Dead or Alive? A Formal Decision Model for Deciding on Customer Recovery Investments

by

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A Formal Decision Model for Deciding on Customer Recovery Investments

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Abstract. As digitization makes customer migration easier and more attractive, managing customer recovery becomes increasingly important for organizations. In this context, the challenge is to avoid two error types that can occur with customer relation recovery. First, mistakenly investing in customer relations that are active ("alive"), and, second, mistakenly not investing in migrated customer relations ("dead"). Consequently, considering the probability that a customer relation is "alive" or "dead" is necessary. Based on this probability, an economically reasonable decision has to be made whether to invest in individual customer relation recovery or not. However, existing literature often neglects the above mentioned probability. Accordingly, based on a comprehensive discussion of related work, we propose a formal decision model on whether to invest in customer relation recovery, considering the probability that the customer relation is still "alive" or "dead." To demonstrate the decision model's applicability, an illustrative case with a sample calculation is presented.

Keywords: customer data, customer recovery, digitization, decision model

1   Introduction

In all types of organizations, customers come and go or, following Schmittlein et al. [1], there are customers who are "alive" (i.e., maintain an active customer relation) and customers who are "dead" (i.e., left the organization for whatever reason). With digitization as a main driver of the global economy, making this distinction is becoming more and more challenging: customer migration becomes easier and more attractive as digitization is breaking down barriers of entry, enables more transparent markets, and is comparatively impersonal [2]. Therefore, the importance of managing customer recovery is increasing. This challenge intensifies in settings where customers are not bound by contracts and have the possibility to change between different vendors [3, 4]. On the other side, digitization does not only amplify customer migration, but can also be an advantage for organizations because of the significant increase in available customer data [5]. Consequently, with the increasing amount of available data, opportunities to identify customer insights from data continue to expand. Organizations have the possibility to collect, store, and analyze available customer data [6] and use it, among others, for custom-designed investment decisions in the recovery of individual customer relations.

The related literature already provides models for deciding between different marketing investment alternatives [7, 8] and develops guidelines for acquisition and retention decisions [9, 10]. However, although economic aspects such as cost-benefit-trade-offs are investigated in the literature, it is not always clear for which customer relation a recovery is actually required. To illustrate this, it would, for example, not be reasonable to invest in recovering a customer relation, which is active and would likely realize further transactions anyway. However, as the point at which a customer relation becomes inactive cannot always be known for sure, it has to be estimated using indicators such as a low number of transactions or an unexpectedly long time since the last transaction [1]. Therefore, if a customer relation is still "alive" can be estimated as a conditional probability, given certain purchase information [1].

In summary, customer recovery faces two challenges. First, organizations need to identify the probability that a customer relation is to be considered "dead" or "alive." Second, once such probability can be estimated, the question is at which probability an investment in the recovery of an individual customer relation is economically reasonable. Thus, we aim at an analytical solution to the following research question: how can a decision maker decide on investing in a customer relation on the basis of the probability that the customer relation is still "alive"?

To answer this question, we develop a formal decision model based on the following ideas. On one hand, investing in the recovery of a customer relation is only reasonable if the present value of future cash flows when investing is higher than the present value of future cash flows when not investing in the recovery of a customer relation. On the other hand, deciding on investing in customer recovery should consider the probability that a customer relation is "dead" or "alive." Consequently, we compute a threshold from which on investment in an individual customer relation is economically reasonable.

We structure the paper starting with a discussion of the problem context and related work. Further, we propose the decision model and demonstrate its application by a sample calculation. Lastly, we discuss the resulting decision model.

