Evaluation of E-Health Strategies: A Portfolio Approach

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Today it is a general belief that e-health has a positive effect on costs as well as on quality of health service delivery. Nevertheless, lots of projects failed in the past to clearly demonstrate a positive value proposition. Difficulties arise especially when not only evaluating a single action but a whole strategy for adopting national or provincial e-health. Grounding on the experience of an ex ante evaluation of the Swiss e-health strategy, a first attempt how to practically demonstrate the value of the planned health system's changes is discussed in this article. On the basis of a "utility" and a "readiness" portfolio, generic allocation decisions are formulated for prioritising investments as well as for identifying weak points in the defined e-health strategy.

Keywords

Assessment, e-health strategy, evaluation, portfolio approach, technology acceptance

1. Introduction

As the great part of e-health initiatives are publicly funded (and taxpayers more than ever expect an obvious value for money), a well-defined vision or road map how to improve safety, quality and efficiency of health service delivery by using information technology (IT) – commonly referred to as 'e-health strategy' – is expected to be formulated and continuously adjusted by national as well as international authorities within the next years. According to [1] an e-health strategy may include statements on "*standards and policies for ensuring interoperability and data security, and […] incorporate a commitment to facilitate consumer empowerment and patient self-care through provision of electronic information and/or telemedicine facilities*." In Europe and Australia, these principles are mostly reflected in consolidated national health information strategies [2, 3]. In Canada and the United States e-health strategies are defined on provincial level [e.g. 4, 5, 6].

In order to validate, revise and control applications, services, and projects to be adopted by provincial, national, and cross-border health information strategies*, evaluation* plays a vital role in both, science and practice. According to [7] it can be characterized as *'[…] a series of activities incorporating understanding, measurement, and assessment. It is either a conscious or tacit process which aims to establish the value of or the contribution made by a particular situation. It can also relate to the determination of the worth of an object.*'

Given that distinct disciplines such as economics, computer science, information systems or health services research use different scientific rationale and methods, divergent connotations and meanings of the same term exist. Independently from any academic field, evaluation can generally be conceived as '*objective and systematic collection of information about a program, project, or instructional material for its improvement*' [8]. By that definition, the pursuit of *objectivity* constitutes a key characteristic of an evaluation [9]. Hence, to ensure the intersubjective verifiability of the evaluation results, methods for and criteria to assess the particular object must be revealed.

However, it is clear from an epistemological point of view that a completely objective evaluation is not possible [10]. On the one hand, as evaluation intents are restricted in time, budget, and human resources, a well-grounded but in most cases subjective selection decision of the specific evaluation methods and criteria must be taken in advance. On the other hand, the evaluation results should be as unequivocal as possible, so that the utility of the evaluated object is clearly understood by all affected stakeholders. Consequently, an evaluator is typically faced with, what Frank denotes as, the 'dilemma of evaluation' [10]. Therefore an evaluation should not be seen as purely scientific activity (or series of activities) to validate theoretical considerations but also as approach to assess and pragmatically discuss the practical value of a suggested or accomplished product, service, project or strategy.

The practical value, however, critically depends on the different stakeholders being asked [11, 12]. Especially in healthcare opinions differ as perceptions, culture, and the level of formation significantly vary between the different stakeholders such as healthcare acceptors (e.g. healthy people, patients and their relatives), healthcare providers (e.g. medical and nursing professionals and related management personnel), supporters (e.g. suppliers, software providers), and controllers (e.g. governmental authorities, insurance companies) [13]. Particularly when evaluating a multitude of IT-reliant artefacts, such as e-health, an indiscretionary exertion of evaluation methods and models often produce inadequate outcomes, which result in an unclear value of the technologies or systems being assessed [14, 15]. Therefore, although it is widely recognized that e-health is supposed to have a positive effect on costs as well as on health service quality [16, 17], a lot of projects failed in the past either because of organizational issues or the inability to state a clear value proposition [18, 19].

