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Leveraging Market Research Techniques in IS – A Review and Framework of Conjoint Analysis Studies in the IS Discipline

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Abstract:

With cloud and mobile computing, information systems (IS) evolve towards mass-market services. While user involvement is critical for IS success, the IS discipline lacks methods that allow integrating the "voice of the customer" in the case of mass-market services with individual and dispersed users. Conjoint analysis (CA), from marketing research, allows for understanding user preferences and measures user trade-offs for multiple product features simultaneously. While CA has gained popularity in the IS domain, the existing studies have mostly been one-time efforts and no cumulative research patterns have been observed. We argue that CA could have a significant impact on IS research (and practice) if it were fully developed and adopted as a method in IS. From reviewing 70 CA studies published between 1999 and 2019 in the IS field, we find that CA can be leveraged in the initial conceptualization, iterative design and evaluation of IS and their business models. We critically assess the methodological choices along the CA procedure to provide recommendations and guidance on "how" to leverage CA techniques in future IS research. We then synthesize our findings into a “Framework for Conjoint Analysis Studies in IS” that outlines “where” CA can be applied along the IS lifecycle.

Keywords: Conjoint analysis, Literature review, Information systems, IS design, IS evaluation

1 Introduction

With advances in technology, including mobile, cloud, and the Internet of Things (IoT), information systems (IS) target a mass market of distributed and heterogeneous users. This poses several challenges for integrating the "voice of the customer", which is the main criterion for ensuring customer acceptance (Jarke, Loucopoulos, Lyytinen, Mylopoulos, & Robinson, 2011; Tuunanen, Myers, & Cassab, 2010). Studies in IS have shown that the main reasons for IT product failures can be traced back to the system being unable to meet users' expectations or a non-functioning system (Dwivedi et al., 2015). Therefore, understanding user requirements and involving users is considered "common wisdom" for IS success (Bano & Zowghi, 2014). Traditionally, user-oriented IS design has been promoted through requirements elicitation techniques that collect data from individual or group users via interviews, surveys, focus groups, or ethnographic techniques (Nuseibeh & Easterbrook, 2000). However, these techniques rely on close interactions with users or their representatives, making them difficult to apply in the context of mass-market IS with individual and dispersed users. Moreover, these techniques depend critically on participant selection, which can bias requirements elicitation and prioritization.

Market research techniques, specifically conjoint analysis (CA), are promising approaches to address these issues and to support the user-oriented design of IS. As "a practical set of methods for predicting consumer preferences for multi-attribute options in a wide variety of product and service contexts" (Green & Srinivasan, 1978), CA adds quantitative measurement and allows analyzing user trade-offs in the selection of products and services, leading to successful product designs. Marketing research has argued that CA is particularly useful in new technical product development (Green, Krieger, & Wind, 2001). In the IS domain, Bajaj (1999) was the first to advocate the CA methodology for studying human behavior in the assessment of IS for purchase decisions and adoption. Following Bajaj's (1999) CA study procedure guide, IS researchers initiated the use of CA to study adoption decisions and users' preference structures in a variety of domains, including e-commerce (Schaupp & Bélanger, 2005), enterprise resource planning (ERP) packages (Keil & Tiwana, 2006), and mobile applications (Bouwman, Haaker, & Vos, 2008). An important advantage of CA is that it allows analyzing trade-offs between functional, non-functional and economic features. This has motivated IS researchers to employ CA for studying business model design for cloud services (Giessmann & Stanoevska, 2012) and privacy trade-offs in social networks (Krasnova, Hildebrand, & Guenther (2009), online data sharing platforms (Schomakers, Lidynia, & Ziefle, 2019; Wessels, Gerlach, & Wagner, 2019) and IoT-based assistants (Mihale-Wilson, Zibuschka, & Hinz, 2017; Mikusz & Herter, 2016; Zibuschka, Nofer, Zimmermann, & Hinz, 2019). These studies illustrate how CA makes it possible to empirically assess (existing or planned) IS in the form of a user preference model and provides data-driven insights to define design and pricing strategies that meet the needs of specific user profiles or segments.

Although the number of CA studies in the IS domain has risen over the past few years, the method remains as a marketing research feature. The existing studies demonstrate the CA's value in the IS domain, but they have mostly been one-time efforts and no cumulative research patterns have been observed to date. This raises three fundamental questions: First, the existing studies show a variety of purposes and applications in IS (Bajaj, 2000; Schaupp & Bélanger, 2005; Krasnova et al., 2009), but they do not go further and analyze its relevance and role in IS. As a result, IS research and practice might miss the opportunity for using this method to assist user-oriented design due to the lack of knowledge about its applications. Second, all the studies are conducted independently, with little reuse of findings or accumulation of knowledge about CA's applications in IS. In fact, CA, as a de-compositional method, views a system as a set of attributes and levels, which correspond to relevant system features. The existing studies do not engage in a discussion around this critical phase of attributes and levels selection, and we have not observed a reuse of previous research results in the setup of CA nor in the data analysis. Third, CA has not been used to its full extent and potential. Most IS studies apply traditional techniques of relative importance and willingness-to-pay. They have not embraced the more sophisticated techniques for simulation and variation analysis that have been developed and discussed in marketing. To summarize, we observe that there is a lost opportunity for CA to complement existing IS methods for system design and evaluation, and IS researchers lack general guidelines and recommendations for applying CA as a method in the IS field.

