RE-DESIGNING THE BUSINESS MODEL OF A MULTI-SIDED DIGITAL PLATFORM

Andrea Pistorio[1], Luca Gastaldi[1], Paolo Locatelli[2], and Mariano Corso[1]

[1]Politecnico di Milano, Italy

[2]Fondazione Politecnico di Milano, Italy

andrea.pistorio@polimi.it

ABSTRACT

The advent of digital innovations and the increasing importance of value co-creation are driving many firms to re-design their business models through the adoption of digital multi-sided platforms. Some researcher focused on the antecedents of business model design, i.e. the viewpoints that should be taken into account before outlining the business model. Through clinical inquiry research in the healthcare context, this study investigates the antecedents to be contemplated for the re-design of a business model based on a multi-sided digital platform. The paper examines the interactions among the different antecedents and presents practical recommendations concerning the tools that could support their usage. Results highlight that an adequate business model re-design is rooted in a proper alternation of antecedents that continuously support the collection and generation of an exponential amount of information. The complexity associated with business model design should be progressively limited by gradually pruning incompatible information and focusing on the most relevant one.

Keywords: *antecedents, business model design, multi-sided platform, healthcare.*

1. INTRODUCTION

Digital innovations require the cooperation of multiple actors and the integration of various digital solutions (Yoo et al. 2010). Given these characteristics, digital innovations constitute the pillars of multi-sided platforms that enable the interactions among firms and with customers (Galvagno and Dalli 2014; Gawer and Cusumano 2002).

Among the diverse typologies of platforms investigated in the literature, this study focuses on digital, multi-sided platforms (Hagiu 2014). Various researchers studied the business model design of these platforms (Amit and Zott 2015; Galvagno and Dalli 2014; de Oliveira and Cortimiglia 2017; Zott and Amit 2010). The studies of Amit and Zott (2015; 2010) are centered on a focal firm interacting with other actors to develop its business model. The related key concepts, such as antecedents, elements and themes, respectively regard the aspects needed before business model design, the choices regarding the design and the purposes of the new business model.

These authors focused on new firms outlining their business models. Therefore, there is still a gap to examine business model design regarding already established firms that are modifying their business model (re-design). Moreover, it is not yet clear if antecedents are still adequate for business model re-design, and which tools are suggested to perform these activities. Different scholars described the connections between the elements and strategic goals, and between themes and antecedents. The analysis of the literature on the business model design illustrated that it is not yet clear which relationships subsist among antecedents.

Coherently with the need to understand how business models are built, Gawer (2014) recommended that additional research on digital platforms should analyze emerging and evolving platforms.
Given the gaps mentioned above, this research aims at answering the following research questions:

RQ1: What are the relationships among the antecedents concerning the re-design of a business model of a digital, multi-sided platform?

RQ2: Which tools can support proper management of the various antecedents concerning the re-design of a business model of a digital, multi-sided platform?

To answer these questions, we conducted clinical inquiry research concerning a European project called DECI (Digital Environment for Cognitive Inclusion - Horizon 2020 program - grant agreement No 643588). The project aims at increasing the quality of life of the people affected with mild dementia or mild cognitive impairment through innovative care processes supported by a digital platform (Pistorio et al. 2017).

2. THEORETICAL FRAMEWORK

This chapter is composed of two sections. The first section outlines digital innovations and multi-sided platforms. The second section describes the essential perspectives of business model design literature.

2.1 DIGITAL INNOVATIONS AND MULTI-SIDED PLATFORMS

Digital innovations mix digital and physical components and allow the development of new products and services (Yoo et al. 2010). The following features characterize digital innovations: (1) reprogrammability, (2) data homogenization, (3) self-referential nature, (4) layered modular architecture. The mix of these features constitutes the ground for the development of multi-sided platforms (Eisenmann et al. 2006; Gawer and Cusumano 2014).
According to Gawer and Cusumano (2014, p. 420), a platform is defined as "foundations upon which a larger number of firms can build further complementary innovations and potentially generate network effects".
Boudreau and Lakhani (2009) investigated platforms and the links among the platform, customers and complementors, and described the following three categories. Integrator platform: the platform owner consolidates the applications of complementors and provides the final product/service to the customers. Product platform: complementors develop the final product/service starting from the platform and then sell it to the customers. Multi-sided platform: complementors and customers can interact with one another, or they can interact with the firm which owns the platform.
Three main aspects distinguish a multi-sided platform. Firstly, it is a platform that enables the interactions between two or more actors. Secondly, each actor is connected to the platform (Hagiu 2014; Hagiu and Wright 2015). Thirdly, the platform is based on the co-creation of value (Galvagno and Dalli 2014; de Oliveira and Cortimiglia 2017).
Different authors analyzed multi-sided platforms. Khuntia et al. (2017) studied them in healthcare settings and highlighted the relevance of an appropriate business model design to avoid failures.
Further investigations should analyze the organizational processes regarding the birth and implementation of a multi-sided platform (Facin et al. 2016; Gawer 2014; Gomes et

al. 2016). Hence, the study of business model design related to a nascent multi-sided platform is consistent with this gap.

