# Business Model Canvas Synthesis Process from DEMO Construction Model

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Abstract:     The notion of a system can be represented in two ways, as a function or as a construction. A transformation can occur between them. Function can be represented by Business Model Canvas (BMC) and construction can be represented by DEMO Construction Model (DEMO CM). To find a new BMC, we can apply these phases; transform existing BMC into DEMO CM, manipulate it into a new CM, and transform it back into new BMC to create a new business. The transformation from BMC to DEMO CM is already provided, however, it only explains about DEMO CM generation from BMC. The manipulation of DEMO CM is also already proposed. This paper proposed the final phase of the process; to synthesize BMC from DEMO CM. Decision Tree is used to generate BMC from DEMO CM, resulting in Pre-BMC. A case study of EU-Rent is used to illustrate the proposed methodology. We proposed Pre-BMC generation as an intermediate process of BMC synthesis, and refine it into a completed BMC.

## 1 INTRODUCTION

Enterprise as a system can be designed and modeled in a discipline aspect of the enterprise, called enterprise engineering. The notion of a system can be represented in two ways, as a function or as a construction, consistent with τ-theory (Dietz et al., 2013). According to this theory, function illustrates the set of services that a system is able to provide, meanwhile construction explains the structure, composition, and environment of a system. These two notions are related; a transformation can occur between them (Mannaert, Verelst, and De Bruyn, 2016).

In case of an enterprise, the function of an enterprise can be represented by Business Model (BM), because it provides the value of the enterprise business, and value is generally understood as a relationship between a thing and observer; in other words, how they perceive the function of a thing. Construction of an enterprise can be represented by DEMO (Design & Engineering Methodology for Organizations) (Dietz, 2006), in particular, Construction Model (CM), because it provides the actor roles and transaction kinds as a construction of an enterprise. And based on the relationship between function and construction, there exists a transformation between BM and CM.

BM is generally understood as a tool of management (Magretta, 2002). BM can provide a concise framework of an enterprise regarding value capture and creation, and monetization of innovation (Carayannis et al., 2014). BM comes in many forms and templates and widely discussed in scientific fields (Wirtz et al., 2016), one such templates is Business Model Canvas (BMC). BMC (Osterwalder and Pigneur, 2010) is one of the most commonly applied frameworks of business models, expresses the building block of a given business serving as a value or function of the business.

DEMO CM is one of the representations of construction in an enterprise. DEMO is a methodology of enterprise ontology (Albani and Dietz, 2011) that produce a truly ontological model (Perinforma, 2015), capable of presenting aspect models of an enterprise and method for the development of aspect models (Dietz, 2006).

To create a new business model, we can create new from scratch or modify the existing one. Suppose we want to create a new business model, we can gather many existing business models. Then we can modify those models to create a new business model. Modification can be done by change some elements of the model, or by rigorously manipulate (compose, decompose, etc.) those models to create a new one. However a function-

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based model (i.e. business model) cannot be rigorously manipulated, because functional (de)composition is fully dependent on the imagination of the 'observing' subjects. Unlike business model, DEMO CM can be manipulated, merged, or decomposed by using algebraic notation (Suga and Iijima, 2015), making it possible rigorously manipulate construction models to create a new one. Therefore manipulation of BMC (a function model, or 'black box') can be achieved by transforming it into DEMO CM (a construction model, or 'white box') as a functional/constructional transformation, then conduct manipulation of such model. This phase is crucial in a sense of creating a new construction model that is meaningful and applicable. After manipulation is finished, the resulting DEMO CM can be transformed back into a new BMC as a new model for a new business. Figure 1 illustrated the New Business Model Creation Process. BMC illustrated as a black box, and CM illustrated as a white box. This process consists of three phases:

1) Transformation from existing BMC to CM

2) New CM generation using split and merge operation

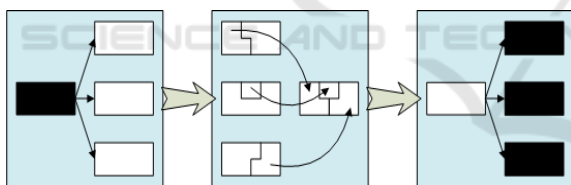3) Transformation from new CM to new BMC



Figure 1: New Business Model Creation Process.