This motivates our research, which seeks to answer the following research questions (RQs):

RQ1: What is the current state of CA in IS?

RQ2: What are guidelines for future IS studies applying conjoint analysis?

We argue that the CA method can have several positive outcomes if applied to IS research as a data-driven approach for user-oriented IS design. With this paper, we aim to lay the foundation for future research by analyzing the current state of CA applications in the IS domain and proposing a framework for future studies. Thus, our contribution is threefold: First, we provide a comprehensive analysis of 70 CA studies in the IS field that were published between 1999 and 2019. Aiming for exhaustive coverage of the published research, this analysis can be classified as a descriptive review that seeks to identify "interpretable patterns" or "trends" with respect to a pre-existing method (i.e., CA) in a body of empirical studies (Paré, Trudel, Jaana, & Kitsiou, 2015). Second, our study also has elements of a critical review (Paré et al., 2015) that assesses the CA applications in IS from a methodological and domain-specific perspective. By providing a critical account of this method from market research in the IS field, we are able to identify recurring issues and develop recommendations to enhance the methodological support of IS-specific applications of CA. Third, based on our review, we develop a framework that supports IS researchers in developing future CA studies. Since CA has multiple implementation scenarios, the framework identifies typical applications, i.e., concrete situations where CA can be applied in different phases of the IS lifecycle. This framework highlights application areas where CA can complement existing IS methods by providing data-driven insights on user preferences in the initial conceptualization, iterative design and evaluation of IS and their business models. Our results are also of relevance for practitioners who can apply our recommendations in the defined IS design phases for high-utility systems and services.

The remainder of this paper is structured as follows: In section 2, we review the foundations of CA and its evolution over time. In section 3, we present our research approach in conducting the literature review. In section 4, we provide an overview of the 70 studies of CA in the IS field. In section 5, we summarize the findings along the analysis framework with a critical assessment and methodological recommendations. In section 6, we present the reference framework for CA applications in IS. Finally, we conclude with a summary of our findings and limitations as well as future research opportunities.

2 Conjoint Analysis

2.1 Foundations

Conjoint analysis has its foundations in the work of Green & Rao (1971), who advocated the use of conjoint measurement in consumer-oriented marketing research. As a concept from mathematical psychology established by Luce and Tukey in 1964, conjoint measurement is used to measure "the joint effects of a set of independent variables on the ordering of a dependent variable" (Green & Rao, 1971). CA allows for the exploration of consumers' preferences by studying how people value product attributes and attribute levels while CONsidered JOINTly during their evaluation. CA builds on the estimation of a preference structure by applying the economics concept of utility. Utility is a measure of the consumer's preference from a set of available alternatives. In CA, a utility function is derived from consumer evaluations of certain product attributes and levels (Green & Srinivasan, 1978). This utility function can be translated into a preference structure, which provides information on the factors that most influence the consumer's decision or product choice. The preference structure not only provides importance measures but also depicts how differing levels within an attribute influences the formation of an overall preference (utility value) (Hair, Black, & Babin, 2010). Accordingly, it was found to be well suited to problems in marketing as an approach to quantify judgmental data related to product purchasing. Over time, the application of CA has gained broad popularity in consumer research and has extended to applied psychology, decision theory, and economics.

In general, a CA study can be summarized in three main phases (Figure 1): In phase 1, the product is defined in terms of the attributes and attribute levels from which product profiles are derived. Phase 2 corresponds to the consumer evaluation of the different profiles in a survey setting. From the results, a preference structure based on utilities' estimation can be calculated. Finally, phase 3 applies different analysis techniques (Green & Rao, 1971) to create data-driven insights on product design: (1) **relative importance** of attributes and levels for multiple purposes, including *vendor evaluation* by developing criteria for vendor rating, *price–value relationship measurement* by analyzing the consumer trade-off for price and quality of products, and *attitude measurement* to analyze the trade-offs between several product attributes and derive the importance of functional vs. symbolic characteristics such as brand image, or to analyze utility for collections of items to facilitate the combination packaging of certain product types; (2) **cost–benefit analysis** to study the willingness-to-pay (WTP) for certain attributes and to design products

accordingly; and (3) **clustering or segmentation of customers** based on their utility functions. Furthermore, Johnson (1974) referred to another application using (4) **market simulation**, which is used to estimate the market shares of currently available or new products based on predicted consumer preferences.