2.2 BUSINESS MODEL DESIGN

Following the literature review of Massa et al. (2016), business model research is characterized by several definitions. Given the need to take into account different actors and to avoid focusing only on a single focal firm, we adopt the definition provided by Zott & Amit (2010, p. 216), who consider business model as "a system of interdependent activities that transcends the focal firm and spans its boundaries". They identified the key design elements of content, structure and governance. All these elements are related to the set of activities, called activity system, which the actors perform to reach the overall objectives of the network.

Content reveals the activities that should be performed. Structure defines the links among the activities, their order and their relevance for the business model. Governance describes who is the owner of every activity. Rai and Tang (2014) further examined the elements of business model design for a focal firm co-creating value with other actors of its network. The authors classified five strategic goals that can be at the foundation of the business model: achievement of ecosystem's efficiencies, increase of market responsiveness, development of innovative products/services, development of markets and customer relationships, generation of complementarities. Authors also described how these goals affect the requirements for business model design elements.

The other aspects analyzed by Zott & Amit (2010) are related to themes, which are the consequences of the activity system and are drivers of value creation. Themes are distinguished in the following four categories: novelty, lock-in, complementarities and efficiency.

Amit & Zott (2015) furtherly developed their research through the study of the antecedents of business model design, which are the aspects that should be taken into account before designing the business model. The antecedents are named goal, template, stakeholders activities and environmental constraints, and were linked to the business model design themes. The scholars focused on the creation of a new business model and did not consider the case of a firm aiming at modifying the already existing business model.

Goal refers to value creation. Template is the tendency of entrepreneurs to copy/recycle from other business models. Stakeholders activities is related to the collaboration among the actors of the network during the design phase and/or during the usage/application of the designed business model. Environmental constraints is related "to the conditions imposed on the business model designer by the economic, legal, socio-political, regulatory, and cultural environment in which the business model will be embedded" (Amit and Zott 2015, p. 343).

The study of Amit & Zott (2015) examined the antecedents separately and the relationships among antecedents and themes, while it is not clear how to connect antecedents with the elements that are components that actually allow reaching the specific theme. The idea of antecedents has commonalities with the requirements described by Rai & Tang (2014), which are instead associated with the elements.

Finally, they intentionally did not contemplate internal constraints (i.e., capabilities and resources required to perform the required activities) to reduce the complexity of the suggested framework. This omission could not fit the case of an already established firm that plans to transform its business model. As affirmed by Amit and Zott (2015), the links among antecedents and themes could demand a review.

This study illustrates the antecedents performed, suggests the possible relationships among antecedents, and suggest some tools to support this process, which is preliminary for the outline of the elements of the business model.

3. METHODOLOGY

The paper is based on the activities fulfilled by the authors during the European project DECI. The overall objective of the project is the improvement of independent living for elderly people affected by Mild Cognitive Impairment or Dementia (Locatelli et al. 2015). This purpose is reached through the definition of a new business model based on a digital platform (Trimarchi et al. 2018).
Following the research of Rai & Tang (2014), the main strategic goal of healthcare organizations (i.e. focal firms) is the development of an innovative care service to support patients and the network of actors involved in the care process.
The three years long project (from June 2015 to May 2018) is marked by four pilots, in Israel, Italy, Spain and Sweden, which are beneficial to test the designed business model. The actors involved in this project were different categories of organizations as healthcare centers, IT providers and universities/research centers, related to five different Countries (Table 1).

Name	Category	Country
Fondazione Politecnico di Milano	Research Center	Italy
Politecnico di Milano	University/ Research Center	Italy
Consoft Sistemi S.p.A.	IT Provider	Italy
Fondazione Don Carlo Gnocchi	Healthcare Organisation	Italy
Centre for Healthcare Improvement - Chalmers University	University/ Research Center	Sweden
Vastra Gotalands Region	Governmental Organisation/Healthcare Organisation	Sweden
Hospital Universitario de Getafe - Servicio de Geriatría	Healthcare Organisation	Spain
Maccabi Healthcare Services	Healthcare Organisation and IT Provider	Israel
Roessingh Research and Development	Research Center	The Netherlands