There are already some researches about BMC mapping to other enterprise models, as summarized by Caetano et al. (2017). They present representation and analysis of some semantic models, including BMC, e3Value, and Archimate. Some researches concerning DEMO model mapping with other models were also already conducted, such as e3Value (Pombinho, Tribolet, and Aveiro, 2014), and Organizational Implementation (Op't Land and Krouwel, 2013). The correspondence between BMC and DEMO CM is already provided (Pratama and Iijima, 2018), however, it only explains about the transformation from function to construction, DEMO CM generation from BMC (Phase 1). The manipulation of DEMO CM (Phase 2) is also already proposed (Suga and Iijima, 2015), and the

mathematical operation is already defined (Suga and Iijima, 2018). However there is still no study about Phase 3; synthesis of BMC from a given DEMO CM, to transform the new construction model into a new function model and apply it as a new business. Phase 3 is the focus of this paper, to propose a methodology of BMC from DEMO CM. These statements lead to the following research question: How can we synthesize Business Model Canvas from DEMO Construction Model?

In this paper, background and literature review is explained in Section 2 and the proposed methodology is explained in Section 3. Section 4 contains the case study used to illustrate the methodology. Section 5 covers discussion of the result and the conclusion of this research are written in Section 6.

## 2 BACKGROUND

### 2.1 DEMO Construction Model

DEMO Construction Model (CM) illustrates the construction of the organization (Perinforma, 2015) consists of transaction kinds and actor roles associated with them, including information links between them. A Transaction Kind represents coordination act/fact in a business conversation, and an Actor Role represents the initiator/executor of such coordination. CM is one of the four aspect models expressing the ontological knowledge of the target enterprise. The other aspect models are Process Model (PM), Action Model (AM), and Fact Model (FM).

CM consists of interaction model as coordination part and interstriction model as production part. In this study, we only focus on the former, which contains Actor Transaction Diagram (ATD) and Transaction Product Table (TPT) that composed the interaction structure of an organization (Dietz, 2006). ATD illustrates the actor roles, transaction kinds, and their relationships. TPT shows the transaction kinds and their respective product kinds. Figure 2 expresses an example of ATD and TPT of a simple organization of retail shop that sells a product. DEMO Construction Model has been applied mainly in information system research, in particular, organizational ontology (Op't Land et al., 2009) and business process (Liu and Iijima, 2015).
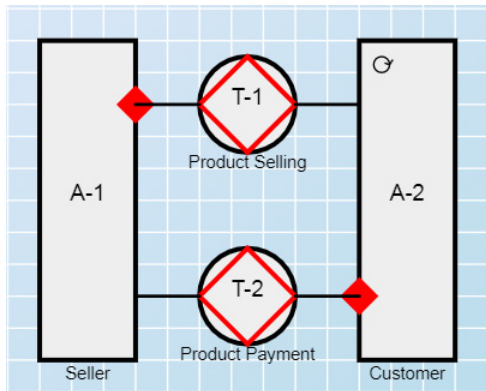
| Transaction Kinds | Product Kinds |
|---|---|
| T1 Product Selling | Product selling has been completed |
| T2 Product Payment | Product fee has been paid |

Figure 2: Example ATD and TPT of an organization.

## 2.2 Business Model Canvas

Business Model Canvas was introduced by Osterwalder and Pigneur (Osterwalder and Pigneur, 2010). Commonly abbreviated as BMC, it is constructed around value propositions for sustainable enterprise (Carayannis et al., 2014). BMC was introduced in the field of business model ontology as a new approach of design science (Osterwalder, 2004). BMC can also evolve as the business run, and the evolution can be visualized (Fritscher and Pigneur, 2014) as leverage for innovation (Martikainen, Niemi, and Pekkanen, 2014). Figure 3 illustrates the general picture of

BMC and description of each building block. The positioning of building blocks in BMC shows their classification (Pratama and Iijima, 2018). Internal business aspects of the company on value creation are positioned on the left side, whereas the external business aspects of customer and value delivery are positioned on the right side. The bottom side represents a financial aspect of the business.