2 Problem Context

Digitization makes customer focus more valuable for organizations and a bigger challenge, as customer migration becomes easier and more attractive than before [11]. In this environment, organizations do not only need to acquire new customers and build loyalty among existing customers, but also target migrated customers. Typically, customer migration arises as soon as there is a gap between the priorities of the customer and the activities of the organization [12]. From an organization's perspective, the reasons for such a gap can be manifold: the lack of success in identifying and using interesting market opportunities, limited information about competitors, no effective communication with the market, no comprehensive customer service, or missing knowledge about customer needs, their perceptions, preferences, and behavior [13]. In summary, in order to avoid customer migration, organizations need to increase customer satisfaction as it affects customers' repurchase likelihood [14]. Customer satisfaction can, for example, be defined as a cumulative evaluation of a customer's purchase and consumption experience to date [14–17]. Generally, customers are considered "alive" as long as they are still cultivating an active relation to the organization, and "dead" if they terminated their relation to the organization for whatever reason [1]. To recover "dead" customer relations, an organization needs to first identify the respective customers. On the one hand, identifying if a customer relation is "alive" or not can be obvious. For instance, if customers cancel their cell-phone contract and change their provider, the customer relation would clearly be considered "dead." On the other hand, there are contexts in which a customer relation transition from "alive" to "dead" is not always that easy to detect for companies, as customers "may not notify the firm when they leave" [1]. This holds true for hotel stays, air travel, or large online retailers such as Amazon, where customers are not bound by contracts and have the possibility to switch between different vendors [3, 4]. Hence, particularly in non-contractual customer relations, it is a challenge for organizations to know whether a customer relation is "alive" or "dead" [1]. One indicator for companies whether a customer relation is "alive" or "dead" is a customer's purchasing information (e.g. an unexpectedly long time period since the last transaction). However, a long transaction break does not necessarily mean that a customer relation is definitively "dead" [18].

Generally, related literature approaches this topic by modeling customer migration. Several researchers use recency in models that predict customer behavior. For example, Bult and Wansbeek [19], Bitran and Mondschein [20], Fader et al. [18], and Rhee and McIntyre [21] find a negative association between recency and purchase likelihood. Dwyer [22] identifies "always-a-share" customers' purchase probability by developing a purchase decision-making tree based on historical buying data. The Dwyer model is used in most customer lifetime value (CLV) research [23]. Comprehensive

explanations on the CLV can be found in Kumar and Reinartz [24] for instance. Blattberg et al. [10] extend the Dwyer model and use the "recency, frequency, monetary index" to develop the purchase decision-making tree [23]. In brief, literature has long contributed to the understanding of customer migration and the factors affecting it. However, at this point, no concrete implications for customer recovery investments have been derived.

Customer recovery campaigns are a specific kind of customer campaigns. According to the campaign management process of Englbrecht [25], campaigns are mainly characterized by target group, channel, and content. Hence, investment decisions are to be made between different campaign alternatives comprising possible target groups, channels, or content. Here, the target group comprises migrated customers, or in other words "dead" customer relations. Channels, for instance, are categorized into offline channels, such as stores or catalogues, and online channels, such as mobile apps, email, or websites. They can also be differentiated by direct and indirect channels, distinguished by whether there is an intermediary responsible for managing the relationship between the customer and the organization [26]. Typically, the content of customer recovery campaigns can entail special offers, discounts, vouchers, coupons or other incentives for recovering customer relations.

For deciding on competing marketing investments, the literature provides numerous approaches. For example, Rust et al. [7] provide a framework to trade off competing marketing investments on the basis of financial return. Neslin et al. [8] demonstrate how to target the right marketing to the right customers at the right time to maximize CLV. Venkatesan and Kumar [27] recommend CLV as a metric for selecting customers and designing marketing programs, as they provide empirical evidence for the existence of a relationship between marketing actions and CLV. As such, Glady et al. [28] show that the dependence between the number of transactions and their profitability can be used to increase the accuracy of the CLV. Venkatesan and Kumar [27] point out that literature provides guidelines for acquisition and retention decisions [9, 10]. There are also studies on the basis of which customers should be "eliminated": Reinartz and Kumar [29], for instance, demonstrate how to decide on terminating a customer relation or not. In summary, literature provides various discussions and models concerning investments in customer relations. However, to the best of our knowledge, there is no formal decision model on the economic feasibility of customer recovery investments while considering the probability that a customer relation is actually "dead."

In order to fill this gap, we introduce a calculation to identify the most economically reasonable investment alternative out of multiple customer recovery investments, and propose a decision model that advises whether to invest in customer recovery or not. Based on an existing decision model designed to manage data currency [30], we premise our model on the probability that a customer relation is still "alive." The detailed decision model is described in the subsequent chapter.