Table 1. List of actors involved in DECI project

Each pilot is delineated by a healthcare organization (i.e. focal firm) that interacts with different actors such as patients, caregivers, social care and healthcare professionals, IT providers, research centers. Except for IT providers and research centers, whose resources are shared among Countries, the other actors are related to the area administered by the specific focal firm.
The results of this paper are related to the first year of the project and the process through which a multi-sided platform-based business model has been designed. This article does not consider the phases concerning pilots and the actual implementation of the business model.
We adopted action research in the form of clinical fieldwork research, also known as clinical inquiry research (Schein 2008).
The primary objective of researchers was helping practitioners to solve a problem. The learning opportunity was caused by a request of the practitioner asking for support (Schein 2008). Therefore, practitioners were more disposed to provide crucial information. Researchers were involved as facilitators to offer technical knowledge and suggestions, but the other actors were responsible for defining the specific interventions that had taken place, i.e. the actual design of the business model.
The intent of the clinical fieldwork consisted of theoretical and practical contributions. From the academic perspective, we aimed at expanding the scientific knowledge regarding the antecedents of business model design. From the perspective of practitioners, the clinical fieldwork aimed at assisting them through the creation of the basis for the creation of a new business model.
During the first 12 months of the project, researchers directed, conducted and participated in various activities leading to the development of the new business model in the four pilot sites and the launch of the related pilots.
Hence, scholars supported practitioners release resources through self-intervention and self-examination (Stebbins and Shani 2009). The research allowed actively including "those who experience or "own" the real world problem", e.g. caregivers, healthcare professionals, (Elden and Chisholm 1993, p. 129).
Data gathering to describe the business model design process followed during the DECI project is based on several sources: (i) direct observation; (ii) documents (e.g. deliverables describing the progress and steps of the project) and emails regarding the project; (iii) focus groups; (iv) reports regarding the meetings among the actors of the DECI project. All the produced documentation was collected during the project and digitally stored. The documentation regarding deliverables encompasses not only the final version of the developed documents but also the drafts of these, including the feedback/comments provided by other actors.
Coherently with other action research scholars in the field of digital innovations, data analysis and collection were interlinked (Braa et al. 2004). To conduct the study, we organized, categorized, chronologically ordered all the collected materials concerning antecedents, and we distinguished the typology of tools adopted or developed. All the activities were analyzed regarding the actors involved, the typology of the required inputs and achieved results (outputs). It allowed identifying the pathways of the various outputs related to the various antecedents and highlighting the connection among antecedents.

4. RESULTS

This chapter illustrates the four phases that delineated the preliminary activities required for the business model design.

Each section concerns one of the phases and details the related activities. The purpose is to describe the moves made by the network of actors involved in the project to proceed from the antecedents to the elements of the business model.
At the end of each section, we provide a graphical representation of the performed activities regarding antecedents illustrating the path of the developed outputs and the tools to perform these activities (Figure 1). Graphical representations are adaptations of the directed graphs (Bondy and Murty 1976; Diestel 2006) to which we attached the information regarding the tools supporting the specific antecedent.

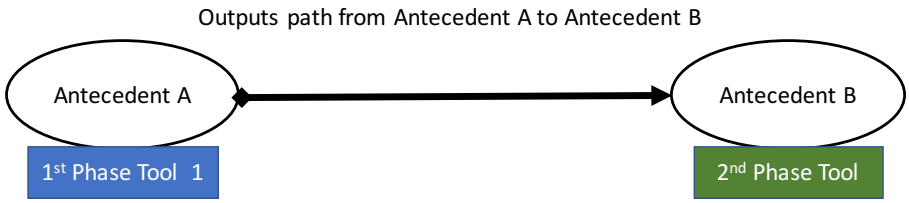

Figure 1. Example of the graphical representation of antecedents and related tools concerning two phases

We also consider the accumulation of the multiple templates gathered during template activities (Figure 2).

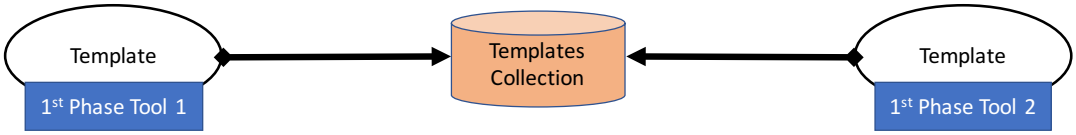

Figure 2. Example of the graphical representation of template antecedents, related tools and collected templates

The decisions regarding the tools adopted and all the outputs of the performed activities in DECI project were subject to the review/judgment of the other actors involved in the project. Therefore, all the antecedents always incorporated a part of stakeholders' activities, because they are also based on collaborations.

4.1 NEEDS, CURRENT PROCESSES AND STATE-OF-THE-ART OF PRACTICES

The objective of the DECI project regarded the improvement of the quality of life for elderly people living at home and affected by Mild Cognitive Impairment or Mild Dementia. A digital multi-sided platform should be the enablers of this improvement.
The designed business models should also support other actors, i.e. the caregiver but also healthcare and social care professionals. Therefore, the first business model design antecedent considered was goal, and it concerned the achievement of the objectives of all the actors that will interact through the multi-sided platform. The main scope of governmental organizations was the improvements in the condition of patients and caregivers, while healthcare organizations were also interested in helping their employees. IT providers and research centers aimed at producing practical solutions.
The accomplishment of these intertwined objectives demanded to identify the needs of patients, caregivers, healthcare and social care professionals.
The assessment of needs was performed through two tools that supported goal definition. The first was a literature analysis regarding patients affected with Mild Cognitive Impairment and Mild Dementia, and also exploiting the Camberwell

Assessment of Need for the Elderly (Reynolds et al. 2000). The second was an analysis of the four pilot sites (i.e. Maccabi Healthcare Services, Fondazione Don Carlo Gnocchi Onlus, Hospital Universitario de Getafe and Vastra Götalands Region).

