Business Models & Business Cases for Point-Of-Care Testing

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Abstract: Point-Of-Care Testing (POCT) enables clinical tests at or near the patient, with test results that are available instantly or in a very short time frame, to assist caregivers with immediate diagnosis and/or clinical intervention. The goal of POCT is to provide accurate, reliable, fast, and cost-effective information about patient condition. POCT can be part of the solution to the rising healthcare and welfare costs without any loss of healthcare quality. In this research, business models are used to create business cases in order to assess the viability of POCT. Two methods to create business models were designed by tailoring and extending them from an existing method. It was found that the method used has impact on the resulting business case. POCT was assessed to be viable in all business cases created for the specific case study used.

1 INTRODUCTION: POINT-OF-CARE-TESTING

Healthcare and welfare costs are rising, in the Netherlands, as well as other developed countries. Solutions need to be found to keep these costs within reasonable limits (Busse, 2001; Hagist and Kotlikoff, 2006), without loss of healthcare quality (Davis and Erixon, 2008). Point-Of-Care Testing (POCT) can be part of the solution. The goal of POCT is to provide accurate, reliable, fast, and cost-effective information about patient condition (St-Louis, 2000). Ehrmeyer and Laessig (2007) define POCT as "patient specimens assayed at or near the patient with the assumption that test results will be available instantly or in a very short time frame to assist caregivers with immediate diagnosis and/or clinical intervention".

Already several forms of POCT exist, such as glucose testing and urine dipsticks (Altieri and Camarca, 2001). These used to be laboratory tests exclusively, but have evolved to focus solely on measuring the most critical parameters of the designed test. By focusing on only a few parameters, the test becomes more specific, faster, and the devices smaller (Dondelinger, 2009).

Although many advantages of POCT have been proven, such as fast diagnosis (Middendorf, 2010), error reduction (Drenck, 2001), and reducing the time patients stay in hospitals (Kiwa Carity, 2014), it has been pointed out that POCT may not be a cost-beneficial development always (Lehmann, 2001).

2 RESEARCH GOAL AND METHODOLOGY

This research aims to provide insight in the viability of POCT as part of the solution to the rising healthcare and welfare costs. We focus on a single case study in Dutch health care. For this case study, we create and evaluate several business cases. Business cases are a generally accepted way of assessing costs and benefits, as they provide "a justification for a proposed project or undertaking on the basis of its expected commercial benefit" (Oxford University Press, n.d.). To avoid creating arbitrary business cases from scratch, we apply the Business Modelling Method (BMM) (Meertens et al., 2012) and subsequently the Business Model to Business Case method (BM2BC) (Meertens et al., 2013).

In the process, we aim to validate the BMM's use to create business models in a structured and repeatable way. In addition, extension of the BMM towards business cases may improve its value and applicability.

The process is as follows. First, we develop several derivatives of the BMM, so that we have methods to create business models that are tailored for healthcare and POCT specifically (section 3). Then, we apply these methods to create business models for our case study (section 4). Finally, we create business cases based on the business models and analyse them to assess their viability (section 5).

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3 TAILORING THE BUSINESS MODELLING METHOD

The basic BMM consists of four steps to create a single business model in a structured and repeatable way (Meertens et al., 2012). As such, it aims to fill the research gap "Design tools" as defined by Pateli and Giaglis (2004) and Vermolen (2010).

The four basic steps are: 1. Identify roles, 2. Recognize relations, 3. Specify activities, and 4. Quantify model. The result of each step serves as input for the next step. The resulting business model is suitable for analysis of the current situation. It can also form the basis for further predictions, such as business cases, scenarios, and alternative innovations.

When using business modelling to evaluate new or alternate business ideas, two additional steps should be followed: 5. Design alternatives, and 6. Analyse alternatives. These steps are not strictly part of the method to create business models. The first four steps can even be reused when designing the alternatives. In addition, several other steps could follow, such as implementing the chosen business model alternative. Section 3.2 provides details of each step.

While for each of the steps example methods are given, none of these is enforced. This allows tailoring the BMM to the demands of the specific situation.

