, enhancing continuity of care and ensuring access to safe and high-quality healthcare”².

Its agenda is defined in the eHealth Network's Multiannual Work Plan (MWP) that is usually revised every four years. The Joint Action to support the eHealth Network (JAseHN), launched in 2015, acts as the main preparatory body for the eHN and thus aims to develop political recommendations and other policy instruments supporting the work of the eHN according to its MWP.

One of the four specific priority areas in which JAseHN is committed to is the *exchange of knowledge* on eHealth between MS. This subject is of the utmost importance because 1) countries are working on strategies to implement eHealth, having gathered significant information about their experience that could be shared with other MS, and because 2) there is a lack of standardization of guidelines and procedures on eHealth implementation across countries.

Therefore, the sharing of national eHealth knowledge and experiences may create synergies between countries, boost a transversal adoption of common practices, or even provide valuable insights to MS on a later stage of eHealth development. Ultimately, it will allow the creation of foundations for a sustainable European eHealth strategy, compatible and in compliance with national strategies.

One of the measures that facilitates this process is the establishment of a structured online platform for the sharing of national experiences and knowledge among MS.

2.1. Purpose

The overall purpose of this document relies on the:

- Conceptualization and proposal of a common framework for sharing national eHealth knowledge through an online platform;

¹ Through the Commission's Implementing Decision 2011/890/EU based on Art. 14.3 Directive 2011/24/EU.

² Article 14, 2(a) of Directive 2011/24/EU

- Definition of common structures to share strategy & action plans, and also reference cases;
- Conceptualization of a national eHealth maturity model to measure eHealth implementation levels and attribute a national score;
- High-level conceptualization of the desired-to-be online platform.

The main goal of this conceptual framework is to enable the creation of a common language to facilitate the sharing of national eHealth knowledge between MS. It includes not only national strategies and respective action plans, but also past experiences in the form of reference cases to help other countries to better address similar problems or challenges.

The national eHealth maturity model will allow to score countries based on their level of eHealth maturity and implementation, and to define the main actions each country must perform to progress along the maturity curve to pursue eHealth optimization stage.

Originally, all this information was planned to be integrated into an online platform, eventually managed by the European Commission (EC), allowing their users to access information shared by other MS through the use of interactive dashboards, or through the download of automatically generated documents based on the predefined available structures, for further detail. Until this is reality, Portugal will study the realization of a proof of concept platform, allowing interested MS to test loading and using the loading process as an exercise of testing their strategies and examples vis-à-vis the present frameworks under this deliverable.

This work does aim to be exhaustive of all possible and useful frameworks, as some additional could be useful specially for cross-border initiatives, such as the Revised European Interoperability Framework (REIF); however, as it focuses on internal and national efforts, the more adaptable structures were considered.

2.2. Scope

The presented conceptual framework is based on extensive research of state-of-the-art references to guarantee total compatibility and adaptability by all MS.

The framework is divided into three major strategic streams that will be explained in detail with several illustrative examples. This framework will guarantee the usage of a common language, and will serve as a starting point to the sharing of national strategies & action plans, and reference cases.

In an effort to standardize and measure eHealth development, this document explains how it will be possible to assess and compare national implementation levels based on a maturity model designed for eHealth.

This document also includes a high-level conceptualization of the online platform, focused on the definition of its main objectives; the definition of the main users; and, some of the main functionalities available by section. This should serve as a starting point for the Proof of Concept (PoC) that will be developed later. Therefore, the definition of the platform's requirements and architecture are not included in the scope of this deliverable.

3. Sharing eHealth knowledge

3.1. Progress towards eHealth implementation in Member States

The commitment of the European countries to the national development of eHealth solutions is undeniable and has been a reference worldwide.

Anchored in a joint collaboration between health sector and Information & Communication Technologies (ICT) sector, MS are "actively building upon their national foundations for eHealth to deliver public health and health services in a more strategic and integrated manner"³, making the best use of the existing resources and capabilities. According to Empirica's report on the European countries progress towards national eHealth infrastructures, almost all MS of the EU "either have already started with or will undertake the implementation of national systems"⁴ in the scope of eHealth.

In addition to this national commitment, Europe is also actively working on the establishment of a European eHealth Vision.

The first formal commitment of MS to collaborate on this subject was the *eHealth Action Plan 2004-2011*⁵, followed by several initiatives and pilot projects to foster eHealth implementation in EU⁶. More recently, the *Directive in the Application of Patients' Rights in Cross-Border Healthcare*⁷ of 2011 established the legal basis for the eHealth Network supported by the *eHealth Governance Initiative (eHGI)*, a mechanism prior to JaseHN. The current *eHealth Action Plan 2012-2020*⁸ focuses on the "interoperability of e-Health services [...], e-Health deployment and uptake (funding, awareness, evidence, digital health literacy, etc.) [...] and the need to strengthen international cooperation among EU MSs and to increase e-Health research and innovation"⁹. Finally, the *Digital Single Market Strategy for Europe* includes telemedicine and eHealth as leading digital technologies in the EU.

Concluding, it is unequivocal that this is a favorable time for Europe to build solid and lasting eHealth solutions that should be shared among MS.

3.2. The need for an European eHealth-based knowledge exchange

Despite the collective effort across MS in the path to establish a common eHealth vision, there are some challenges that still need to be addressed.

Firstly, there are structural differences in eHealth development between EU countries. Some MS like Ireland, Sweden or Scotland have built national-wide eHealth strategies and clearly defined their goals and priorities. However, the majority of MS has not adopted yet comprehensive and integrated strategies, being some of them only focused on isolated initiatives that are not part of a

³ World Health Organization. 2016. *From Innovation to Implementation: eHealth in the WHO European Region*.

⁴ Stroetmann, Karl A.; Artmann, Jörg; Stroetmann, Veli N.; et al. 2011. *European countries on their journey towards national eHealth infrastructures - evidence on progress and recommendations for cooperative actions – Final European progress report*. Empirica. European Commission. Retrieved from: http://www.ehealthnews.eu/images/stories/pdf/ehstrategies_final_report.pdf

⁵ Commission of the European Communities. 2004. *Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions: e-Health - making healthcare better for European citizens: An action plan for a European e-Health Area*. SEC(2004)539. Retrieved from: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52004DC0356&from=EN>

⁶ Examples include: *epSOS* (Smart Open Services for European Patients) pilot project aiming to ensure cross-border interoperability between electronic health record systems at a pan-European level; *Renewing Health* (REgionNs of Europe WorkINg toGether for HEALTH) pilot in nine countries to validate and evaluate new telemedicine services; and *Lead Market Initiative for Europe* to facilitate demand growth for innovative products and services in six leading markets – bio-based products, eHealth, sustainable construction, protective textiles, recycling, and renewable energy.

⁷ OJ L88, 4.4.2011, p.45 - 65

⁸ European Commission. 2012. *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: e-Health Action Plan 2012-2020 – Innovative healthcare for the 21st century*. SWD(2012)413. Retrieved from: http://ec.europa.eu/health/sites/health/files/ehealth/docs/com_2012_736_en.pdf

⁹ Quaglio G, et al. 2016. *E-Health in Europe: Current situation and challenges ahead*. Health Policy and Technology. 5, 314-317. Retrieved from: <http://dx.doi.org/10.1016/j.hlpt.2016.07.010>

national strategy. This evidence demonstrates how complex and demanding it is to implement eHealth strategies, even when developed ICT national environments exist to support them.

Secondly, despite all initiatives at the EU level regarding this issue, there is still a lack of standardization on guidelines and procedures, meaning that MS have moved in different directions and focused in different areas.

Given these diverse backgrounds and development stages, the diffusion and exchange of knowledge and experiences between MS may prove to be especially relevant in the European context, helping to accelerate the pace of development and to bring lagging countries to a similar eHealth development level.

4. Conceptualization of a framework for eHealth knowledge sharing

In order to guarantee that knowledge is shared and understood among MS, it is crucial to create a common language structure. The conceptualization of a framework may help to define how eHealth knowledge of each country can be shared at a European level.

Throughout the years, several countries and work groups worldwide have developed conceptual frameworks in an attempt to schematize eHealth reality in a structured and logical way.

In order to create a framework for the European context that is able to reconcile different strategies in a single structure, some mandatory requirements were defined:

- **Comprehensive** – the framework should include all the elements of the eHealth context (even in a generic way), so that all the information produced by a country can be shared;
- **Adaptable** – the framework should be easily adjustable to each country’s reality, regardless of the degree of eHealth development of the country;
- **Credible** – the framework should be based on the work already developed by renowned institutions or leading eHealth countries that successfully built their strategies based on these frameworks.

Several frameworks were considered and analyzed, including some models developed in the scope of European projects. At the end, the framework presented was based on three main references (see Annex A for more details on both frameworks and Annex B for a comparison between the proposed conceptual framework and the original frameworks):

- the “National eHealth Strategy Toolkit” framework produced in 2012 by World Health Organization (WHO) in collaboration with the International Telecommunications Union (ITU)¹⁰;
- the Australian national eHealth strategy developed in 2008, in a partnership with Deloitte, that clearly addresses the eHealth reality and served as a basis for the WHO framework above;¹¹
- the model presented in “EU eHealth Interoperability Roadmap” developed in 2010 within the CALL for InterOPERability (CALLIOPE) network¹²;

¹⁰ World Health Organization, and International Telecommunication Union. 2012. *National eHealth Strategy Toolkit*.

¹¹ Deloitte. 2008. *National E-Health and Information Principal Committee. National E-Health Strategy*. Retrieved from: [http://www.health.gov.au/internet/main/publishing.nsf/content/69B9E01747B836DCCA257BF0001DC5CC/\\$File/National%20eHealth%20Strategy%20final.pdf](http://www.health.gov.au/internet/main/publishing.nsf/content/69B9E01747B836DCCA257BF0001DC5CC/$File/National%20eHealth%20Strategy%20final.pdf)

¹² European Commission. 2010. *European eHealth Interoperability Roadmap – Final European Progress Report*. Retrieved from: [http://www.ehgi.eu/Download/European%20eHealth%20Interoperability%20Roadmap%20\[CALLIOPE%20-%20published%20by%20DG%20INFSO\].pdf](http://www.ehgi.eu/Download/European%20eHealth%20Interoperability%20Roadmap%20[CALLIOPE%20-%20published%20by%20DG%20INFSO].pdf)

Several terminologies and concepts presented in these three documents were used, integrally or partially. Nevertheless, a critical analysis was carried out on both frameworks, which resulted in several changes and adaptations that were considered necessary for the proper understanding of eHealth reality, and that were incorporated in the new proposed conceptual framework.

This framework intends to be the basis for the sharing of eHealth information, through the creation of a common structure organized in strategic streams and categories to correctly address and understand eHealth, and that MS should follow to upload and share their knowledge. Each MS will have the possibility to share:

- **National strategies and action plans** – the sharing of national strategies and action plans with other MS will allow a full understanding of the conception and implementation of several initiatives and potential adaptation to each national context, if necessary;
- **Reference cases** – the more reference cases are shared about past experiences in eHealth, the easier will be to replicate them in other countries and avoid predictable errors;
- **eHealth maturity scores** - through the creation of a national eHealth maturity model, it will be possible to score each country based on the maturity stage where it stands for each dimension and sub-dimension of analysis, that coincide with the streams and categories of the framework.

4.1. General framework description

The proposed framework consists of three major strategic streams that are intrinsically connected, playing a key role in the development of the eHealth strategy:

- **Governance**

As explained in the WHO eHealth Toolkit, this strategic stream intends to guarantee an “effective leadership, coordination and oversight of the national eHealth work program” by ensuring the activation of appropriate mechanisms and structures at a governance level with the ultimate goal of value creation for stakeholders and alignment with European guidelines;

- **eHealth Solutions**

This strategic stream focuses on the set of services and systems that use electronic health information to satisfy the needs of the several stakeholders and key users of health information, in order to deliver healthcare activities in a broader and more efficient way;

- **Foundations & Enablers**

To guarantee the effective delivery of eHealth solutions, it is fundamental that the whole core structure supporting implementation and adoption of these services is available – infrastructure; standards & interoperability; IT processes management; legislation, policy and compliance; workforce; adoption mechanisms, and technological & innovation trends.

As we believe that foundations and enablers of change & adoption are intrinsically related and, only if both are coordinated, eHealth solutions can be delivered and sustained, we propose the creation of a joint strategic stream of Foundations & Enablers, a slight change in relation to the reference frameworks.

Therefore, below it is presented the proposed conceptual framework to share national eHealth strategies:

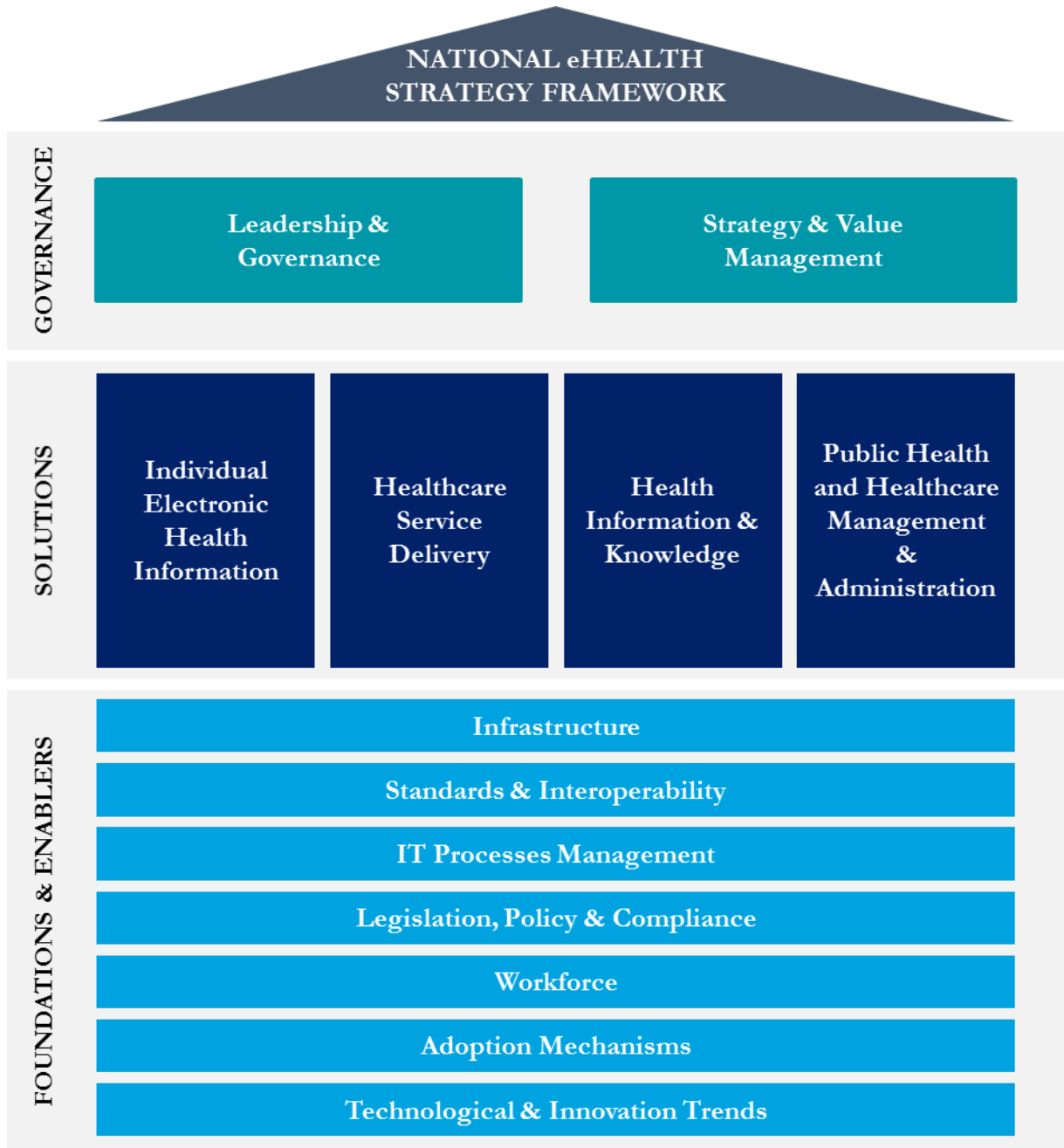


Figure 1 - General conceptual framework for national eHealth strategy

The following chapters will deepen the analysis of each strategic stream, presenting in detail its main categories, and giving specific examples on included subjects to facilitate the comprehension of each category.

