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Rethinking Multichannel Management in a Digital World – A Decision Model for Service Providers

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Rethinking Multichannel Management in a Digital World – A Decision Model for Service Providers

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Abstract. Digitization empowers customers and creates corporate opportunities. Among others, new technology-based communication channels enable and force service providers into interacting with customers in a more target-oriented manner. Though crucially needed in practice, academic literature offers no approaches for determining a service provider's multichannel strategy that balance the process and the customer perspective and that build on a thorough economic analysis. Academic literature neither considers individual steps of the purchase decision process nor customers' channel switching behavior. Thus, we propose a decision model that helps determine an appropriate multichannel strategy, i.e., which steps of the purchase decision process should be supported by which channels for which service offerings. In line with value-based management, the decision model values multichannel strategies in terms of their present value cash flow effects. Finally, we demonstrate the model's applicability using the multichannel setting of an international financial service provider as example.

Keywords: Multichannel management, channel switching, decision model, customer relationship management, digitization

1 Introduction

Digitization is redefining market success factors, empowering costumers, and creating corporate opportunities [1]. New technologies such as mobile internet and social media significantly change the customers' self-confidence and their desire for individual treatment [2]. Digitization particularly affects service providers (SPs) as new technology-based communication channels enable and force them into interacting with customers in a more target-oriented manner [2, 3]. Elderly people, for instance, tend to prefer face-to-face interaction in traditional brick-and-mortar branches, whereas digital natives demand convenient online channels [4]. In Germany, HypoVereinsbank has recently transformed its business model to fortify its presence in multichannel services, addressing the group of elderly people, who represent the financially strong segment today, and the promising segment of digital natives [5]. Ever more organizations even pursue an omnichannel strategy, aiming for a unified customer experience across all channels without influencing the customers' channel choice [6]. Given that

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some channel characteristics (e.g., costs, product fit, customer acceptance) vary greatly, the determination of an appropriate multichannel strategy (MS) is a demanding task that must consider the customers' preferences and the economic effects of implementing as well as operating a MS [6, 7].

Academic literature from the information systems, marketing, and customer relationship management (CRM) fields predominantly focuses on generic guidelines for identifying an appropriate MS [8, 9]. Payne and Frow, for example, suggest reviewing strategic success factors such as channel participants, channel options, and alternative channel strategies [9]. Most approaches strongly recommend analyzing customers' channel preferences and matching these preferences to specific channels [7, 9]. Other authors take on a statistical perspective and provide guidance on how to build models for customer segmentation. Thomas and Sullivan, for instance, develop a statistical framework that allows for predicting the customers' channel choice over time [10, 11]. Only very few literature provides decision support for determining an appropriate MS. For example, Chu et al. model the profit impact of different channel actions such as the addition of channels in the personal computer industry [12]. Buhl and Kreyer optimize how to allocate budget on different channels [13]. Freitag and Wilde determine which MS maximizes the channel fit, an index that incorporates how a MS affects processes and customers [14]. However, Freitag and Wilde do not define how to quantify the factors that influence the channel fit. Nor do they analyze the economic effects of implementing and operating a distinct MS.

This review revealed the following research gap: SPs require in-depth guidance on how to determine an appropriate MS. So far, literature neither differentiates individual steps of the purchase decision process nor does it consider the customers' channel switching behavior. However, treating the purchase decision process as a seamless product- or service-specific process is not enough. Rather, the process steps a customer traverses until the purchase decision must be analyzed individually. Moreover, the effects of enforced channel switching need to be integrated into MS decisions as well. In sum, SPs lack approaches that balance the process and the customer perspective based on an economic analysis. Therefore, our research question is as follows: *Which communication channels should a SP offer for which steps of the purchase decision process in line with the principles of value-based management?*

To answer this question, we develop a quantitative decision model, which allows a SP evaluating different MSs in order to select the MS associated with the highest value contribution. The decision model considers a SP's service offerings, the process steps that customers must traverse prior to purchasing a service offering, and the communication channels the SP can choose for interacting with its customers. On this foundation, the decision model helps determine the MS with the highest value contribution in terms of cash outflows for implementation and operation, direct service-specific inflows, and indirect cash effects induced by a MS.

The paper is organized as follows: In section 2, we sketch the theoretical background of multichannel management, service processes, and CRM. In section 3, we introduce the decision model, before applying it to the multichannel setting of a major international financial service provider in section 4. We conclude by summarizing key results, limitations, and pointing to further research.

2 Theoretical Background

Channel selection decisions were first described by single-channel models built to determine which distribution channel to use for distinct product or service types [15]. MSs comprise the decision on an appropriate combination of multiple channels for distribution or communication [9, 16]. We define channels as routes of communication between an organization and its customers. Channels can be categorized into offline or online as well as into direct/owned or indirect/non-owned channels. Offline channels are physical channels such as stores, sales force, and catalogs, whereas online channels are based on the internet in the form of mobile apps, email, or websites. Indirect channels involve an intermediary responsible for managing the customer relationship, whereas organizations communicate directly with their customers via direct channels [17]. Although communication channels do not necessarily serve for distribution, the product or service type is a key driver of the customers' channel preferences [15].