3.1 Extending the BMM

One extension step for the BMM is considered in this research. It splits step 4 (quantify model) of the basic BMM into two separate parts for costs and benefits. This makes it more suitable for business case analysis.

While step 4 of BMM aims to quantify the model, previous work only focusses on the costs of the model (Meertens et al., 2012). As a business that only spends money will not last long, revenue needs to be generated. Quantifying using only cost accounting methods is not sufficient.

Pricing methods can be used if to model "To be"-business models. To model the "As is"-business model, numbers from accounting systems and (annual) reports can be taken. To model the "To be"-business model pricing methods need to be used to determine the price.

Three approaches can be taken to set a price: cost-based, competition-based, and customer-based (Peter et al., 1991). Each of these approaches has its own advantages and disadvantages, as well as specializations.

3.2 Tailoring: Two Derivations of the BMM

While the previous sections outline the global process of the BMM, in this section we will provide two derivatives of it. These derivatives, BMMa and BMMb, are tailored by choosing appropriate methods for each of the steps. As Van Dijk (2015) identified roles and recognized relations for the same case study, steps 1 and 2 follow the methods he used. Only from step 3 onwards do the two derivatives differ from each other.

3.2.1 Step 1: Identify Roles

The first step focusses on identifying the relevant parties (i.e. roles) involved in a business model. Originally, the BMM suggests stakeholder analysis for this step.

In the preliminary research, Van Dijk (2015) chose to use the three-stage stakeholder analysis method presented by Pouloudi (1998). This method was designed for healthcare settings, such as our case study. For these reasons, we include this method in step 1 for both derivatives.

3.2.2 Step 2: Recognise Relations

The second step aims to recognise and characterise the relationships among the roles identified in the first step. Step 2 prepares for step 3, and follows naturally from the first step. The result can be as simple as a role-relationship matrix (Meertens et al., 2012). While a stakeholder analysis often follows a hub-and-spoke pattern, the second step of the BMM forces to specify and rethink all possible relations between the roles. The relations consist of interaction between two roles, with some form of value exchange. This is in line with Gordijn and Akkermans (2001) who state that all roles in a business model can capture value from the business model.

From this perspective, the proposed technique for this step, e3-value modelling, is a valid one. The e3-value model models the economic-value exchanges between actors (Andersson et al., 2009; Kartseva et al., 2006). This economic-value exchange can be tangible as well as intangible (Allee, 2008; Andersson et al., 2009). Van Dijk (2015) used e3value to visualise value exchanges with and without MobiHealth for the case study of this research. For these reasons, we include e3value in step 2 for both derivatives.

3.2.3 Step 3: Specify Activities

The third step specifies the activities needed for the roles to maintain their relationships and value exchanges. Every role-relationship, as recognized in the previous step, consists of at least one interaction between two roles, requiring activities by both roles. The activities reveal what should happen for the business to function properly.

Originally, the BMM proposes techniques from business process management to create the intended output. For tailoring, we follow this guideline and limit the difference between BMMa and BMMb to the choice of Business Process Modelling Language (BPML).

For BMMa, we choose Business Process Modelling and Notation (BPMN) (OMG, 2006). BPMN models consist of diagrams for both business users and developers. BPMN aims to simplify the understanding of business activity flows and processes. BPMN is chosen as it is the de facto standard for business process modelling.

For BMMb, we choose Event-Driven Process Chain (EPC) (Scheer and Schneider, 1992). EPC was developed for modelling business processes with the goal to be easily understood and used by business people. EPC is chosen, as it is aims to be understood by business people, similar to the business models and cases for this case.

3.2.4 Step 4: Quantify Model

The fourth step turns the qualitative model into a quantitative model by obtaining numbers on cost and volume of the activities, which the previous step specified. This step helps to see what is happening in more detail, and allows for objective comparison between business models (Meertens et al., 2012). Numbers on cost and volume of activities are needed to completely overview the costs captured by the business model.

The origin of numbers depends on whether the "As is"-business model or "future"-business model is being modelled. To model the "As is"-business model, numbers from accounting systems and (annual) reports can be taken. To model the "To be"-business model, cost accounting methods need to be used to estimate the costs.

