Archives of Business Research – Vol. 13, No. 07
Publication Date: July 23, 2025
DOI:10.14738/abr.1307.19137.
Yamamoto, S. (2025). A Decomposition-based Integration Approach to Business Modeling. *Archives of Business Research,* 13(07). 67-77.

A Decomposition-based Integration Approach to Business Modeling

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ABSTRACT

As information technology has become more deeply ingrained in society, many business modeling methods have developed rapidly. On the other hand, new problems have arisen, such as how to use different business modeling methods appropriately. In this paper, we propose an integration method for creating new business modeling methods by breaking down existing business modeling methods into elements and recombining them, based on the assumption that common elements exist in business modeling methods. We also evaluate the effectiveness of this business modeling method by applying it to multiple business modeling methods.

Keywords: Business Modeling Method, Method Integration, Value Proposition Canvas, Minimum Viable Product, Customer Journey Map.

INTRODUCTION

There are many different business modeling methods, and it was not clear which method to apply and how. Therefore, if there were a unified business modeling method, this problem could be solved.

On the other hand, it would be impossible to build an all-purpose business modeling method by integrating all business modeling methods. Therefore, a realistic approach would be to combine candidate business modeling methods to build an appropriate method.

What business modeling methods have in common is that they have components. Therefore, by decomposing business modeling methods into their components, it may be possible to integrate them by eliminating duplication of common elements and complementing differences.

The rest of the paper is organized as follows. Section 2 explains the related work. The business modeling method integration framework is proposed in Section 3. Section 4 shows an integration of business modeling methods using the proposed approach. The effectiveness, novelty, and limitations are discussed in Section 5. Finally, Section 6 concludes the paper.

RELATED WORK

The SECI model [1] involves a combination process where existing explicit knowledge is combined to produce new explicit knowledge. The externalization part of the SECI model creates concepts that rely on tacit knowledge gained through behavioral activities with colleagues. Guetat and Dakhli [2] proposed the SIKIT organizational model, which consists of 1) strategy, 2) innovation, 3) knowledge, and 4) information technology. The SIKIT framework connects knowledge and innovation processes to help organizations innovate and gain a

sustainable competitive advantage. Their knowledge space correlates knowledge gaps, knowledge creation, and knowledge transfer, but does not aim to integrate methods to create new methodological knowledge.

Knowledge Integration Theory and Engineering (KUTE) is a methodology for supporting interdisciplinary knowledge integration [3]. The basic concepts of KUTE consist of knowledge integration principles, knowledge creation process, knowledge architecture, knowledge assurance process, and design patterns for interdisciplinary knowledge integration. KUTE architecture assumes that knowledge elements are given in advance.

TRIZ derives new solutions using solutions extracted from a solution knowledge base that contains general solutions to solve general problems [4]. TRIZ can be thought of as an integrated knowledge base for creating new patents, but it does not integrate a given methodology.

Yamamoto [5] proposed the common reference model for requirements management knowledge by analyzing different requirements engineering knowledge. Knowledge has objectives, a strategy to compose knowledge, and elementary knowledge. Strategy types are issue and process. By using the reference model, different knowledge can be integrated. The knowledge integration method for a set of existing baseline knowledge is as follows. First, all the baseline knowledge is gathered and analyzed by the above knowledge integration reference model. Then, a concept model on baseline knowledge is extracted based on the analysis result. Finally, new integrated knowledge is designed based on the reference model if necessary. This approach enables to evolution of the baseline knowledge.

A method for integrating knowledge by decomposing and combining different definitions of digital transformation into components and relationships has been proposed [6]. However, this paper integrates knowledge definitions consisting of different elements, but does not integrate the methods.

Yamamoto [7] compared various notations for describing business models. The study clarifies which notations are suitable for which situations in understanding, communicating, and transforming business models. The paper compares multiple business model notations such as the Business Model Canvas, the Lean Canvas, and the Service Blueprint, and analyzes their advantages and limitations. The paper also considers the possibility of combining different notations to obtain a more comprehensive understanding of business models, and the challenges that arise in this case, such as consistency between notations. However, it does not clarify the integration of specific methods.