Payne and Frow identify general MS categories based on the variety of the provided channels and the consideration of different customer segments. For instance, the "customer segment channel strategy" addresses different customer groups offering them distinct channels, whereas an "integrated multichannel strategy" describes an omnichannel approach providing all customers with the full range of channels without influencing their channel choice. Our decision model builds on an "activity-based channel strategy" where it is taken into account that customers may want to switch channels depending on their preferences and the service under investigation [9].

In this paper, we optimize the MS of a SP. Services are typically defined via constitutive criteria such as immateriality, integration of customers into the value-creation process, and inseparability of production and consumption [18, 19]. From the customers' perspective, a service offering does not only refer to a concrete output of the service process, but also to the SP's promise to deliver a distinct quality and the customers' experience. This experience depends, among other things, on the degree of personal interaction as well as the SP's flexibility and responsiveness. In our decision model, we analyze three stages of the purchase decision process, namely information search, evaluation service options, and purchase decision [20].

When determining an appropriate MS, it is crucial to understand the customer perspective. MSs are becoming a substantial component of successful CRM, which is "a customer-focused business strategy that aims at increasing customer satisfaction and customer loyalty by offering more responsive and customized services" [21]. CRM has proven to be a vital driver of the company value as it strives for continuous cash flows leveraging customer loyalty [10]. The long-term economic value of a single customer is measured via the customer lifetime value (CLV), i.e., the net present value of all customer-specific cash in- and outflows throughout the customer relationship [17]. The sum of all CLVs defines a company's customer equity (CE), which is known to be a reasonable proxy for the company value [22]. In times of digitization, organizations are about to rethink the traditional concept of customer relationship as new technologies lead to empowered customers who want to actively choose the channels they use when interacting with an organization [2, 23]. Terms like "social

CRM" or "CRM 2.0" capture this "new way of developing and maintaining customer relationships within the current business and IT landscape", which companies must consider when determining an appropriate MS [23].

3 The Decision Model

3.1 Basic Idea and General Setting

The decision model aims to identify the MS with the highest contribution to the SP's company value. It therefore considers all service offerings (henceforth referred to as offerings) of the SP, multiple steps of the purchase decision process that customers must traverse prior to purchasing a service offering, and the channels the SP can choose for interacting with its customers.

From a valuation perspective, MSs affect cash in- and outflows, which are the components of the value contribution, differently strong. Fig. 1 depicts the relationship between MSs, cash in- and outflows, and relevant cash flow drivers. Below, we briefly introduce different cash flow components and their drivers following the layers shown in Fig. 1, i.e., the strategy, demand, and valuation layer.

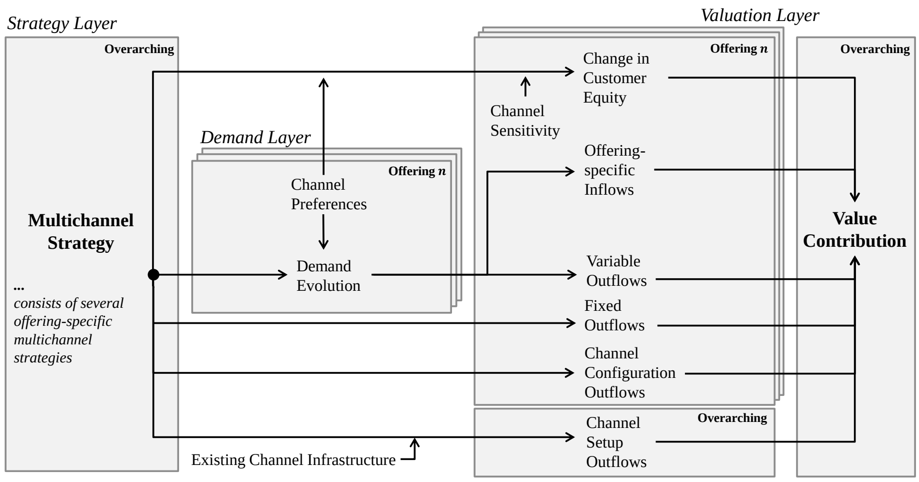

Fig. 1. Effects of a Multichannel Strategy on the Value Contribution

The strategy layer includes the SP's overall MS. This MS, in turn, consists of several offering-specific MSs that define which process steps (in the following referred to as processes) are supported by which channels for a distinct offering. We only consider the steps of the purchase decision process information search, evaluation of service options, and purchase decision. In a concrete case, these processes may split into multiple SP-specific sub-processes. Other processes with intense costumer interaction, such as after-sales services, are excluded from our analysis. We define the purchase decision process as a strict sequence of mandatory processes p_j

with $j = 1, \dots, J$. For example, signing a car insurance at Axa comprises "informing", "premium computation", and "signing" [24]. We assume:

Assumption (A.1): On a high level of abstraction, the purchase decision process comprises a strict sequence of mandatory processes, which are identical for all service offerings. Customers who purchase a service offering must have traversed all processes before.