For an organisation to assign costs, several systems are available, both traditional systems and more refined systems, such as Activity-Based Costing (ABC) (Drury, 2008). Two main types of cost accounting methods exist: absorption costing, and variable costing. Their calculations differ mainly on the way they allocate overhead. Therefore, their results mainly differ when sales and production do not match (e.g. seasonal sales with production in the rest of the year).

ABC in general is a type of absorption costing, but is argued to have its flaws (Anderson and Kaplan, 2003). Time-driven Activity-Based Costing (TD-ABC) is an improvement of basic ABC by requiring estimates of only two parameters: unit cost of supplying capacity, and time required to perform a transaction or an activity.

For BMMa, we choose the modern TD-ABC method, as its parameters best match the available input for the case study.

For BMMb, we choose variable costing as described by Drury (2008). Variable costing is considered less complex, and therefore better matches the choice for understandability by business people. As healthcare in general has service-based organizations, sales and production occur at the same moment, and therefore, the results should be the same as for absorption costing.

3.2.5 Extension Step: Pricing Method

This extension adds to the previous step by focusing on quantifying the revenues instead of the costs. As we want to design not only "As is" models, but also "To be" models, a pricing method is needed to determine the future revenue.

The most common used pricing method is the cost-based pricing method called cost-plus pricing (Drury, 2008; Gregson, 2012), also known as mark-up pricing. A limitation of cost-plus pricing is that demand is ignored. The price is set by adding a mark-up to the cost, and this may bear no relationship to the price-demand relationship. It assumes that prices should depend solely on costs (Drury, 2008). An other frequently used pricing method is value-based pricing (Gregson, 2012). The difference between value-based pricing and cost-plus pricing is "pricing down from value versus pricing up from cost". Value-based pricing is a customer-based pricing method as the added value for the customer is translated into a price. Value-based pricing is setting a price that accurately reflects customers' perception of value and proposes a process to do so (Bernstein and Macias, 2002).

For BMMa, we choose cost-plus pricing, as it is most commonly used method.

For BMMb, we choose value-based pricing, as this allows to confidently set the right price, as well as making a realistic prediction of revenue and profitability, which are two objectives of the process.

4 CASE STUDY: BUSINESS MODELS FOR POCT BY MOBIHEALTH

The eHealth technology provider MobiHealth is the main actor for the case study of this research. MobiHealth is a Dutch company that was founded in 2007. The company's roots lie in the European projects MobiHealth and HealthService24. In these projects, a prototype for mobile telemonitoring was designed, tested, and clinically validated in several European countries.

As this case study focusses on POCT, we will first describe the setting in which this takes place. However, the main part of this section applies the derivatives of the BMM to the case. The "As is"-business models reflect the situation without automated processing of POCT by MobiHealth. In the "To be"-business models MobiHealth takes part and performs offers different services. The "As is" and "To be"-business models reflect the same situations using two methods, BMMa and BMMb.

4.1 Case Study Setting: POCT at a General Practitioner in the Netherlands

When a sample needs to be taken for a test, this can either be done at the general practice (by the assistant or the general practitioner) or at the laboratory. Whether or not the sample is taken at the laboratory or at the general practice, it needs to be processed by the laboratory. If the sample is taken at the general practice, the sample needs to be transported by courier to the laboratory. Depending on the location of the general practice and the production volume (i.e. number of samples taken), the courier will visit the general practice at least once a day. When the sample is transported to the laboratory, the laboratory performs the necessary test(s) on it using specialised equipment. The test results are printed; a so-called printout. The printouts are entered by hand into the laboratory information system (LIS) and double-checked by a second pair of eyes. A third party transports the test results entered into the LIS to the system of the general practitioner (HIS; Huisarts informatie systeem). When the test results are entered into the HIS, the general practitioner is able to check the test results of their patients.

Some general practitioners, not all, have POCT equipment in their practice. This allows them to not only take test samples, but also test it using the POCT device. The result is shown on the display of the device and allows the general practitioner to act upon the result immediately. The test results displayed on the POCT device need to be transcribed on a form or can be printed from the device directly. These forms and printouts are transported by the courier to the laboratory to be entered into the LIS. Sometimes, the data is send by email to the laboratory either by scanning it in or the assistant typing the email. The processing of test results can take up to a couple of days. Performing tests on test samples can, depending on the capacity of the equipment and volume, also take a couple of days. Although the general practitioner has the test results immediate available using the POCT device, still the processing takes a couple of days.