Since the evaluation of publicly funded projects and programs – due to the recent financial crisis – is becoming increasingly relevant, it is the aim of this paper to make a first attempt how to practically demonstrate the value of actions undertaken to implement a national or provincial e-health strategy. For this purpose, a brief introduction to strategic planning and evaluation as well as a contextualization for e-health is given in section 2. In addition, the major drawbacks when evaluating e-health strategies are discussed. Based on these findings, a portfolio-approach is presented in section 3 that was used for the ex ante evaluation of the e-health strategy of Switzerland [20]. Finally, in section 4, we discuss the consequences for the future and give an outlook for continued research in the area.

2. Strategic planning and evaluation in the context of e-health

[21] note that strategies concerning the adoption of IT in healthcare often lack focus, yielding to unclear assignments of tasks among organisations for collection, analysis and communication of information as well as to isolated work environments and infrastructures. Before presenting our approach for evaluating e-health strategies, it is crucial to understand the general principles as well as common drawbacks of strategic planning and evaluation in the context of e-health. This section 2 is therefore dedicated to give a brief discussion of these themes.

2.1 General principles of strategic planning

National or provincial e-health initiatives generally not only centre on the advancement of a single healthcare organisation but on the improvement of parts or complete healthcare networks and the community as a whole. Thus, in order to coordinate actions, a formalised articulation of the intended changes and its later realization is needed. According to [22] the activity to gather such a plan, commonly referred to as 'strategic planning', can be divided into two steps: strategy formulation and strategy implementation (see Figure 1).

The purpose of *strategy formulation* is to help public agencies as well as private organisations to produce effective decisions (doing the right things) shaping the nature and direction of e-health within societal, legal, economic, and technological bounds. Starting point typically is an initial agreement – a 'plan for planning' [22] – that defines the role, functions, and membership of the strategy planning committee (SPC). Provided that the necessary resources are available and in consideration of internal

and external environmental factors, the strategy is developed in a next step. In doing so, the SPC must not mandatorily be the performer of this task. A third-party assisted strategy building – as in the case of Switzerland [23] – or a completely outsourced development – as for example in Australia [3] – are possible, too.

Aiming at efficiently realizing the suggested changes (doing the things right), different actions are launched during the *strategy implementation* phase. Amongst others this can be the development of new e-health services; amelioration of existing e-health services concerning e.g. functionality, ease of use, security, interoperability; promotion of new and existing e-health services; training of large user groups; privatisation/socialisation of existing e-health services; or building of new organisational and professional structures such as associations, research centres, action groups etc.

It is evident that these actions produce some type of results. As described above, it is the job of an evaluation to clearly demonstrate the practical value of the efforts undertaken using well-grounded criteria and rigorous methods. Hence, in the next section general principles for evaluating e-health are discussed.

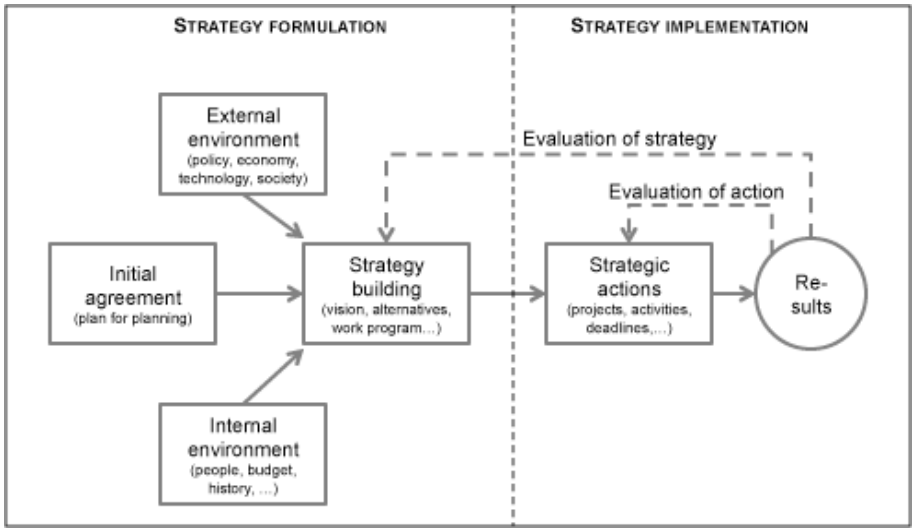


Figure 1 Simplified strategic planning process adapted from [20].