4.1.1. Governance Stream

The desired outcomes of a national eHealth strategy will not be feasible unless there is a governance structure that ensure its correct development and implementation by guaranteeing a global coordination, monitoring and evaluation of the strategy and respective action plan.

The role of the Governance is fundamental for the sustainability of the eHealth, and can be divided in two main categories: “Leadership & Governance” and “Investment & Value Management” explained below, based on *WHO National eHealth Strategy Toolkit* definitions:

Governance Categories	Description
Leadership & Governance	<ul style="list-style-type: none"> • Direct and coordinate eHealth at the national level by ensuring alignment with health goals and political support, and by promoting awareness and stakeholders engagement; • Use mechanisms, expertise, coordination and partnerships to develop or adopt eHealth categories; • Support and empower required change by overseeing the correct implementation of the recommendations.
Strategy & Value Management	<ul style="list-style-type: none"> • Ensure a responsive strategy and plan for the national eHealth environment, guaranteeing the involvement of major stakeholders and sectors and alignment with European guidelines for eHealth; • Manage investment in eHealth initiative to assertively align financing with priorities and guarantee value creation; • Evaluate and monitor results for delivery of expected benefits.

Table 1 - Description of Governance Stream Categories

As a result, below are presented some Governance-based subjects adopted from *WHO National eHealth Strategy Toolkit*, and that could be addressed when sharing national eHealth knowledge and experience:

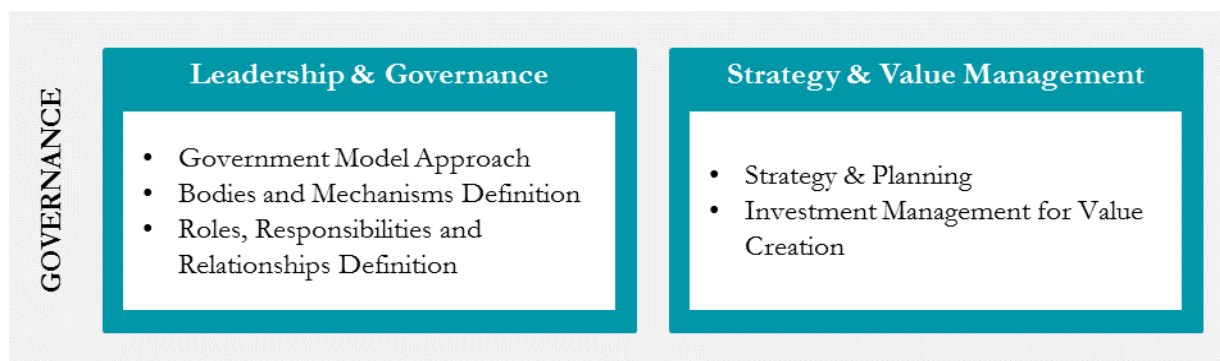


Figure 2 - Governance framework for eHealth

a. Leadership & Governance

To deeply understand the Leadership & Governance of a national eHealth strategy, we propose a framework structure not only focused on presenting its mechanisms (as the original one), but also on the explanation of the government approach towards eHealth, identification of bodies and entities that participate in the process and the description of their roles, responsibilities and relationships.

Therefore, the first topic to address should be the **Government Model Approach**, as the role of the government will directly influence eHealth development and the level of stakeholders' engagement.

If the market is *fully regulated*, the government will be the sole responsible for driven eHealth development, limiting stakeholders' participation and involvement throughout the process. In opposition, a *free market* government do not provide central coordination, delegating on key stakeholders and external parties the development of the national eHealth strategy, playing the role of facilitator and advisor during the process. Between these two approaches, there is a *guided market* where the government provides central coordination on areas of national relevance, working together with key stakeholders who have a greater flexibility to intervene in issues of their expertise area.

After the contextualization of the government's role, it is needed to present existing **Bodies and Mechanisms** and how they are structured at the national, regional and local level.

This governance structure is composed by a core group responsible for the eHealth vision, strategy and planning definition and endorsement that include, for example, the national governing board and all the complementary ministries, legislator and regulatory bodies, councils and committees involved in the process.

Depending on the Government Model Approach, this central structure will be more or less supported by several stakeholder groups with specific subject matter expertise who will be in charge of providing guidance to the core group. These groups can range from advocacy groups, health professional associations, insurance or funding organizations, healthcare academics, healthcare managers or administrators or other specific subject matter specialists.

Finally, based on this governance structure, each body and mechanism will have specific **Roles, Responsibilities and Relationships** with other organisms that should be clearly defined in order to avoid inefficiency and ensure the proper functioning of the entire ecosystem from national to local level.

b. Strategy & Value Management

More than direct and oversee the implementation of eHealth-based initiatives, the Governance stream should be also in charge of the definition of the Strategy & Value Management category.

One of the Governance's functions is to define eHealth **Strategy & Planning** to meet the vision and mission predefined. Strategy defines the eHealth solutions to implement, the core foundations and enablers to deliver such solutions, and a governance model for high-level management. By its turn, the planning project intends to develop a comprehensive action plan to understand what should be done and how to deliver the proposed strategy. The action plan outlined will only be feasible if properly budgeted and if the investment effort is correctly managed. Therefore, the governance should plan eHealth strategy considering budget and funding mechanisms available and should allocate the investment according with the established priorities.

Once again, strategy and the respective action plan should be developed at a national, regional and local level, and at the same time, should be in line with the European guidelines on eHealth, in order to foster a stronger integration and allow the progress of the European eHealth strategy.

However, as eHealth is considered an area where the usefulness of investments is sometimes questioned, funding and investment allocation should not primarily focus on profitability, but on value creation – **Investment Management for Value Creation**. Investments should be justified by the benefits that they will bring, and should be aligned with stakeholder needs and healthcare ecosystem goals. Therefore, it should be useful to share initiatives about the creation of

methodologies to assess and evaluate eHealth benefits for the main stakeholders on a specific initiative, taking also into account an optimal resource allocation, and risk optimization¹³.

4.1.2. eHealth Solutions Stream

The eHealth Solutions stream describes the set of services and systems to collect, store, access and share electronic healthcare information, bringing considerable benefits in terms of efficiency gains, accuracy and quality of the health services delivered.

Based on the Australian national framework, eHealth solutions can be organized according to four categories: Individual Electronic Health Record, Health Service Delivery, Health Information & Knowledge, and Healthcare Management & Administration.

eHealth Solutions Categories	Description
Individual Electronic Health Information (IEHI)	Support the collection, storage and presentation of an individual health information that could be seen by healthcare providers and the individual himself
Healthcare Service Delivery	Support healthcare delivery actors, mainly healthcare providers but also patients and caregivers, in direct healthcare service delivery, by helping them to: <ul style="list-style-type: none"> • make diagnosis and treatment decisions; • manage the delivery of care to an individual, whether electronically or in person; • communicate and share information with other delivery actors, concerning a specific healthcare case
Health Information & Knowledge	Enable individuals, healthcare providers and society to access trusted and verified health data, information and knowledge sources to support their own knowledge
Public Health and Healthcare Management & Administration	Enable healthcare managers and administrators to effectively manage the delivery of care to individuals and enable National Authorities to monitor public health and plan appropriate responses

Table 2 - Description of eHealth Solutions Stream Categories¹⁴

Considering this, below is presented a framework with the main contents included in each category that may drive eHealth Solutions sharing of information:

¹³ ISACA. 2012. *COBIT5: A Business Framework for the Governance and Management of Enterprise IT*. “The Governance Objective: Value Creation” framework.

¹⁴ Adapted from WHO *National eHealth Strategy Toolkit* and the Australian *National E-Health and Information Principal Committee. National E-Health Strategy*.



Figure 3 - Solutions framework for eHealth¹⁵

Nevertheless, it is important to highlight that, more important than developing single independent eHealth tools and systems, is to guarantee integrated service solutions and the design and optimization of the processes that connect these eHealth tools, creating therefore synergies to the entire healthcare ecosystem.

a. Individual Electronic Health Information (IEHI)

Nowadays, individual health information like current health profile, tests results, hospitalizations or even allergies can easily be electronically accessed by healthcare providers or the individual himself using different solutions:

- **Electronic Health Record (EHR)**
A set of electronic health records that can be created, accessed by and shared between healthcare providers across several organizations or even geographic boundaries to support the provision of patients' care. It includes a comprehensive summary of the patient history like demographics, medications, or discharge summaries.
- **Electronic Medical Record (EMR)**
A set of electronic medical and clinical data gathered in one organization during the provision of care to support health providers on diagnosis or treatment decisions.
- **Personal Health Record (PHR)**
A set of electronic records originally created and managed by the patient himself, controlling what is written and by whom. Each individual has the ability to define if the records are exclusively for personal consultation or if they can be made available

¹⁵ Adapted from WHO *National eHealth Strategy Toolkit* and Australian National E-Health Strategy.

for health providers. Some examples include family history, adverse drugs reactions, chronic diseases, or even diets.

b. Healthcare Service Delivery

Advances in ICT have improved health service delivery to patients by empowering healthcare providers with electronic tools and systems that brought efficiency to the entire health ecosystem, facilitating communication and collaboration between healthcare providers, informed decision-making and accurate health and practice management.

Although most of these solutions depend on each other, or only make total sense when they are interconnected, we proposed an analysis based on the following three sub-segments:

- **Communication, Collaboration & Workflow Management Tools for Integrated Care**

The delivery of integrated healthcare services imply that healthcare providers can easily communicate with other healthcare providers, or with other departments or organizations.

Firstly, with the final purpose of facilitating communication and information exchange between healthcare providers, several eHealth solution services were developed to share electronic healthcare information as, for example, electronic referrals, specialist letters, health event summaries, notifications, test ordering & results, or other subset of information hold in EHR, EMR or PHR. Secondly, workflow systems can efficiently integrate healthcare provision processes inside or across healthcare provider organizations to monitor the full cycle of specific workflows, namely hospital drugs cycle of prescription, preparation and administration, or laboratory and imaging workflows.

Electronic medication service like electronic prescription & dispensation is also a good example of how information can be transmitted electronically throughout an entire prescription cycle process. Prescription information is electronically communicated by healthcare providers to pharmacies, which reduces medication errors. In pharmacies, due to electronic dispensing, emission control and dispensing becomes more secure and efficient as it is required an authenticated electronic access, and patients may choose to dispatch all prescribed products or only part of them, being possible to collect the remaining ones afterwards or in another pharmacy.

Telecare, telemedicine and telemonitoring services also help healthcare providers to communicate with each other, being possible to orientate healthcare services delivery at a distance, being especially useful in remote areas with scarce specialized resources at the healthcare delivery level.

- **Patient's Digital Services & Contact Center**

Healthcare service delivery can be also analyzed from a patient's point-of-view, in the sense they can also have an active role on healthcare provision.

The use of digital services by patients to support access to care and self-care management can benefit not only patients who can upload information on their current health condition, or access medications prescription and test results, but also benefit healthcare organizations that can remotely monitor patients health conditions and avoid unreasonable healthcare costs.

An example of these solutions is a chronic disease management system solution that enables monitoring of chronic disease individuals, by tracking their health status and

triggering automatic alerts, reminders and follow-ups to prevent future occurrences. These solutions may also include multi-channel contact center to support patients on the process of self-care management in terms of medications or chronic diseases.

Other example concerns generalist health contact centers aiming to support patient's decision about which actions to take when facing specific symptoms.

- **Health Decision Support Systems**

During healthcare delivery service, several solutions can support healthcare providers on the decision-making process regarding diagnosis, medications or tests options.

These systems may comprise not only individual health information of the patient, but also valuable health information built on professional knowledge sources, such as medical practice procedures, giving inputs to healthcare providers regarding drug interactions, prescribing mistakes or dosing guidelines, allowing informed decisions.

- **Health Management Systems**

Health management systems complement the remaining solutions ensuring the collection, uniformity, centralization and management of electronic information across the sector.

These management systems include, for example, electronic appointment booking & management systems that facilitate, on one hand, patients who can remotely schedule consultations or tests and, on other hand, healthcare administrators who can efficiently manage healthcare workforce. In addition, these systems can also integrate messaging services as reminders to patients.

c. **Health Information & Knowledge**

To access trusted and reliable health information, both individuals and healthcare providers have available some knowledge sources adapted to their needs that manage and provide access to verified and updated information. Some examples are presented below based on the specific target:

- **Individual Health** – Medical platforms or applications, managed at a national and central-level, developed to clarify public doubts about health topics;
- **Healthcare Providers** – Solutions that make available electronic medical journals, resource collections, national open archives, or eLearning courses for health professionals.
- **Open Data Sources** – Solutions that gather a set of dynamic, relevant and cross-cutting data from various health entities that can be openly accessed by every health stakeholder to enable academic research, industry development or simply a greater data transparency to society in general.

d. **Public Health and Healthcare Management & Administration**

To deliver excellence healthcare services to patients, it is necessary to have eHealth solutions that support management and administration's teams to effectively manage healthcare professionals' activity and monitor public health issues.

Although original frameworks detail several solutions regarding healthcare management and administration, we propose to focus on three specific eHealth solutions.

One of the concerns of healthcare authorities relies on **Events and Public Health Monitoring & Planning** in the sense that they should safeguard the maintenance and proper functioning of public health, not only of the patients, but also of the broader population. This includes eHealth solutions able to monitor adverse events occurrence by collecting information about any undesirable medical occurrence or error in a patient or clinical investigation to avoid future errors. It also comprises communicable disease (CD) management solutions, capable to collect, store, analyze and share updated information on public health surveillance and at-risk cases for the purpose of prevention and containment damages. Non-communicable disease (NCD) solutions are also important to support planning and management of diseases like diabetes, cancers, or chronic respiratory diseases, by integrating data from epidemiological studies like patients health conditions and other relevant information (environmental, social and demographic data).

Additionally, administration teams also intend to optimize **Healthcare Operations Management** to achieve operational excellence, by guaranteeing a balance between optimal health costs and quality delivered. For that purpose, there are eHealth solutions that allow the access and monitoring of several indicators and information that help to efficiently manage workforce capacity, surgical schedules, drugs administration in a hospital, or technological and logistical expenditures.

4.1.3. Foundations & Enablers Stream

In order to correctly deliver these eHealth solutions and improve the quality of healthcare services by using ICT, it is crucial to build appropriate foundations that are able to sustain and underpin the national strategy defined by the Governance. Foundations will define the core infrastructure, information standards, processes, legislation and incentives that support eHealth solutions. This should be a national-based matter as the majority of the investments will be unreasonable if not nationally and centrally coordinated, due to their complexity, risk and overall cost. At the same time, it is at the upmost relevance to guarantee that workforce is well-prepared, adoption mechanisms are implemented and cutting-edge technology and innovation trends have impact on the improvement of eHealth solutions.

Therefore, below are presented categories considered within Foundation & Enablers Streams with some adaptation from the original frameworks' references that will be explained later on:

Foundations & Enablers Categories	Description
Infrastructure	Form the foundations for electronic information exchange across geographical and health-sector boundaries. This includes the physical infrastructure (e.g. networks), and software platforms and services that support a national eHealth environment
Standards & Interoperability	Introduce standards that enable consistent and accurate collection and exchange of health information across health systems and services
IT Management Processes	Define processes to manage IT activities, critical to guarantee the correct functioning of eHealth solutions
Legislation, Policy & Compliance	Create a legal and enforcement environment to establish trust, protection and compliance in eHealth practice and systems, by ensuring the adoption of regulations and specific policies

Workforce	Make eHealth knowledge and skills available through internal expertise, technical cooperation, and education and training programs for health workforce capacity building
Adoption Mechanisms	Create mechanisms and incentives to motivate, prepare and facilitate the adoption of eHealth systems in healthcare management and delivery
Technological & Innovation Trends	Monitor technological trends that can bring innovation to the entire healthcare sector and improve healthcare delivery

Table 3 - Description of Foundations & Enablers Stream Categories¹⁶

For each category, below is presented a framework with the main contents necessary to address eHealth Foundations & Enablers:

¹⁶ Adapted from WHO *National eHealth Strategy Toolkit*



Figure 4 - Foundations & Enablers framework for eHealth

• **Infrastructure**

The electronic sharing of health information is only possible if built on core infrastructure that allow health information to be shared in a structured way between healthcare stakeholders.