MobiHealth has developed a service to process the test results of the POCT device automatically. They do this by adding hardware to the POCT device to read the test results and send it to the computer of the general practitioner. The results are then send directly into the LIS. Using the existing integration between the LIS and HIS, the test results are entered into the HIS. This eliminates the time needed for the courier to take the results to the laboratory and the time it takes to enter the data into the LIS.

The laboratory supplies reagents to the general practitioner. These reagents can be used in the POCT device, but also to take samples or perform other medical operations. Only when a general practitioner submits a test sample or printout (by either courier, email, or using the service of MobiHealth) the laboratory is able to claim a reimbursement at the health insurer. The reimbursement is a fixed negotiated amount per test (amount depends on the type of test). Because of this, it is very important for the laboratory that performed tests are submitted by the general practitioner.

4.2 Business Model Foundation: Identified Roles and Relations

Van Dijk (2015) did the first two steps of the BMM for this case in previous work. Therefore, his work is a solid foundation to build upon in the following sections.

The first step of BMM, identifies roles taking part in the business model. The roles identified by Van Dijk (2015) is an extensive list. Not all roles can be found in the e3value model, as several are grouped. Groups of roles show a relationship more clearly than the individual roles themselves. Also it simplifies the situation and increase transparency and understanding. The listed roles match the roles in the extended e3value model (Staring, 2015). The roles can be found in Table 1.

Table 1: Identified roles, including descriptions.

Courier	transports reagents from the laboratory to the general practice and test samples and print outs from the general practice to the laboratory.
General practitioner	works in a general practice; multiple general practitioners can work at a single general practice.
Health insurance company	reimburse general practitioners and laboratories; issue health insurance policies to (potential) patients.
Patient	person in need of medical attention..
MobiHealth	provides integration service between POCT device and laboratory.
Laboratory-HIS integration company	provides one-way integration service between laboratory information system (LIS) and the information system of the general practitioner (HIS).
Laboratory	responsible for performing tests on test samples.
POCT device supplier	manufacturer/seller of POCT devices

The second step of BMM requires determining the relationships among the roles. Figure 1 shows the relationships in a simplified e3value model for a situation with courier, “As is”-model. Several of the roles and relationships that were in the extended model have been left out, as they are not influenced by the “To be”-business models.

4.3 As Is Models

4.3.1 Specify Activities

Four processes are identified from Figure 1. These are the activities for the business model, as shown in Table 2. For each of the process, business process diagrams have been elaborated by Staring (2015).

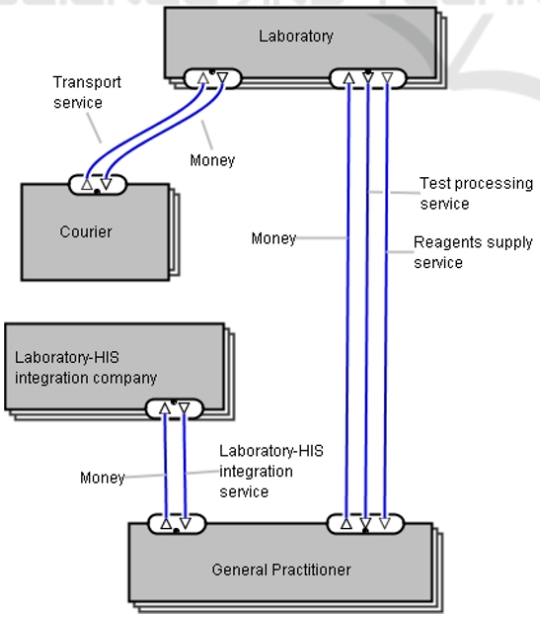

Figure 1: Simplified "As Is" e3value model.

The reagents supply process relates the reagents supply service and the test processing process. Both services are provided by the laboratory and are used by the general practitioner. The test processing process uses two other processes: the transport process (related to the transport service provided by the courier) and the laboratory-HIS integration process (related to the laboratory-HIS integration service provided by the laboratory-HIS integration company). The transport process is used by the laboratory to pick up the test samples from the general practitioner. The laboratory initializes the laboratory-HIS integration process, but it is of value to the general practitioner as this enables test results to flow back into their systems (HIS).