2.2 General principles of evaluation

In recent years considerable research has been directed toward studying the methodological challenges in the evaluation of e-health [24-26]. However, a general and widely accepted framework how to specifically evaluate e-health is still missing, but there is evidence to suggest that it can be broken down into a number of elements or activities [27]:

- Define purpose (*why?*): Findings from e-health evaluation studies can contribute to a number of conditions. For instance, from a practical point of view, it can be used for continuously learning or improving decision-making if it is conducted on a regular basis. From a scientific point of view, evaluations can be used for developing or testing theories.
- Identify the subject (*what?*): As illustrated in Figure 1, the subject of an evaluation can be the results (or sub results) of a single action or the evaluation of the entire strategy (bunch of actions). Admittedly, the great part of evaluation studies focused on the appraisal of new but single IT implementations. According to [28] around 24% of the published studies between 1982-2002 centred on the adoption of expert systems, 20% on teleconsultation systems, and 15% on clinical information systems. To our knowledge, little is published regarding the evaluation of e-health strategies so far.
- Determine criteria (*which aspects?*): In accordance with [29] distinct levels for studying the effects of IT-reliant systems exist. An example on an individual or group level can be the evaluation of e-

learning systems for medical knowledge and skills acquisition; on an intra-organisational level, e.g. the evaluation of online-resource planning systems within a hospital; on an inter-organisational level, e.g. the evaluation of an electronic referral system between hospitals and general practitioners; on a societal level, e.g. the evaluation of health portals. Each level requires different criteria for assessing the value of IT. As to [28] the majority of evaluation studies base upon quantitative measures (approx. 85%). However, qualitative measures (or a combination of both) can be used as well [20].

- Fix time frame (*when?*): As simplistically illustrated in Figure 2, an evaluation can be effected ex ante (i.e. before implementing and deploying the e-health service) or ex post (i.e. after the implementation and deployment of the e-health service) [30]. Reviewing recently published evaluation reports and articles let us assume that the great part is based on an ex post examination [20].

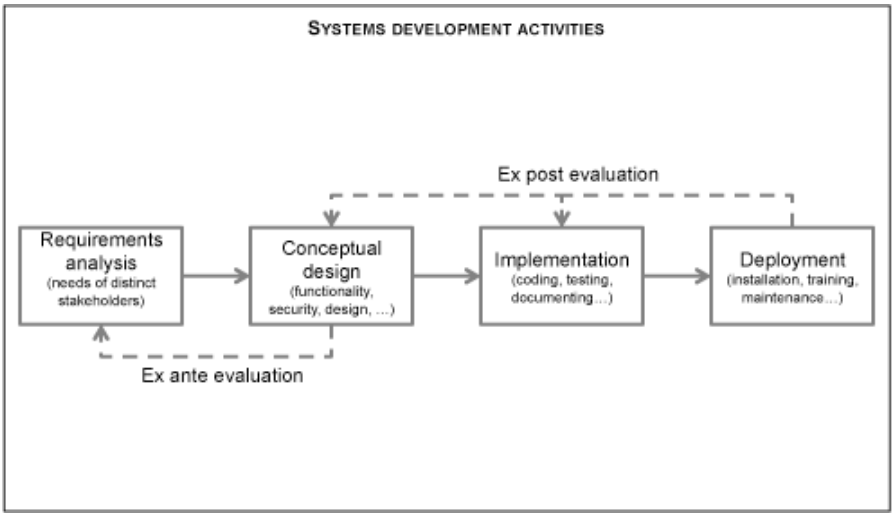


Figure 2 Simplified development activities of IT-reliant systems.

- Involve people (*who?*): Since the results of an evaluation critically depend on the stakeholders' perceptions (i.e. healthcare acceptors, healthcare providers, supporters or controllers), it is extremely important to clearly specify from which point of view e-health is evaluated. However this is excluded or not explicitly specified in many evaluation studies.
- Specify methodologies (*how?*): Following [31] basically empirical and analytical evaluation methods can be differentiated (see Figure 3). Empirical methods can further be subdivided in quantitative (e.g. surveys, lab experiments) and qualitative approaches (e.g. focus group discussion, observation). Likewise it is possible to split analytic methods in approaches originating from IT (e.g. ontology-based evaluation, feature comparison) and procedures from other disciplines (e.g. econometrics, historical analysis). In the context of e-health approx. 75% of the studies use empirical and 25% analytical evaluation methods [28].