Yamamoto [8] also proposed a common research process for creating new research by retroactively reverse-engineering a knowledge creation model of a research paper on information technology that they co-authored in the past. The core idea of this model is to view research activities as a series of systematic processes for creating and sharing knowledge, rather than simply a series of experiments and analyses. The research creation model has also been applied to the authors' papers and has been evaluated. Koyama et al. [9] propose a methodology to manage the complexity of service business models and promote understanding

among different stakeholders. In this study, we reveal an approach to integrate different aspects of service business models, such as the service value provided by the service, the operational structure, and the revenue model, with the enterprise architecture description language ArchiMate. Specifically, they construct an integrated service business model by identifying the elements of a service business model and showing how the elements of the service business model can be described using the Business and Application architecture elements of ArchiMate. This methodology aims to provide a systematic approach in designing and analyzing new service business models and to strengthen the alignment between business and IT.

Yamamoto [10] proposed the Digital SDGs (DSDG) framework to efficiently integrate the Sustainable Development Goals (SDGs) and Digital Transformation (DX) efforts that companies implement individually. In this paper, he raises the issue that it is inefficient for companies to implement SDGs and DX efforts individually, and proposes a solution to the question of "how to combine knowledge of SDGs and DX." However, it is not an attempt to integrate business modeling methods.

DECOMPOSITION-BASED INTEGRATION

The procedure of the decomposition-based method integration is as follows.

- [Input] Set M of methods to be integrated
- [Procedure]
  - Step 1: Decompose the elements of M into components
  - Step 2: Extract common elements and call the set C
  - Step 3: Identify differences and call the set D
  - Step 4: Create an integration method based on C and D
- [Output] Integration method: I

A NEW OPTIMIZED RANKING ALGORITHM

Below, we present an example of applying the proposed method to business modeling.

Target of Integration

The business modeling techniques to be integrated are Value Proposition Canvas (VPC), Minimum Viable Product (MVP), and Customer Journey Map (CJM).

(1) VPC was systematized and introduced by Alexander Osterwalder et al. in their 2014 book “Value Proposition Design” [11, 12].

To find the fit of the value proposition to customers, we define a Customer Profile that clarifies customer segments and a Value Map for value propositions. In the Customer Profile, we define Jobs, which indicate what the customer wants to do, Pains, which are the problems the customer faces, and Gains, which are what the customer wants to obtain. In the Value Map, the products and services provided, how to resolve problems, and how to achieve what people want are defined as Products & Services, Pain Relievers, and Gain Creators, respectively.
(2) MVP was proposed by Frank Robinson in 2001. It was later widely known by Eric Ries [13] and popularized as part of the Lean Startup. MVP is an approach to developing a minimum viable product and learn incrementally through evaluation. First, define the minimum

URL: http://doi.org/10.14738/abr.1307.19137

functionality that satisfies the fundamental needs of customers as Core Features. The hypothesis verification process is repeated using a feedback loop (Learn - Build - Measure). Here, the problems customers face and hypothetical solutions to those problems are defined using experimental hypotheses and success criteria. This approach has been accepted as part of the lean startup concept, as it is highly compatible with agile development in that it does not create products that do not create value.

(3) CJM dates back to the 1960s and 1970s, and was clarified academically in 2009[14,15].
CJM is a map that visualizes customer experience in chronological order, encompassing four key aspects: phases, which represent the main stages of customer behavior; customer touchpoints, which illustrate customer interactions; customer behavior; and insights.

Table 1 shows the similarities and differences between VPC, MVP, and CJM.

Table 1: Normalized DCG gains of Google and our fuzzy JEKS algorithm

Viewpoint	**VPC**	**MVP**	**CJM**
Objective	Customer and value proposition alignment	Minimal hypothesis verification	Understanding customer experience
Focus	Customer issues and value	Prototypes and learning	Touchpoints and emotions
Target Phase	Concept/design stage	Experiment/construction stage	Overall service usage stage
Customer Understanding Perspective	Customer needs and expectations	Hypothetical responses	Actual behaviors and emotions
Artifact	Canvas with 2 blocks	Prototype/Early product	Journey Map
Common points	Customer perspective/hypothesis verification	Starting from customer needs	Methods for learning and improvement

Common Component by Comparison

The common components among VPC, MVP, and CJM are shown in Table 2. They are Actor, Problem, Goal, Solution, Context, and Feedback.