4.3.2 Quantify Model

The specified activities in the previous step are quantified to determine the costs. Table 2 shows the results from this quantification step. As no overhead costs are occurred within the identified activities, the costs are the same for both methods.

Table 2: Costs for "As is"-business models.

Activity	**Costs in euros**
Reagent supply	0 (reimbursed)
Test processing	2 / test
Transport	N/A
Laboratory-HIS integration	15/month/practice

As described in the case study, the laboratory sends the reagents to the GP for free. The laboratory does make costs for the reagents, but these are covered by the health insurer and fall outside the scope of the business models. Similarly, a third party handles the laboratory-HIS integration process. The costs for this are the same for both the “As is” and “To be” model. For these reasons, these two processes are not handled anymore hereafter.

4.3.3 Pricing Method

As we are examining the As is-model, the different pricing methods are not applicable. The actual set prices can be used for the current situation. These are directly the costs for the GP, as shown in Table 2.

4.4 To Be Models

The "To be" scenario is an outcome of "step 5: Design alternatives". The alternative that we examine in this case, introduces MobiHealth's automated processing of POCT test results, as a replacement of the courier service. In the research for this paper, other more radical alternatives were designed as well (Staring, 2015).

Figure 2 shows the relationships in a simplified e3value model for a situation without courier, but with MobiHealth, "To be."

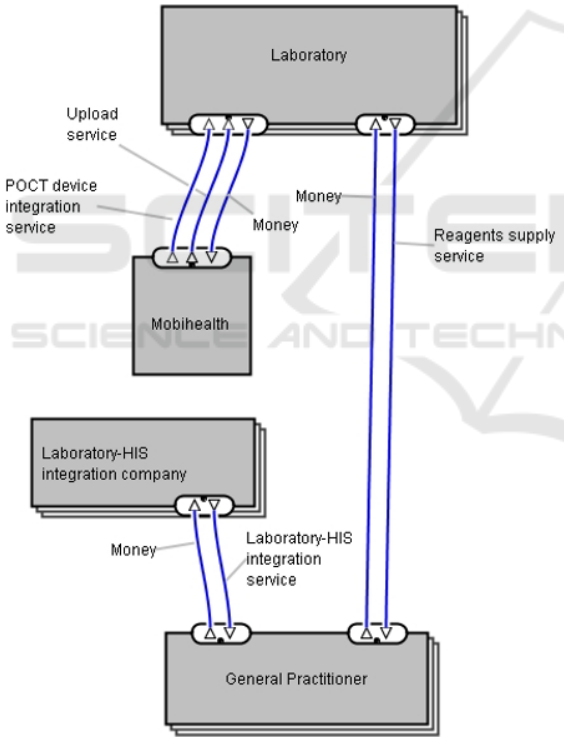

Figure 2: Simplified "To Be" e3value model.

4.4.1 Specify Activities

Similar to the "As is"-situation, four processes are identified for the "To be"-models. The reagents supply process still is the same, yet the other processes differ. The POCT device integration process is initialised by the general practitioner and replaces the test processing service of the laboratory as the POCT device takes care of testing. The POCT device integration process relates to the POCT device integration service in the e3value model. Tests performed with the POCT devices are uploaded to the laboratory by the test upload service of MobiHealth. Using the existing laboratory-HIS integration, the results are pulled from the LIS to the HIS by the laboratory-HIS integration process.

While different BPMLs were used to model the processes for BMMa (BPMN) and BMMb (EPC), the resulting set of specified activities remain the same (Staring, 2015). Therefore, these models are not included in this paper.

4.4.2 Quantify Model

The costs for the activities specified in the previous step are determined using the methods defined in BMMa and BMMb. Table 3 shows the costs per activity. The costs for the administration of the POCT device integration is for the laboratory, while integration and hardware are costs for MobiHealth.

While different cost accounting methods were used to determine the costs for BMMa (TD-ABC) and BMMb (variable costing), the results were the same. This is logical, since no overhead is visible in the process, and that is where the methods differ.