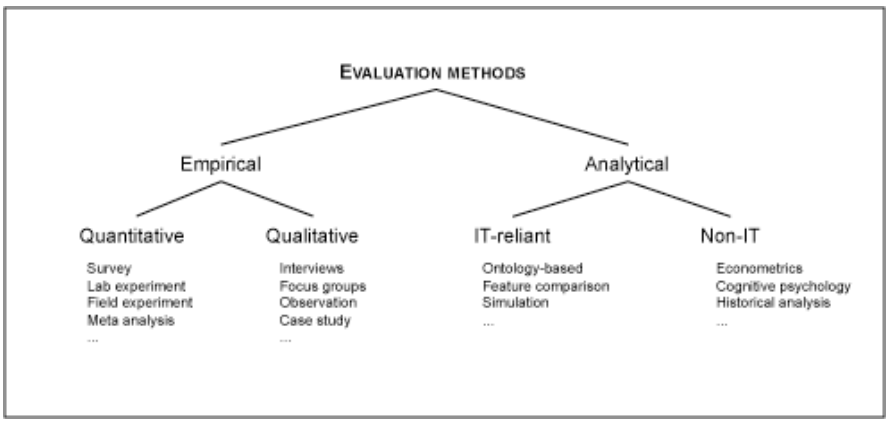


Figure 3 Methods for evaluating e-health.

2.3 Drawbacks when evaluating e-health strategies

Based upon the prior described general principles of strategic planning and evaluation, the following drawbacks when evaluating e-health *strategies* can be identified:

- Gaps between strategy formulation and implementation: A major problem in the outlined strategy planning process (Figure 1) is the break between the formulation (strategic decision making) and the implementation (strategic change). Frequently the SPC puts too much effort into the conceptualisation of the e-health strategy and less into control and influence of its factual execution. As a consequence of this, gaps between the planned and the realized measures emerge. A continued variance comparison may therefore be favourable.
- Focus on single actions: The great part of evaluation studies is focused on the assessment of dedicated actions (e.g. benefits of electronic health records in organisation or region X), thus leaving behind possible interrelations with other actions (e.g. effects on e-health service Y in organisation or region Z). Especially when the e-health strategy is directed to prioritise future actions, it crucial to get a general idea of the utility and chance of success within the overall context.
- Unclear scope: Lots of evaluation studies start without having an explicit idea of what, why, how and for whom it is done. Even if this idea is clear it is often not manifested to the targeted audience of the evaluation. If addressing the scientific community it is extremely important to accentuate the rigour of the study, however, practical relevance should not be neglected. On the other hand, if rather focussing on the information needs of practitioners, first and foremost the relevant insights for practice should be highlighted but without loosing rigour while arguing.
- One-dimensional consideration of opinions: Often evaluation studies are devoted to represent the value proposition from a particular point of view (e.g. the benefits generated for the medical community or the patients). As e-health strategies are supposed to evenly address the needs of all stakeholders, a multi-dimensional approach may be taken into account for assessing the value of the planned and/or realized actions. Furthermore, as the SPC's conception of e-health can significantly differ from other stakeholders' view, a faceted approach may help to disclose possible reasons for resistance.
- Concentration on quantifiable measures: As discussed before, the majority of evaluation studies are centred on quantitative methods and criteria (e.g. verification of 'technical' requirements or cost-benefit-analysis), usually leaving behind hardly explainable and measurable facts such as culture and beliefs. However, the consideration of this kind of criteria may be particularly adjuvant when the evaluation is conducted before implementing the e-health strategy.
- Focus on ex post examination: In most instances evaluation studies are conducted ex post, that is after the implementation and/or deployment of the specified actions. The preference to this approach over others (such as ex ante or a combination of both) is mainly attributed to the fact that reliable data – following a positivist epistemology – is gathered easier when something concrete for measurement exists (e.g. an executable prototype or a fully-fledged running e-health service). Otherwise the obtained data may only be considered as rough or imperfect estimation of stakeholder beliefs. Nevertheless, publicly funded projects and programs need a prejudgement of the value of the intended actions (funds may else be retained) and thus additional approaches such as ex ante interpretative studies are required as well.