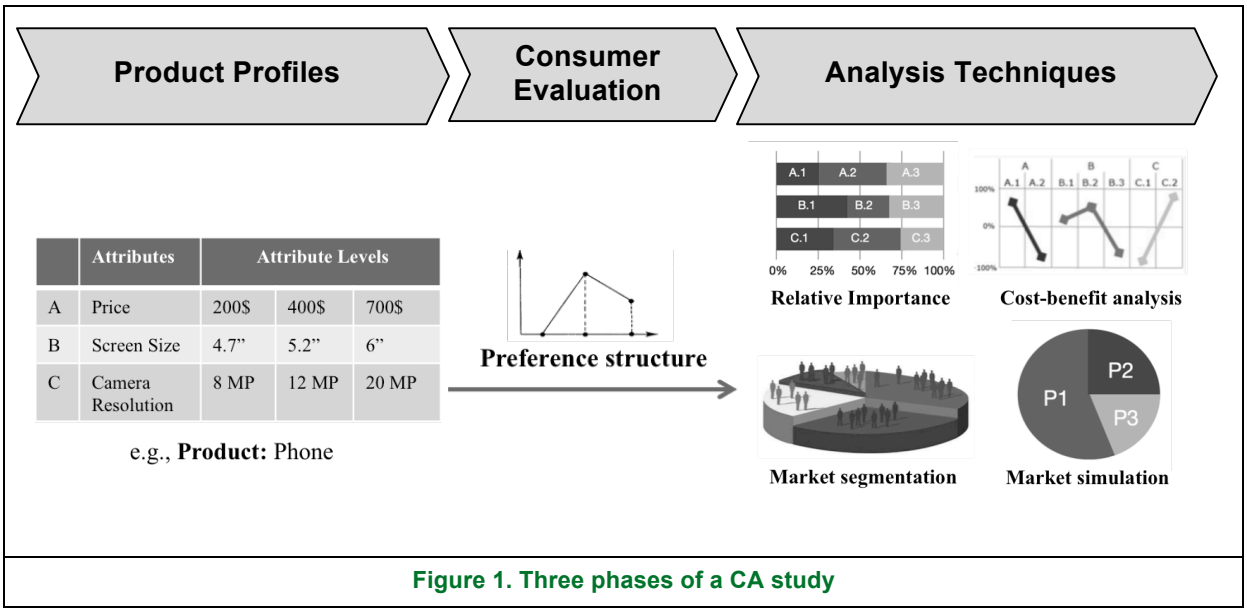

Figure 1. Three phases of a CA study

2.2 CA Methodology

Applying the CA can be challenging due to the many steps and methodological choices required to achieve the preference structure. It also involves selection from different alternatives. Green & Srinivasan (1978) highlight some differences between the alternatives suggested for each step in a CA study:

1. The **selection of a preference model** determines the preference function based on the defined attributes' influence over the respondents' utility. It forms the basis for determining partial benefit values for the respective attributes. The three main models of preference suggested are the vector (1), ideal-point (2), and part-worth (3) models. With a set of T attributes and J stimuli in a study, y_{jp} denotes a respondent's preference level for the pth attribute of the jth stimulus. The vector model depicts the respondent's preference s_j for the jth stimulus as:

$$s_j = \sum_{p=1}^{T} w_p y_{jp} \quad (1)$$

where w_p denotes the individual's importance weight for T attributes

The ideal-point model depicts preference s_j as inversely related to the weighted squared distance d_j^2 of the location y_{jp} of the jth stimulus from the individual's ideal point x_p, where d_j^2 is defined as:

$$d_j^2 = \sum_{p=1}^{T} w_p (y_{jp} - x_p)^2 \quad (2)$$

The part-worth model depicts preference s_j as:

$$s_j = \sum_{p=1}^{T} f_p(y_{jp}) \quad (3)$$

where f_p is a function denoting the part-worth for the levels of y_{jp} of the pth attribute

A part-worth function is mainly used in CA because of its flexibility in designing the attribute evaluation function. The part-worth function model is compatible with different shapes of preference functions, and it allows for better estimation when evaluating categorical attributes. In addition, a mixed model combining the three alternative models (vector model, ideal-point model, part-worth function model) was suggested; it introduces a dummy variable and is similar to a multiple regression approach.

2. The **data collection method** involves selecting the conjoint method for evaluation. Traditional approaches involve the full-profile or pairwise evaluation. The original approach in CA, also called

concept evaluation or *full-profile*, is based on rank orders of consumers' preferences regarding product profiles (also called stimuli), which comprise several attributes and levels associated with the product characteristics. As such, CA provides insights into user preferences for the different attributes based on a complete product evaluation. Besides *concept evaluation,* Johnson (1974) suggests an alternative approach called the *trade-off matrix* or *pairwise approach*. In this approach, respondents evaluate a pair of attributes providing information about the trade-offs among all product features. Its strength is its ability to support a large number of attributes since it can provide predictions based on the evaluation of subsets of attribute pairs (Johnson, 1974). The full-profile approach is the most frequently used one since it provides a more realistic description of the stimuli. With the extensions of the adaptive and choice-based CA methods (see 2.3), the variety of choice for evaluating the full-profiles increases.