One of the first infrastructure requirements to collect, record and share electronic information is **Computing Infrastructure**. This may include not only access devices, at a micro level, like PCs and mobile devices for the healthcare workforce and remaining stakeholders use software applications, but also data center (DC) infrastructure, at a macro level, to host and manage centrally large volumes of information. Despite being crucial to support healthcare service delivery, computer infrastructure is not always

considered a priority investment in health sector, because results are not perceived to have an immediate and tangible impact on patients' health.

However, computing infrastructure is barely useless if not combined with **Secure Broadband Connectivity** services to allow high-speed access and transmission of information, at the same time that ensures data security. Appropriate mechanisms to develop broadband networks should be created in order to guarantee coverage in metropolitan and remote areas, contributing for digital inclusion of all healthcare providers. Suitable models and technology should also be used to guarantee that healthcare information can be exchanged securely, without the risk of the information flow be disrupted, jeopardizing the confidentiality of data.

Electronic information access and transmission should follow strict requirements on safety and reliability to assure information is securely shared and arrives to the desired receiver. Therefore, **Identification & Authentication Services** play a crucial role in ensuring these premises. Identification services concern all the ones that request individual's identification to guarantee information is delivered to the right recipient like. Authentication services ensure that messages will be securely addressed, validated and transmitted between healthcare providers.

Another way to guarantee identification of healthcare providers, patients or services is through **National Registers & Directories**. These portals are permanently updated and serve as reference to identify specific individuals or services provided and as a complement to other solutions.

Additionally, all eHealth solutions presented previously are based on a set of **Healthcare Information Repositories and Datasets** that contain all the aggregated information securely stored to be displayed in these solutions.

In order to enable communication among different healthcare providers or national authorities it is required to have **Information Brokers** capable to manage addressing, queuing and logging. There is also a need to assure MS provide eHealth Cross-Border Information Services, and so, each MS should implement its National Contact Point for eHealth (NCPeH), in accordance with *D.5.1.1. Organizational Framework for eHealth National Contact Points*, which should act as an "organizational and technical gateway with other MS", an "interface with existing national infrastructures", and also as a "mediator for delivering services"¹⁷.

There are several infrastructure requirements when it comes to communicate eHealth data between information systems. In order to achieve technical interoperability, it needs to be implemented large-scale interfaces supported by national information brokers that should be responsible for managing integration workflows. These integration engines play a crucial role in ensuring communication reliability according to standard validations, business rules and security policies. Their scope encompasses such diverse workflows as the Patient Summary or the Electronic Prescription. The input flows should be initiated by the *Data Producers* or *Data Clients* which publish data through the broker that is later subscribed by the *Data Consumers*. Then, the broker is responsible for exposing integration services through a network layer that can assure reliable and safe access. Broker's internal modules should report their status to the Monitoring & Analytics component, enabling troubleshooting and real-time control of the active workflows.

- **Standards & Interoperability**

¹⁷ European Commission. 2015 *Guideline on Proposal for an Organizational Framework for eHealth National Contact Points*. JAseHN.

The collection and exchange of electronic information across health systems and services will only be possible if governed by standards and interoperability requirements that will guide and enable consistent and accurate exchange of information across different systems.

EU is committed to guarantee that interoperability contributes to the creation of the Digital Single Market, and therefore, the European Interoperability Framework (EIF) was recently revised to “*put more emphasis on how interoperability principles and models should apply in practice and consider emerging policy-related and technological needs*”¹⁸. A refined framework for managing interoperability challenges of eHealth in Europe was also developed in the scope of the *D.5.4.4.* of JaseHN group¹⁹.

In accordance with the European Interoperability Framework (EIF), interoperability has four different levels, being one of them the **Technical Interoperability** defined as the “ability of two or more information and communication technology applications, to accept data from each other and perform a given task in an appropriate and satisfactory manner without the need for extra operator intervention”²⁰. This involves the definition of consistent *data structure standards* to standardize the way data is stored and displayed in eHealth software solutions, and avoid misunderstandings. It also includes the definition of *messaging standards structures and protocols* to allow a uniformed and secure transmission between healthcare providers. Additionally, there are standards that define *acknowledgments* to be provided at the delivery or opening of a message, and the subsequent warnings generated in case of the message is not successfully received.

Semantic Interoperability is other dimension that refers to the “ability to ensure that the precise meaning of exchanged information is unambiguously interpretable by any other system, service or user”²¹. For this purpose, it is important to develop *common terminologies and coding* to allow different health stakeholders to communicate and exchange information like diagnoses or treatments based on a common established language.

In addition to this, eHealth solutions also comply with **Certification & Accreditation Software Standards** to have legitimacy to exchange health information.

- **IT Processes Management**

The correct functioning of eHealth solutions relies not only on a strong governance, to direct, coordinate and measure the strategy, but also on a solid management structure that plans, builds, delivers and monitors activities defined by the governance to implement strategy, and that guarantees that all IT processes are underway. This management can be done centrally when activities are of the scope of the main organisms involved in the governance; or they can be decentralized, when other companies are in charge of developing and monitoring eHealth solutions.

Because of its vital importance for the development and monitoring of eHealth solutions, and considering that frameworks of reference did not contemplate this perspective, we

¹⁸ European Commission. 2017. *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: European Interoperability Framework – Implementation Strategy*. SWD(2017)112/113 Final. Retrieved from: http://eur-lex.europa.eu/resource.html?uri=cellar:2c2f2554-0faf-11e7-8a35-01aa75ed71a1.0017.02/DOC_1&format=PDF

¹⁹ http://jasehn.eu/wordpress/wp-content/uploads/2016/03/ev_20151123_co03_en.pdf

²⁰ European Commission. 2012. *Discussion Paper on Semantic and Technical Interoperability*. Retrieved from: http://ec.europa.eu/health/sites/health/files/ehealth/docs/ev_20121107_wd02_en.pdf

²¹ European Commission. 2012. *Discussion Paper on Semantic and Technical Interoperability*. Retrieved from: http://ec.europa.eu/health/sites/health/files/ehealth/docs/ev_20121107_wd02_en.pdf

include “IT Processes Management” as one of the categories that make up the Foundations’ stream.

Following COBIT 5 methodology and its “Process Reference Model” framework²², we propose a four-stage approach to address IT Processes Management that is transversal to any eHealth solution (see Annex C

for further details).

In an initial stage of eHealth solution development, it is essential to **Align, Plan and Organize** activities to perform. This includes, among others, architecture planning, the management of the budget and costs to incur, human resources needed, suppliers and service agreements needed to develop eHealth solutions.

After the planning stage, it is necessary to **Build, Acquire and Implement** eHealth Solutions. To design how the information will look like and develop these solutions, it is necessary to efficiently manage the several programs and projects; to manage the requirements and standards definition, the configurations desired for the solution and the integrations between solutions to guarantee end-to-end processes on the delivering of healthcare.

The **Delivery and Support** stage comes next and intends to prepare the go-live of the solution, and to give support after the go-live, by managing operations, service requests, problems or incidents.

Transversally, it should be done a **Monitoring, Evaluation and Assessment** to all these stages to control if all activities are working properly and in conformance with what was defined internally and externally.

- **Legislation, Policy & Compliance**

The national eHealth environment should also be grounded on legislation and policies that provide guidance on how health information should be stored, managed and shared, in order to guarantee privacy and data security.

Legislation refers to national laws that have been promulgated to regulate, in this case, how health information will be accessed, stored and shared across the sector.

One of the core concerns relates to the privacy and data protection regulation (General Data Protection Regulation²³) in order to safeguard the interest of individuals in keeping their health information confidential and only accessible by authorized personnel. Privacy and data protection legislation can include access and consent policy to regulate the access, usage and disclosure of personal health information by an individual or other person. It can also include storage and retention policies to regulate how saved health information should be arranged so it can be easily searched and accessed; and how to dispose of information no longer needed. Audit and complaint procedures should be also legislated to settle how to proceed when there is a suspicion of privacy breaches.

Security arises as another major concern because, the more information is available electronically, the higher the risk of data exposure, unauthorized access or even loss from central systems, if the mechanisms to avoid it are not legislated or regulated. Legislation on healthcare sector also include licensing regimes to enforce healthcare professionals to meet privacy, security and other standards defined.

²² ISACA. 2012. *COBIT 5: A Business Framework for the Governance and Management of Enterprise IP*

²³ GDPR Regulation (EU) 2016/679

Beyond legislation, it is necessary to ensure that broader **Public Policies** drive eHealth development, at a national, regional and local levels. This includes not only health sector policies or even eHealth-specific policies like payment models for eHealth services or medical jurisdiction for eHealth services, but also non-health sector policies such as digital transformation of the economy, or eGovernment. At the same time, eHealth initiatives should be in line with European guidelines that foster and contribute to eHealth development, as it was referred before.

Additionally, it is essential to guarantee the **Compliance, Conformance and Accreditation** of eHealth products and services by defining national standards and interoperability requirements to ensure that all categories that support eHealth solutions are interconnected, compatible with each other, and follow the laws, rules and regulations established.

- **Workforce**

The creation and implementation of eHealth solutions are strongly dependent on workforce engagement and capability. Therefore, it is necessary to guarantee that healthcare workforce have the required skills and competencies to perform its activities, regardless of whether they are **Healthcare Providers**, who need to collaborate in the development of useful and functional solutions, or **Healthcare IT Workforce**, who are in charged to design, build and support those solutions. Education and training programs can be adjusted to integrate eHealth-based subjects, being a good solution to develop those competencies and increase the number of eHealth skilled users among healthcare community.

- **Adoption Mechanisms**

Efforts to drive workforce towards eHealth solutions usage should be followed by initiatives to promote society's adoption of these systems within the health sector. These mechanisms should be centrally coordinated to guarantee alignment and consistency, but there is a very important work that can be managed and operationalized at a regional and local levels.

To improve society's digital literacy in health sector, the first step consists on the development of target-specific **Awareness Campaigns** focused on communicating and promoting what eHealth is and what benefits bring to consumers and healthcare community in general. Additionally, the organization of **Stakeholder Engagement Forums** is also important to incite working group's discussions composed of different stakeholders to debate eHealth.

Other adoption mechanisms consist of **Financial Incentive Programs** focused on specific health stakeholders to facilitate the adoption of eHealth solutions as they arise. Linked to healthcare workforce development is the necessity to adapt **Accreditation Regimes** to include eHealth requirements.

- **Technological & Innovation Trends**

Throughout the years, advances in research and development have resulted in numerous technological innovations created to improve quality and efficiency of their users. Most of these innovations have a transversal impact on society's functioning and activity sectors, being healthcare one of the sectors aiming to adapt these innovations and trends to its reality and context.

eHealth services and systems are born of this close collaboration between healthcare and the ICT sector to enable more effective delivery of care. Attending to today's pace of technological evolution, these innovations can easily become outdated and be replaced by new ones, and the Health sector should be able to adapt to these changes. That is why it is critical to add "Technological & Innovation Trends" as the last, but not least, foundation to eHealth solutions, being highlighted below some of the trends that drive health sector innovations.

One of the technological advances with significant impact on healthcare sector is the **Wearable Technology**, which refers to smart electronic devices used by patients with a form of implant or accessory. With the development of the Internet of Things (IoT), health sector was able to use this technology to create bio-sensing wearables that "provide useful, real-time information by allowing continuous physiological monitoring in a wide range of wearable forms"²⁴. This includes, for example, fitness bands, monitors of blood pressure, respiratory rate or glucose, digital hearing aids, or pain management systems. Data is transmitted to an application allowing healthcare professionals to remotely monitor the status of the patients.

Additionally, **Cloud Computing** is an increasingly widespread trend not only in business context, as many enterprises are migrating their data from a physical to a cloud-based environment, but also for personal usage. Cloud computing offers multiple benefits to the healthcare sector by providing service efficiency and ease and speed of information access. On a daily basis, healthcare providers need "quick access to computing and large storage facilities which are not provided in the traditional settings; moreover, healthcare data needs to be shared across various settings and geographies which further burden the healthcare provider and the patient causing significant delay in treatment and loss of time."²⁵ Nevertheless, there are still some concerns regarding security and privacy issues that postpone full adoption of cloud computing that should be addressed.²⁶

Furthermore, it is undeniable the adoption of **Digital and Mobile** technology by all society's dimensions. Healthcare is not an exception. Digital technologies use PCs, tablets and other mobile devices to communicate and interact with patients. A good example of this digital development is mHealth that refers to information services provided through mobile technology including data collection, real-time monitoring, and clinical support for healthcare professionals. Digital technology also contributes to the development of telehealth enabling the delivery of safe and quality healthcare services to patients at a distance.

Other incontestable trend nowadays is **Big Data & Analytics**. Over the last years, the amount of data generated and produced has increased significantly, and technology has found the way to store and analyze it, bringing relevant benefits to every sectors, including healthcare. Big Data in healthcare is helping not only to improve financial efficiency, but also patient's outcomes, because data facilitates the prediction of potential epidemics and avoidance of preventable deaths. However, it is needed to transform data into useful insights to help healthcare providers to analyze information and take action. For this purpose, Analytics can help to interpret and analyze meaningful data to support decision-making processes. The potential of Analytics' insights for a healthcare institution, for instance, depend if it is used *Descriptive Analytics* (ability to quantify and report on past healthcare data), *Diagnostics Analytics* (ability to understand past experiences by correlating data and using data mining), *Predictive Analytics* (ability to use data to

²⁴ Deloitte Center for Health Solutions. 2015. *Connected Health: How digital technology is transforming health and social care*.

²⁵ Cloud Times. 2013. *The Healthcare Sector Will Invest \$5.4 Billion in Cloud Computing by 2017*. Retrieved from: <http://cloudtimes.org/2013/09/30/the-healthcare-sector-will-invest-5-4-billion-in-cloud-computing-by-2017/>

²⁶ Further details on the use of cloud computing in health on D 7.2.1. of JaseHN group

forecast what is likely to occur) or, in a near future, *Prescriptive Analytics* (ability not only to predict an upcoming event but also to suggest the best actions to undertake).

Considering that the original frameworks may be frequently used, to facilitate adaptation to this new framework presented, it is possible to find in Annex B a mapping table that succinctly explains the similarities and differences between the frameworks.

4.2. Proposed structure for sharing eHealth strategies and action plans

In the context of sharing eHealth knowledge between MS, one of the most important topics to report refers to national strategy for eHealth and respective action plan to implement it. Giving the different paces of eHealth development across MS, the possibility to visualize what the more advanced countries have defined as their strategies and how they intend to implement can positively influence other MS to adopt similar strategies.

The framework presented previously intends to define a common initial structure for MS to share their plans and experiences on eHealth. However, it is necessary to outline a second layer of analysis: *What structure should be followed to share national strategies and action plans?*

Each MS will share its national strategy and action plan by completing a number of predefined fields that will help to synthesize and standardize different national information in a common framework. Some of these fields will be free-filled, while others will be linked to drop-down lists with predefined options, which will later help to carry out statistical analysis across all countries.

The sharing of information of eHealth strategies and action plans will be divided in two different phases: 1) initial upload of information and, 2) periodical update of information on monitoring measures.

- **Initial upload of strategy & action plan information**

The upload of the main information about national strategy & action plan will occur initially.

To organize information upload, there will be two sections. The first one is the “Overview and Context” and intends to give a brief summary of the eHealth context of the country, in order to better understand its strategy and action plan.

OVERVIEW AND CONTEXT

Member State ▼

Strategy Time Period ▼ to ▼

State of play of national health system and past eHealth strategies

National health sector priorities ▼

National eHealth Vision and Mission

National eHealth priorities ▼

Strategic documents attachment +

Figure 5 - "Overview and Context" section for sharing strategies and action plans (Illustrative example)

First of all, each MS should select from the drop-down list the **name of the country** and the **time period** in which the strategy is comprised.