3   Decision Model

The basic idea of the model is to decide on investing in customer recovery or not by comparing a threshold from which an investment is economically useful to the current probability that a customer relation is "alive." This threshold depends on investment specific variables, such as the costs of the investment and an effectiveness factor, and customer specific ones, such as the present value of future cash inflows of a customer relation. Beside, we make some assumptions in our decision model. First, the decision model is designed to cover a single period. Second, we assume that the organization's risk attitude is neutral when deciding on customer recovery investments. Third, for reasons of simplicity, we only distinguish between "dead" and "alive" customers and do not consider possible attributes in between.

The decision model has four steps: (1) selection of the most economically reasonable investment alternative; (2) determination of the current probability that a customer relation is "alive;" (3) derivation of the threshold; and (4) making the investment decision.

Step 1: Selection of the most economically reasonable investment alternative

Organizations have to decide between several investment alternatives for customer recovery. As such, the decision underlies the expected cash flow $E(CF_{ij}) \in \mathbb{R}_0^+$ of a customer relation i ($i = 1, \dots, n \ with \ n \in \mathbb{N}$) when successfully recovering it with a specific investment alternative j ($j = 1, \dots, m \ with \ m \in \mathbb{N}$). To calculate $E(CF_{ij})$, the present value of future cash inflows of a customer relation $\pi_i \in \mathbb{R}^+$, the investment costs $I_j \in \mathbb{R}^+$, and the effectiveness factor $\eta_{ij} \in (0; 1]$, which determine the success probability of a recovery investment, are necessary as they all influence the economic assessment of the investment alternatives. The domain of π_i is defined as $\mathbb{R}^+$, as only customers with positive cash flows are of interest. The domain of η_{ij} excludes the value 0, as we exclude investment alternatives for which customer recovery is impossible. Additionally, investments in customer relations with negative expected cash flows $E(CF_{ij})$ are not economically reasonable. Therefore, $E(CF_{ij})$ is only defined for $\pi_i \cdot \eta_{ij} - I_j \geq 0$. Hence, the calculations represented by equation 1 lead to the economically optimal investment alternatives J^*.

$$J_i^* = \{j \in (1, \dots, m); \forall k \in (1, \dots, m)\backslash\{j\} : E(CF_{ik}) \leq E(CF_{ij})\},$$

$$\text{with } E(CF_{ij}) = \pi_i \cdot \eta_{ij} - I_j, \tag{1}$$

where J_i^* represents the set of all indices j for which the expected cash flow $E(CF_{ij})$ of a customer relation i for a specific investment alternative j is maximal. In case of multiple resulting indices j, that is, indices j with the same expected cash flows, $E(CF_{ij})$, the decider should take the investment alternative j that is cheaper after

normalization to effectiveness (e.g., if $J_i^* = \{1,2\}$ and $I_1 < I_2 \cdot \frac{\eta_{i1}}{\eta_{i2}}$, then decide for $j = 1$).

Step 2: Measuring the probability that a customer relation is "alive"

In the following, we use the model for assessing conditional probability of Schmittlein et al. [1] as a basis for estimating the probability that a customer relation i is "alive." According to Fader et al. [31], the model of Schmittlein et al. [1] shows an impressive predictive performance, its empirical validation is often presented, and there are several applications in different contexts, such as customer profitability, churn prediction, and customer base analysis [4, 18, 29, 32–35]. The conditional probability $P_i("alive"|Information) \in [0; 1]$ depends on a customer's individual purchasing information [1]. This can be $Information = x, t_x, T$, where x is the number of transactions observed in the time interval $(0, T]$ and $t_x (0 < t_x \le T)$ is the time of the last transaction [1]. That means that recency and frequency are sufficient statistics for an individual customer's purchasing behavior [18]. $P_i("alive"|Information)$ represents the actual probability that a customer relation i with an observed behavior is still "alive," which should be compared to the threshold in order to make an economically reasonable investment decision.

Step 3: Threshold derivation

As it is highly improbable to know for sure if a customer relation is "alive" or "dead," there is always the possibility that the organization comes to a "correct" or "wrong" investment decision for a customer relation i. Regarding "wrong" investment decisions, it is possible that organizations either unnecessarily invest in "alive" customer relations (see Table 1, case Ia) or do not invest in "dead" customer relations with positive expected cash flows in case of customer relation recovery (see Table 1, case Ib). By taking such "wrong" decisions, the organization either unnecessarily loses investment costs or cash inflows which might result from investment j. Accordingly, cases IIa and IIb represent "correct" decisions as long as $\pi_i \cdot \eta_{ij} \ge I_j$. Table 1 represents all possibilities of total expected cash flows depending on $P_i("alive"|Information)$ and the decisions to invest in customer relations or not.