3. For full-profile, the next step is **stimulus set construction**, which is mainly based on fractional factorial orthogonal design, which reduces the number of stimuli and facilitates evaluation. This method assumes no interaction effects between the selected attributes. For adaptive methods, partial profiles and self-explicated tasks are used to reduce complexity of the conjoint evaluation.
4. For the **stimulus presentation**, there are several variations based on verbal description, paragraph description, or graphical representation. The choice of the presentation depends on the subject of the study and can be a combination of methods. Furthermore, the application of conjoint analysis to some product categories could use other stimulus types as prototypes or actual products.
5. The **measurement scale** depends on the study purpose and the data collection method. Both the full-profile and the pairwise approach can use ranking to capture the order of preferences or purchasing intentions. The full-profile approach can also use ratings, which requires respondents to grade (subjectively) the perceived benefit on a numbered scale. As an alternative, choice-based methods introduced another measurement scale that can then be treated as a choice-probability model.
6. Finally, the **estimation method** for the partial benefit values is selected based on the dependent variable type resulting from the measurement scale. While an ordinal-scaled variable could use MONANOVA, an interval-scaled variable can use an ordinary least squares (OLS) regression, for example. In addition, LOGIT or PROBIT models can be used when the data collection method is choice-based. In that case, individual-level utility function is estimated using Hierarchical Bayes.

To illustrate the CA, consider the simplified example of a smartphone. In Table 1, we introduce attributes and attribute levels of the selected product class on the basis of existing product specifications on the market. For the conjoint method, a part-worth function model is selected (Step 1) in a full-profile approach (Step 2). The stimulus set of three attributes with three levels would lead to 27 ($=3^3$) product concepts. Fractional factorial design (Step 3) would be employed to arrive at a reduced design – in this case, with nine stimuli. In our smartphone example, the stimulus presentation (Step 4) can benefit from a combination of verbal description and pictorial representation (or a de facto prototype, if available) to help participants see the differences between screen sizes. This would enable them to rank (Step 5) the stimuli according to their preferences. Multiple regression analysis could be employed to estimate the part-worth utilities (Step 6). The utilities are then calculated by adding individuals' part-worth utilities, i.e., following model (3). Finally, the part-worth utilities are standardized in order to ensure the same unit of scale.

Table 1. Example for Attributes and Attribute Levels of a Conjoint Analysis

Product	***Attributes***	***Attributes' Levels***		
Mobile Phone	**Price**	$200	$400	$700
	Screen size	4.7 inches	5.2 inches	6 inches
	Camera resolution	8 MP	12 MP	20 MP

2.3 CA Development and Extensions

Due to the prevalence of the traditional CA, the methods for applying it have been further developed and improved to address limitations in terms of attribute formulation and product evaluation (Green & Srinivasan, 1990). Sawtooth Software, as specialized software vendor, developed an adaptive conjoint analysis (ACA) to solve the traditional full-profile CA's issue with the number of attributes (Johnson, Huber,

& Bacon, 2003). The ACA is based on a hybrid technique that combines self-explicated tasks with an evaluation of partial-profile descriptions (Green, 1984; Johnson, 1987). The self-explicated task allows respondents to rate the attributes individually and exclude unacceptable attribute levels from the evaluation task in order to reduce its burden (Johnson, 1987).

Choice-based conjoint analysis (CBCA) can be considered a replacement for ranking-based or rating-based conjoint methods. It simulates the process of purchasing a product, as participants are asked to make hypothetical choices in a scenario similar to a competitive marketplace (Johnson et al., 2003). The main concern with this approach is that participants need to evaluate a large number of purchase scenarios; however, it has the advantage of being able to deal with the complexity of choosing among competitive profiles, which makes it a mixed blessing (Green et al., 2001).

Adaptive choice-based conjoint analysis (ACBCA) is an extension of these two approaches to estimate part-worth utilities from a small sample size with fewer than 100 participants (Johnson et al., 2003). ACBCA asks participants to choose among a set of stimuli, thus simulating a purchase behavior similar to the CBCA after they perform a self-explicated task (as in ACA) to select the most relevant attributes and levels beforehand.

Further developments of the presented CA method have been discussed by several researchers (Rao, 2008; Netzer et al., 2008); they mainly targeted technique and application issues (see Table 2). The selection of a CA method is typically based on several criteria, including product- and study-related factors. Orme (2009) discusses this matter comprehensively by demonstrating the advantages and limitations of each CA type and then building a recommendation guide to select the appropriate method. He proposes the following main selection criteria: number of attributes, mode of interviewing, sample size, interview time, and inclusion of pricing research in the study. Adaptive methods are more favored for a large number of attributes or when the sample size is small, and choice-based methods are preferred for pricing studies.