Table 2: Common components

Component	**VPC**	**MVP**	**CJM**
Actor	Customer	User	User
Problem	Pains	Hypothesis	Pain point of failure
Goal	Gains	The hope behind the hypothesis	Action Goals
Solution	Products / Relievers / Creators	Function	Touch point
Context	Jobs	Terms of use	Phase/Status
Feedback		Evaluation	Emotion Curve/ Insight

The integrated meta-model, based on Table 2, is shown in Fig. 1. The integrated meta-model is named the VMC meta-model. VMC means VPC, MVP, and CJM.

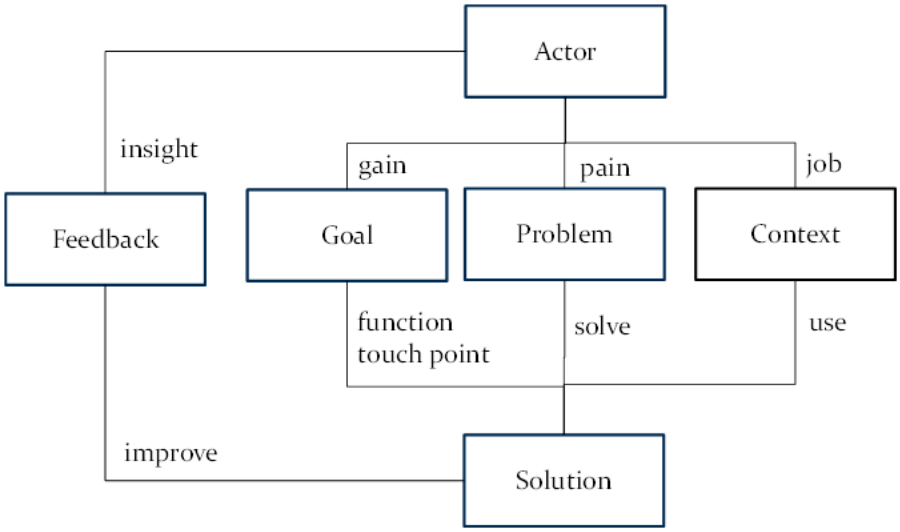

Fig 1: VMC meta-model

Actors try to achieve their jobs within the context. In the course of achieving their jobs, actors may encounter some problems that cause them pain. Actors realize their goals by executing their roles when completing their jobs. The solutions are used to support the actor's job. The problems are relieved by the solutions. The solutions also provide functions and touchpoints for the goals. By using solutions, the actors gain insights and provide feedback to improve the solutions.

Phases of the VMC Framework

Table 3 shows the VMC framework integrated by VPC, MVP, and CJM. The framework consists of three phases: value discovery, hypothesis testing, and optimizing the experience. The goal of the value discovery phase is to theoretically design the value propositions for customers. The actions of the phase are to clarify the customer's Jobs/Pains/Gains, and to design a hypothetical Value Map. The goal of the hypothesis testing phase is to test hypotheses in the market and learn through iteration. The actions of the phase are to develop an MVP based on the value proposition derived from the VPC, and experiments with a minimalist product focused on the core of the hypothesis. The goal of optimizing the experience phase is to earn loyalty through the continued use of experiences. The actions of the phase are to create a CJM during actual use to understand customer behavior, emotions, and obstacles over time, and improve touchpoint issues.

Table 3: VMC framework

Phase	Goal	Action
Value Discovery (VPC)	Theoretically design value propositions for customers	Clarify the customer's Jobs/Pains/Gains Design a hypothetical Value Map
Hypothesis Testing (MVP)	Test hypotheses in the market, and learn through iteration	Develop an MVP based on the value proposition derived from the VPC. Experiment with a minimalist product focused on the core of the hypothesis.