Table 1. Matrix of the total expected cash flow

Decision	"Dead"		"Alive"	
	$1 - P_i("alive"|Information)$		$P_i("alive"|Information)$	
Investment	IIa	$\pi_i \cdot \eta_{ij} - I_j$	Ia	$\pi_i - I_j$
No investment	Ib	$-\pi_i \cdot \eta_{ij}$	IIb	π_i

The total expected cash flow of case Ia represents the present value of future cash inflows π_i resulting from a customer relation i minus the investment costs I_j of

investment alternative j for investing in a customer relation (see equation 2). Here, the investment costs I_j arise unnecessarily.

$$E(CF_{ij})(investment \wedge "alive") = \pi_i - I_j. \tag{2}$$

In contrast, case Ib leads to a lost present value of future cash inflows $-\pi_i$ caused by not recovering a customer relation i. This lost present value of future cash inflows, which corresponds to opportunity costs, only comes into force to the extent to which the customer recovery investment would have been successful, which is represented by the effectiveness factor η_{ij}:

$$E(CF_{ij})(no\ investment \wedge "dead") = -\pi_i \cdot \eta_{ij}. \tag{3}$$

Given $\pi_i \cdot \eta_j \geq I_j$, investing in a "dead" customer relation and not investing in an "alive" one are correct decisions. Hence, case IIa entails the present value of future cash inflows of a customer relation π_i multiplied with the effectiveness factor η_{ij}, reduced by the costs of investment I_j:

$$E(CF_{ij})(investment \wedge "dead") = \pi_i \cdot \eta_{ij} - I_j. \tag{4}$$

Case IIb represents not investing in an "alive" customer relation, which results in the present value of future cash inflows π_i:

$$E(CF_{ij})(no\ investment \wedge "alive") = \pi_i. \tag{5}$$

Based on these mathematical terms, the threshold for an economic decision on whether to invest in a customer relation or not can be deduced. From an economic point of view, investing in a customer relation is only reasonable if the total expected cash flow in case of an investment for recovering a customer relation is higher than the total expected cash flow for not investing (see equation 6). The cases Ia, Ib, IIa, and IIb arise with the probabilities that a customer relation i is "alive," $P_i("alive"|Information)$, or already "dead," $1 - P_i("alive"|Information)$, as presented in Table 1. Equation 6 covers decisions under risk neutral preferences:

$$E(CF_{ij})(investment \wedge "alive") \cdot P_i("alive"|Information) +$$

$$E(CF_{ij})(investment \wedge "dead") \cdot (1 - P_i("alive"|Information)) >$$

$$E(CF_{ij})(no\ investment \wedge "alive") \cdot P_i("alive"|Information) + \tag{6}$$

$$E(CF_{ij})(no\ investment \wedge "dead") \cdot (1 - P_i("alive"|Information)).$$

After computing terms 2–5, we solve the inequality for $P_i("alive"|Information)$ (see equation 7), which results in the threshold $T_{ij} \in [0; 1)$:

$$T_{ij} > P_i(\text{"alive"}|Information),$$

$$\text{with } T_{ij} = \frac{2\pi_i\eta_{ij}-I_j}{2\pi_i\eta_{ij}}. \tag{7}$$

The threshold enables making investment decisions in which the total expected cash flow in case of an investment is higher than the total expected cash flow for not investing in recovering a customer relation.

Step 4: Making the investment decision

To make the investment decision D_i for a customer relation i, the organization should now compare the probability that the customer relation is still "alive," $P_i(\text{"alive"}|Information)$, with the threshold T_{ij}:

$$D_i = \begin{cases} invest & for\ T_{ij} > P_i(\text{"alive"}|Information) \\ not\ invest & for\ T_{ij} \leq P_i(\text{"alive"}|Information) \end{cases}. \tag{8}$$

In summary, the four proposed steps lead to an economically reasonable decision on whether to invest in an individual customer relation's recovery or not by comparing the threshold to the current probability that a customer relation is "alive," as per equation 8.