## 3 RESEARCH METHODOLOGY

In this section, we will explain our proposed methodology. The authors use correspondence table between Business Model Canvas and DEMO Construction Model (Pratama and Iijima, 2018), as illustrated in Table 1. This table acts as a guide of conversion from DEMO CM to BMC.

Table 1: Correspondence between BMC and CM concepts (Pratama and Iijima, 2018).

| Business Model Canvas | Construction Model |
|---|---|
| Customer Segments | Actor Roles |
| Value Propositions | - |
| Channels | - |
| Customer Relationships | Transaction Kinds |
| Revenue Streams | Transaction Kinds |
| Key Resources | Actor Roles |
| Key Activities | Transaction Kinds |
| Key Partners | Actor Roles, Transaction Kinds (involved the Actor Roles) |
| Cost Structure | Transaction Kinds |



Figure 3: Business Model Canvas (Osterwalder and Pigneur, 2010).

The proposed decision tree is illustrated in Figure 4, this Decision Tree is explained as follows: The Decision Tree consists of 16 nodes and 9 leaves. Each element in DEMO CM is identified, then classified it into BMC Building Block element using this Decision Tree. This Decision Tree can only apply to business-related DEMO CM, that is DEMO CM that includes customer-related actor roles and payment-related transaction kinds that is executed by such actor roles. The end nodes/leaves may not be filled; some of the leaves may be empty.

The generated BMC from this process is incomplete, as there might be some building blocks that are empty. It is similar to the prototype of a model that needs to be finalized. We call it Pre-Business Model Canvas (Pre-BMC), the Pre-BMC Generation is considered an intermediate process. To refine Pre-BMC into a completed BMC, we need additional information regarding the business. This refinement process is conducted by the stakeholders of the company as a data collection process using each building block description as a guide. There are many possibilities of the resulting completed BMC; the additional information is uniquely determined. Therefore this process cannot be done automatically.

The process of adding additional information explains as follows. First, determine whether each building block has sufficient information regarding the content of each block. If additional information

is necessary, proceed to determine the additional information for all necessary blocks. Then check the contents of each building block, apply modification if necessary.

Some key questions (Osterwalder and Pigneur, 2010) can help in determining additional information:

**1) Customer Segments (CS)**
- Who is the target customer of the business?
- Which class or segment of customer is the business creating values for?

**2) Value Propositions (VP)**
- What core value does the business deliver?
- Which customer needs is fulfilled by the business?

**3) Channels (CH)**
- Through which channels that the customers reached by the company?
- What are ways of transmission and transfer of product/service to customer?

**4) Customer Relationships (CR)**
- What relationship established between the target customer and the company?
- What are business activities representing the relationship between customer and company?

**5) Revenue Streams (R$)**
- What and how do the customers pay?
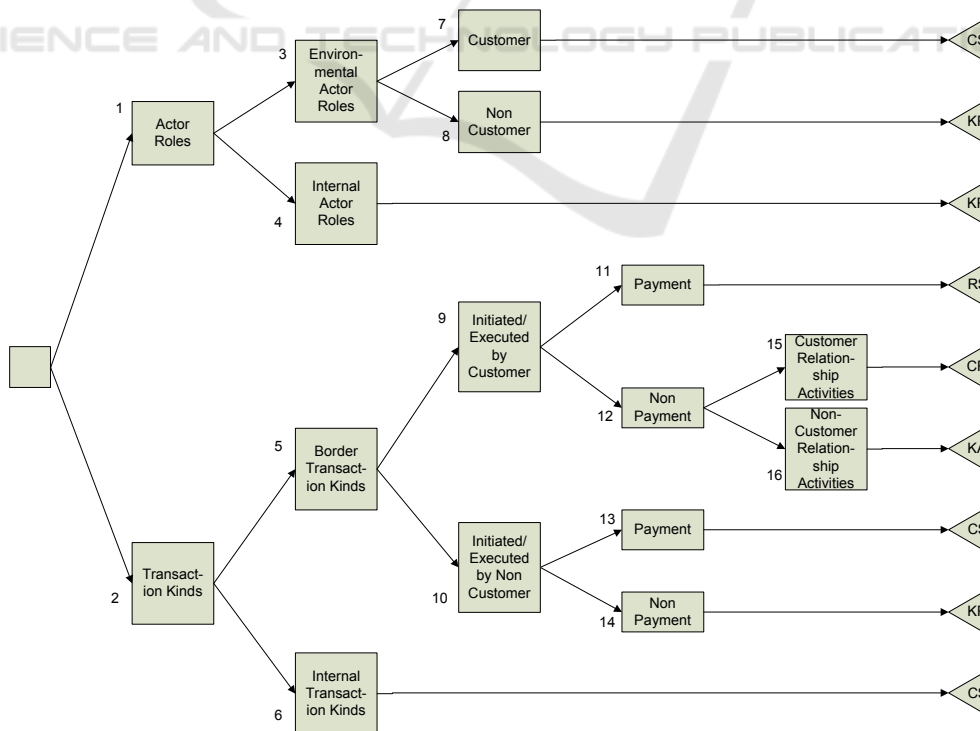- What are business activities that include payment