URL: http://doi.org/10.14738/abr.1307.19137

Optimizing the experience (CJM)	Earning loyalty through continued use through experiences	Create a CJM during actual use to understand customer behavior, emotions, and obstacles over time, and improve touchpoint issues

The advantages of an integrated framework are as follows:

- It complements the perspectives of each stage. Specifically, you can design with VPC, verify with MVP, and optimize with CJM.
- It deepens customer understanding. In other words, it creates a virtuous cycle of hypothesis, observation, and empathy.
- The metamodel can be used as a common language within the organization, making it easier to divide roles and share information.

Application Example of VMC Framework

A hypothetical application example of the "VMC (VPC-MVP-CJM)" integrated framework for home air conditioners is shown below.

[Phase 1] Value Exploration using VPC:

The purpose of phase 1 is to identify the customer's real problems and expectations and build a value hypothesis

The Customer Profile defines Jobs, Pains, and Gains.

The jobs are identified as follows:

- Want to automatically maintain a comfortable room temperature
- Want to save on electricity bills
- Want to keep the air clean
- Want to control it from outside using a smartphone

The pains are identified as follows:

- Adjusting the temperature is a hassle (too hot/too cold)
- Cleaning the filter is a hassle
- High electricity bills
- Elderly people cannot use the remote control

The gains are identified the follows:

- Automatically adjust temperature/humidity to a comfortable level
- Make electricity bills visible and help save money
- Supports smartphone and voice control
- Automatic filter cleaning function

Next, the Value Map defines products/services, Pain Relievers, and Gain Creators.

The following are identified as products/services:

- AI-equipped smart air conditioner
- Smartphone app linkage

- Automatic cleaning function

The following are identified as Pain Relievers:

- Automatic optimization of temperature and humidity
- Voice control (for the elderly)
- The filter system that does not require cleaning

The following are identified as Gain Creators:

- Real-time display of electricity bills and advice on saving
- Notification of optimal timing for air conditioner use
- Automatic monitoring of air quality

Phase 2: Hypothesis Verification using MVP:

The purpose of phase 2 is to verify customer value hypotheses with a minimal product. In MVP, select the minimum functions, develop and verify, and execute a feedback loop.

Select the following as the minimum functions.

- Automatic temperature control
- On/off operation via smartphone
- Visualization of electricity bills (simplified version)

In development and verification, the following will be carried out

- Preliminary monitoring in a limited area
- Verify smartphone usability based on the hypothesis that "no remote control operation is required."
- Provide to elderly households and evaluate voice operation and ease of viewing of the screen

The following will be carried out through a feedback loop:

- Acquire data on the frequency of app use, temperature satisfaction, and changes in electricity bills
- Collect dissatisfaction with operability and ease of use

Phase 3: Optimizing the Experience with CJM:

The purpose of phase 3 is to discover areas for improvement from actual customer experiences. The journey map of the air conditioner is shown in Table 4.

Table 4: CJM of the air conditioner

Phase	Touch points	Customer action	Customer sentiment	Issues
Awareness	Web advertising, word of mouth	Interested	Interest/doubt	Is it useful?
Purchase	EC site, Electronics retailer	Specification comparison/purchase	Expectations and concerns	Lack of information on operability

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Installation	On-site installation, initial settings	App installation and configuration	is troublesome	Difficult to set up for elderly people
Use	Daily heating and cooling operation, power-saving display	Operate and check using the app	Comfortable and satisfying	Frequent notifications are annoying
Continue	Maintenance and energy saving report	Recommend to others	Sense of security and trust	I'm worried about whether I need to clean the filter

The effects of the above integration are as follows:

- By structuring value with VPC, it becomes clear which value is important to customers.
- By verifying hypotheses with MVP, it is possible to reduce waste before implementation and obtain the customer's "voice" early.
- By visualizing the customer experience with CJM, it is possible to understand and improve issues from implementation to daily use.

DISCUSSION

Effectiveness

The proposed method can construct a new business modeling method from the perspective of the components of multiple business modeling methods. It can also define a metamodel of the new business modeling method based on the commonalities and differences of the referenced business modeling methods. In this paper, the effectiveness of the new modeling method was confirmed by demonstrating that it can be applied to the design of a virtual product.