Then, in order to contextualize eHealth national strategy, it is important to understand the overall health sector and past eHealth strategies. Therefore, it will be requested to succinctly report on the **state of play of the current national health sector**, as well as **past eHealth strategies**. Furthermore, **national health sector priorities** defined by the Government can be synthesized with the help of the following drop-down list²⁷:

- **HP1. Quality and Effectiveness** – ensure patient-centric health systems that guarantee the delivery of safe and high quality care, based on established standards
- **HP2. Equity and Accessibility** – guarantee that all individuals receive equitable access to adequate healthcare services at the right place and time, particularly those in rural, remote and disadvantaged communities
- **HP3. Coordination** – attempt to improve coordination and integration of healthcare services across the entire healthcare ecosystem and stakeholders
- **HP4. Leadership** – strength public health leadership and participatory governance for health, including preparation and capacity for dealing with communicable and non-communicable diseases, and potential emergencies
- **HP5. Prevention and Monitoring** – ensure the promotion of healthy habits and lifestyles, and the strengthening of epidemiological surveillance and public health alert monitoring systems
- **HP6. Efficiency** – guarantee that the utilization of health resources is efficiently and rationally performed throughout the delivery of healthcare

²⁷ Health priorities were adapted from *Health 2020: a European policy framework supporting action across government and society for health and well-being* (http://www.euro.who.int/__data/assets/pdf_file/0009/169803/RC62wd09-Eng.pdf)

- **HP7. Sustainability** – guarantee the sustainability of the healthcare system supported on funding strategies, prepared workforce, and suitable infrastructures
- **HP8. Citizenship and Transparency** – promote health literacy among patients and implement successful workforce development planning that realigns ways of working with the needs of patients
- **HP9. Innovation** – promote the use of innovative technology and systems to improve the timeliness and accuracy of healthcare delivery and facilitate disease monitoring and surveillance
- **HP10. Cross-border integration** – guarantee alignment with European guidelines on the health sector to promote a closer integration between MS health services

Focusing on eHealth strategy, further information on **national eHealth vision and mission** of the current strategy is asked, as well as the main **national eHealth priorities** to accomplish based on the following drop-down list²⁸:

- **eHP1. Improve access to healthcare services**
- **eHP2. Generate efficiency gains in health services delivery**
- **eHP3. Guarantee quality and safety of care**
- **eHP4. Ensure health monitoring and reporting**
- **eHP5. Secure exchange and transmission of health information**
- **eHP6. Improve access to health knowledge and education**
- **eHP7. Improve operations planning and management**
- **eHP8. Foster individuals empowering**
- **eHP9. Guarantee standardization, innovation and growth**

Both health and eHealth priorities presented previously intend to synthesize and schematize the main options, being however possible to manually add further priorities.

To finish, the most updated version of the **strategic document** of the country should be uploaded for consultation of the remaining MS, as well as other relevant documents that help to explain national strategy and action plan.

The second section is the “Detail of Strategy and Action Plan” section where, as the name says, each MS will upload detailed and relevant information on its strategy and respective action plan.

One of the main goals of this section is to relate “Initiatives” of the action plan with the strategic framework presented in the last chapter, in an effort to standardize information of different countries. This means that each “Initiative” must be associated to a specific “Strategic Line”, “Category” and “Stream”:

²⁸ World Health Organization, and International Telecommunication Union. 2012. *National eHealth Strategy Toolkit* adapted from: Eysenbach G. What is e-health? *Journal of Medical Internet Research*, 2001, 3:e20. *National E-Health and Information Principal Committee. National E-Health Strategy, 30th September 2008*. Adelaide, Deloitte Touche Tohmatsu, 2008. Booz & Co. *Optimising e-Health value – using an investment model to build a foundation for program success*. 2010.

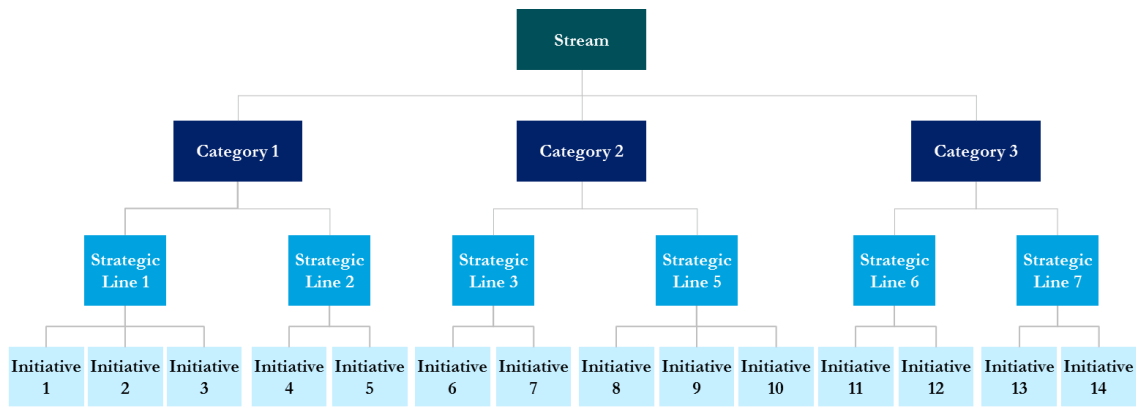


Figure 6 - Relationship between Streams, Categories, Strategic Lines and Initiatives (Illustrative example)

An illustrative example of the required fields of the “Detail of Strategy and Action Plan” section is shown below, being the entire table divided in two different figures to facilitate visualization of each field.

DETAIL OF STRATEGY & ACTION PLAN (1/2)																		
Stream	Category	Strategic Line	eHealth Priorities	Main Initiatives of the action plan														
				Ref.	Initiative	Description	Dep.	Territorial Scope	Estimated Timing			Stakeholders						
									Duration (months)	Starting date	Ending date	Beneficiary		Responsibility		Other Stakeholders involved		
												Classif.	Designat.	Classif.	Designat.	Classif.	Designat.	
▼	▼	▼																

Figure 7 - "Detail of Strategy and Action Plan" section for sharing strategies and action plans (Illustrative example) (1/2)

DETAIL OF STRATEGY AND ACTION PLAN (2/2)											Obs.
Main Initiatives of the action plan											
Estimated Budget		Resource Requirements	Risks and Constraints	Mitigation Measures	Evaluation Measures						
€	% of total				Type of KPI	KPIs by initiative	KPIs description	Baseline measure	Target Measure		
								Value	Year		

Figure 8 - "Detail of Strategy and Action Plan" section for sharing strategies and action plans (Illustrative example) (2/2)

Following a top-down approach, the first field to complete is the “Stream”. Based on the strategic conceptual framework presented on chapter 4.1., the drop-down list for this field will have three options:

- I. Governance,
- II. Solution, or
- III. Foundations & Enablers.

This means that, to completely explain a national strategy and action plan, each country will have to upload information regarding the governance model adopted, proposed solutions to implement, and the foundations to support them.

The second field to complete is the “**Category**” one. Once again grounded on the strategic conceptual framework, each country should select, from the drop-down list, the appropriate category according to the “Stream” field selected previously:

- Ia. Leadership & Governance;
- Ib. Strategy & Value Management;
- IIa. IEHI;
- IIb. Healthcare Service Delivery;
- IIc. Health Information & Knowledge;
- IId. Healthcare Management & Administration;
- IIIa. Infrastructure;
- IIIb. Standards & Interoperability;
- IIIc. IT Processes Management;
- IIId. Legislation, Policy and Compliance;
- IIIe. Workforce;
- IIIf. Adoption Mechanisms;
- IIIg. Technological & Innovation Trends.

Each “Category” will have associated one or several “**Strategic Lines**”. These strategic lines describe the high-level actions that are needed to materialize national eHealth strategy. To correctly classify strategic lines inside a specific category, countries should use the sub-categories addressed on the Figures 2, 3 and 4 to describe it (e.g. Implementation of a national health *identification & authentication service*).

Each “Strategic Line” should be aligned with the “**eHealth Priorities**” defined by the Government to achieve the desired results. Therefore, each “Strategic Line” of the “Solutions” Stream should be associated to one or several eHealth priorities, using the specific reference number (i.e. eHP1, eHPn).

To implement a specific “Strategic Line”, each country has a set of “**Initiatives**” to perform. These initiatives are high-level strategically important projects or other similar actions required to achieve a specific goal (e.g. Develop and approve national health identifier standards). Initiatives will be the basis of the action plan, meaning that more detail on specific activities inside each initiative will not be included in the scope of this knowledge exchange project.

Each initiative will then be characterized with the help of several fill fields.

First of all, each initiative has a “**Reference**” identification (i.e. In1., In2.) to facilitate the attribution of “**Dependencies**” – when the beginning, development or ending of a specific initiative is conditioned by another. Therefore, if an initiative is dependent on the development of other ones, it should be include on the dependency field the reference of those initiatives.

An open field is dedicated to the “**Description**” of the initiative. Here should be included a concise explanation of the initiative and the specific goals to achieve with it.

“**Territorial Scope**” will allow countries to classify each initiative as:

- European,
- National,
- Regional, or
- Organizational-centric

If one of the last two options of the drop-down list were selected, there will be a second drop-down list with a detailed list of regions and organizations to select. This functionality will be particularly important for countries with a strong decentralized strategy.

Each initiative will have an “**Estimated Timing**” field to be completed. Information regarding “**Duration**” will be uploaded taking into account the initial number of *months* to conclude the initiative. “**Starting Date**” will have a predefined format to be filled, being “**Ending Date**” calculated automatically.

Then, there will be several fields associated with “**Stakeholders**” information. First, the “**Beneficiary**” concept refers to the main stakeholder who will benefit from the implementation of a specific initiative. Second, “**Responsibility**” field consist on the main entities, institutions or other stakeholders in charge of each initiative. To complement the previous information, the last field intend to compile information on “**Other Stakeholders involved**” in each initiative. To standardize information between countries, each one of these different stakeholders’ categories will have a “**Classification**” field with a drop-down list to choose one of the stakeholders’ denomination of the figure below. Additionally, there will be a second field called “**Designation**” where will be possible to specify the name/ designation of the stakeholder.

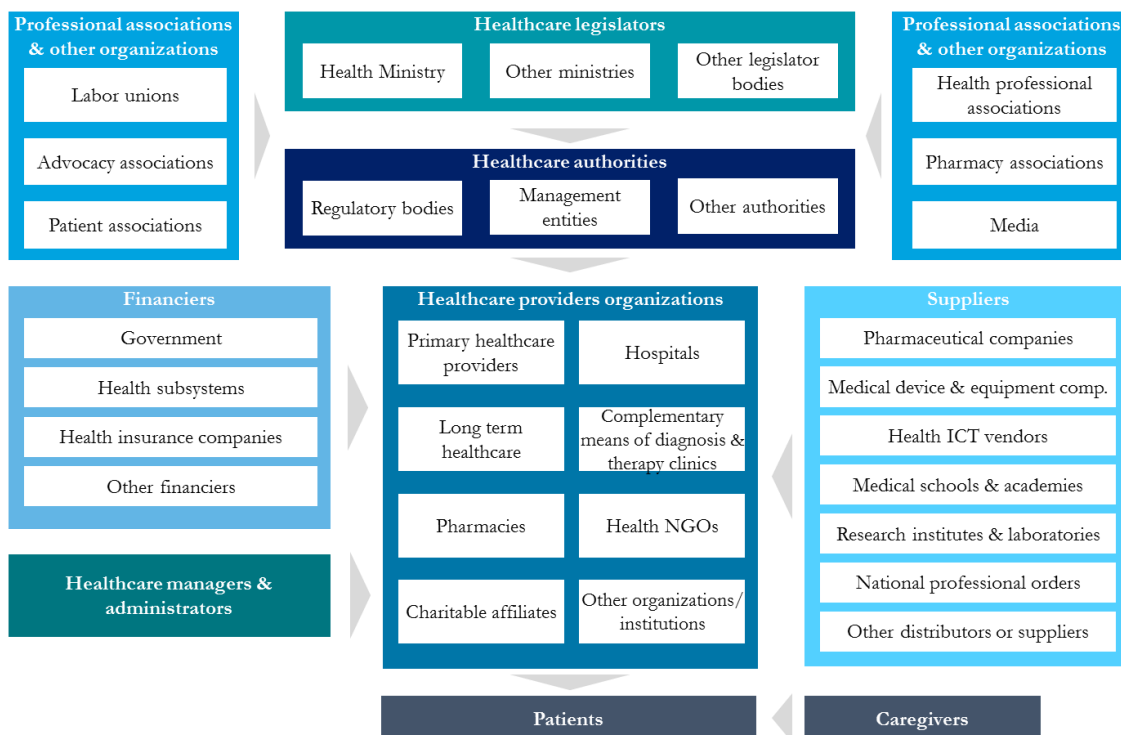


Figure 9 - Healthcare stakeholders' ecosystem²⁹

²⁹ Source: Deloitte analysis

One of the most important information to share with other countries - especially the ones trying to catch-up - is the **”Estimated Budget”** by initiative, because, depending on the estimated value, they will have higher or lower financing needs. Taking also into account that the EU is composed by a set of structurally unequal countries, it is relevant not only to share the budget in euros (“€”), but also as a percentage of the total strategy budget (“%”), to serve as an adaptable measure to the reality of other countries.

Each initiative needs a set of **“Resource Requirements”** to ensure the delivery of the action plan. In this field, we propose a high-level sharing of the main type of resources required in terms of skills, expertise, funding, or others.

Other relevant information to share are **“Risks or Constraints”** identified to develop each initiative and the respective **“Mitigation”** measures to attenuate them, so that lagging-countries can implement these initiatives in an easier and prevented way.

To guarantee that each initiative is fulfilling its purpose, it is necessary to define **“Evaluation Measures”**, in the form of Key Performance Indicators (KPI). Therefore, information on the **“KPIs by initiative”** should be uploaded to assess and monitor the success of the initiative, as well as a **“KPI description”** to clarify the calculation formula. Each indicator should be classified according to the **“Type of KPI”** options available in the drop-down list:

- *Adoption/ Coverage* - indicators that aim to evaluate the success of an initiative, measuring its implementation and adoption (i.e. Percentage of electronic prescriptions & dispensations in the total of prescriptions & dispensations);
- *Impact* - indicators that measure the impact of implemented eHealth initiatives on healthcare and society goals (i.e. number of adverse incidents avoided due to ePrescriptions/ eDispensations; savings on no longer needed paper due to ePrescriptions/ eDispensations).

MS should then upload the **“Baseline Measure”** of each KPI to provide the starting point value at the beginning of the action plan. To establish measurable goals throughout the initiative execution, each country should upload one or several **“Target Measure”** that sets measurable, realistic and achievable goals to reach in a specific time frame. **“Value”** is the target measure itself to achieve in a specific **“Year”**.

To conclude, there will be space to add some additional **“Observations”** considered pertinent.

- **Upload of monitoring information about the strategy & action plan**

After the upload of this initial information, we suggest to report on the monitoring of the strategy & action plans on a regular basis. Therefore, this second stage intends to give information on the current degree of execution of each initiative to ensure that the eHealth action plan is proceeding as planned and that is delivering concrete results.

STRATEGY AND ACTION PLAN MONITORING

MONITORING OF STRATEGY & ACTION PLANS							
Ref. Initiative	Real Timing	Real Budget		% Execution by initiative	Evaluation Measures		
	Real Ending date	€	% of total		KPIs by initiative	Current Measure	
						Value	Year
▼					▼		

Figure 10 - "Strategy & Action Plan Monitoring" section for sharing strategies and action plans (Illustrative example)

First of all, the “**Reference**” of each initiative should be searched on the drop-down list, based on the information uploaded initially.

Then, although each action plan has an estimated budget and ending date, it not always corresponds to the reality. That is why it is crucial to share the “**Real Budget**” and “**Real Ending Date**” of each initiative with other countries to warn on the risks of non-compliance with the initial plan.

It will also be required to share information on the “**% of Execution by initiative**” to give a sense of the degree of completion of a particular activity.

Finally, to monitor and measure the degree of accomplishment of the KPIs in relation to the targets set, there will be a drop-down list with all the “**KPIs by initiative**” defined initially, and a field to add the “**Current Measure**” by KPI.

4.3. Proposed structure for sharing eHealth reference cases

The more information is shared, the greater the added value of this online platform. Therefore, along with national strategies and respective action plans, it can be extremely useful for MS to share also their past experience on specific eHealth initiatives using reference cases. Sharing reference cases is particularly relevant to communicate successful initiatives, by briefly explaining all the path from the initial problem definition to the solution found, key results and critical success factors.

In this case, we propose the sharing of reference cases centered on the eHealth Solution itself, explaining throughout the case the Governance and Foundations initiatives necessary to deliver the eHealth solution.