Figure 4: Business Model Canvas Synthesis Decision Tree.

- from customer to company?

**6) Key Resources (KR)**

- What resources required in running the business?
- What are internal influencers within the company?

**7) Key Activities (KA)**

- What are business activities required to deliver the value?
- What are business activities that deliver the product/service of the company?

**8) Key Partners (KP)**

- Who are business partners/suppliers required in running the business?
- What are external influencers of the business?

**9) Cost Structure (C$)**

- What are the costs necessary to run the business?
- What are business activities that incurred costs that the company has to cover?

# 4 CASE STUDY: EU-RENT

In this section, we will explain about testing our proposed methodology to an EU-Rent Case from Business Motivation Model (BMM) (The Business Rules Group, 2010) as a case study. The description of EU-Rent is as follows: *EU-Rent is a company that rents cars to persons, operating from geographically dispersed branches. The cars of EU-Rent are divided in car types (brands and models); for every car type there is a particular rental tariff per day. A car may be rented by a reservation in advance or by a 'walk-in' customer on the day of renting. A rental contract specifies the start and end dates of the rental, the cartype one wishes, the branch where the rental starts (called the pick-up branch), and the branch where the rental will end (called the drop-off branch). Rentals have a maximum duration. The person who rents the car is called the renter. The one who is going to drive is called the driver.* (Op't Land and Dietz, 2012). A DEMO Construction Model of this case is already provided (Op't Land and Dietz, 2012); TPT in Table 2, and ATD in Figure 5.

Table 2: TPT of EU-Rent (Op't Land and Dietz, 2012).

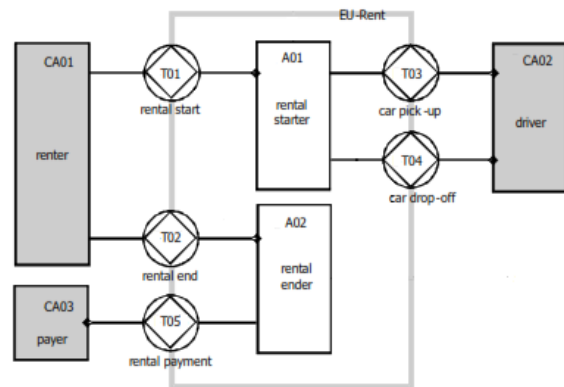| Transaction Kinds | Product Kinds |
|---|---|
| T01 rental start | [rental] has been started |
| T02 rental end | [rental] has been ended |
| T03 car pick-up | the car of [rental] has been picked-up |
| T04 car drop-off | the car of [rental] has been dropped-off |
| T05 rental payment | [rental] has been paid |



Figure 5: ATD of EU-Rent (Op't Land and Dietz, 2012).

Some additional information regarding this case can be obtained in BMM (Business Rule Group, 2010) and Business Rules (BR) (The Business Rules Group, 2000). We obtained information regarding Mission Statement, Internal Influencer, and External Influencer of EU-Rent from BMM, meanwhile information about business activities that incurred costs to EU-Rend is obtained from BR. The Mission Statement of EU-Rent is as follows: *"Provide car rental service across Europe and North America for both business and personal customers."* The Internal Influencer of EU-Rent consists of *Cars* and *Branch Staff*, meanwhile the External Influencer is *Business Partner* (EC-Lease) and *Supplier* (Car manufacturers and Insurers). The business activities that incurred costs that EU-Rent has to cover are *Car maintenance & repairs* and *Car purchase*.