The literature analysis allowed listing all the aspects useful to describe the patients and the healthcare context in which they were inserted. They regarded medical, functional and socioeconomic perspective, the various related needs, the characteristics of the related care network, and the level of ICT literacy and acceptance of patients.

The examination of the pilot sites allowed collecting information about the attributes of the associated care services (e.g. care activities, processes, roles, information shared), i.e. the elements of the current business models. Therefore, this analysis highlighted also the related organizational needs, another key aspect to ensure the adoption of the platform also from the viewpoints of healthcare and social care actors. Nevertheless, the primary outputs are the current care processes and the related business models. These outputs are recallable to internal constraints (not considered in the model of Amit & Zott (2015)). The current business model should also be examined for the potential synergies between the current and the new business model (Markides and Charitou 2004).

Together with the analysis of the care systems, a literature analysis was conducted regarding the state-of-the-art of clinical and assistance management practices. It regarded the most affirmed, evidence-based pharmacological and non-pharmacological therapies for the targeted patients. It also included the analysis of successful international examples of integrated care programs and related quality guidelines.

This study recalls the antecedent template because it suggests solutions that can be "borrowed" (Amit and Zott 2015) for the design of the new business model.

This phase of the business model design process needed goal and template antecedents. The literature review and the care processes analysis are useful to perform goal activities and allowed developing the list of needs and describing the current care systems in the four pilot sites (internal constraints). Another literature review contributed to template activities and helped to collect the first components that could be borrowed to design the new business model (Figure 3).

The only interaction among antecedents, i.e. stakeholders' activities and the other antecedents of the first phase, concerns the feedback provided by stakeholders related to the review of the outputs.

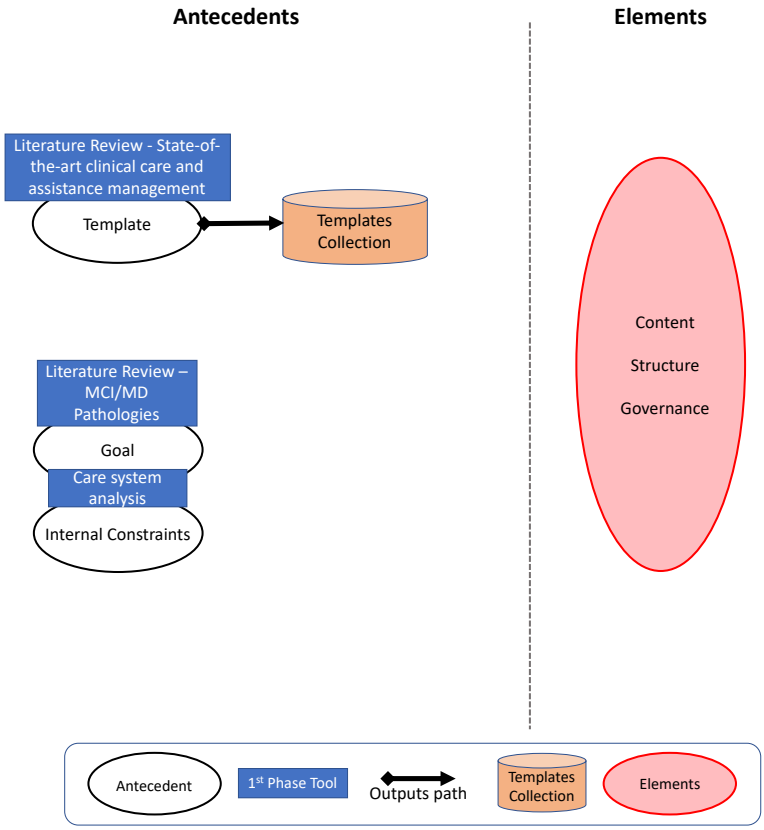

Figure 3. Antecedents regarding the first phase (stakeholders activities related to outputs review are not shown)

4.2 VALIDATED NEEDS AND PROCESSES, BORROWING COMPONENTS

The second phase required the passage from needs to the potential solutions to address these needs. Two literature reviews characterized it. The first regarded technologies to support the targeted patients and the other actors involved in the care process. The second regarded the components of business models related to digital solutions to support targeted patients. This information was appropriate for the identification of the modules that would have been integrated into the platform. These tools are recallable to template, and they were used to integrate the outputs of this antecedent obtained during the previous phase.

The framework adopted to categories the various aspects of business models was the business model canvas of Osterwalder & Pigneur (2010). It was exploited to classify the results of the literature review regarding technologies and the list of needs obtained in the previous phase. The work done in the previous phase regarding the needs was beneficial to understand the characteristics of the targeted customers better. The information regarding the potential patients, caregivers and healthcare professionals allowed examining all the solutions not only designed for Mild Cognitive Impairment/Mild Dementia but also for other pathologies with similar characteristics.

Since this moment, stakeholders activities were only associated with the meetings of the research groups, the emails among people of different institutions to coordinate and provide feedback about the developed works. These aspects are examples of collaboration, one of the typical traits of action research (Greenwood et al. 1993).