Table 2. CA Steps and Extensions

Steps	***Traditional conjoint analysis (Green & Srinivasan, 1978)***	***Developments and extensions (Johnson, 1987; Johnson et al., 2003; Rao, 2008; Netzer et al., 2008)***	
		Adaptive Conjoint Analysis (ACA)	**Choice-based Conjoint Analysis (CBCA)**
1. Selection of a preference model	Vector model, ideal-point model, part-worth function model, mixed	-	
2. Data collection method	Two-factor-at-a-time (trade-off analysis), full-profile (concept evaluation)	Adaptive choice-based CA (CBCA)	
3. Stimulus set construction	Fractional factorial design, random sampling from multi-method variate distribution	Partial profiles, self-explicated method	-
4. Stimulus presentation	Verbal description (multiple cue, stimulus card), paragraph description, pictorial or three-dimensional model representation	Actual products, prototypes	
5. Measurement scale	Paired comparisons, rank order, rating scales, constant-sum paired comparisons, category assignment	-	Choice
6. Estimation method	MONANOVA, PREFMAP, LINMAP, Johnson's non-metric trade-off algorithm, multiple regression, LOGIT, PROBIT	-	Hierarchical Bayes

3 Research Approach

3.1 Research Objectives and Method

IS researchers started using CA to study adoption decisions and users' preference structures governing IS design based on Bajaj's (1999) CA study procedure guide. Although the number of studies in the IS domain has risen over the past decades, they remain one-time efforts, with little synthesis and accumulation of knowledge about applications in IS. Throughout our investigation, we aim at analyzing how IS researchers applied conjoint analysis to generalize application areas and provide recommendations for using CA in the IS discipline.

In view of our research goals, we opted for an exhaustive review of existing CA studies in IS, which can be characterized as a combination of descriptive and critical literature review (Paré et al., 2015). As a descriptive review, we followed the recommendations from Templier & Paré (2015) on conducting a literature review in the IS field to collect, extract and analyze the data. We reflect the "current state of applications of CA in IS" by highlighting the main patterns in literature. As a critical review, we provide a critical assessment of the main methodological choices throughout the CA procedure and suggest recommendations for methodological improvements.

3.2 Literature Selection

Seeking to attain completeness and quality in our review, we followed recommendations from vom Brocke et al. (2015) on conducting effective literature searches and searched for peer-reviewed publications from the first IS publication on CA by Bajaj (1999) until the end of 2019. We followed a sequential process to identify and select relevant CA studies from multiple sources (comprising publications from IS journals and conference proceedings). To cover a whole range of empirical studies using CA, we started by performing an electronic search in databases including AIS Electronic Library (AISe), EBSCOHost, ScienceDirect, SpringerLink, and Wiley. Next, we carried out a Google Scholar search to cover missing literature. To ensure that we captured all relevant pieces of research, the search criteria were based on the following keywords: "*conjoint analysis*" AND (("*consumer"* OR *"customer"* OR *"user")* AND *"preferences*"). In an advanced search, we restricted the research area to information technology and business management whenever the search resulted in many irrelevant articles. In Google Scholar we restricted the search to publications in "Information Systems" journals and conferences. Subsequently, we complemented our research process with a search of publications among the top 40 rated IS journals (Lowry et al., 2013) including the *senior scholar's basket of journals* from the Association of Information Systems (AIS): European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of AIS, Journal of Information Technology, Journal of MIS, Journal of Strategic Information Systems, and MIS Quarterly. This helped us capture any additional empirical studies using CA in the IS field that earlier steps had missed.

The literature search phase (Figure 2) resulted in 239 publications in the proceedings of highly reputable international and regional IS conferences (including AIS conferences), as well as publications from academic journals relating to IT and business research. After removing duplicates and screening the meta-information including title, abstract and keywords, 112 publications remained. These were carefully scanned to judge their relevance; we then eliminated 40 publications that lacked methodological illustrations of the CA procedure or fell outside relevant IS domains, resulting in 72 publications. For instance, decision-making studies in an IT related context that do not study system characteristics were not included in our publication list (e.g., Schuth, Brosi, & Welpe, 2018). We restricted our search to purely IS related outlets, and studies outside core IS domains (e.g., health or medical) were eliminated. In addition, we performed backward and forward citation searches to identify both prior and relevant articles that the search criteria may have missed. The procedure resulted in 76 publications. Bouwman et al. (2008) have two CA studies in the same publication, while certain authors published their CA study first in conference proceedings and then in a journal article. Thus, the final sample comprises 70 unique studies since we combined six studies in conferences with their extended versions in journals.