Each process must be supported by at least one channel c_i with $i = 1, \dots, I$. A channel can be provided for any number of processes. That is, the SP must decide for each offering $n = 1, \dots, N$ which processes are supported by which channels. The resulting MS X_n for a distinct offering can therefore be interpreted as an $I \times J$ matrix where each x_{n,c_i,p_j} indicates whether process p_j is supported by channel c_i.

$$X_n = \begin{pmatrix} x_{n,c_1,p_1} & \cdots & x_{n,c_1,p_J} \\ \vdots & \ddots & \vdots \\ x_{n,c_I,p_1} & \cdots & x_{n,c_I,p_J} \end{pmatrix} \text{ with } x_{n,c_i,p_j} = \begin{cases} 1 \text{ if channel } c_i \text{ supports process } p_j \\ 0 \text{ else} \end{cases} \text{ and } \forall\, j\colon \sum_{i=1}^{I} x_{n,c_i,p_j} \geq 1$$

As depicted in the demand layer, an offering-specific MS influences how the demand for that offering, i.e., the number of customer inquiries per period, evolves through the purchase decision process. A MS that offers more channels might increases the served demand as the customers' individual channel preferences can be met more accurately. In line with assumption (A.1), the demand can only remain constant or decrease since customers must start the purchase decision process with the first process and traverse all subsequent processes. However, customers may cancel their inquiries after each single process, e.g., in order to purchase the service from a competitor. We assume:

Assumption (A.2): The customers' preferences and the demand evolution are constant and deterministic during the planning horizon.

The valuation layer includes offering-specific and overarching cash flow components that drive the value contribution of a MS. On the one hand, there are two types of cash inflows affected by a given MS, i.e., direct offering-specific cash inflows that depend on the demand evolution and indirect cash effects measured as changes in the SP's CE. These changes in the SP's CE depend on the channel sensitivity that represents long-term channel-related effects, e.g., finding restricted loyalty for customers who purchase online. On the other hand, providing more channels increases the cash outflows associated with a MS, i.e., variable, fixed, and investment outflows. All inquiries cause offering-specific variable outflows for each traversed process. Offering-specific fixed outflows, e.g., maintenance and employee training, accrue recurrently for the channel support of any process. The investment outflows depend on the required changes in the SP's channel infrastructure compared to the current MS. The investment outflows again split in two types, i.e., channel setup outflows for building up a new channel or for closing down existing channels and channel configuration outflows for preparing a channel to enable the support of a distinct process for a given offering.

When determining an optimal MS, the trade-off between additional cash in- and outflows must be considered. Therefore, we use the value contribution of a MS as evaluation criterion. The value contribution is measured as the net present value of the cash flow effects over time. Below, we provide more details on the demand evolution and the cash flow components of the value contribution.

3.2 Demand Layer

For each multichannel setting, the primary driver of the cash inflows is the customer demand. Therefore, we analyze the demand evolution, i.e., how the number of customer inquiries evolves through the purchase decision process given a distinct MS and in light of the customers' channel preferences.

At the beginning of the purchase decision process, the SP faces a channel-specific initial demand $\vec{D}_{n,p_0} = (d_{n,c_1,p_0}, \dots, d_{n,c_I,p_0})^{\mathrm{T}}$ for each offering. For instance, the demand d_{n,c_1,p_0} captures the number of inquiries for gathering information about a particular offering via channel c_1. In line with assumption (A.1), the initial demand is an upper boundary of the demand $\vec{D}_{n,p_j}$ $(j > 0)$ that materializes at subsequent processes. The number of inquiries captured in $\vec{D}_{n,p_J}$ that reaches the last process is called the served demand. The demand evolution from the first to the last process depends on the customers' channel preferences during the purchase decision process as well as on which channels are offered given a distinct MS.

The customers' preferences to stay in the same channel or to switch to other channels for two consecutive processes are captured in terms of an $I \times I$ conversion rate matrix $R_{n,p_j,p_{j+1}}$. Each matrix captures the preferences from the SP's customer portfolio including the perceived process/channel fit and competitive offerings regarding a distinct service offering. There are J conversion rate matrices per offering. In our case, the preferences of different customer segments – such as digital natives or deniers – must be determined and aggregated by the SP before the decision model is applied.

$$R_{n,p_j,p_{j+1}} = \begin{pmatrix} r_{n,c_1,p_j,c_1,p_{j+1}} & \cdots & r_{n,c_1,p_j,c_I,p_{j+1}} \\ \vdots & \ddots & \vdots \\ r_{n,c_I,p_j,c_1,p_{j+1}} & \cdots & r_{n,c_I,p_j,c_I,p_{j+1}} \end{pmatrix} \text{ with } r_{n,c_i,p_j,c_k,p_{j+1}} \in [0;1]\ \forall\, i,k \in \{1;\dots;I\} \text{ and } j \in \{0;\dots;J-1\}$$

For a specific offering n, each element $r_{n,c_i,p_j,c_k,p_{j+1}}$ represents the conversion rate from channel c_i in the current process p_j to another channel c_k in the consecutive process p_{j+1}. In other words, the conversion rate describes the fraction of customers coming from a particular channel c_i who aim to proceed in channel c_k. The sum over all conversion rates of a channel c_i indicates the fraction of customers who proceed with the next process. In turn, $(1 - \sum_{k=1}^{I} r_{n,c_i,p_j,c_k,p_{j+1}})$ equals the cancellation rate related to channel c_i between the processes p_j and p_{j+1}.