To standardize the way reference cases will be shared, below is presented a structure guideline, divided into seven major stages, complemented by some categorization requirements:

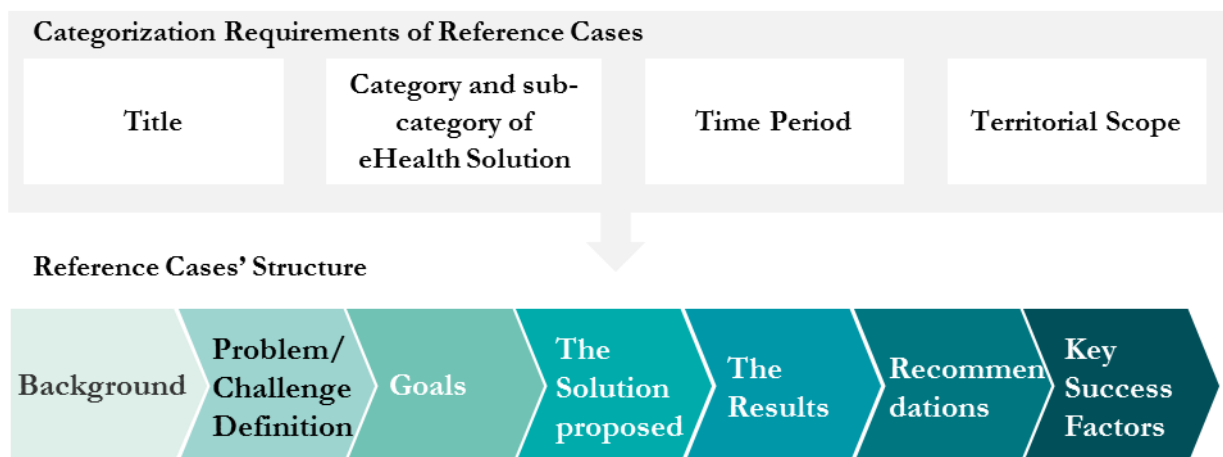


Figure 11 – Proposed structure and categorization requirements for reference cases

To facilitate consultation by other MS, and easily access to the desired contents, each reference case should have the following categorization requirements:

- “**Title**” that succinctly and objectively describes the subject of the case. It should contain specific key words that can be easily searched;

- “**Category and sub-categories of the eHealth Solution**” that most fits the case’s scope
 - IEHI and its sub-categories (Figure 3),
 - Healthcare Service Delivery and its sub-categories (Figure 3),
 - Health Information & Knowledge sub-categories (Figure 3), or
 - Healthcare Management & Administration and its sub-categories (Figure 3);
- “**Time Period**” in which the reference case occurred;
- “**Territorial scope**” of the reference case:
 - European,
 - National,
 - Regional or
 - Organizational

The first stage of the reference case description is a general assessment of the “**Background**” situation. This stage serves as an introduction to the case, where an overview of the context is made, highlighting relevant facts and the most important issues to understand what follows.

Background description will support and give inputs to define the main “**Problem/ Challenge**” to overcome or address. Based on this problem/ challenge definition, it is important to outline the main “**Goals**” to achieve and that may serve as a reference for the development of the case and for the measuring of the final results.

“**The Solution proposed**” stage comes next and will be divided in two main subjects: the overall description of the proposed solution (*What is the solution?*), and the approach followed to implement it (*How will the solution be implemented?*). To guarantee standardization, the latter should follow the previously proposed structure for sharing strategy and action plans (see 4.2. for further details).

Therefore, for the solution proposed stage, we suggested the following fields:

The Solution Proposed																		
Overall description of the solution	Approach to the solution																	
	Stream	Category	Ref.	Initiative	Description	Territorial Scope	Timing			Stakeholders				Budget		Resource requirements		
							Duration (months)	Starting date	Ending date	Beneficiary		Responsibility		Other Stakeholders involved			€	% of total
										Classif.	Designat.	Classif.	Designat.	Classif.	Designat.			

Figure 12 - Proposed structure for "The Solution Proposed" stage of reference cases

- Overall description of the solution and its final goals;
- Approach to the solution:
 - List of the main initiatives, with the respective Stream, Category and Reference;
 - Brief description of the initiative itself;
 - Territorial Scope of the initiatives;
 - Timing for each initiative;

- Main beneficiary stakeholder of each initiative;
- Institution or entity responsible for each initiative;
- Other stakeholders involved in the execution of each initiative;
- Budget for each initiative;
- High level resource requirements needed for each initiative.

However, it is important to highlight that the degree of detail of the reference cases should be less than in the description of the strategy and respective action plan.

After exposing the solution found, it is necessary to summarize the main “**Results**”, following the structure of the table below:

The Results									
Final outcomes & outputs <i>(Key numbers and measurable results)</i>	Benefits perceived	Evaluation Measures <i>(if existent)</i>							
		Type of KPI	KPIs defined <i>(not mandatory to associate to each initiative)</i>	KPI description	Baseline measure	Target Measure		Final Measure	
						Value	Years	Value	Years

Figure 13 - Proposed structure for "The Results" stage of reference cases

This includes a description of the final outcomes and outputs, sustained in relevant key numbers and measurable results achieved, and the enumeration of the main benefits perceived based on the following drop-down list (linked with the eHealth Priorities presented in 4.2.)³⁰:

1. Access to healthcare services

eHB1.1. Deliver health services at a distance to rural, remote or disadvantage communities via electronic means

eHB1.2. Improve the timeliness and accuracy of healthcare services

eHB1.3. Provide patients with better visibility of healthcare providers location, availability and area of specialization in order to promote choice and access.

eHB1.4. Access of patients and healthcare providers to a second opinion from specialists at a distance

2. Efficiency gains in health services delivery

eHB2.1. Improve health workforce productivity due to greater efficiencies related with the use of electronic means to deliver healthcare

eHB2.2. Enhance optimization of health workforce, technical and financial resources through the delivery of remote healthcare services

3. Quality and safety of care

eHB3.1. Better access of healthcare professionals to decision support tools, best practices and knowledge sources, reducing the likelihood of adverse events occurrence

³⁰ World Health Organization, and International Telecommunication Union. 2012. *National eHealth Strategy Toolkit* adapted from: Eysenbach G. What is e-health? *Journal of Medical Internet Research*, 2001, 3:e20. *National E-Health and Information Principal Committee. National E-Health Strategy, 30th September 2008.* Adelaide, Deloitte Touche Tohmatsu, 2008. Booz & Co. *Optimising e-Health value – using an investment model to build a foundation for program success.* 2010.

eHB3.2. Better quality of care due to the access to reliable and complete patient health records through electronic means

eHB3.3. Easier collaboration and coordination of healthcare delivery with other health professionals via secure and timely electronic information sharing

4. Health monitoring and reporting

eHB4.1. Improve ability to manage and monitor adverse events occurrence and public health interventions

eHB4.2. Improve ability to prevent avoidable occurrences through epidemiological surveillance and public health alert monitoring systems

5. Secure exchange and transmission of health information

eHB5.1. Storage, collect and exchange healthcare data in a secure and confidential way

6. Access to health knowledge and education

eHB6.1. Improve healthcare providers' access to trusted and reliable health knowledge sources, as solutions that make available electronic medical journals, resource collections, national open archives, or eLearning courses for health professionals

eHB6.2. Improve patients' access to trust and reliable health knowledge sources, including medical platforms or applications for health education, awareness, and prevention information

7. Operations planning and management

eHB7.1. Improve access to high-quality data and indicators in order to efficiently manage healthcare services and workforce capacity

eHB7.2. Enable healthcare managers to more effectively monitor and address system/processes inefficiencies

eHB7.3. Improve the quality of operational performance data for decision making purposes

eHB7.4. Improve productivity through administrative processes simplification and dematerialization

8. Individuals empowering

eHB8.1. Empower patients with the ability to remotely monitor their health condition through the use of sensors and monitoring equipment

9. Standardization, innovation and growth

eHB9.1. Increase standardization of information exchanged across the healthcare ecosystem

eHB9.2. Greater opportunity for health market innovation and growth through the use of new technologies

eHB9.3. More incentives for the development of eHealth innovation areas

eHB9.4. Further dissemination of results achieved with research/ innovation projects

eHB9.5. More qualification and accreditation of healthcare units

Additionally, like in the proposed structure for sharing strategies and action plans, it is relevant to share evaluation measures in the form of KPI, if existent.

In order to help other MS to implement the same or similar cases in their countries, it is useful to include a “**Recommendations**” chapter where should be shared the main difficulties throughout the implementation, and also, risks and constraints that were found and mitigation measures to attenuate them.

The final chapter proposed focuses on the sharing of “**Key Success Factors**” (KSF), a list of the most important areas, practices or activities required to accomplish the expected goals.

4.4. National eHealth maturity model definition

A maturity model is a common framework used to assess and measure the path of an organization (in this case, a country) towards continuous improvement, based on a scale of maturity stages. Each stage ranks the organization/ country according to its level of implementation of good practices in the subject being assessed.

From a viewpoint of information sharing and standardization of eHealth best practices across MS, it is important to define a maturity model that allows not only to assign a specific score to each country based on their level of maturity and implementation of eHealth, but also to define how they should progress along the maturity curve to pursue eHealth optimization stage.

Therefore, we propose the creation of a National e-Health Maturity Model to implement among MS. It identifies the stages, dimensions, sub-dimensions and actions required for countries to progress towards the optimization of eHealth delivery. Through the creation of a Maturity Assessment Tool, it will be possible to make a self-assessment of the maturity level achieved, generating the attribution of a National eHealth Score to each MS. This information will therefore be shared with other MS in the online platform.

4.4.1. Definition of maturity stages

Based on the Capability Maturity Model (CMM) proposed by Carnegie Mellon University in the late 1980s, and subsequent models as the IDC MaturityScape, the maturity model is composed by five maturity stages through which a country must pass in order to achieve a fully integrated stage of national eHealth. Each maturity stage defines an important part of the path of each country and comprises a predefined set of characteristics. These maturity stages correspond to the overall maturity of a country in terms of eHealth.

The figure below presents the National eHealth Maturity Model stages from the initial and unstructured stage to the systematized and optimized stage.

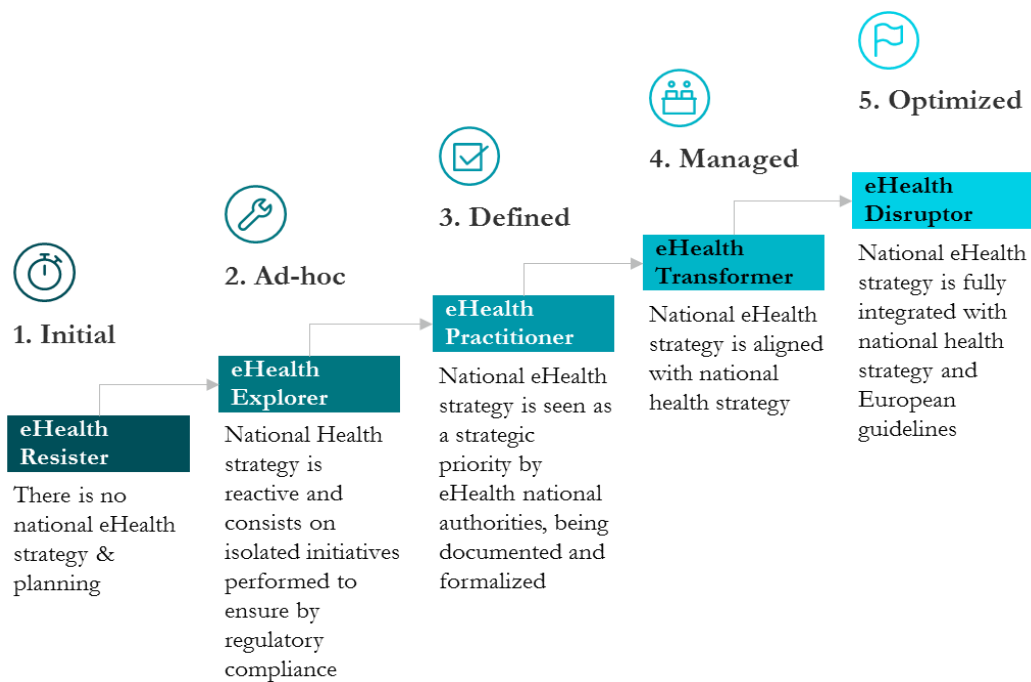


Figure 14 - National eHealth maturity model overview

- **Initial – eHealth Resister**

There is no national eHealth strategy & planning. There are no specific electronic solutions developed and there is no health information sharing between organizations. Infrastructure is under-developed. No use of standards or shared data models. No formal legislation on eHealth. Healthcare workforce have no eHealth skills and competencies.

- **Ad-hoc – eHealth Explorer**

National Health strategy is reactive and consists on isolated initiatives performed to ensure by regulatory compliance. Solutions are developed and implemented, but they are not integrated with other systems at a national level. Information is sometimes shared between organizations. There are some guidelines on standards, infrastructure and health workforce training, but no formal policies implemented.

- **Defined – eHealth Practitioner**

National Health strategy is seen as a strategic priority by eHealth national authorities, being documented and formalized. National eHealth solutions are in an embryonic stage and have started to be formally implemented and used. National infrastructure and standards are formalized and developed. Specific legislation and policies on eHealth-subjects are promulgated.

- **Managed – eHealth Transformer**

National eHealth strategy is implemented and aligned with national health strategy. Uniformed architecture and standards enable a constant electronic health information sharing across the healthcare ecosystem. eHealth solutions are used nationwide, managed centrally, and updated with new improvements. There is a solid legislation on eHealth-subjects. Society is actively interested in use eHealth solutions.

- **Optimized – eHealth Disruptor**

National Health strategy is fully integrated with national health strategy and with European guidelines. eHealth initiatives are a reference abroad and directly contribute to value creation and to drive healthcare transformation. Services and systems are

completely integrated and automated, and adapted to new technological innovations. Full systems interoperability and standards support integration of eHealth solutions. Healthcare workforce, and society in general, are completely aware of eHealth reality and is actively engaged in building eHealth ecosystem.

4.4.2. Classification of maturity dimensions and sub-dimensions

These final maturity stages will be achieved according to the relative position of the country in relation to each dimension and sub-dimension of analysis. The maturity model includes three dimensions that correspond to the three strategic streams – *Governance, Solutions* and *Foundations & Enablers* – to guarantee standardization and consistency, and 13 sub-dimensions corresponding to the categories of the framework.

Countries can position themselves in a 1 to 5 range score for each sub-dimension, based on the stage description that better illustrates their level of maturity.

Therefore, the table below provides an overview of the stages, dimensions and sub-dimensions of the national eHealth maturity model, inspired in the “IDC MaturityScape: The Digital Hospital 1.0.” report.³¹

STAGES										
1. INITIAL National eHealth Resister		2. AD-HOC National eHealth Explorer		3. DEFINED National eHealth Practitioner		4. MANAGED National eHealth Transformer		5. OPTIMIZED National eHealth Disruptor		
GOVERNANCE										
Leadership & Governance	There is no formal national leadership & governance model defined to develop eHealth strategy. Isolated initiatives are directed and coordinated in a decentralized way by separated bodies and mechanisms, with limited governance sponsorship.		A leadership & governance model is developed, implemented and used to deliver some relevant isolated initiatives. The main bodies and mechanism are defined, but their roles and responsibilities are not well established.		A national leadership & governance model is documented, formalized and approved to deliver a national eHealth strategy. A governance structure with different bodies and mechanisms supported by several stakeholder groups at a national, regional and organizational level is formalized, as well as their roles, responsibilities and relationships. Governance promotes national awareness and stakeholders involvement.		Leadership & governance model is implemented nationally in alignment with national health sector goals. Strategy is evaluated and monitored to guarantee the delivery of the expected results. It supports and empowers required change by creating improvement measures to correctly implement recommendations.		Leadership & Governance model is fully integrated and is one of the cornerstones of the success of the national eHealth strategy. It is aligned with national health sector goals and European guidelines on eHealth Governance.	
	Strategy & Value Management	There is no formal strategy & planning process definition. Isolated initiatives are developed in a decentralized way. Each initiative is budgeted but there are no structured funding mechanisms available.		Several relevant eHealth initiatives are developed, implemented and used by several health stakeholders, but are not fully integrated into a national strategy & planning. Investment and funding mechanisms are available.		A national eHealth strategy is documented, formalized and approved, as well as the respective action plan to implement it, with initiatives at a national, regional and organizational level. Investment and funding mechanisms are formalized and approved and are allocated according to the established priorities.		National eHealth strategy & planning is implemented. Indicators to evaluate and monitor implementation progresses are defined and are a crucial tool to measure performance. Investment and funding mechanisms are implemented according to priorities and evaluated to guarantee value creation.		National eHealth strategy & planning is fully integrated within the healthcare ecosystem and is delivering the expected results. Investment management is optimized and is creating value. It is aligned with European guidelines for eHealth development and may serve as a reference to other MS.