4   Application and evaluation

We illustrate the applicability, completeness, understandability, feasibility, and operationality of the decision model by an example in which an online retailer aims at recovering possibly "dead" customer relations. At the same time, the online retailer wants to avoid unnecessarily investing in "alive" customer relations. By using our decision model, the online retailer addresses only those customer relations for which an investment is reasonable on the basis of the probability that they are "alive" compared to the calculated threshold. As such, we show the economic benefit of the decision model.

Step 1: Selection of the most economically reasonable investment alternative

At first, the online retailer has to identity different investment alternatives for customer recovery and select the most economically reasonable investment alternative for every customer relation i. In our example, the online retailer selects four possible investment alternatives j, that is, two different channels, letter and mail, and two different contents, voucher and special offer. According to the experience of the online retailer, customer recovery via letter is more effective than email, and a voucher is more effective than a special offer. Moreover, in this example, customer recovery with

vouchers incurs more investment costs than special offers. Table 2 shows the effectiveness factor η_{ij} and the costs of the four investment alternatives I_j.

Table 2. η_{ij} and I_j for the investment alternatives

		Special offer via letter ($j = 1$)	Voucher via letter ($j = 2$)	Special offer via email ($j = 3$)	Voucher via email ($j = 4$)
η_{ij}	$i = 1$	0,09	0,05	0,17	0,08
	$i = 2$	0,08	0,06	0,08	0,17
	$i = 3$	0,06	0,19	0,08	0,15
I_j		USD 20	USD 30	USD 12	USD 22

To select the most economically reasonable investment alternatives for different customers according to Formula 1, we take the present values of future cash inflows π_i of three customers as example: $\pi_1 = USD\ 640$, $\pi_2 = USD\ 857$, and $\pi_3 = USD\ 428$. Table 3 shows the expected cash flows for each customer relation i and the four different investment alternatives j.

Table 3. $E\left(CF_{ij}\right)$ for the customer relations and investment (USD)

		Investment alternatives			
		$j = 1$	$j = 2$	$j = 3$	$j = 4$
Customer Relations	$i = 1$	35.89	3.52	**97.07**	32.33
	$i = 2$	45.75	20.96	55.46	**126.67**
	$i = 3$	7.33	**52.06**	21.98	40.09

The results of Table 3 show that the most economically reasonable investment alternative for the customer relation $i = 1$ is $j = 3$, for $i = 2$ is $j = 4$, and for $i = 3$ is $j = 2$ (see bold marked values in Table 3), as these investment alternatives have the greatest expected cash flow for the different customers as per equation 1.

Step 2: Measuring the probability that a customer relation is "alive"

Next, the online retailer has to quantify the probability that a customer relation is still "alive," $P_i("alive"|Information)$. For instance, the organization can follow Schmittlein and Peterson [32] and Reinartz and Kumar [4], who determine the probability depending on recency and transaction frequency. For example, we assume the following values for the three customers: $P_1("alive"|Information) = 0.30$, $P_2("alive"|Information) = 0.96$, and $P_3("alive"|Information) = 0.23$.

Step 3: Calculation of the threshold

Further, the online retailer has to calculate the threshold for the customers and the selected investment alternative by using equation 7.

Table 4. Results of the threshold T_{ij}

	$J_1^* = 3$	$J_2^* = 4$	$J_3^* = 2$
T_{ij}	94.40%	92.60%	81.72%

Step 4: Making the investment decision

The application of equation 8 shows whether the online retailer should invest in the customer relations or not by comparing the threshold T_{ij} with the probability that the customer relation i is still "alive," $P_i(\text{"alive"}|Information)$.

Table 5. Investment decision for the customer relations i

			D_i
$i = 1$	T_{13}	94.40%	invest
	$P_1(\text{"alive"}|Information)$	30.00%	
$i = 2$	T_{24}	92.60%	not invest
	$P_2(\text{"alive"}|Information)$	96.00%	
$i = 3$	T_{32}	81.72%	invest
	$P_3(\text{"alive"}|Information)$	23.00%	

Table 5 shows that the online retailer should invest in customer relation $i = 1$ and $i = 3$ because the results of the threshold T_{13} and T_{32} are greater than $P_1(\text{"alive"}|Information)$ and $P_3(\text{"alive"}|Information)$, respectively. For customer relation $i = 2$ the investment decision is not to invest, as T_{24} is less than $P_2(\text{"alive"}|Information)$.