3. Portfolio approach used for evaluating the Swiss e-health strategy: A case study

In order to address the before mentioned weak points a new approach was developed, which consists of five steps:

1. Delimitation of the evaluation study: In a first step the fundamental design decisions for shaping the evaluation are taken (cf. Table 1; italics exemplify the Swiss e-health strategy case). This includes the delineation of the purpose of the study (i.e. a technical, financial, field, or theoretical study) and the limitation of the subject (i.e. IT-services and infrastructure, organisational practices, people behaviour and capabilities or other issues). In our case, the aim was to provide a general picture of the usefulness of intended IT-services. Hence, the study should not reflect the

perception of one particular stakeholder, but a broad and ex ante impression across all relevant stakeholders of healthcare.

As in Switzerland there is no common e-health platform yet, a total of four planned e-health services were chosen (i.e. electronic health record, referral portal, health information service, provider performance statistics) which represent a good mix between the multiple actors of healthcare and are also balanced with respect to its contributions as well as with respect to the investment horizon.

In order to derive the constituent criteria for evaluating the selected e-health services, a profound literature review as well as statistical analysis was undertaken (for a detailed discussion refer to [32]), yielding a list of 65 key questions relating to access and capability, information quality, efficiency, governance, outcome, and trust.

Purpose	Technical study		Financial study	*Field study*		Theoretical study
Subject	*IT-services and infrastructure*		Organisational practices	People behaviour and capabilities		Other
People	*Healthcare acceptor*		*Healthcare provider*	*Supporter*		*Controller*
Criteria	*Information quality*	*Outcome*	*Efficiency*	*Gover-nance*	*Access and capability*	*Trust*
Time	*Ex ante*			Ex post		
Method	*Empirical methods*			Analytical methods		

Table 1 Design decisions for shaping the evaluation.

2. Configuration of questionnaire: The list of questions served as a reference catalogue, which could be adapted depending on the kind of e-health service and type of evaluator. This was needed because not every service has an effect on all criteria and not every stakeholder is in the position to make an educated statement of the potential effects (e.g. a healthcare acceptor is definitively able to estimate the impact of a new service relating to trust, access, information quality and partially to efficiency criteria, but he is almost uninformed with respect to outcome and governance effects). If not conducting this step, a considerable bias in the answers may result. A focus group discussion with 2-3 representatives per stakeholder category gave a good impression of the comprehensibility and practicability of the actor-specific questionnaire.
3. Estimation of "utility": The actor-specific questionnaires formed the basis for conducting a survey. In doing so, 700 key persons of the healthcare sector were asked between October and December 2008 either by postal mail, or by e-mail to take part in the study. Of the 700 invitations sent out, 79 persons filled in the questionnaire, giving a response rate of 11.3 percent. Thereof 23 percent were completed by healthcare providers, 28 percent by supporters, 23 percent by health care acceptors, and 26 percent by controllers.

   After a general section for collecting demographic information about the evaluator, the second part of the questionnaire was dedicated to appraise three constructs: (1) the benefits of the four e-health services relating to the prior defined criteria (e.g. information quality, efficiency etc.), (2) the durability of impact (e.g. short-term impact, medium-term impact, long-term impact), and (3) the likelihood that the benefits occur (e.g. not likely, definitively happen). By contrasting the aggregated values of the three constructs it was possible to visualise the "utility" (cf. Figure 4; greater size of bubbles indicates a better likelihood).