³¹ Knudsen, Jonas; Claps, Massimiliano; Allocato, Adriana; Dunbrack, Lynne. 2016. *IDC MaturityScape: The Digital Hospital 1.0*. IDC

SOLUTIONS					
IEHI solutions	Individual health information on clinical data is predominantly manually collected and used only inside each healthcare provider organization.	Individual health information is electronically collected and contains patient clinical data. Healthcare provider organizations sporadically share individual healthcare data with other organizations. There is no common structure, terminologies or codes between EMR of the several healthcare providers.	Individual healthcare information is constantly shared with other healthcare providers. EMR records all clinical information of patients nationwide. A common structure for sharing information with the goal of creating unique EHR is defined and formalized at a national level.	Patient information is shared among the national healthcare ecosystem. EHRs are implemented at a national level and are integrated with complementary solutions, including PHR, allowing the aggregation of multiple health data. IEHI begins to be shared at an European level.	A transversal view of patient information is achieved across the national ecosystem. These solutions are completely integrated and automated with the remaining eHealth solutions, and are susceptible to improvements resulting from new technological innovations. IEHI is effectively shared at an European level between MS.
Healthcare Service Delivery solutions	Healthcare service delivery is predominantly managed manually. There is no health information sharing between organizations.	Internal healthcare service delivery solutions are developed, implemented and used in several organizations, but they are not integrated with each other at a national level.	Transversal healthcare service delivery solutions are formalized at a national level. Electronic healthcare information starts to be communicated and shared between healthcare providers at a national level, due to uniformed architecture and standards and efficiency of the workflow management. Health decision support systems are formalized and integrated at a national level, as well as health management systems, and digital services to support patients.	Healthcare service delivery solutions are fully implemented nationwide. Electronic healthcare information is always communicated and shared between healthcare providers at a national level. Health decision support systems are constantly updated with new knowledge sources. Health management systems are completely implemented and improved, as well as digital services to support patients. European cross-border solutions begin to be created.	Healthcare service delivery tools are the basis of health ecosystem efficiency and informed decision-making. Solutions allow the sharing of real-time information between healthcare providers. These solutions are completely integrated and automated with the remaining eHealth solutions, and are susceptible to improvements resulting from new technological innovations. European solutions on cross-border services are consistently used.
Healthcare Information & Knowledge solutions	There are no specific solutions developed for the aggregation of trusted and reliable health information.	Healthcare information & knowledge solutions are developed, implemented and used in several organizations to address organizational needs, but they are not integrated with each other at a national level. Individual and healthcare providers-based solutions exist in isolation and are developed in a decentralized way, as well as open data sources.	Healthcare information & knowledge solutions are documented and formalized at a national level. Solutions targeted to patients focus on medical platforms and systems managed at a national and central-level with information about relevant health topics. Healthcare providers solutions give transversal access to national scientific knowledge sources. Open data sources gather a set of relevant data from various health entities to be shared with other stakeholders.	Healthcare information & knowledge solutions are fully implemented nationwide and are constantly updated. Patients and healthcare providers actively access to these solutions and provide suggestions to improvement opportunities. Uniformed European solutions begin to be created.	Healthcare information & knowledge solutions are the enablers of the existence of informed individuals and healthcare providers with access to high-quality and updated information. These solutions are completely integrated and automated with the remaining eHealth solutions, and are susceptible to improvements resulting from new technological innovations. European solutions for information and knowledge sharing are consistently used.

Joint Action to support the eHealth Network

Public Health and Healthcare Management & Administration solutions	Public Health and Healthcare management & administration solutions are specific of local organizations and are primarily centered in back-office processes such as accounting and payroll.	Public Health and Healthcare management & administration solutions are developed, implemented and used in several organizations to address organizational needs, but they are not integrated with each other at national level. Solutions are developed to monitor organizational adverse events occurrence, organizational surveillance and at-risk cases, organizational NCD cases, and organizational operations management.	Public Health and Healthcare management & administration solutions are approved and formalized at a national level. National information on adverse events occurrence, public health surveillance and at-risk cases, as well as NCD epidemiological information is accessed by management teams. National solutions for healthcare operation management are formalized and shared among healthcare organizations.	Public Health and Healthcare management & administration solutions are fully implemented nationwide. Adverse events and public health monitoring solutions of CD and NCD cases are fully adopted at a national level, as well as operation management solutions. Cross-border solutions with broader information on public health and healthcare management & administration begin to be created.	Public Health and Healthcare administration & management solutions are optimized, being the basis to effectively manage healthcare activities and monitor public health issues nationally. These solutions are completely integrated and automated with the remaining eHealth solutions, and are susceptible to improvements resulting from new technological innovations. Cross-border solutions are successfully implemented and used.
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FOUNDATIONS & ENABLERS

Infrastructure	Physical infrastructure is fragmented and vertically integrated with applications. There are no physical access devices or broadband connectivity in all healthcare organizations able to collect, record and share electronic information. Informal, random and manual identification & authentication services. There are no national directories, and information repositories or datasets.	There are pilot-initiatives to consolidate and virtualize national infrastructure. Physical access devices are made available in priority areas and secure broadband connectivity is implemented in remote areas. Security control process for identification and authentication is developed and implemented to meet regulatory requirements. Directories and information repositories and datasets are developed at an organizational level.	National datacenters are constructed to allow full virtualization. Physical access devices are made available nationwide and secure broadband connectivity is implemented in all the country. Data classification, role-based access and encryption policies, methods, and procedures are documented, formalized and applied across multiple. Directories and information repositories and datasets are nationally based to aggregate information that supports national solutions.	Private cloud infrastructure arises to increase automation and speed of response. Physical access devices are optimized nationwide and there is a national high-quality and secure broadband connectivity. Identification & authentication services are fully implemented across the healthcare ecosystem and improvement measures are taken. Directories and information repositories and datasets are improved to accommodate the massive adoption of eHealth solutions.	A fully hybrid cloud national infrastructure is adopted to pursue operational efficiency of eHealth solutions. The high-quality and secure national broadband connectivity allows high-speed access and transmission of information between state-of-the-art physical access devices. Seamless integration of advanced security on identification & authentication services, such as predictive analytics and real-time threat detection. Directories and information repositories and datasets are optimized.
Standards & Interoperability	Data and messaging structure standards and terminologies are specific of a proprietary system or application	Data and messaging structure standards and common terminologies between several applications are developed and implemented.	Data and messaging structure standards and common terminologies at a national level are documented, formalized and communicated, guaranteeing technical and semantic interoperability.	Data and messaging structure standards and common terminologies are transversally implemented in every eHealth applications, being subjected to performance measurements and improvements. European standards and terminologies start to be created.	Data and messaging structure standards and common terminologies are consistently used, constantly optimized, and fully implemented by the health ecosystem players to ensure integrated care and a consistent and accurate exchange of information nationwide, being a reference for other MS. European standards and terminologies are successfully implemented and used.
IT Processes Management	Non formalized IT processes.	Several IT processes are developed and implemented inside organizations and entities, allowing to be known the practices that should be taken at ongoing basis, roles and responsibilities and respective goals and metrics.	IT processes are documented, formalized and disseminated to ensure adequate governance and management of IT since the planning stage until the delivery and support of solutions.	IT processes fully implemented and measured in each organization and integrated end-to-end at national level.	Networked end-to-end IT processes are optimized, being the basis for the correct functioning of eHealth solutions and ecosystem.

Legislation, Policy and Compliance	No formal legislation, policies or regulatory compliance regarding eHealth.	Some regulations and procedures are developed and implemented in a decentralized way, not being consistent neither integrated at a national level.	Specific legislation and policies on eHealth-subjects are documented and promulgated at a national level, helping to formalize and regulate how health information is accessed, stored and shared across the sector.	Legislation and policies on eHealth are consistently applied by all healthcare ecosystem players at a national level. Laws and regulations are quite detailed and demonstrate a profound knowledge on eHealth subjects. At the same time, they are aligned with broader national policies that drive eHealth development.	National legislation and policies on Health are fully integrated and aligned with European legislation on the subject. Laws and regulations are constantly optimized, being extremely robust and diversified, and are able to easily accommodate new subject-concerns.
Workforce	Healthcare workforce have no skills and competencies on eHealth.	Several healthcare workforce groups are enrolled in education and training programs on eHealth-based subjects that are developed and implemented at a organizational level, without central guidelines on subject-contents.	Education and training programs are centrally developed and formalized at a national level. It targets all the healthcare ecosystem players, like healthcare providers who need to understand how to work with eHealth solutions, and healthcare IT workforce who are in charge to design, build and support those solutions.	Education and trainings programs are fully implemented at national, regional and organizational levels among healthcare community, being eHealth skills and competencies mandatory.	Healthcare workforce has a full understanding on eHealth subjects and solutions, and is strongly engaged to use it on a daily basis, and share best practices with other healthcare stakeholders.
Adoption Mechanisms	There are no formal mechanism to drive society's adoption of eHealth solutions.	Adoption mechanisms as awareness campaigns or engagement forums occur sporadically and in a decentralized way.	Adoption mechanisms are centrally developed, formalized, and communicated to guarantee alignment and consistency at a national level, and a correct operationalization at a regional and organizational level. Awareness campaigns and engagement forums are carefully planned and communicated, being integrated into a calendar of initiatives. Financial incentive programs are formalized, as well as accreditation regimes to the eHealth-skilled workforce.	Adoption mechanisms are fully implemented across the healthcare ecosystem, being organizational initiatives linked with national ones. Society is actively interested in awareness campaigns and engagement forums. It is possible to evidence the results of the financial incentive programs. Accreditation regimes are fully adopted.	Society is completely aware of the benefits of eHealth and actively participates in and helps to build the eHealth ecosystem.
Technological & Innovation Trends	There is no formal technological innovation process.	There are some pilot-initiatives developed at an organizational level to implement technological innovations.	Innovation management process is formalized, assuring awareness of emergent technologies and opportunities for benefit from these innovation. Pilot initiatives are evaluated to decide whether to adopt at national level.	Technological innovations chosen to be generalized are fully implemented by all healthcare providers. Performance is monitored and improvement measures are identified.	Innovation is the main driver to improve quality and efficiency in healthcare delivery by continuously search for new opportunities.

Table 4 - National eHealth maturity model description

4.4.3. Assessment and sharing of national eHealth maturity scores

With the creation of a common conceptual framework, countries can share their strategies & action plans and reference stories by using a common language. In turn, with the creation of a standardized maturity model applied to eHealth reality, countries can assess their level of maturity in terms of eHealth adoption, and to compare their scores with other MS, by sharing this information in the online platform.

Therefore, we propose the creation of a Maturity Assessment Tool, in the form of a questionnaire, which countries must respond periodically to make a self-assessment of the current maturity level of the country in relation to eHealth.

Based on the table presented in the previous chapter, each country will be asked to select the description that better fits the current state of maturity of each sub-dimension. The average of the answers given to each question will generate a final National eHealth Score that will be shared with other MS in the online platform.

5. High-level conceptualization of the online platform

After presenting and explaining which national eHealth information that should be shared among MS, it is important to proceed to a high-level definition of the online platform focusing on its main goals, type of users and sections available.

It is important to highlight that this chapter intends to be a first approach to the conceptualization of the online platform, meaning that what is described below is not definitive and can be subject to future changes. A deeper and final analysis of platform requirements and functionalities will not be included in this report, being developed later on.

5.1. Platform goal and type of users

The online platform will be created, developed and managed by the EC, and its main goal will be:

The uploading, sharing and visualization of relevant national eHealth information about strategy & action plans, reference cases and maturity levels in one single platform, in order to identify, analyze and spread best practices that can be adopted and implemented by other MS.

The online platform will allow the filling of information about strategies & action plans, reference cases and maturity levels directly on the platform, according to the previously proposed structures. Each MS will have a national institutional entity that will be in charge to upload and update all the national eHealth information in pre-established periods defined by the platform administrator.

After data collection and validation has ended, it will be possible to visualize and download information, depending on the specific user profile.

Type of platform users	Description
Administrator user	Responsible for the administration and management of users and information loaded on the platform, guaranteeing its correct functioning
National representative user	National institutional entity responsible to aggregate, upload and update all the national eHealth information on the platform
Institutional users	National entities, institutions and groups with preferential permissions to visualize platform information (include Administrator user and National representative user)
General users	All the remaining users accepted by the administrator user to access to authorized eHealth information

Table 5 – Platform users' description

5.2. Platform sections

The platform will be organized in four different sections, to which users have access depending on their type of profiles: back-office (BO) for platform administration and management; BO for information upload; front-office (FO) for institutional users; and FO for general users.

- **BO for platform administration and management**

This BO section will be carried out by the EC and will give support to the management and administration of the platform in terms of accesses, information uploads and visualizations.

One of the administration functionalities of the online platform relates with the management of users and permissions. It will be possible to add or remove users from the platform, as well as edit their permissions in terms of accesses, uploads and visualizations.

Other functionality is the management of the information that is provided to users. This means that the BO administrator will be in charge to upload relevant information regarding European eHealth guidelines or other subject-related themes to be consulted by other users, like news or publications. It also includes the creation of a glossary of terms and a guide with user instructions of the platform adapted to each type of user.

Additionally, the BO administration will also manage the upload of information by each MS. The administrator can parameterize filling forms of the strategy & action plan, maturity levels and reference stories, and can control their completion status by each MS. Moreover, it will be able to validate the quality of the information uploaded before it can be visualized in the FO, and to centrally manage the databases that support dashboards.

- **BO for information upload**

This BO section will be targeted to the set of national representative users, who will be in charge of uploading all the information to be shared among MS.

This section will be divided by the type of information to upload – strategy & action plans, reference stories, and maturity level of eHealth adoption.

Strategy & action plans and reference stories will have a filling form, as presented previously, with drill-down options in several fills. To help to upload information, this section will have a glossary and a user instructions guide functionality to support the fill-in process. After submitted, there will be a functionality to visualize the process status until the final validation by the administrator, and consequent information display at the platform for consultation. Regarding strategy & action plan information, each national representative user can select specific fields that they prefer to keep confidential and that may not be shared with general users. Nevertheless, the administrator should validate and approve each privacy request.

In what concerns information regarding the maturity level of eHealth adoption, as explained previously, each country will have a questionnaire with 13 questions where they will be asked to select the statement that better describes the current state of maturity of the country in relation to each sub-dimension. Each statement will be associated to a specific stage meaning that, when the questionnaire is completed, the average of the answers will generate a final National eHealth Score. At the end, a visualization is generated automatically with the main results of the given answers in the form of charts and key indicators.

Other functionality will be a specific area to visualize warnings, deadlines, or other relevant information regarding the upload of information.

- **FO for institutional users**

The FO for institutional users will enable national entities, institutions and groups with preferential permissions to access, visualize and download information about other MS.

First of all, there will be a specific area to enable registration and login.

Other initial functionality of the section will be an information area about the JAseHN project, its context and the main goals of the platform.

Then, it will be possible to access strategy & action plan information uploaded by each MS. Users will have three different ways to access, visualize and download information:

- Original document developed at a national-level and uploaded by each MS;
- Automatically generated file following the filling form format proposed in chapter 4.2.;
- Dashboard functionality where will be presented several charts, based on the information uploaded, that will vary according to the selected filters.

Moreover, institutional users will also have access to reference cases. They can be searched according to four different criteria: by MS; by territorial scope; by category of eHealth solution; and by time period in which it occurred. To visualize download reference cases, there will be automatically generated files with the proposed structure in chapter 4.3.