Given the necessity to validate the outputs of the previous phase and to combine the first results of the literature reviews on business models and technologies, four focus

groups were organized, one per Country in which the pilots would have next been accomplished.
Every focus group lasted on average four hours and engaged diverse categories of actors, i.e. nurses, physicians, therapists, social care workers, ICT professionals, managers cure/care institution, nutritionists.
These focus groups were useful to consider perspectives different from the one of the researchers conducting the analysis, and to encourage the incorporation of local knowledge (Greenwood et al. 1993).
The outputs of the focus groups were: (i) validation of the current care systems, the list of (ii) validated needs, (iii) further possible organizational solutions and (iv) further technological functionalities (useful to identify the possible modules for the multi-sided platform).
The validated representation of the current care systems (internal constraints) constitutes one of the inputs required for the re-design of the business model. The choice of business model elements is also based on the existing processes, and the required organizational and technological changes.
In this phase, the previous outputs of goal and template were validated and enlarged through stakeholder activities. The extension of the list of "templates" was also pursued through further literature analysis regarding technological aspects and business models. All the components (e.g. needs, functionalities), except for the current care systems, are still considered independently (i.e. which technological functionalities addressed the various needs was not stated) and are not context-specific (Figure 4).

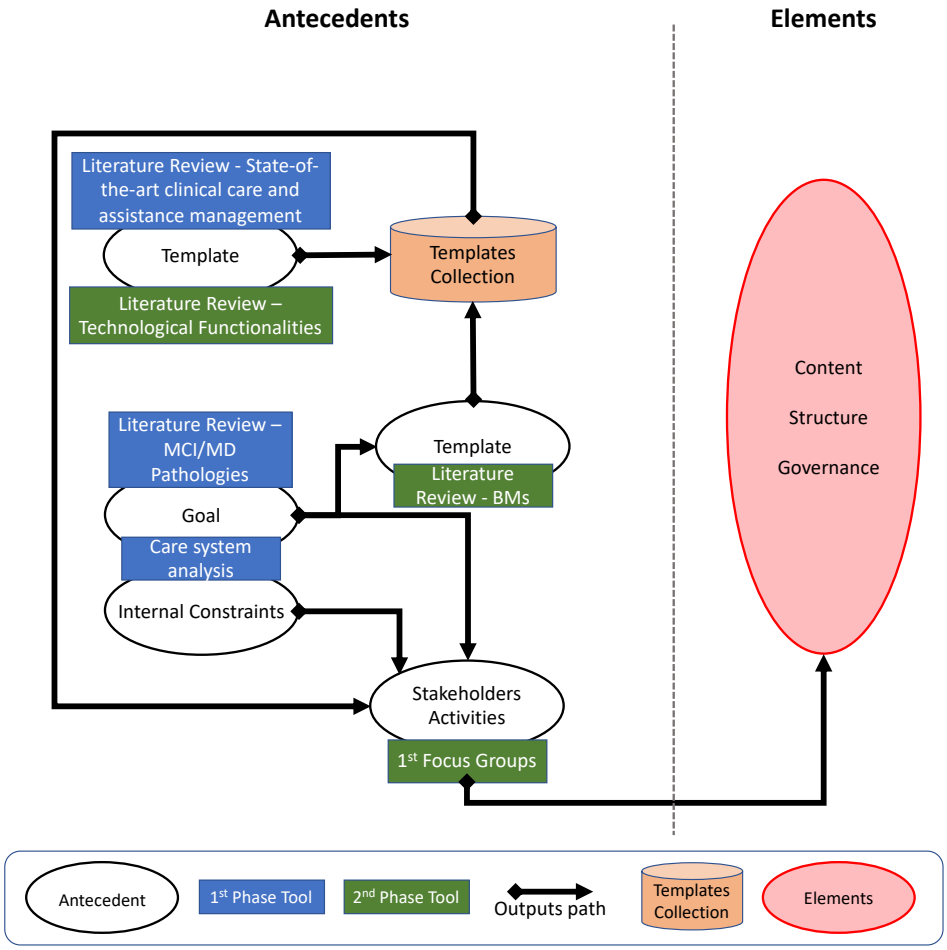

Figure 4. Antecedents regarding the first and second phase (stakeholders activities related to outputs review are not shown)

4.3 ENVIRONMENTAL CONSTRAINTS AND PAIRS NEED-FUNCTIONALITY

The third phase of the business model design process was characterized by three main activities useful to examine contextual variables, context-specific preferences and to link technological functionalities with needs.

The research aimed at listing all the Country-specific characteristics, for the four pilot sites, regarding (i) key trends, (ii) macroeconomic forces, (iii) industry forces and (iv) market forces. This research was performed through a literature analysis, and the results were extended by the suggestions of the other actors within the DECI project.

Once the list of various needs was validated in the previous phases, it was linked to the relevance of these needs in the four contexts where the pilots would take place. Therefore, a questionnaire was developed and delivered to the four pilot sites. It included the list of the needs (adapted from the Camberwell Assessment of Need for the Elderly (Reynolds et al. 2000)) and the request to provide, through a Likert scale, information about the relevance of the various needs in the case of care processes for the targeted patients.