The rates contained in the conversion rate matrices reflects the preferred customer journeys meaning how the customers would traverse the purchase decision process in case all potentially available channels are provided. However, if the SP applies a different MS, where certain channels are not offered, customers may not be able to follow the customer journey the way they originally intended to. We refer to this phenomenon as enforced channel switching, which results in either channel switching or the cancellation of customer inquiries. For example, in case channel c_k is closed for process p_{j+1}, the conversion rate $r_{n,c_i,p_j,c_k,p_{j+1}}$ splits and positively affects the rates $r_{n,c_i,p_j,c_t,p_{j+1}}(t \in \{1; \ldots; I\} \land t \neq k \land x_{n,c_t,p_{j+1}} = 1)$ to other channels provided in process p_{j+1}.

The demand split in case of enforced channel switching depends on the customers' willingness to switch, a concept that can be operationalized in terms of the perceived channel similarity. In line with the channel switching model by Gupta et al., customers are more likely not to cancel their inquiries in case of enforced channel switching if the alternative channel and the preferred channel have similar characteristics [25]. Thus, the more similar two channels, the higher is the probability of successful channel switching. Originally, Gupta et al.'s channel switching model only considered offline and online channels. However, a generalization seems reasonable as many channels can be classified as offline or online. In our decision model, we formalize the willingness to switch using the symmetric $I \times I$ matrix S.

$$S = \begin{pmatrix} s_{c_1,c_1} & \cdots & s_{c_1,c_I} \\ \vdots & \ddots & \vdots \\ s_{c_I,c_1} & \cdots & s_{c_I,c_I} \end{pmatrix} \text{ with } s_{c_i,c_k} \in [0;1]\ \forall\, i,k \in \{1;\ldots;I\} \text{ and } \forall\, i = k:\ s_{c_i,c_k} = 1$$

The willingness to switch s_{c_i,c_k} indicates the highest percentage of customer inquiries that can be transferred from channel c_i to channel c_k in case one of them is closed. Correspondingly, $1 - \mathrm{s}_{\mathrm{c_i},\mathrm{c_k}}$ equals the cancellation rate due to enforced channel switching. We assume:

Assumption (A.3): The customers' willingness to switch channels depends on the perceived pairwise similarity of the offered channels. The customers' willingness to switch channels is independent from a concrete service offering.

To align the customers' channel preferences expressed in terms of the conversion rate matrices $R_{n,p_j,p_{j+1}}$ with a given MS X_n and the customers' willingness to switch expressed in terms of the matrix S, we define the modified conversion rate matrices $R^{\text{mod}}_{n,p_j,p_{j+1}}$ as follows:

$$R^{\text{mod}}_{n,p_j,p_{j+1}} = \begin{pmatrix} r^{\text{mod}}_{n,c_1,p_j,c_1,p_{j+1}} & \cdots & r^{\text{mod}}_{n,c_1,p_j,c_I,p_{j+1}} \\ \vdots & \ddots & \vdots \\ r^{\text{mod}}_{n,c_I,p_j,c_1,p_{j+1}} & \cdots & r^{\text{mod}}_{n,c_I,p_j,c_I,p_{j+1}} \end{pmatrix} \text{ with } r^{\text{mod}}_{n,c_i,p_j,c_k,p_{j+1}} \in [0;1]\ \forall\, i,k \in \{1;\ldots;I\} \text{ and } j \in \{0;\ldots;J-1\}$$

Following the idea of the conversion rates introduced above, the modified conversion rates represent the conversion rate from one channel c_i in the current process p_j to another channel c_k in the consecutive process p_{j+1} considering a given MS. In other words, the modified conversion rates reflect the customers' modified preferences in case their preferred customer journey is not feasible due to a given MS. The modified conversion rates $r^{\text{mod}}_{n,c_i,p_j,c_k,p_{j+1}}$ are calculated as shown in Formula (1).

$$r^{\text{mod}}_{n,c_i,p_j,c_k,p_{j+1}} = x_{n,c_k,p_{j+1}} \cdot (r_{n,c_i,p_j,c_k,p_{j+1}} + (\sum_{\substack{t=1 \\ t \neq k}}^{I} \frac{s_{c_k,c_t}}{\sum_{\substack{a=1 \\ a \neq t}}^{I} s_{c_a,c_t} \cdot x_{n,c_a,p_{j+1}}} \cdot s_{c_k,c_t} \cdot r_{n,c_i,p_j,c_t,p_{j+1}}(1 - x_{n,c_t,p_{j+1}})) \tag{1}$$

Formula (1) can be explained as follows: Customer inquiries in channel c_i and process p_j can only be transferred to channel c_k in process p_{j+1} if it is enabled in the