We apply Decision Tree in Figure 4 to generate Pre-BMC of EU-Rent. These elements of DEMO CM are identified: renter, driver, payer, rental starter, rental ender, rental start, rental end, car pick-up, car drop-off, and rental payment. Allocated to Node 1 are renter, driver, payer, rental starter, and rental ender; rental start, rental end, car pick-up, car drop-off, and rental payment went to Node 2. From Node 1, **renter**, **driver**, and **payer** went to Node 3 and continued to Node 7, and become **Customer Segments**; Node 8 is empty, meanwhile rental **starter** and **rental ender** entered Node 4 and become **Key Resources**. At Node 2, rental start, rental end, car pick-up, car drop-off, and rental payment continued to Node 5 all the way to Node 9; implied Node 6, Node10, Node 13, and Node 14 is empty. From Node 9, **rental payment** entered Node 11 and becomes **Revenue Streams**; **rental start**, **rental end**, **car pick-up**, and **car drop-off** allocated to Node 12 continued to Node 16, become **Key Activities**.

| Key Partners | Key Activities | Value Propositions | Customer Relationships | Customer Segments |
|---|---|---|---|---|
| EC-Lease<br>Car Manufacturers<br>Insurers | *Rental Start*<br>*Rental End*<br>*Car Pick-Up*<br>*Car Drop-Off* | Provide Car Rental Service | Reservation in Advance<br><br>Walk-in | ~~*Renter*~~<br>~~*Payer*~~<br>~~*Driver*~~<br>Business & Personal |
| | **Key Resources**<br><br>~~*Rental Starter*~~<br>~~*Rental Ender*~~<br>Branch Staff<br>Cars | | **Channels**<br><br>EU-Rent Branch | |

| Cost Structure | Revenue Streams |
|---|---|
| Car Maintenance & Repairs<br>Car Purchase | *Rental Payment* |

Figure 6: Completed BMC of EU-Rent. The italic part is the component of Pre-BMC, some of them showed strikethrough indicating modification done to those components.

To make a completed BMC from Pre-BMC, further synthesis process and additional information are necessary. It is determined that Revenue Streams and Key Activities has sufficient information, while the rest of building blocks required additional information. The authors examine documents from BMM (The Business Rules Group, 2010) and Business Rules (BR) (The Business Rules Group, 2000) of EU-Rent as additional information to produce completed BMC, as data collection process to answer the key questions in Section 3. Figure 6 illustrates the completed BMC. The result will be explained for each building block:

**1) Customer Segments (CS)**

The Mission Statement of EU-Rent mentioned in BMM is *"Provide car rental service across Europe and North America for both business and personal customers."* Target customer is mentioned in customer part (…*for both business and personal customers*). Renter, Payer, and Driver are actor roles representing customer of EU-Rent, so all of them integrated into Business and Personal to avoid redundancy. Therefore this building block consists of: Business and Personal.

**2) Value Propositions (VP)**

Also using the mentioned Mission Statement, the action part (*Provide*) and product or service part (*car rental service*) of Mission Statements composed the value proposition. This represents the core value and the customer needs. Therefore this building block consists of: Provide Car Rental Service.

**3) Channels (CH)**

The channel that the customer reached by the company is EU-Rent Branch and the way of transmission and transfer of rental car service to customer is via EU-Rent Branch. Therefore this building block consists of: EU-Rent Branch.

**4) Customer Relationships (CR)**

The relationship established between the target customer and the company is explained in business description. In the business description, it is mentioned that *"A car may be rented by a reservation in advance or by a 'walk-in' customer on the day of renting."* This sentence represents the business activities of relationship between customer and EU-Rent. Therefore this building block consists of: Reservation in Advance, Walk-in.

**5) Revenue Streams (R$)**

The existing component Rental Payment is enough to represent revenue streams of EU-Rent, so no change is necessary. Therefore this building block consists of: Rental Payment.