The following is a comparison of the case where the methods to be integrated are used individually for design and the case where the integrated method is used for design.

When integrating the results of individual designs, it is necessary to adjust the terms of the different business modeling methods. In contrast, with the integrated method, the terms are unified in advance, so there is no waste. It is also clear that what can be done with individual methods can also be done with the integrated method.

Novelty

Until now, there have been many different business modeling methods, and it has not been clear which method to apply and how. The proposed method solves this problem by building an integrated method. In addition, the integrated method can create new business modeling methods that differ from existing methods. For example, we can compare the constructed VMC with existing methods.

Below, we compare Design Thinking [16, 17] and VMC.

Design Thinking and VMC are both user-centered problem-solving methods, but there are differences in the structure, tools, and emphasis of the approach. Below, we compare the two in terms of their constituent processes, objectives, deliverables, values, and scope of application, and clarify their similarities and differences in Table 5.

Table 5: Comparison of Design Thinking and VMC

Viewpoint	Design thinking	VMC
Purpose	Understanding the essence of the problem and creating creative solutions	Verifying and visualizing customer value and applying it to the business
Philosophy	Empathy, creation, repetition	Structuring, hypothesis verification, and visualizing experience
Focus	Ideas based on redefining the "problem itself"	Adjusting and improving "value provided" and "customer experience"
Starting point	The user's life context and potential needs	Verification of business hypotheses (value proposition, functions, experience)

Design thinking is the creative stage for solving social issues and unknown problems, emphasizing empathy, ideas, and creativity to redefine the problem and devise solutions. In contrast, VMC is the creative stage for solving product problems and issues, emphasizing structuring, verification, and UX analysis to design customer value and prototype, and implement products.

The above comparison shows that the proposed method can create a new problem-solving method that didn't exist before.

Applicability

In this paper, we applied the integration procedure for VPC, MVP, and CJM. The proposed method can be applied to other combinations of methods. For example, we have confirmed that it is possible to integrate Soft System Methodology (SSM) [18] and Theory of Constraints (TOC) [19], which are well-known methods in the field of systems thinking. We plan to present these results when the opportunity arises. In this way, the proposed method can be applied to areas other than business modeling.

Automation by Generative AI

The proposed integration method can be automated by using generative AI. The prompt template of the integration method is as follows.

Definition Prompt template

- [Input] Set M of methods to be integrated
- [Procedure]
- Step 1: Decompose the elements of M into components
- Step 2: Extract common elements and call the set C
- Step 3: Identify differences and call the set D
- Step 4: Create an integration method that is based on C and D
- [Output] Integration method: I

If M is replaced with "M as VPC, MVP, and CJM," the VMC framework will be developed by generative AI. In this way, the above prompt template automates the proposed method easily, and it moreover shows the applicability of the proposed method.

Limitations

The limitations of this paper are as follows:

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- We only provided an example of integrating VPC, MVP, and CJM. It is necessary to integrate and evaluate other methods as well.
- The methods to be integrated must have commonality. There is no value in integrating methods that have absolutely no commonality. In addition, we did not confirm the upper limit on the number of methods to be integrated. It is unclear whether it is advisable to integrate too many methods. Further research is needed.
- The proposed method can integrate any method, but it seems meaningless to integrate methods with completely different directions that are completely unrelated. Future research will be to clarify the conditions that the methods to be integrated must satisfy. It is also necessary to clarify the success criteria that the method generated as a result of the integration must satisfy.

CONCLUSION

This paper introduced a method based on element decomposition for integrating business modeling methods. It also clarified that by applying the proposed method to VPC, MVP, and CJM, it is possible to create a VMC framework as a new method. It also demonstrated that the VMC framework can be used to design a business model for a virtual home air conditioner product. Furthermore, by presenting a prompt template for the proposed method, it clarified the possibility of automation using generative AI.

The approach to the method integration method based on element decomposition introduced in this paper will make it possible to realize integrated management of different business modeling methods, which is likely to accelerate the development of business model strategies.

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