MS X_n. In case channel c_k is closed in process p_{j+1}, the binary variable $x_{n,c_k,p_{j+1}}$ is 0. Consequently, the modified conversion rate $r^{\mathrm{mod}}_{n,c_i,p_j,c_k,p_{j+1}}$ is 0, too. In case c_k is enabled in process p_{j+1}, $x_{n,c_k,p_{j+1}}$ is 1. The modified conversion rate $r^{\mathrm{mod}}_{n,c_i,p_j,c_k,p_{j+1}}$ then is at least as large as the unmodified conversion rate $r_{n,c_i,p_j,c_k,p_{j+1}}$. Based on assumption (A.3), the modified conversion rate increases if alternative channels are closed in p_{j+1}. The increase depends on the customers' willingness to switch s_{c_k,c_t} from the closed channel c_t to the current channel c_k weighted by the willingness to switch from c_t to all other provided channels. In sum, the increase depends on two factors: the similarity between channels [25] and the number of alternative enabled channels.

The modified conversion rates formally capture the demand evolution from the initial demand $\vec{D}_{n,p_0}$ to the served demand $\vec{D}_{n,p_J}$ for a distinct offering. The number of inquiries can be modeled by multiplying the demand vector of the preceding process with the corresponding modified conversion rate matrix:

$$\vec{D}^{\mathrm{T}}_{n,p_{j+1}} = \vec{D}^{\mathrm{T}}_{n,p_j} \cdot R^{\mathrm{mod}}_{n,p_j,p_{j+1}} \ \forall\, j \text{ with } j \in \{0; \dots ; J-1\} \tag{2}$$

3.3 Valuation Layer

As introduced above, a MS leads to different cash in- and outflows. We examine these cash flow effects in more detail below. We assume:

Assumption (A.4): All considered cash in- and cash outflows are constant and deterministic during the planning horizon.

On the one hand, there are two types of cash inflows affected by a given MS: direct offering-specific cash inflows and indirect cash effects measured by changes in the SP's CE. Offering-specific cash inflows $I(X_n)$ are determined as in Formula (3) by multiplying the served demand $\vec{D}_{n,p_J}$ with the average present value PV_n of offering n.

$$I(X_n) = \vec{D}^{\mathrm{T}}_{n,p_J} \cdot PV_n \cdot \vec{1} \tag{3}$$

Apart from offering-specific inflows, we consider changes in the SP's CE that result from a specific MS. These indirect effects do not result from selling offerings, but from the MS itself. To be more precise, empirical studies revealed long-term channel-related effects, e.g., finding restricted loyalty for customers who purchase online. Furthermore, sales via the Internet are related with a lower long-term purchase volume compared to offline sales [26].These empirical findings corroborate the existence of a channel-specific factor referred to as channel sensitivity that captures how a specific channel c_i influences the customers' future value contribution. Hence, when evaluating a specific MS X_n, customer inquiries that are processed in offline channels should be considered with a higher channel sensitivity and hence a higher value contribution compared to online inquiries. In our decision model, we model these impacts by changes $\Delta CE(X_n)$ in the SP's CE. These changes are purposely modelled in an abstract manner since their measurement highly depends on the characteristics of the company and case at hand.

On the other hand, a MS leads to cash outflows that can be divided into three components, namely variable outflows for processing customer inquiries, fixed outflows caused by operating the channel infrastructure, and investment outflows for the setup and configuration of channels.

Variable cash outflows are offering-specific and induced by each customer inquiry in each process. They also depend on the channel where an inquiry is processed. The variable outflows v_{n,c_i,p_j} per inquiry are reflected in the $I \times J$ matrix V_n.

$$V_n = \begin{pmatrix} v_{n,c_1,p_1} & \cdots & v_{n,c_1,p_J} \\ \vdots & \ddots & \vdots \\ v_{n,c_I,p_1} & \cdots & v_{n,c_I,p_J} \end{pmatrix} \text{with } v_{n,c_i,p_j} \in \mathbb{R}_0^+$$

The sum of all offering-specific variable cash outflows depends on the total number of customer inquiries for each process and channel as shown in Formula (4).

$$O_{\mathrm{var}}(X_n) = \sum_{j=1}^{J} \vec{D}_{n,p_j}^{\mathrm{T}} \cdot \begin{pmatrix} v_{n,c_1,p_j} \\ \vdots \\ v_{n,c_I,p_j} \end{pmatrix} \tag{4}$$

In addition, operating a channel for a distinct process and offering causes recurring fixed cash outflows (e.g., for maintenance or trainings). These outflows are independent from the demand evolution. We consider the present value of the fixed cash outflows. The fixed outflows $\vec{O}_{\mathrm{fix},n} = \left(o_{\mathrm{fix},n,c_1}, \dots, o_{\mathrm{fix},n,c_I}\right)^{\mathrm{T}}$ of a channel, where $o_{\mathrm{fix},n,c_i} \in \mathbb{R}_0^+$, accrue for each process supported by that channel. We assume:

Assumption (A.5): Fixed cash outflows are offering-specific and occur if process p_j is supported by channel c_i. They are equal for all processes within a specific channel.