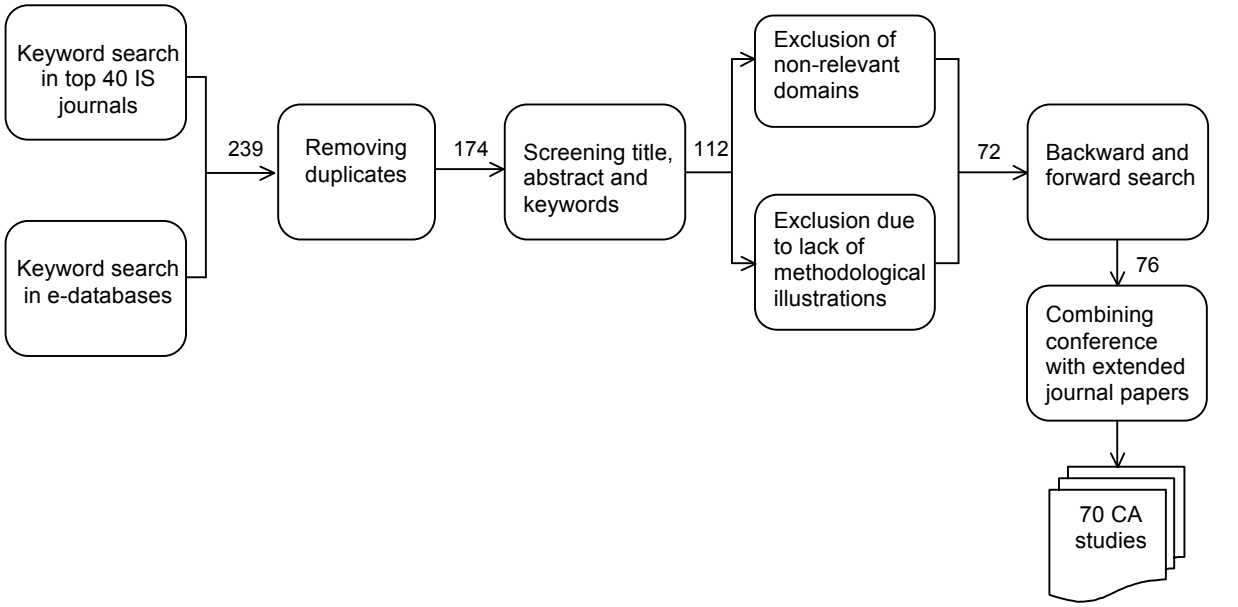

Figure 2. Literature search and selection process

3.3 Literature Analysis and Coding

To analyze the literature, we used a concept matrix as suggested by Salipante, Notz, & Bigelow (1982) and adapted for IS literature reviews by Webster & Watson (2002). It divides the topic-related concepts into different units of analysis that make it possible to arrange, discuss, and synthesize the CA studies. In our case, the matrix is based on a CA procedure combining the most relevant aspects of Green & Srinivasan (1978) and Bajaj's (1999) CA study procedure guide:

1. **Attributes and Levels Selection:** We were interested in the system class being studied, as well as the selection methods for attributes and their number, levels selection, and types relevant to each study purpose. The coding involves ***IS domain***, ***attributes selection*** (literature review, focus groups, user interviews, questionnaires, expert interviews, or existing products), ***number of attributes***, and ***attribute levels type*** (binary, multi-leveled, or multi-criterion).
2. **Data Collection Method Selection:** We wanted to understand what is mainly followed as a methodology in IS research (traditional (T) approaches based on rankings and ratings of full-profile, adaptive (ACA), or choice-based (CBCA and ACBCA) and for what purposes. The coding includes ***method type***.
3. **Stimulus Set Construction and Presentation:** In this step, we were interested in the method for the stimuli design based on the CA type and how the stimuli are presented to gain the most valuable insights from the study participants. This includes verbal description, paragraph description, pictorial representation, mixed representation, and actual prototype. The coding includes ***stimuli design*** and ***type of stimuli***.
4. **Study Administration:** In this step, we wanted to understand how the researcher decides on the sample size and user base on which he will perform the CA study. Thus, the coding includes ***study sample size*** and ***subjects' background***. We then analyzed the ***study setup***, including face-to-face interviews, experiments, questionnaires, online surveys, and specific software to perform the study. This code is referred to as ***software-used*** and can help to provide suggestions for the designs of future studies.
5. **Data Analysis:** Finally, we were interested in the selected estimation method to analyze data and identify other data analysis techniques in CA that are frequently performed whenever a conjoint study is conducted in IS. The coding for this step includes the types of data analysis tools introduced in section 2.1. The items involved in this step are ***estimation method*** (part-worth utilities estimation, since it is the dominant preference model in conjoint analysis studies) and

other ***analysis techniques***, including market segmentation (it also involves the clustering method), willingness-to-pay based on a defined price attribute, and market simulation to provide a competitive analysis.

In addition, we included the ***publication type*** as well as the ***study purpose***, which was deductive based on the authors' objectives, study context and sample's background. The coding scheme allowed us to obtain insights into the existing approaches and alternatives for each CA step of the study procedure. Two authors were involved in the coding process and validated the codes; the first author coded the literature and then the codes were validated by the second author. In the case of disagreement, both authors discussed the codes until reaching a mutual consensus. For instance, common consensus on derived items such as the IS domains and purposes was required for completing the coding scheme. We grouped the results for each unit within the concept matrix to highlight commonly used items and provide methodological reflections. Based on our analysis, we provide guidelines for future studies and a framework for CA studies in IS to highlight implementation areas based on the study purpose.