Table 3: Costs for "To be"-business models.

Activity	Costs in euros
POCT device integration	
Administration	6.25 / device
Integration	50 / device
Hardware	100 / device
Test upload process	N/A

4.4.3 Pricing Method

Both the specified activities and the costs, determined in the previous sections, are used to set the prices using the methods defined in BMMa and BMMb. Table shows the results of this second quantification step.

For the POCT device integration activities, MobiHealth sends the laboratory an invoice for the integration of POCT devices with their systems, the costs for the integration includes time and hardware. From the costs in the previous step, this is estimated to be 150 euros per POCT device.

Table 4: Pricing for "To be"-business models.

	BMMa	BMMb
POCT device integration	100 euros profit margin	0 euros (free)
Test upload process	0.30 euro per upload	1 euro per upload

For BMMa, using the Cost-plus pricing method, interviews revealed a 100 euros profit margin.

For BMMb, using the Value-based pricing method, device integration allows MobiHealth to ensure future revenue by hooking the GPs up to their systems. Therefore, this process is mainly of value to MobiHealth itself and they should not charge for this.

In the test upload process, MobiHealth sends the laboratory an invoice per upload for their services. While the costs for this service are difficult to estimate or allocate, prices may still be set.

For BMMa, using the Cost-plus pricing method, interviews revealed a fixed profit margin. A profit margin of 30 eurocents is used per upload, as costs are estimated to be close to zero.

For BMMb, using the Value-based pricing method, test upload is a high value service for MobiHealth and for the laboratory as this enables the POCT test results to flow to the laboratory. MobiHealth can therefore ask 1 euro per upload.

5 BUSINESS CASE DEVELOPMENT AND ANALYSIS

This section attempts to complete "step 6: Analyse alternatives" of the BMM. We create business cases based on the business models developed in the previous section. To create the business cases, we use the Business Model to Business Case method (BM2BC). It is not an extension of BMM, but rather a method that comes after BMM to further quantify and compare business models (Meertens et al., 2013). It is based on the work of Ward et al., (2008), but is tailored to the development of business cases based on business models. Similar to their work, it has eight components that the business case needs to address.

The created business cases are also the subject of a sensitivity analyses. Since the number or POCT tests performed and the number of POCT devices per general practice (multiple general practitioners can work in the same practice) determine the outcome of the bottom line, different scenarios have been constructed, as Table 5 shows. The scenarios are based on the case study and interviews.

Table 5: Scenarios for sensitivity analysis.

	POCT tests per year	Devices per practice
Scenario 1	720	2
Scenario 2	960	3
Scenario 3	1200	3

Instead of only looking at the bottom line (shown in Table 6), we used tools for three elements of the business case: effects, risks, and costs. An effects radar shows how the positive and negative effects are distributed among the different business models (Davis and Erixon, 2008). Risks per business model are mapped on a matrix. This clearly shows how risk is shaped overall, and which alternative involves most risk (Bentley, 2010). A costs & benefits radar shows the financial dynamics of each business model. All these tools visually provide more insight in the business cases and the differences per business model.

Table 6: Cashflow per GP over a 5 year period (in euros).

	BMMa		BMMb	
	Lab	MH	Lab	MH
1	5,707.50	1,180.00	3,587.00	3,300.00
2	7,591.25	1,540.00	4,781.25	4,350.00
3	9,479.00	1,900.00	5,975.00	5,300.00

As this paper focuses on the viability of POCT, and the differences between two derivatives of the BMM, only the details applicable for this are handled here. The full details of the research are available in other work (i.e. Staring, 2015).

The viability of POCT in the case study is good. As Table 6 shows, both the laboratory (Lab), and MobiHealth (MH) profit from the introduction of POCT and MobiHealth's automated processing solution. In the business cases, the difference in pricing method between BMMa and BMMb is translated to the distribution of the benefits for the laboratory and MobiHealth.

6 METHOD EVALUATION AND LIMITATIONS

A pitfall in BMM is that the extensiveness of the first two steps have a large impact on the result. When roles or relationships are missed, this will result in not specifying their activities and they will not be quantified. In some cases, this has to do with the scope at which BMM is applied. In other cases roles and relationships are easily overlooked.