Accordingly, we can derive the following formula for the fixed outflows $O_{\mathrm{fix}}(X_n)$:

$$O_{\mathrm{fix}}(X_n) = \left({X_n}^{\mathrm{T}} \cdot \vec{O}_{\mathrm{fix},n}\right)^{\mathrm{T}} \cdot \vec{1} \tag{5}$$

Finally, a MS causes investment outflows. Investment outflows depend on the required changes in the SP's channel infrastructure when implementing a distinct MS. To identify such changes, the SP's current channel infrastructure must be compared with the infrastructure implied by the target MS. Investment outflows further split into channel configuration outflows for preparing existing channels to support a distinct process for a given offering as well as into channel setup outflows for building up new channels or closing down existing channels. Channel configuration outflows accrue for each offering if an already established channel is enabled for a so far not supported process. For example, the SP intends to support a distinct process for a new offering via its online channel. Though already having an online platform (the channel per se is already set up), the SP must additionally configure the online channel for the new offering process combination (e.g., offering-specific interface adaption, customizing of software, or definition of offering-specific content). In sum, the channel configuration outflows are given by $\vec{O}_{\mathrm{conf},n} = \left(o_{\mathrm{conf},n,c_1}, \dots, o_{\mathrm{conf},n,c_I}\right)^{\mathrm{T}}$ where $o_{\mathrm{conf},n,c_i} \in \mathbb{R}_0^+$. We assume:

Assumption (A.6): The channel configuration outflows are offering-specific. They are equal for all processes within a specific channel.

Based on the offering-specific MS X_n, that indicates which processes are supported by which channels in the target state, and a corresponding matrix X_n^{cur} for the current MS, we can derive the $I \times J$ matrix X'_n according to Formula (6). This matrix indicates which processes are newly supported by a distinct channel and which processes will be disabled with regard to the target MS.

$$X'_n = \begin{pmatrix} x'_{n,c_1,p_1} & \cdots & x'_{n,c_1,p_J} \\ \vdots & \ddots & \vdots \\ x'_{n,c_I,p_1} & \cdots & x'_{n,c_I,p_J} \end{pmatrix} \text{ with } x'_{n,c_i,p_j} = |x_{n,c_i,p_j} - x_{n,c_i,p_j}^{\mathrm{cur}}| \tag{6}$$

For any offering n, the variable $x'_{n,c_i,p_j} = 1$ indicates that channel configuration outflows occur either for supporting or for closing a channel c_i for process p_j. Therefore, the investment outflows notion covers both the investment and divestment case.

The second type of investment outflows, the channel setup outflows, reflects the outflows that accrue if specific channels must be built up or closed down. Therefore, it is necessary to assess whether, in the target state, there are new channels to be supported compared to the current MS and whether existing channels are no longer needed. As shown in Formula (7), the $I \times J$ matrix X_{all} indicates whether a distinct process is supported by a distinct channel for at least one offering based on the target MS.

$$X_{\mathrm{all}} = \begin{pmatrix} x_{\mathrm{all},c_1,p_1} & \cdots & x_{\mathrm{all},c_1,p_J} \\ \vdots & \ddots & \vdots \\ x_{\mathrm{all},c_I,p_1} & \cdots & x_{\mathrm{all},c_I,p_J} \end{pmatrix} \text{ with } x_{\mathrm{all},c_i,p_j} = \begin{cases} 0, \text{if} \sum_{n=1}^{N} x_{n,c_i,p_j} = 0 \\ 1, \text{else} \end{cases} \tag{7}$$

Comparing X_{all} with $X_{\mathrm{all}}^{\mathrm{cur}}$, which is determined analogously but refers to the current MS, we can determine which channels need to be built up and which channels must be closed down. Therefore, $|\mathrm{sgn}(\sum_{j=1}^{J} x_{\mathrm{all},c_i,p_j}) - \mathrm{sgn}(\sum_{j=1}^{J} x_{\mathrm{all},c_i,p_j}^{\mathrm{cur}})| = 1$ indicates that investment outflows $o_{\mathrm{setup},c_i} \in \mathbb{R}_0^+$ occur for building up or closing down channel c_i.[1] The setup outflows are captured by $\vec{O}_{\mathrm{setup}} = \left(o_{\mathrm{setup},c_1}, \dots, o_{\mathrm{setup},c_I}\right)^T$. Considering outflows for both channel configuration and setup, we can calculate the entire investment outflows as shown in Formula (8).

$$O_{\mathrm{inv}}(X_1, \dots, X_N, X_1^{\mathrm{cur}}, \dots, X_N^{\mathrm{cur}}) = \vec{O}_{\mathrm{setup}}^{\mathrm{T}} \cdot \begin{pmatrix} |\mathrm{sgn}(\sum_{j=1}^{J} x_{\mathrm{all},c_1,p_j}) - \mathrm{sgn}(\sum_{j=1}^{J} x_{\mathrm{all},c_1,p_j}^{\mathrm{cur}})| \\ \vdots \\ |\mathrm{sgn}(\sum_{j=1}^{J} x_{\mathrm{all},c_I,p_j}) - \mathrm{sgn}(\sum_{j=1}^{J} x_{\mathrm{all},c_I,p_j}^{\mathrm{cur}})| \end{pmatrix} + \sum_{n=1}^{N} ((X'_n{}^{\mathrm{T}} \cdot \vec{O}_{\mathrm{conf},n})^{\mathrm{T}} \cdot \vec{1}) \tag{8}$$