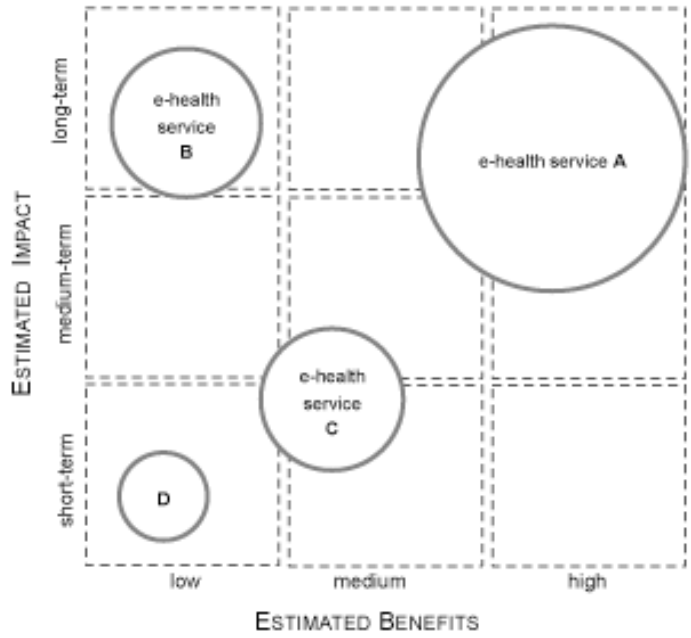


Figure 4 Visualisation of e-health service "utility".

4. Appraisal of "readiness": As the first considerations were made without association to the current situation, a further section of the survey was formulated for evaluating the "readiness" of a health system to adopt the intended e-health service. This includes the (1) appraisal of the level of capabilities and prerequisites (e.g. not available, partially available, available), (2) the consideration of investment costs (e.g. low, medium, high) as well as (3) the acceptance of the intended technology (e.g. problematic, regular, unproblematic). Again, by contrasting the aggregated values of the three constructs it was possible to visualise the "readiness" (cf. Figure 5; greater size of bubbles indicates a higher technology acceptance).

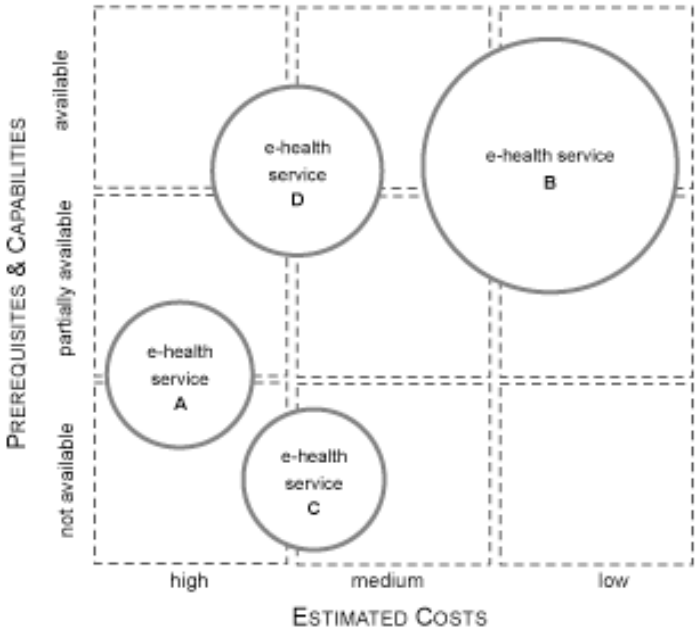


Figure 5 Visualisation of e-health service "readiness".

5. Analysis of overall results and thesis formulation: In order to get an overall impression of the planned e-health services and to contrast these results with the formulated e-health strategy, the “utility” portfolio and the “readiness” portfolio were linked (cf. Figure 6). This yielded a final portfolio from which generic allocation decisions were formulated.