**6) Key Resources (KR)**

In BMM, Resource of EU-Rent consists of *Cars* and *Branch staff*, and is mentioned as *internal influencer*. Both Rental Starter and Rental Ender are actor roles represent staff of EU-Rent in EU-Rent Branch, so they are integrated into Branch Staff to avoid redundancy. Therefore this building block consists of: Branch Staff, Cars.

**7) Key Activities (KA)**

The existing components Rental Start, Rental

End, Car Pick-Up, and Car Drop-Off are enough to represent key activities of EU-Rent, so no change is necessary. Therefore this building block consists of: Rental Start, Rental End, Car Pick-Up, Car Drop-Off.

**8) Key Partners (KP)**

In BMM, Business Partner consists of *EC-Lease*; meanwhile Supplier consists of *Car manufacturers* and *Insurers*, and is mentioned as *external influencer*. Therefore this building block consists of: EC-Lease, Car Manufacturers, Insurers.

**9) Cost Structure (C$)**

In BR, the business activities that incurred costs that EU-Rent has to cover are *Car maintenance & repairs* and *Car purchase*. Therefore this building block consists of: Car Maintenance & Repairs, Car Purchase.

## 5 DISCUSSION

This paper proposed the synthesis of Business Model Canvas from DEMO Construction Model. The important finding of this research is that we found the synthesis process from DEMO CM to BMC in the form of Decision Tree based on correspondence between them. Using Decision Tree, one can transform the elements of CM into elements of BMC to form a Pre-BMC, then add some additional information to synthesize a completed BMC. The case study of EU-Rent illustrates the methodology of synthesis process from CM to BMC. This case also shows that the EU-Rent case is a very simplified model of that kind of business, as it does not include essential elements to make it a clear business model. We proposed Pre-BMC generation as an intermediate process, and complete it into a completed BMC, thus answered our research question.

The introduction of Decision Tree can help the synthesis process, in particular, the Pre-BMC generation by automatically generating contents in Pre-BMC building blocks. This Pre-BMC serves as a baseline to refine and complete the BMC. The resulting BMC is able to show the business model of the company as a manifestation of function from construction. This proved that the transformation from CM to BMC is possible, although only to some extent. The resulting BMC is not complete (that is why it is Pre-BMC), to refine it into completed BMC, additional information is necessary. The refinement process can be conducted with the help of key questions proposed, and there are many possibilities of completed BMC resulting from this process.

This paper only discusses application of BMC as a business model; another form of business model representation might also be applicable, but outside the scope of this research. Future studies can apply another form of business model and conduct a comparative study; this will enhance this particular research area. Also, there is still a void in the correspondence table; no correspondence of Value Proposition and Channels, this gives the opportunity for DEMO researchers to identify these missing correspondence in DEMO Aspect Model. To better formulate this functional-constructional transformation, a mathematical approach can be conducted, and tools to aid the transformation process can be developed.

## 6 CONCLUSION

In this paper, we proposed a methodology to synthesize Business Model Canvas from DEMO Construction Model. Based on the correspondence between building blocks in BMC and DEMO CM, we propose a Decision Tree to generate Pre-BMC as an intermediate process to create completed BMC. This paper proposed a methodology to create Business Model Canvas from DEMO Construction Model.

This paper visualized the connection between BMC as a function and DEMO CM as a construction. In this paper, we only focused on function generation from system construction, as construction generation from function is already done. This paper only focused on BMC synthesis form DEMO CM, the synthesis from another aspect is not extensively discussed. Some thoughts about future research related to this work are also proposed. Another form of business model can be tested, include the proposition of correspondence between it and DEMO CM. Formulation of functional-constructional transformation can be refined using mathematical approach.

This paper contributes to the idea that by gathering many BMCs, convert them into CMs and then perform model manipulation to those CMs to create a new CM, we can synthesize BMC from the modified CM to create a new business, as described in Figure 1. This paper makes up Phase 3, complementing Phase 1 and Phase 2 of new business model creation process. A future study can be conducted by applying the whole process to a certain type of industry. Suppose we have a new construction model as a result of model manipulation, we can transform it into business models to see what values (functions) this model can provide. Assuming that one or more models provide a good value proposition and is/are applicable, we can apply the

newly created business model as a new business, and evaluation can be made based on the results.

## ACKNOWLEDGEMENTS

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