The first part of Formula (8) reflects the channel setup outflows. As soon as a process is supported by a channel, the corresponding channel is required. As explained,

[1] The signum function equals 1 in case at least one process for at least one offering is supported in a distinct channel. $\mathrm{sgn}(\sum_{j=1}^{J} x_{\mathrm{all},c_i,p_j}) = 1$ indicates that the channel c_i is needed in the target MS. Consequently, channel setup outflows occur if the channel has not been implemented yet, which is identified correspondingly by $\mathrm{sgn}(\sum_{j=1}^{J} x_{\mathrm{all},c_i,p_j}^{\mathrm{cur}}) = 0$.

this circumstance is modelled by the signum function that considers whether the channel has already been part of the current channel infrastructure or not. The second part of Formula (8) reflects the channel configuration outflows for configuring a channel to enable the support of a distinct process for a given offering.

Based on the introduced cash flow components and corresponding drivers, we can determine the MS with the highest contribution to the SP's company value. The value contribution is measured in terms of the present value changes in cash flows induced by the MS. This leads to the following objective function:

$$\begin{aligned} MAX: V(X_1, \ldots, X_N, X_1^{\text{cur}}, \ldots, X_N^{\text{cur}}) = \\ - O_{\text{inv}}(X_1, \ldots, X_N, X_1^{\text{cur}}, \ldots, X_N^{\text{cur}}) \\ + \sum_{n=1}^{N} (- O_{\text{fix}}(X_n) - O_{\text{var}}(X_n) + I(X_n) + \Delta CE(X_n)) \\ \text{with } \textstyle\sum_{i=1}^{I} x_{n,c_i,p_j} \geq 1 \; \forall \, j \in \{1; \ldots; J\} \; \wedge \; n \in \{1; \ldots; N\} \end{aligned} \tag{9}$$

4 Demonstration Example

To demonstrate how the decision model can be used in practice, we report on the insights gained from applying the model to the multichannel setting of an international financial SP. We first provide some background information about the context of the case company and the case itself. We then challenge the company's MS and determine whether the company's online channel should be extended by a mobile app.

Especially financial SPs are under pressure to redefine their way of customer interaction [4]. The main challenge is not only the integration of multiple channels, but also understanding the customers' journey through these channels. Two of the company's market research experts, who focus on multichannel offers, emphasized that traditional customer segmentation is no longer possible in a digital world. Especially, the interaction patterns of so-called hybrid customers, who prefer to switch between online and offline channels, can hardly be categorized. This circumstance significantly complicates MS decision making. When applying our decision model, we discussed our model and related questions with the experts in the course of a telephone and a follow-up personal interview. Owing to confidentiality, the company's identity will not be disclosed. Moreover, all data had to be anonymized and slightly modified.

The company currently provides three major owned channels (i.e., online, call-center, and agencies) and two non-owned channels (i.e., brokers and other intermediaries). We focus on the owned channels. The company considers to extend its online channel by a mobile app for its car insurance offering. The purchase decision process splits into three steps, i.e., informing, premium computation, and signing. All steps are already supported by all channels. The company's main question is how to reasonably integrate the mobile app into the current MS from an economic perspective.

When applying the decision model, we required specific data to estimate the parameters. First, the demand had to be determined. The experts were able to provide us with estimates regarding the customer journey, which we translated into conversion rates. To calculate cash in- and outflows, we estimated the variable outflows for processing one inquiry and the fixed outflows for maintaining a channel. Due to the costs of labor and a significant amount of physical equipment, the offline channels (i.e., call-center and agency) cause much higher outflows than the online channels. Moreover, we estimated the channel configuration outflows for extending the online channel by the mobile app. It is assumed that integrating the mobile app leads to one-time configuration outflows of 60.000 € per process (e.g., for development, design, and technical integration). Since the mobile app represents an extension of the existing online channel, setup outflows do not accrue. According to the company, closing existing channels was not an option. Therefore, divestment outflows were assumed to be prohibitively high. As for the inflows, the present value of the car insurance offering as well as indirect effects, influencing customer equity, were required. The former was determined based on the average insurance premium, the expected coverage for damage, and an internal discount rate. According to the company, the indirect effects on the CE are very hard to estimate. Therefore, we operationalized the findings of Ansari et al. [26], applying the following proxy for quantifying $\Delta CE(X_n)$:

$$\Delta CE(X_n) = \sum_{i=1}^{I} \emptyset CLV \cdot \varepsilon_{n,c_i,p_J} \cdot d_{n,c_i,p_J} \text{ with } \varepsilon_{n,c_i,p_J} \in \mathbb{R}_0^+ \tag{10}$$

The variable ε_{n,c_i,p_J} captures the channel sensitivity that describes how a specific channel c_i, where the purchase decision is made, influences the customers' future value contribution. It is multiplied with the average CLV of the customer portfolio indicating the increase of CLV per customer served. The sum over all served customers equals the overall change in CE.