Another critical step concerned the association between the needs and the technological functionalities useful to address these needs. Through the information of previous literature analysis regarding technologies and business models, we identified coherent pairs functionality-need, i.e. functionalities that are useful to address the various needs. The output of this activity is a prerequisite for the following phase and constitutes useful information for the developers of modules.

The relevance of needs and the coherent pairs functionality-need were validated during the second round of focus groups organized in the four pilot sites and characterized by the involvement of several categories of actors.
The results of the questionnaires and the outputs of the second series of focus groups allowed considering the needs of all the actors. Therefore, it is another example of the antecedent goal mixed with stakeholder activities (Figure 5).
Furthermore, the activity conducted to discern the coherence among needs and functionalities is not recallable to any of the antecedents defined by Amit & Zott (2015). Consequently, we decided to adopt the word "integration" to distinguish this further antecedent.

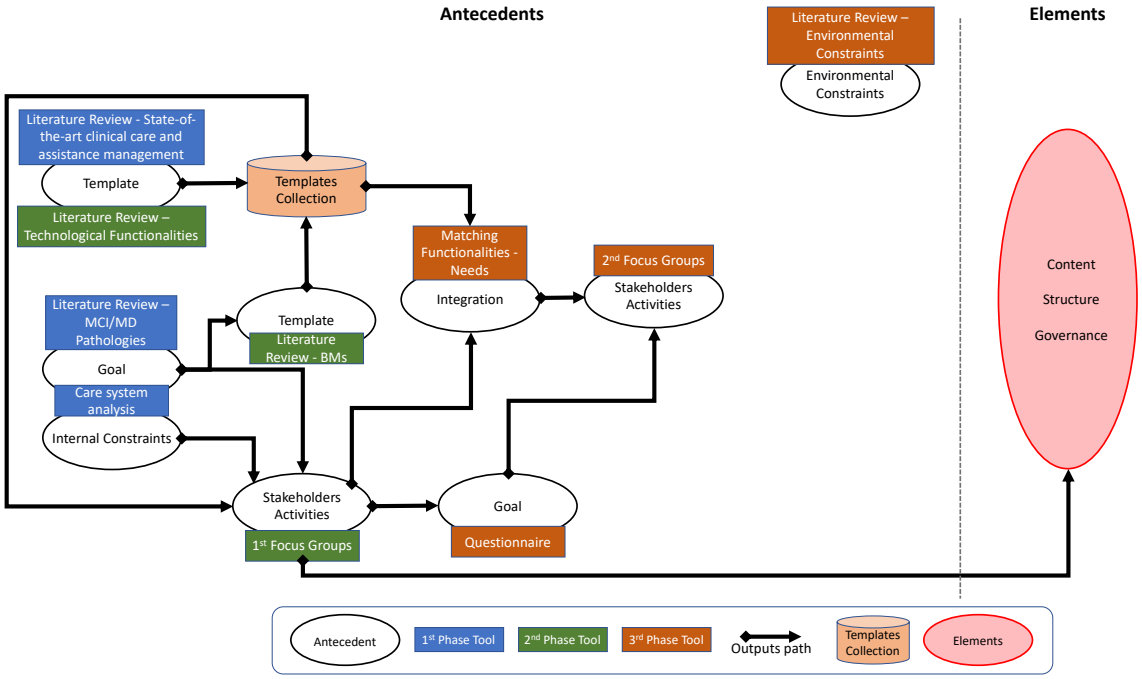

Figure 5. Antecedents regarding the first, second and third phase (stakeholders activities related to outputs review are not shown)

4.4 ENVIRONMENTAL COHERENCE AND DECISION SUPPORT SYSTEM

The last phase regarding the antecedents of the business model design was based on the check of the collected templates regarding consistency with external constraints and the development of a decision support system.
Coherence between the components of the collected templates and environmental constraints is one of the information required to design a business model. It allowed the exclusion of the components, related to the collected templates, which were not coherent with the constraints. Therefore, it decreased the complexity that decision makers should face during the selection of the elements of the new business model. Given the fact that the re-design of a business model based on a multi-sided platform is intrinsically complicated (e.g. different needs of different actors, different digital innovations and related modules to be integrated with the platform, different contexts), the reduction of options is suggested.
Therefore, the reduction of options is also pursued through the decision support system. The decision support system allows discerning between: coherent and incoherent pairs functionality-need, relevant and not relevant pairs functionality-need, and Country-specific and common among Countries pairs functionality-need.