4 Overview of CA Studies in IS

Since 1999, 70 unique CA studies were published in 36 journal articles and 34 conference proceedings. Table 3 synthesizes the coding of these studies with regard to their domain, study purpose, CA method type, attribute selection and analysis techniques. The appendix (Table 6) provides detailed bibliographic and meta-information on each article. Our review identified a large variety of more than 20 IS applications and services that were investigated using CA. Based on the type and nature of the systems, we grouped these predominantly innovative technologies into five parsimonious and inclusive domains:

- **Enterprise Systems (ES):** This domain includes studies of typical systems used in the enterprise context, including computing architecture, Office systems, and ERP systems.
- **Mobile Applications and Communications (MC):** Studies in this domain mainly cover innovative mobile platforms, mobile applications, and mobile communication (VoIP telephony).
- **Online (O) Services:** Studies cover online shopping (e-commerce), online social networks, online banking, and online information privacy.
- **Cloud (C) Services:** This domain is related to the different services provided through the cloud such as data storage or infrastructure as a service (IaaS), software as a service (SaaS) and platform as a service (PaaS).
- **Internet of Things (IoT):** Studies cover connected and smart devices.

From the study objective, context and results, we derived four typical purposes for applying CA in IS. These purposes can be mapped to applications in marketing research (see section 2.1) and associated with one or more CA analysis techniques (i.e., relative importance, WTP, segmentation, and simulation):

- **Decision-making (DM):** The purpose is mainly associated with situations involving a managerial decision on adopting IS in an organizational context. This includes identifying relevant decision criteria for systems evaluation based on the relative importance of the studied attributes. These studies are similar to vendor evaluations in marketing research.
- **Adoption (A):** The purpose is to understand individual preferences or behavior in adopting new technologies. While they are similar to decision-making studies, they target users' intention to use rather than the organizational rationale in selecting or evaluating a system. This is based on preference predictions derived from utilities estimated from evaluations of product characteristics to obtain the users' perspectives on the system and adoption intentions. In addition, the study could also employ segmentation to analyze different group preferences. Compared with marketing research, this is part of attitude measurement.
- **Design (D):** The purpose is to elicit user preferences for designing an IS product, application, or service. This is based on measuring preferences and trade-offs among attributes and levels related to system characteristics. This will then reflect the relative importance of each attribute and levels from the estimated part-worth utilities to guide the design process of the product class. These types of studies can include analysis techniques of willingness-to-pay and user segmentation, and they also involve studies of user trade-offs for certain product attributes. CA studies can extend beyond attributes describing functional and non-functional characteristics to embrace business model or information privacy attributes.

- **Pricing (P):** The purpose is to understand the willingness-to-pay for product or service features. These studies mainly involve cost–benefit analysis. It is based on analyzing the effect of price attribute variations on the resulting user preferences and related predictions.

Table 3. Overview of CA Studies in IS

Coding Item	*Coding Options*	*Number of Studies*	*Percentage (%)*
IS Domain	Enterprise Systems	10	14.29
	Mobile Applications & Communication	23	32.86
	Online Services	24	34.29
	Cloud Services	7	10.00
	Internet of Things	6	8.57
Study Purpose*	Decision-Making	8	11.43
	Adoption	21	30.00
	Design	34	48.57
	Pricing	15	21.43
Attribute Selection*	Literature Review	56	80.00
	Existing Products	24	34.29
	Expert Interviews	16	22.86
	Questionnaires	9	12.86
	User Interviews	10	14.29
	Focus Groups	7	10.00
Method Type	TCA	35	50.00
	ACA	6	8.57
	CBCA	26	37.14
	ACBCA	3	4.29
Analysis Techniques* (in addition to relative importance)	Willingness-to-pay	21	30.00
	Segmentation	30	42.86
	Simulations	7	10.00

Note: * multiple coding possible

5 Methodological Choices along the CA Procedure

5.1 Attributes and Levels Selection

Attribute selection is the most demanding step in designing a good CA, as attributes should represent the study object's most relevant characteristics and correspond to the customers' most important needs. Most CA studies rely on a literature review (80%) to select domain-specific attributes or evaluate existing product features (34.29%). More than 50% of the studies followed a multi-stage selection process. The most common combinations are a literature review plus either an evaluation of existing products or expert interviews to get insights into relevant features. In some cases, a three-stage selection process was used to get user insights through questionnaires, interviews (Choi, Shin, & Lee, 2013), or focus groups (Brodt & Heitmann, 2004; Giessmann & Stanoevska, 2012; Nikou, Bouwman, & Reuver, 2014).

The number of attributes ranged between 2 and 13 and extends beyond functional and non-functional attributes to cover pricing, or channel selection. Thus, we can conclude that CA is interesting whenever user preferences about business model design are to be explored. In fact, the number of attributes correlates with the conjoint method selected. Most studies followed the pattern suggested by Orme (2002) on attribute selection, where traditional full-profile studies considered up to six attributes, and adaptive studies included more. However, there were exceptions where full-profile CA contained more than six attributes. These cases depend on the study purpose and were mainly in decision-making studies, where the attribute levels are limited to binary (low or high) (e.g., Benlian & Hess, 2011; Keil & Tiwana, 2006) or

multi-level (low, medium, or high) (e.g., Mahindra & Whitworth, 2005) or in service design studies that involved bundling options with binary attributes corresponding to services (included or not included) (e.g., Daas, Keijzer, & Bouwman, 2014).