Table 1 Data Input of the Demonstration Example

Demand Layer				
Initial Demand				
Channels	**Online**	**Call-center**	**Agency**	**Mobile App**
Number of Inquiries	41.000	28.000	11.000	20.000
Conversion Rates from Process Step "Informing" to "Premium Computation"				
Channels/Channels	**Online**	**Call-center**	**Agency**	**Mobile App**
Online	10%	35%	5%	10%
Call-center	5%	50%	5%	5%
Agency	5%	10%	65%	0%
Mobile App	25%	5%	5%	40%
Conversion Rates from Process Step "Premium Computation" to "Signing"				
Channels/Channels	**Online**	**Call-center**	**Agency**	**Mobile App**
Online	10%	35%	15%	0%
Call-center	5%	45%	10%	0%
Agency	5%	10%	65%	0%
Mobile App	15%	10%	5%	5%
Willingness to Switch Channels				
Channels/Channels	**Online**	**Call-center**	**Agency**	**Mobile App**
Online	100%	25%	25%	75%
Call-center	25%	100%	75%	25%
Agency	25%	75%	100%	25%
Mobile App	75%	25%	25%	100%
Valuation Layer				
Variable Outflows per Unit Processed				**Fixed Outflows**
Channels/Processes	**Informing**	**Premium Comp.**	**Signing**	**per Process**
Online	2 €	2 €	3 €	72.000 €
Call-center	8 €	8 €	10 €	144.000 €
Agency	10 €	10 €	13 €	216.000 €
Mobile App	1 €	2 €	1 €	18.000 €
Channel Configuration Outflows		**PV per Offering**	**Ø CLV**	**Channel Sensitivity**
Channel	**per Process**	250 €	500 €	10% Online
Mobile App	60.000 €			5% Offline

All applied input data refers to a planning horizon of three years and is summarized in Table 1. As the established channels shall not be questioned, there remain eight possible MSs considering the integration of the mobile app. Depending on the changes in cash in- and outflows, the value contribution compared to the current MS differs for each possible combination. The results are summarized in Table 2. Offering the mobile app exclusively for the informing process leads to the highest value contribution of additional 799.297 €, whereas unfavorable MSs may even lead to value destruction, e.g., when supporting only the last or last two processes. This is rooted in the low conversion rates between the processes premium computation and signing the contract. If these processes are supported by the mobile app, the high configuration outflows accrue although only few customers use the mobile app for signing. Simultaneously, the majority of these few customers would also be willing to switch to the classic online channel since both channels are very similar. In contrast, supporting the informing process attracts a lot of additional customers whose inflows compensate for the investment outflows. Apparently, customers are willing to get informed via a mobile app, but prefer other channels for the following processes. In sum, the decision model allows valuing the MSs including the mobile app and thus enables the company deciding on how to extend the existing online channel based on an economic analysis.

Table 2 Multichannel Strategies and Corresponding Value Contributions

MS – Mobile App Extension Informing – Premium Comp. - Signing	**Value Contribution** Compared to Current MS
	0 €
	- 78.000 €
	- 115.766 €
	- 154.280 €
	799.297 €
	721.297 €
	642.252 €
	646.897 €

Legend: mobile app supports process step
mobile app does not support process step

5 Conclusion

Addressing the increasing importance of digitization, we developed a quantitative decision model for determining the communication channels a SP should provide for different steps of the purchase decision process in line with the principles of value-based management. The decision model allows a SP to select the MS with the highest value contribution. It covers a SP's service offerings, the process steps that customers must traverse prior to purchasing a service offering, and the communication channels the SP can choose for interacting with its customers. The decision model also pays attention to the fact that channel characteristics may vary greatly (e.g., costs, offering fit, customer acceptance). It considers that customers may be willing to switch channels during the purchase decision process – voluntarily or of necessity, which is reflected by so-called conversion rates. Conversion rates reflect the customers' channel preferences between two consecutive process steps. The effects of setting up or closing down channels are derived based on the customers' willingness to switch channels, which in turn depends on the customers' perceived similarity of channels. As for a demonstration example, we applied the model in the financial services industry.

As in any modelling endeavor, our decision model is beset with limitations that stimulate further research. First, all input parameters of our model are assumed to be constant and deterministic. In reality, customer preferences as well as cash in- and outflows tend to be uncertain and may change over time. Thus, the enhancement of the decision model towards a risk-aware calculus requires further research. Second, customer preferences are considered on an aggregated level only. In a next step, the preferences of different customer segments should be analyzed in greater detail especially focusing on hybrid customers whose interaction behavior includes offline and online communication. In particular, an investigation of why and how often customers switch channels and how this can be measured is of great interest. Third, the decision model excludes some interaction-intensive process steps, e.g., after-sales services, as well as non-sequential purchase decision processes. Extending the decision model to capture more process steps, loops within the purchase decision process, and processes from other industries, e.g., retailing or automotive, seems promising for further research as well. Fourth, estimating the needed parameters such as conversion rates, willingness to switch, and long-term customer equity reflecting the strategic value of a MS is a main difficulty of applying the decision model to industry settings. Therefore, additional case studies may provide further insights and allow building up a knowledge base for determining reliable values of these critical parameters.

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