The third step in BMM proved to be very important as it allowed to quantify the business model by showing costs objects and points where revenue was made. The difference between the used methods was not significant in terms of results. Both methods suit their purpose in specifying the activities needed to maintain value exchanges between the roles in the e3value model. However, there is a difference in terms of accessibility of the method. BPMN was more

complete than EPC as the language was richer in elements. EPC on the other hand was easier to understand by non-technical people.

The difference in cost determination in the usage of time-driven ABC and variable costing proved to be non-existent. This is because the specified activities showed no overhead. Overhead is treated differently in the different methods. When the processes are specified in more detail overhead could become visible and the used methods would show a difference. The level of detail at which the processes are modelled might be too high to reveal any overhead in the process. Although any level is better than none and the current models do provide enough insight to perform calculations upon. Still some calculations were unable to be performed as this would require specifics on an individual basis. The calculations for the transport process were neglected as it was highly depended on the distance between the laboratory and general practice as well as the route taken by the courier.

Time-driven ABC proved to be an effective method to calculate the costs, as it was easy to obtain the time it took to complete an activity (simple time measurements). Quantifying the processes specified in the previous step follows a natural path, but is also limits the quantification of the business model. For example, costs on infrastructure, human capital, or other fixed costs may not be covered when following BMM.

The extension with of a pricing method proved to be useful, especially in the development of business cases. The cost-plus pricing method was easy to implement and ensured that costs were covered. The value-based pricing method allowed for a new perspective and focussed on environmental and strategic factors to incorporate into the price. It is important to note that the costs for one role can be the price for another role. However, most costs need to be converted using a pricing method, or are internal costs.

After the business models were developed, the Business Case method for Business Models (BM2BC) was used to create business cases. BM2BC listed the components required to build a business case. However, no relationship or method existed to derive effects and risks from the business models. Therefore, we are unable to verify the completeness of those components. For example, it is unknown whether all effects and risks are covered in the business cases. The most obvious ones have been covered, but the identification of effects and risks is subject to the cognitive capabilities of the researchers. The researcher could (unconsciously) have decided a certain effect or risk is outside the scope the business model and business case. The cost/benefits component was trivial given the two quantitative steps in BMM. This again proved the value of the added pricing method to BMM. Resource restrictions are not considered a real problem in BM2BC, which is a potential pitfall, as human capital or liquidity requirements are not taken into account. They might come up in the implementation planning stage of the business case, but is should be under consideration during the decision-making in the alternative selection stage.

An assumption that was made, which clearly shows the difference between theory and practice, is that business models and business cases assume only a single business model can be in existence at a time. The “To be”-business models remove the need for a courier, while in practice the courier still plays part in transporting reagents. Not all test can be performed by POCT devices either, requiring the patient to go the laboratory or a courier to transport a test sample (as per the “As is”-business models). In essence, there will always be a combination of “As is” and “To be”-business models.

Concluding, BMM and ultimately the derivatives proved to be a useful method to build business models. It provided a natural logical structured method covering all components of a business model. BM2BC was used to create the business cases because of its focus on business models and provided, similar to any other business case method, a list of components which should be included in a business case. The e3value model proved to be useful. It extended the role-relationship matrix by showing the value exchanges for each relationship. To maintain the relationships, the activities were modelled. In terms of communication to non-technical people EPC was the best choice, but if the goal is to later develop a business support tool BPMN should be used. As the activities showed no overhead, the methods used to calculate the costs showed no differences. In addition, the cost determination is likely to be incomplete as BMM only quantifies the specified activities. The added pricing method made it possible to calculate the benefits in the business case and was therefore essential to be included in the business model. The meta-business model visually summarised the business model making it ideal to communicate to others.

7 SUMMARY

In summary, the findings in this paper are threefold. Firstly, in the case study, all of the business cases for

POCT were assessed to be viable.

Secondly, the basis of the BMM allows for reproducible creation of business models, as two different derivatives came up with the same results, although their calculation and representation is different.

Thirdly, extending the BMM with an extra step, namely selecting a pricing method, showed to be useful for creating business cases.

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