Furthermore, information on the maturity scores obtained by each country will be accessed through a dashboard functionality. This dashboard will facilitate the visualization of the results through the usage of several charts and filter options, as illustrated below³²:

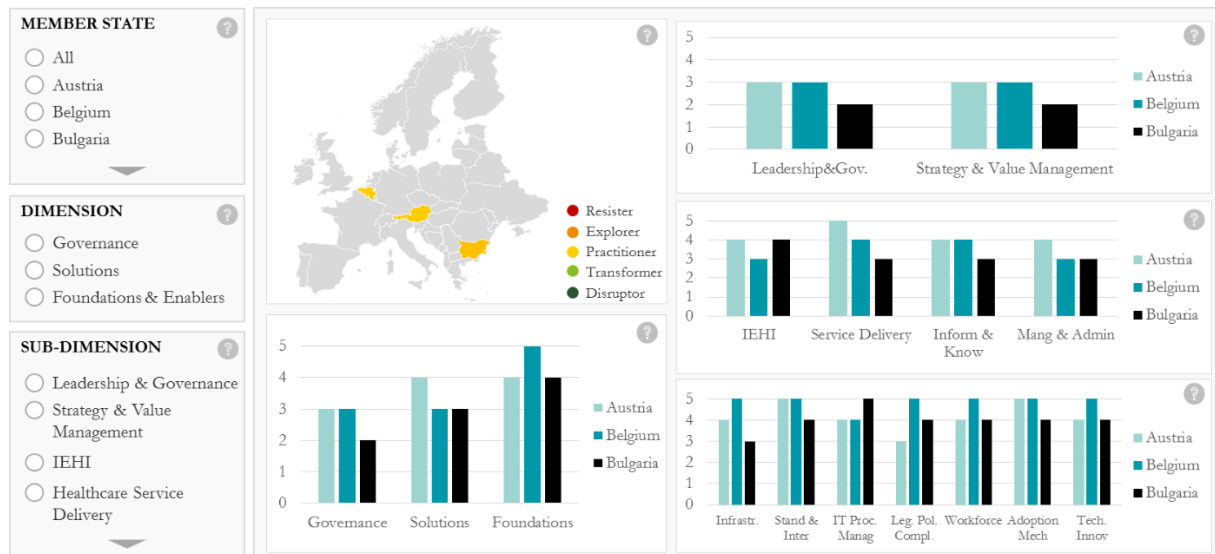


Figure 15 - National eHealth maturity level assessment dashboard (Illustrative example)

The left-side of the dashboard will be dedicated to filter options. It will be possible to select the MS to analyze, as well as the dimensions and sub-dimensions to be showed. Automatically, graphics on the right-side of the dashboard will be refreshed to show the desired information. In case of doubt in any term, or to consult the description of each dimension or sub-dimension, there will be question mark buttons to clarify them. At the end, it will be possible to download the graphics related with the analysis performed.

³² Note: Figure presented is an illustrative example of a potential dashboard. It should not be considered as definitive as it may be subject to changes in subsequent phases of work.

Other functionality refers to the consultation of relevant information regarding European eHealth guidelines and other subject-related themes like news or publications, or even information related with predefined notifications on selected themes. Additionally, to guide users throughout the platform, there will be a user guide and a FAQs functionality available.

- **FO for general users**

This section can be accessed by any registered user, independently if they are non-health sector institutions, academics, researchers or public in general. The available functionalities will be very similar to the ones of the FO for institutional users; however, there will be information that will not be shared with general users.

Unlike institutional users, general users will not be able to visualize information concerning monitoring and evaluation performance of the action plans in course as, for instance, real budget, real timing, and KPI accomplishment, as well as some information that MS prefer to maintain confidential.

6. Conclusion and Final Remarks

Europe is witnessing a moment of digital transformation. Digitalization is driving consumers, companies and Governments in search for greater efficiency, quality and comfort. Although at different development stages of maturity, MS are engaged to develop strategies that promote digitalization and innovation in all activity sectors. In health sector, technology is being used to make healthcare available at a distance, and to facilitate public health monitoring and surveillance, and to enable rapid response and solid decision-making when delivering healthcare services.

Despite all the progress made, initiatives are not always coordinated and aligned at national level, and this evidence is even more striking at European level. Therefore, in order to accelerate Europe's digital transition on the health sector, one of the main challenges is the need for awareness among all MS of the benefits of sharing experiences and knowledge on eHealth.

The creation of an online platform managed by EC for the sharing of eHealth information represents an important step in the path of MS engagement towards knowledge exchange.

In order to guarantee that MS derive maximum benefit from the full potential of the platform, it becomes essential to adopt a common language through the conceptualization of a framework for knowledge sharing.

However, despite the effort of standardization and conceptualization using best-in-classes references, the existence of very disparate strategies and experiences across countries makes it difficult to create a completely consensual framework for all MS. A non-consensual structure may represent a barrier to the active participation and collaboration of every single MS in this exchange of experiences.

Therefore, before the design of the platform itself, it is fundamental to pilot this proposed conceptualization of the framework among MS and to collect feedback about potential enhancements, so that applicability and completeness may be verified towards eHealth reality.

Afterwards, with a solid and holistic framework for sharing eHealth knowledge, it will be easier to develop all the requirements, functionalities and architecture of the platform to be used by every country.

7. Appendices

7.1. Appendix A: Glossary

ACRONYM	DEFINITION
BO	Back-Office
CALLIOPE	CALL for InterOPERability
CD	Communicable Disease
EC	European Commission
eD	Electronic Dispensation
eHGI	European eHealth Governance Initiative
eHN	eHealth Network
EIF	European Interoperability Framework
EHR	Electronic Health Record
EMR	Electronic Medical Record
eP	Electronic Prescription
epSOS	European Patients – Smart Open Devices
EU	European Union
FO	Front-Office
ICT	Information and Communication Technologies
IEHI	Individual Electronic Health Information
IoT	Internet of Things
ITU	International Telecommunications Union
JAseHN	Joint Action to support the eHealth Network
KPI	Key Performance Indicators
KSF	Key Success Factors
MS	Member States (of the EU)
MWP	eHealth Network's Multiannual Work Plan
NCD	Non-Communicable Disease
NCPeH	National Contact Point for eHealth
PHR	Personal Health Record
PoC	Proof of Concept
RENEWING HEALTH	REgioNs of Europe WorkINg toGether for HEALTH
WHO	World Health Organization

7.2. Appendix B: Definitions

CONCEPT	DEFINITION
Administrator user	Responsible for the administration and management of users and information loaded on the platform, guaranteeing its correct functioning.
Adoption/ Coverage KPI	Indicators that aim to evaluate the success of an initiative, measuring its implementation and adoption (i.e. Percentage of electronic prescriptions & dispensations in the total of prescriptions& dispensations).
Adoption Mechanisms category	One of the Categories of the Foundations & Enablers Stream. Mechanisms and incentives to motivate, prepare and facilitate the adoption of eHealth services and systems in healthcare management and delivery.
Baseline measure	Starting point value of a specific KPI at the beginning of the action plan.
Category	Second level of the conceptual framework structure. Component inside a Stream about a specific topic that help to explain it.
Dependencies	Set of Strategic Lines or Initiatives that influence the beginning, development or ending of another Strategic Line or Initiative.
eHealth Solutions stream	One of the strategic streams of the conceptual framework. Set of services and systems that use electronic health information to satisfy the needs of the several stakeholders and key users of health information, in order to deliver healthcare activities in a broader and more efficient way.
EHR	A set of electronic health records that can be created, accessed by and shared between healthcare providers across several organizations or even geographic boundaries to support the provision of patient's care. It includes a comprehensive summary of the patient history like demographics, medications, or discharge summaries.
EMR	A set of electronic medical and clinical data gathered in one organization during the provision of care to support health providers on diagnosis or treatment decisions.
Foundations & Enablers stream	One of the strategic streams of the conceptual framework. Set of information standards, processes, infrastructure, legislation and incentives that guarantee and support the development, delivery and adoption of eHealth solutions.
Framework	A real or conceptual structure intended to serve as a support or guide for the building of something that expands the structure into something useful.
General users	All the remaining users accepted by the administrator user to access to authorized eHealth information.
Governance stream	One of the strategic streams of the conceptual framework. It intends to guarantee an effective leadership, coordination and oversight of the national eHealth work program by ensuring the activation of appropriate mechanisms and structures at a governance level with the ultimate goal of value creation and alignment with European guidelines.
Healthcare Information & Management category	One of the Categories of the eHealth Solutions Stream. Solutions that enable individuals, healthcare providers and society to access trusted and verified health data, information and knowledge sources to support their own knowledge.
Healthcare Service Delivery category	One of the Categories of the eHealth Solutions Stream. Solutions that support healthcare delivery actors, mainly healthcare providers but also patient and caregivers, in direct healthcare service delivery, by helping them to: 1) make diagnosis and treatment decisions; 2) manage the delivery of care to an individual, whether electronically or in person; and 3) communicate and share information

	with other delivery actors concerning a specific healthcare case.
IEHI category	One of the Categories of the eHealth Solutions Stream. Solutions that enable the collection, storage and presentation of an individual health information that could be seen by healthcare providers and the individual himself.
Impact KPI	Indicators that measure the impact of implemented eHealth initiatives on healthcare and society goals (i.e. number of adverse incidents avoided due to ePrescription/eDispensation; savings on no longer needed paper due to ePrescription/eDispensation).
Infrastructure category	One of the Categories of the Foundations & Enablers Stream. It forms the foundations for electronic information exchange across geographical and health-sector boundaries. This includes the physical infrastructure (e.g. networks), and software platforms and services that support a national eHealth environment
Initiatives	High-level strategically important projects or other similar actions required to achieve a specific Strategic Line (i.e. Develop and approve national health identifier standards).
Institutional users	National entities, institutions and groups with preferential permissions to visualize platform information (include Administrator user and National representative user).
IT Processes Management category	One of the Categories of the Foundations & Enablers Stream. Definition of processes to manage IT activities, critical to guarantee the correct functioning of eHealth solutions.
KPI	Key Performance Indicators. Indicator that assesses and monitors the success of an initiative or project. KPIs should be linked to objectives, quantifiable, observable, reliable and controllable.
Leadership & Governance category	One of the Categories of the Governance Stream. This category of analysis refers to the direction, coordination, evaluation and monitoring of eHealth at the national level by ensuring alignment with health goals and political support, and by promoting awareness and stakeholders engagement.
Legislation, Policy and Compliance category	One of the Categories of the Foundations & Enablers Stream. Definition of the legal and enforcement environment to establish trust, protection and compliance in eHealth practice and systems, by ensuring the adoption of regulations and specific policies.
Maturity dimensions and sub-dimensions	Different levels of analysis that, depending on the relative score given, will define a final maturity score. In this case, dimensions correspond to the strategic streams of the framework – <i>Governance</i> , <i>Solutions</i> and <i>Foundations & Enablers</i> – and the sub-dimensions to the 13 categories of the framework.
Maturity model	Framework used to assess and measure the path of an organization (in this case, a country) towards continuous improvement, based on a scale of maturity stages.
Maturity stages	Levels of maturity in a maturity model. Stages rank an organization/ country according to its level of implementation of good practices in the subject being assessed. In this case, countries can position themselves in a 1 to 5 range score for each sub-dimension based on the stage description that better illustrates their level of maturity.
National representative user	National institutional entity responsible to aggregate, upload and update all the national eHealth information on the platform.
National Contact Points for eHealth	Organizational and technical gateway with other MS to enable communication between different MS for the provision of eHealth Cross-Border Information Services

PHR	A set of electronic records originally created and managed by the patient himself, controlling what is written and by whom. Each individual has the ability to define if the records are exclusively for personal consultation or if they can be made available for health providers. Some examples include family history, adverse drugs reactions, chronic diseases, or even diets.
Public Health and Healthcare Management & Administration category	One of the Categories of the eHealth Solutions Stream. Solutions that enable managers and administrators to effectively manage the delivery of care to individuals and monitor and enable National Authorities to monitor public health and plan appropriate responses.
Standards & Interoperability category	One of the Categories of the Foundations & Enablers Stream. Definition of standards that enable consistent and accurate collection and exchange of health information across health systems and services.
Strategic Line	High-level actions, focused on final outcomes, that are needed to materialize national eHealth strategy (i.e. Implement a national health identification service). They should be classified inside a specific Category.
Strategy & Value Management category	One of the Categories of the Governance Stream. This category of analysis refers to the creation of a responsive strategy and plan for the national eHealth environment, guaranteeing the involvement of major stakeholders and sectors and alignment with European guidelines for eHealth. It also includes management and evaluation of eHealth investments to align financing with priorities and guarantee value creation, through the delivery of the expected benefits.
Stream	First level of the conceptual framework structure. Strategic building blocks necessary to support the development of a national eHealth strategy – Governance, Solutions and Foundations & Enablers
Target measure	Measurable, realistic and achievable goal of a specific KPI that helps to evaluate the success of an initiative or project.
Technological & Innovation Trends category	One of the Categories of the Foundations & Enablers Stream. Set of technological trends that can bring innovation to the entire healthcare sector and improve healthcare delivery.
Telemedicine	Healthcare services provided at a distance, being especially useful in remote areas to deliver high-quality and safe healthcare services. It can also be complemented with telecare services like remote monitoring and alerts to support individuals with special needs on their daily life.
Workforce category	One of the Categories of the Foundations & Enablers Stream. Development of eHealth knowledge and skills through internal expertise, technical cooperation, and education and training programs for health workforce capacity building.