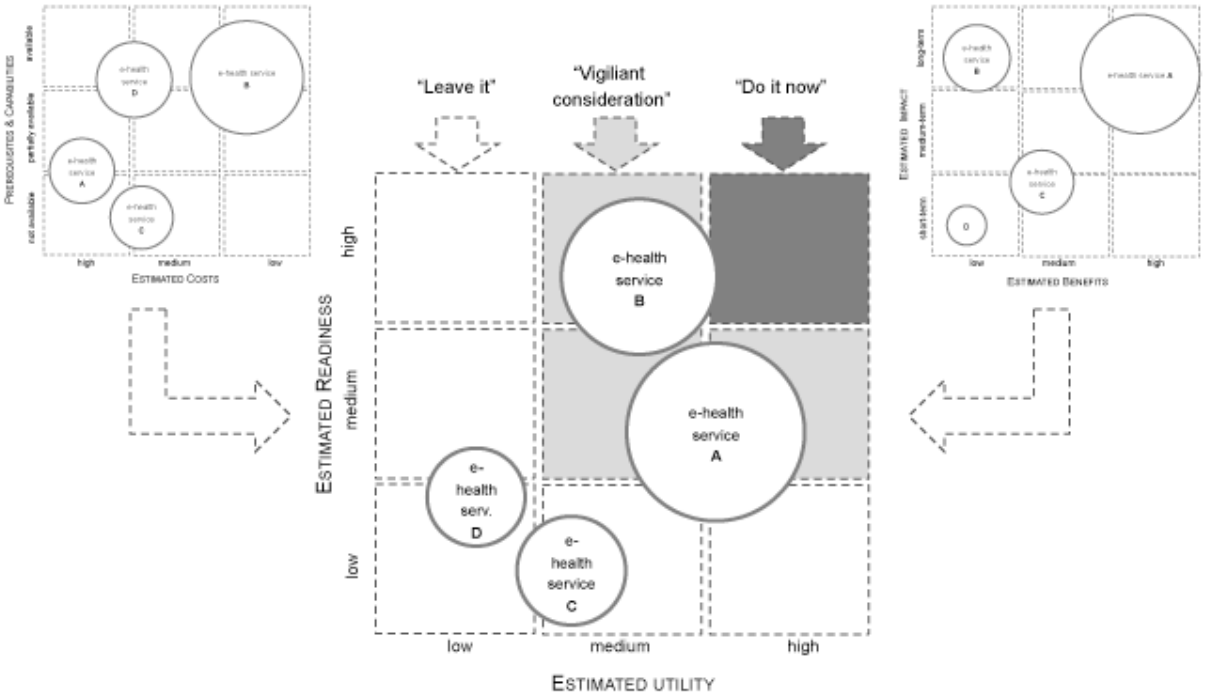


Figure 6 Generic allocation decisions for e-health strategy.

4. Conclusion and limitations

In this paper it was argued that in order to provide evidence of the effects on costs as well as on quality of e-health services, a clear strategy (on provincial, national, and international level) is required that is regularly assessed and evaluated. Since resources are scarce, an approach is needed that values the bunch of planned actions to able to prioritise its financing and the order of implementation. However, current methods mainly concentrate on the evaluation of single actions (i.e. a particular e-health service). Hence, using the portfolio method, a new approach is presented that helps decision makers to allocate investments regarding the estimated utility and chance of success of an e-health services. In order to test our proposition, the method was applied within the evaluation of the recent version of the Swiss e-health strategy.

Even so, the presented approach is limited in a number of ways: First, the selection of services for the evaluation may have an impact on the acceptance and estimated usefulness of the approach. In order to minimise a potential bias, the selection of services (electronic health record, referral portal, health information service, provider performance statistics) represents a good mix between the multiple actors of healthcare and is also balanced with respect to contributions to efficiency, effectiveness and safety, as well as with respect to the investment horizon (current investment focus vs. future investments). Second, due to an oversaturation of surveys in the Swiss healthcare sector, the response rate of the presented case study is low and should necessarily be improved in a next iteration. Third, having in mind the variability of functionalities of a particular e-health service (e.g. distinct electronic health record systems behave differently), differences in organisational and individual capabilities and other distinctions, the results of the described method should not be seen as “ultima ratio” for every stakeholder of healthcare but as aggregated view of the “net utility” of the defined e-health strategy. Fourth, the questionnaire to obtain the required data for aggregating the “bubbles” is limited to the Swiss healthcare sector and cannot necessarily be directly transferred to other health systems.

To our opinion, the results build a good starting point for prioritising investments on provincial, national or international level and for identifying weak points in the formulated e-health strategy (e.g. overestimation/underestimation of a e-health service within the strategy). Furthermore, it can be used as basis for ex post evaluations that prove whether the promised "value for money" really was achieved or not. However, given the mentioned limitations further research should be dedicated towards a broader application of the presented portfolio approach. For this, the definition of a standardised questionnaire is needed in order to be able to use it in an international setting.

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