The decision support system considered and integrated multiple inputs, i.e. the list of the needs, technological functionalities, pairs technological functionality-need, and the Country-specific relevance of the needs for the two categories of patients (i.e. Mild Cognitive Impairment or Mild Dementia). Moreover, the tool allowed highlighting the relevant pairs "technological functionality-need". It was achieved through the definition of a threshold related to the relevance of needs (e.g. coherently with the Likert-scale values, the user can select a value of 4 to consider all the needs with a relevance equal or higher than 4) and the selection of the Country analyzed. The decision support system was designed to be also adopted for further changes in business models and different contexts (i.e. Countries). It was also applied and tested in the context of The Netherlands through the support of Roessingh Research and Development. Furthermore, this tool was devised to insert additional functionalities, keep record of the Country-specific information concerning the relevance of the needs, update the Country-specific information regarding the relevance of the needs, highlight the commonalities with other Countries in terms of relevance of the various needs. This tool highlights useful information for various actors (e.g. governmental organizations, firms, healthcare organizations) and integrates the results of the activities related to the antecedents' goal, stakeholders activities and template. Then, the activity associated with the consistency with external constraints contemplated the efforts related to all the four antecedents described by Amit & Zott (2015).

The decision support system is an example of the integration of outputs regarding antecedents. The tool considers the various key aspects needed by the decision makers to design the business model. The tool allows analyzing these aspects, highlighting the relationships among them and considering the relevance of the needs. Therefore, given the relevance of needs, decision support system helps also in terms of priority of the coherent alternatives. Considering the four antecedents separately limits the overall understanding of business model design processes. Therefore, we propose that integration should be considered as one of the antecedents. Environmental coherence and decision support system constitute the tools supporting the activities concerning integration antecedent.

At the end of this phase, the outputs are the information that will be the basis for the design of the business model, i.e. the definition of the elements (Figure 6).

They comprise, for each pilot site, the list of key pairs functionality-need, the information that is consistent with the environmental constraints, and the description of the existing care process.

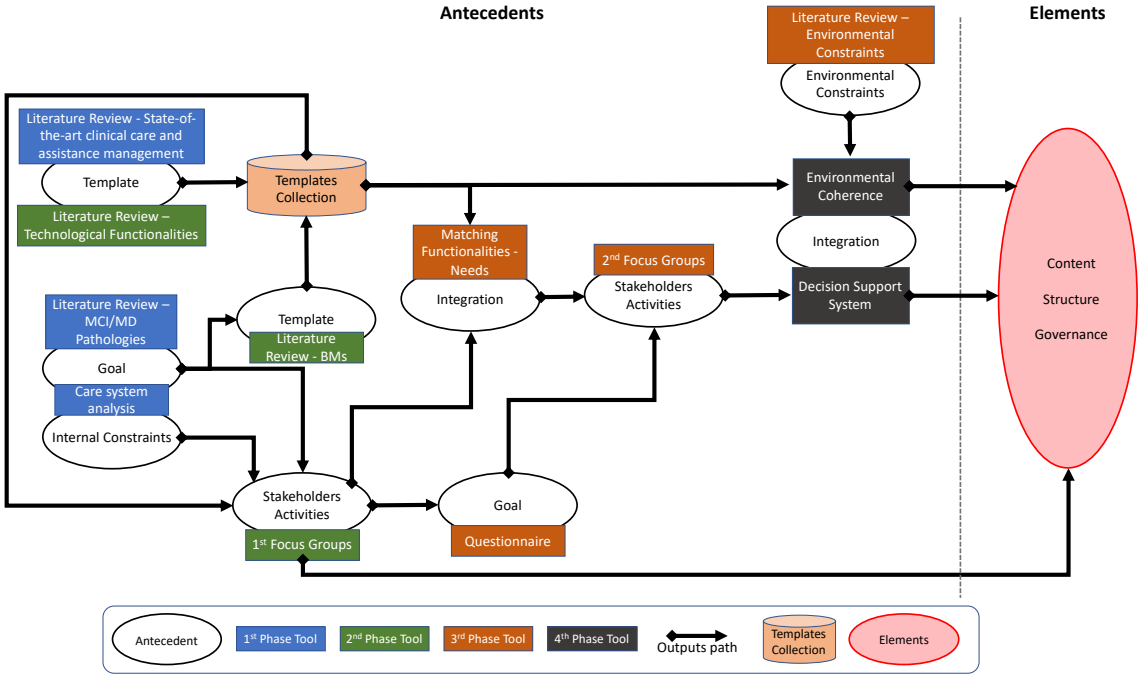

Figure 6. Overall Antecedents of business model design process (stakeholders activities related to outputs review are not shown)

5. CONCLUSIONS AND DISCUSSION

The research described the preliminary activities for the design of new business models based on the adoption of a multi-sided platform and the development of its modules.

Adopting the concepts developed by Amit & Zott (2015), in this research different antecedents were continuously analyzed during the clinical inquiry research and explained in four phases. The research allowed studying the relationships among antecedents and further detailed the description provided by Amit & Zott (2015) through the inclusion of some characteristics that are important for the practitioners striving to re-design a business model based on a multi-sided platform. These aspects constitute an academic contribution to the literature of business models that considered antecedents singularly and abstractly (Amit and Zott 2015). We also studied business model re-design instead of design. In this way, we considered internal constraints that require boundaries to the alternative decisions but constitute a pivotal point to promote synergies among the previous and the new business model (Markides and Charitou 2004).

We suggest the adoption and development of some tools to carry out the activities regarding antecedents and to assist decision makers.