7.3. Appendix C: References

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8. Annex

8.1. Annex A: eHealth framework references

- WHO National eHealth Strategy Toolkit

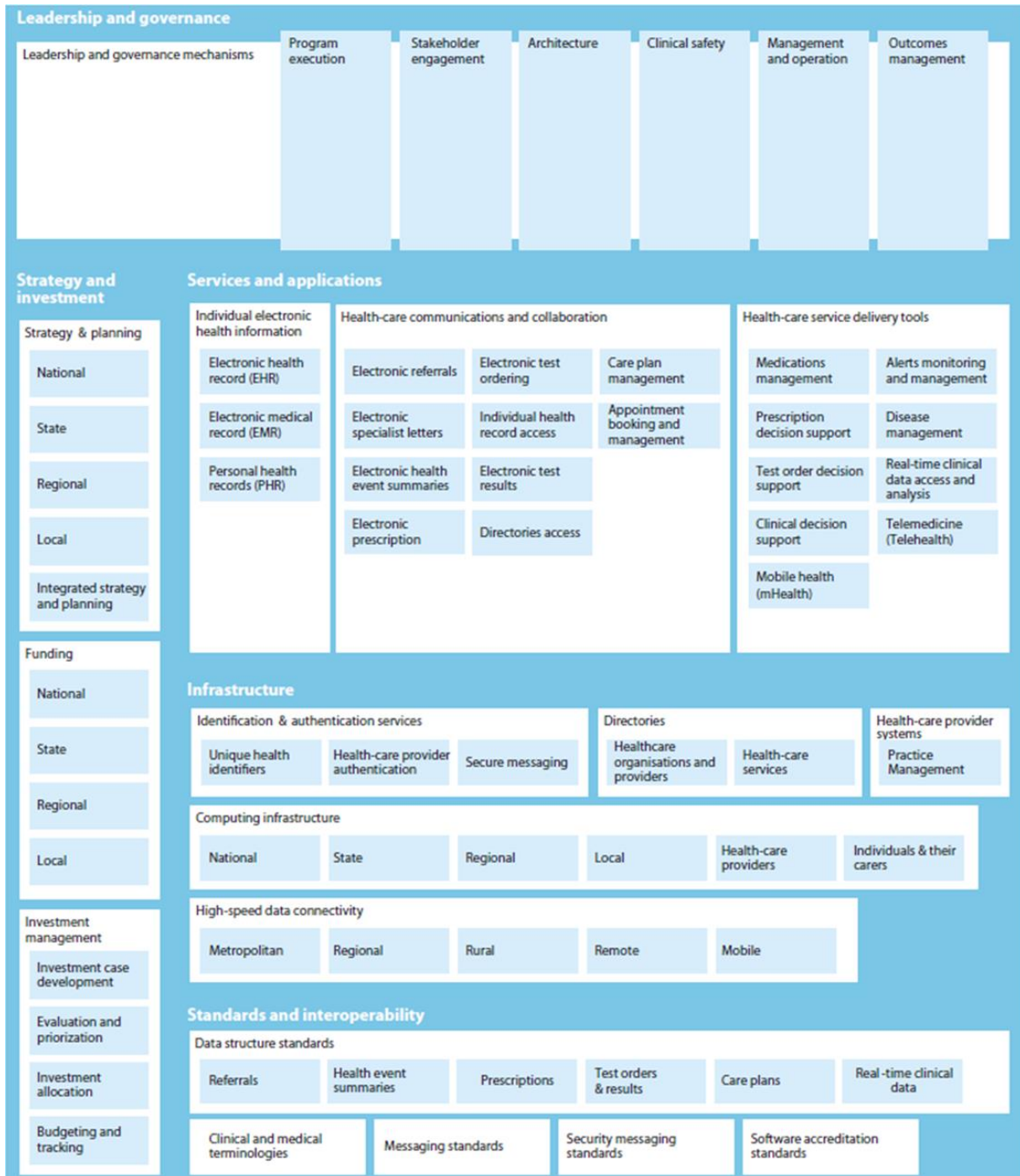
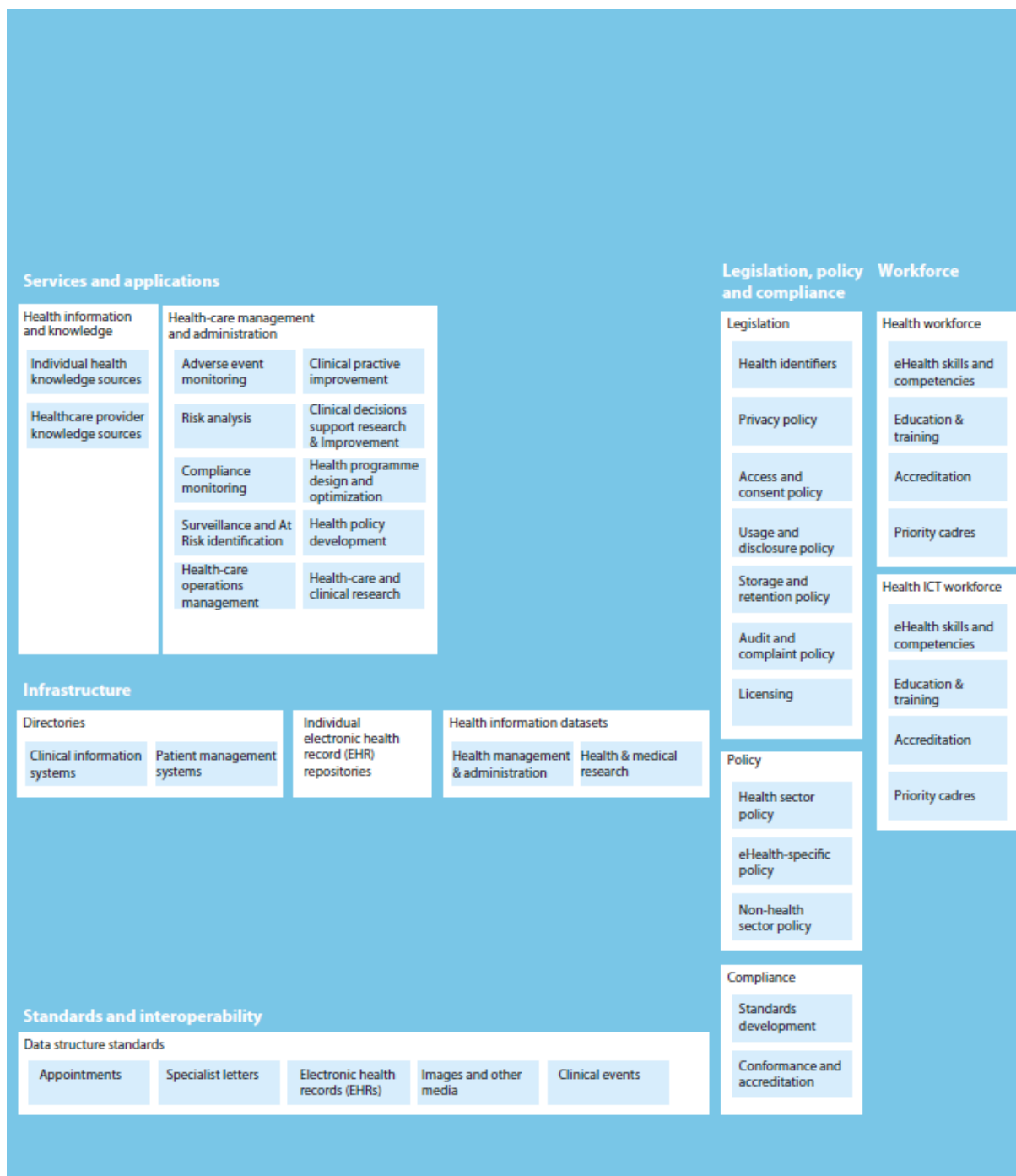


Figure 16 - WHO National eHealth Strategy Toolkit framework

(Continuation)



- *National E-Health and Information Principal Committee: National E-Health Strategy (September 2008)*

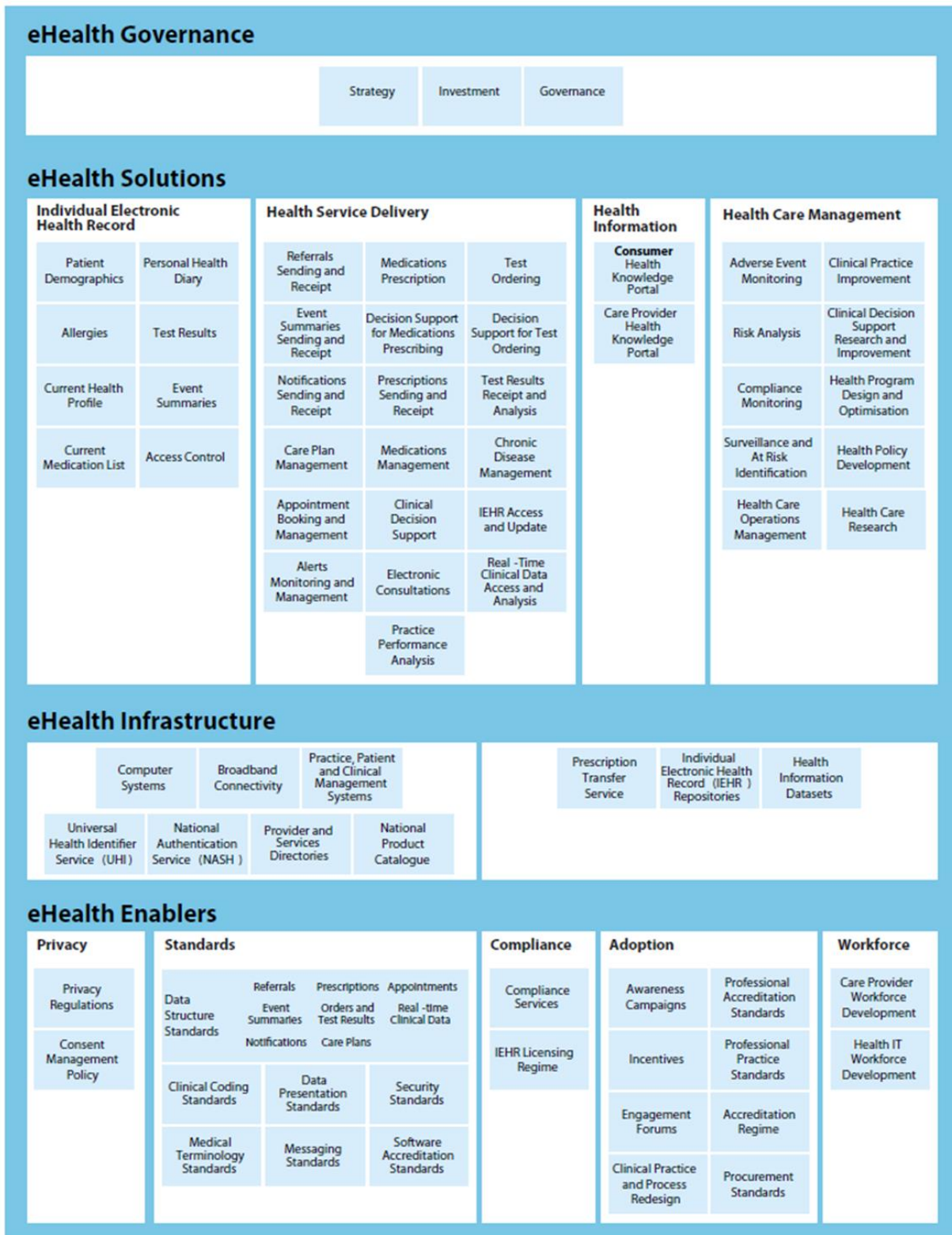


Figure 17 - Australian eHealth Strategy framework

- *CALLIOPE Model*

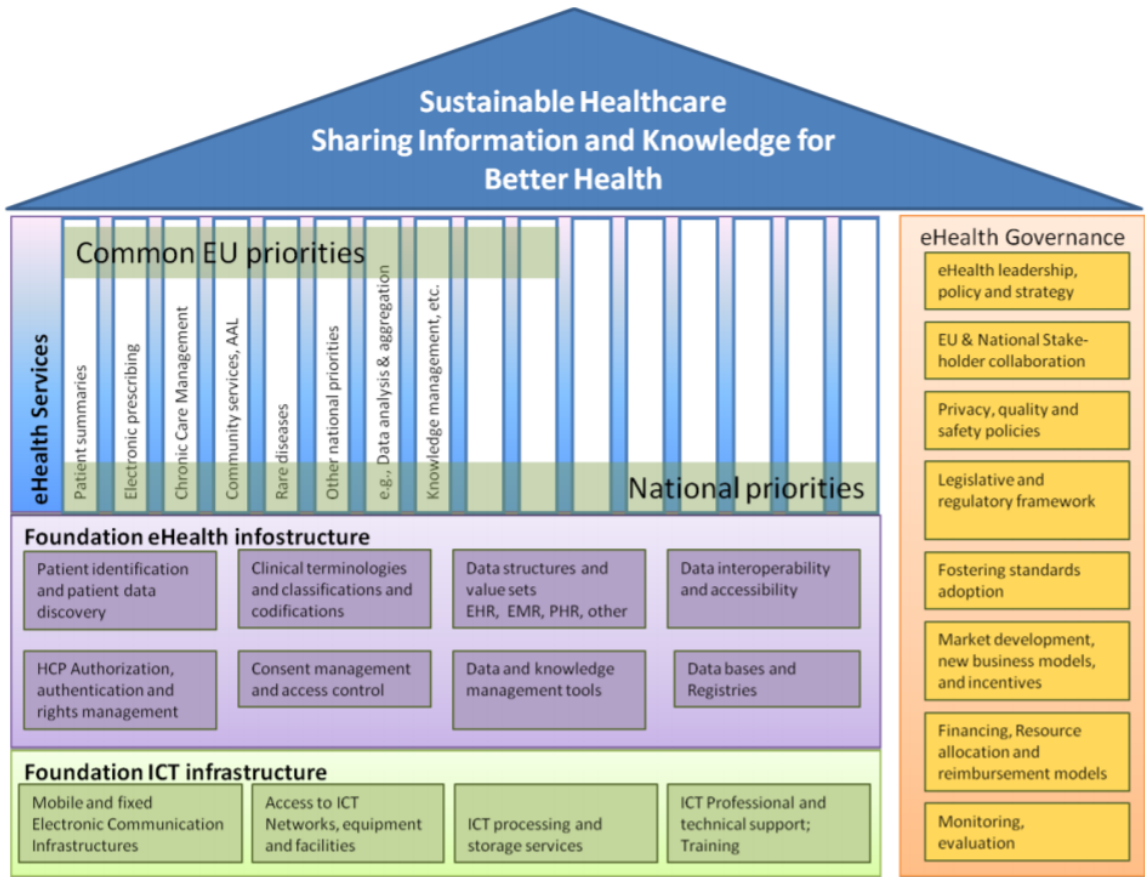


Figure 18 - CALLIOPE Model framework

8.2. Annex B: Comparison between the proposed conceptual framework and the original frameworks

Conceptual Strategic Framework		WHO National eHealth Strategy Toolkit	Australian National eHealth Strategy	CALLIOPE Model
Governance	Leadership & Governance	“Leadership & Governance”	“e-Health Governance”	“eHealth Governance”
	Strategy & Value Management	“Strategy and Investment”		“eHealth Governance”
Solutions	IEHI	“IEHI”	“IEHI”	“eHealth Services”
	Healthcare Service Delivery	“Healthcare Communications and Collaboration” and “Healthcare Service Delivery tools”	“Healthcare Service Delivery”	“eHealth Services”
	Healthcare Information & Knowledge	“Healthcare Information & Knowledge”	“Healthcare Information”	“eHealth Services”
	Public Health and Healthcare Management & Administration	“Healthcare Management & Administration”	“Healthcare Management”	“eHealth Services”
Foundations & Enablers	Infrastructure	“Infrastructure”	“Infrastructure”	“Foundation ICT infrastructure” and “Foundation ICT infostructure”
	Standards & Interoperability	“Standards & Interoperability”	“Standards”	“Foundation ICT infostructure”
	IT Processes Management	<i>None</i>	<i>None</i>	“eHealth Governance”
	Legislation, Policy and Compliance	“Legislation, Policy and Compliance”	“Privacy” and “Compliance”	“eHealth Governance”
	Workforce	“Workforce”	“Workforce”	“Foundation ICT infrastructure”
	Adoption Mechanisms	<i>None</i>	“Adoption”	“eHealth Governance” (<i>partially</i>)
	Technological & Innovation Trends	<i>None</i>	<i>None</i>	<i>None</i>

Table 6 – Comparison between the proposed conceptual structure framework and the original frameworks

8.3. Annex C: IT Processes Management Framework of COBIT 5

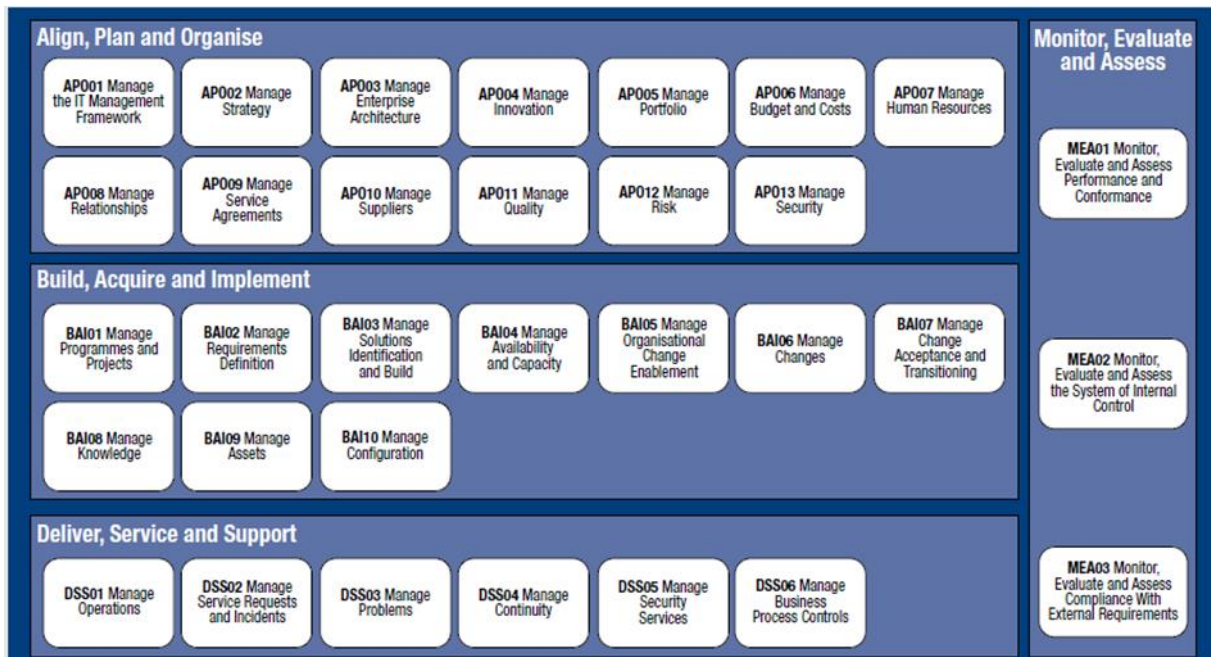


Figure 19 - Framework for IT Processes Management based on COBIT 5 methodology