Next, we explain why the evaluation criteria is fulfilled. First, applicability is shown by conducting this example calculation. Further, this evaluation type demonstrates the decision model's completeness as all input variables are comprehensive and quantitative measures. The evaluation criterion understandability is shown as the actual measure is easy to interpret and applicable for users. Feasibility and operationality is given as the parameters are determinable, well defined, and the decision model is based on a quantitative measurement. Additionally, the data necessary for the model calculation are accessible and affordable, as the number of transactions or the time of the last transaction usually exist in organizations. In order to evaluate the decision model from an economic perspective, we extend the sample calculation and instantiate the decision model with 10,000 customer relations that have equally distributed probabilities of being "alive" in an interval of 0–100% and equally distributed expected cash flows in an interval of USD 0–1,000. The effectiveness factors of the investment

alternatives are equally distributed in an interval of 0–20%. In this sample calculation, we use the parameter setting of the four investment alternatives listed in Table 2. In case of a perfect estimation of the probabilities that customer relations are still "alive," $P_i("alive"|Information)$, the sample calculation reveals that about 25% of individual recovery investments can be saved, which leads to significant cost savings by applying the decision model. As shown in Table 6, a sensitivity analysis suggests that – on the one hand – estimation errors of expected cash flows and effectiveness factors only lead to disproportionately low changes in cost savings. That is, the model can said to be robust in terms of these parameters.

Table 6. *Impacts of estimation errors on cost savings*

Parameter estimation error	*-20%*	*-15%*	*-10%*	*-5%*	*0%*	*+5%*	*+10%*	*+15%*	*+20%*
η_{ij}	+1%	0%	0%	0%	0%	-1%	-1%	-2%	-2%
$E(CF_{ij})$	+6%	+5%	+3%	+1%	0%	-2%	-4%	-6%	-7%
$P_i("alive"|Inf.)$	-82%	-71%	-56%	-29%	0%	+25%	+48%	+72%	+92%

On the other hand, the sensitivity analysis exposes that $P_i("alive"|Information)$ has to be estimated carefully, as estimation errors lead to disproportionately high changes in cost savings. However, even for poorer estimations, savings on a low percentage basis can be generated, that easily be significant in monetary terms for large customer recovery investments.

5   Summary and Discussion

In this paper, we point out that, for customer recovery, distinguishing between "alive" and "dead" customer relations becomes a challenge with the increase in market transparency and impersonality. Therefore, organizations risk wrong investment decisions when managing customer recovery. Addressing this challenge, literature offers solutions to determine the economic value of a customer relation as a basis for this decision. However, to the best of our knowledge, no approach considers the probability that a customer relation is "alive" for such investment decisions. Therefore, we combine these ideas in a formal decision model for deciding on customer recovery in an economically reasonable manner by considering the probability that a customer relation is "dead." In doing so, we strive for practical applicability and demonstrate the decision model's operationalization in an illustrative example.

Nevertheless, our decision model has limitations that stimulate further research. First, further research should examine the decision model in a real world context in order to evaluate its usefulness [36]. However, we can evaluate the decision model in terms of its applicability, completeness, understandability, feasibility, and operationality by using an example. In doing so, we follow Sonnenberg and Vom Brocke [36], and argue that it is reasonable to disseminate research findings in early stages to communicate them to interested peers and research communities. Second, the decision model is designed to cover a single period. In practice, in order to permanently

ensure maximum of customer recovery, periodical assessments could be a possible extension of the decision model. Third, in the decision model it is assumed that the organization's decision regarding customer recovery investments is risk neutral. In reality, risk attitude can be context and branch specific, which should be further examined in future research. Fourth, future research can unfold the range between the attributes "dead" and "alive" to further approach the decision model for context- and industry-specific dependencies due to individual stages in the customer lifecycle. Finally, we assume that investing in an "alive" customer relation is not reasonable in terms of a recovery effect. In reality, recovery investments could also increase the satisfaction of "alive" customer relations.

However, besides these limitations and the identified need for further investigation, we consider the presented approach to be a valuable contribution to research and practice in order to enable data-driven recovery investment decisions. Accordingly, whether to invest in recovering a customer relation can be decided on the basis of a substantiated formal decision model. Moreover, by using digitally available customer data in the proposed decision model, organizations have the possibility to better meet digitization challenges in customer recovery.

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