The analysis of the paths of the outputs developed during each activity concerning antecedents (Figure 6) is exploited to answer to the RQ1. The figure provides information regarding a suggested sequence of adoption of antecedents.

The results showed that the different antecedents continuously alternate with each other during the process of business model re-design.

Except for internal and environmental constraints, which can be conducted independently from other antecedents, the other categories of antecedents require inputs from other antecedents such as template or stakeholders activities.

Therefore, we can suggest the following propositions:

P1: The alternation of antecedents characterizes the process of business model re-design and results in the continuous development of knowledge and increase in the collected information.

P2: The various categories of antecedents, in the re-design process of a business model, are not independent of each other.

The regular presence of the antecedent stakeholders activities, the continuous support provided by researchers and the constant contacts with the actors that are facing problems (e.g. patients, caregivers, healthcare professionals) highlight the relevance of collaboration and incorporation of local knowledge during the process of re-design of a business model based on a multi-sided platform (Greenwood, Whyte, and Harkavy 1993).
The results of the analysis showed that among the various antecedents analyzed during the clinical inquiry, goal has the highest priority because it is needed for all the other antecedents (except for internal constraints). This aspect is consistent with the framework of Rai & Tang (2014) concerning the importance of the strategic goal for the definition of the elements of the business model.
Hence, we suggest the following proposition:

P3: Goal constitutes the prerequisite for other antecedents concerning the re-design process of a business model.

Another aspect concerning the answer to the first RQ is related to the presence of the antecedent of “internal constraints” in the process of business model re-design. It is coherent with the concepts of the framework developed by Amit & Zott (2015).
Furthermore, the amount of information generated through the different antecedents is continuously increasing and leads to a rise in complexity that should be managed by decision makers during the selection of the elements of the new business model. Managing the increasing complexity of re-design of a business model is not possible with the adoption of a single antecedent. The integration of the gathered information to remove inconsistency of information is needed to decrease this complexity. This aspect supports decision-makers in the choice of the elements of the business model. Given that the primary strategic goal was the development of innovative services, the need for the antecedent "integration" is coherent with the model suggested by Rai & Tang (2014). We recommend that “integration” should be included as another crucial aspect concerning antecedents that were not considered in the framework introduced by Amit & Zott (2015).
Based on the discussion, we suggest the fourth proposition:

P4: The integration of the information collected over time and the exclusion of inconsistent information are suggested for the re-design process of a business model based on a multi-sided platform

The integration of information is supported by the development and adoption of tools such as the decision support system or the environmental coherence that guide the choices of the focal firm and the developers of modules. These tools constitute part of the answer to the RQ2 that is summarized in Table 2, which shows the tools adopted or developed to support the activities concerning the various antecedents during the four phases analyzed.

Environmental constraints and template are performed through bibliographic analysis and do not require the contribution of several actors. The other antecedents require the contribution of the various actors instead and are characterized by several tools to support the related activities.
Given the involvement of several actors from all the existing perspectives within the network, the adoption of focus groups was the critical aspect for to the generation of the knowledge that will be exploited during the choice of the elements of the business model.
The matching between functionalities (modules) and needs allows identifying potential areas characterized by needs not addressed by any existing modules. If these needs are recognized as relevant, this lack of modules highlights a market opportunity for IT developers.
We conclude that the adoption of focus groups and decision support systems constitutes a practical contribution for organizations working within a network of firms for the development of a new business model based on a digital multi-sided platform. The decision support system helps decision makers regarding the priorities of the consistent options concerning the modules that can be integrated with the digital platform.
The tools listed in Table 2 sustain the value creation and capture through the re-design of the business model, within the network regarding the multi-sided platform (Adner and Kapoor 2010; Massa, Tucci, and Afuah 2016; Afuah 2000).

Business model design antecedent	**Phase 1**	**Phase 2**	**Phase 3**	**Phase 4**
Goal	Literature Review; Care System analysis	–	Questionnaire	–
Template	Literature review	Literature review	–	–
Stakeholders activities	Review/feedback	Focus Groups; Review/feedback	Focus Groups; Review/feedback	Review/feedback
Environmental constraints	–	–	Literature review	–
Internal constraints	Care system analysis	–	–	–
Integration	–	–	Matching Functionalities - Needs	Environmental coherence; Decision Support System

Table 2. Antecedents and tools adopted during the phases

The recommendations concerning the tools to support the process of business model re-design based on a multi-sided platform constitute a contribution to the platform literature (Gawer and Cusumano 2014).
Finally, this research does not come without limitations. Given the characteristics of the project, there is a lack of repetition. It is not possible to generalize the results of this study, but it is the starting point for other researchers examining the antecedents of business model design. Moreover, the analysis was restricted only to the antecedents, and did not assess the impact of the antecedents to the themes.
Future studies could analyze the impact on the themes of the various tools and frameworks adopted to perform the activities concerning antecedents. Moreover, other components of business model design presented by Amit & Zott (2015) could be included, evaluating the contributions of antecedents on the elements and then analyzing the impact on themes. These further studies could be performed in the immediate future given the set of KPIs, defined for the pilot projects, which consider clinical, organizational and technological perspectives.

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