5.2 Data Collection Method

Interestingly, studies in the IS domain relied mostly on traditional full-profile CA (35). Thus, despite criticism of the traditional CA approach, most conjoint studies in IS did not consider the developments of the method outlined in section 2.3. Even though studies with a large number of attributes – according to CA guidelines – should better rely on adaptive methods, there were only three applications of ACBCA; by Giessmann & Stanoevska (2012) on platform cloud services, Fölting, Daurer, & Spann.(2017) on information search mobile applications, and Naous & Legner (2019) on privacy design of cloud storage services. Choice-based CA is also being used by several IS researchers as a preference measurement tool under relatively realistic purchasing situations, where 26 studies used this variant and most frequently in recent years between 2017 and 2019.

The dominance of the full-profile CA implies that CA studies in IS rely on hypothetical system representations rather than realistic choices and are more constrained with regard to the number of attributes. It must be also noted that the methodologies were not strictly applied with the specific study purpose stated in CA literature: For instance, CBCA was applied for pricing, adoption, decision-making, and service design studies, although it is said to mainly support pricing decisions.

5.3 Stimulus Set Construction and Presentation

The stimulus set construction depends on the data collection method. Studies of traditional or choice-based CA employed fractional factorial design to reduce the number of stimuli for a large number of attributes or levels. When adaptive methods are used, the self-explicated method helps to reduce the attributes set to facilitate the study procedure. Most studies employed verbal description in the form of profile cards, and paragraph description as vignettes and scenarios. Interestingly, few studies used visual representation to evaluate website features for online services (Mahindra & Whitworth, 2005; Hann, Hui, Lee, & Png, 2007) and e-commerce (Tamimi & Sebastianelli, 2015). In adoption studies of existing products in IS, an actual product would be of great significance to the study participants. This might not be applicable as it would constrain the study setup due to lack of resources (e.g., for enterprise systems). However, it would be of major importance and more feasible for domains like online services, cloud services, e-commerce, and mobile applications.

5.4 Study Administration

Marketing research deploys commercial panels to identify target samples, while in IS research there are no established panels for this type of methodology. So far, very few studies have used existing online panels; examples include Fritz, Schlereth, & Figge (2011) and Mihale-Wilson et al. (2017). In addition, Pu & Grossklags (2015) were first to use a crowdsourcing platform, Amazon Mechanical Turk, to hire participants and obtain a fast response rate, which can be considered a potential solution for future CA studies on mass-market systems. Although the sample in most conjoint studies exclusively comprises consumers, the sample background in the IS literature is dependent on the purpose of the study. For instance, managers are considered as a study sample in research involving organizational decision-making regarding IS purchase or adoption. Many other studies on users have used student populations because of the convenience of this sample in research. For example, students performed a decision-making study taking roles as managers in a situation that involved evaluating corporate browsers (Mahindra & Whitworth, 2005). Moreover, some researchers have applied CA to student-dedicated studies, for example, on mobile adoption (Head & Ziolkowski, 2010) and cloud service adoption (Burda & Teuteberg, 2015).

The typical sample size in a market research has a median of 300, especially in traditional conjoint approaches, while for adaptive methods the sample size can be smaller than 100 and still retain its statistical significance. In IS research, no specific patterns were identified. However, the median determined for the sample literature is 170, with a high variance due to studies with more than 1,000 respondents (mainly corresponding to a sample from service subscribers) and controlled studies with fewer than 30 respondents (e.g., Brinton Anderson, Bajaj, & Gorr, 2002).

It is worth noting that the research method influences the sample size, as this could be considered a problem of reach. In controlled studies where interviews or experiments are used, we can notice the dominance of small sample sizes. Online surveys are the most frequently used research method owing to their adaptability to a large sample size and the novelty of the CA studies in the IS domain, characterized by the high availability of online resources and survey software. Ideally, CA could be performed using statistical tools such as R and SPSS with a conjoint package integrated into them, or through the use of specialized commercial software such as Sawtooth Software (e.g., Berger, Matt, Steininger, & Hess, 2015; Giessmann & Stanoevska, 2012; Hu, Moore, & Hu, 2012), the market leader, or Globalpark Software (Mann, Ahrens, Benlian, & Hess, 2008). The latter typically administer an online survey and are mainly used in studies applying adaptive methods.

5.5 Data Analysis

The method for estimating the part-worth utilities of product attributes varies depending on the measurement scale. For ranking and rating OLS is the main estimation method used. As for choice-based studies, a mix of the LOGIT model is used for estimating utilities based on probabilistic assumptions from users' choices and Hierarchical Bayes for obtaining individual utilities of participants.

Besides the relative importance of attributes based on the part-worth utilities, other data analysis techniques are not frequently leveraged in IS. **Market segmentation** is only applied by 30 studies, i.e. less than 50%. It is used to develop market segments based on groupings generated from sample demographics or specific clustering analysis techniques corresponding to the type of the conjoint method (the most commonly used are k-means clustering for full-profile or ACA and hierarchical agglomerative clustering analysis for CBCA). This technique is mostly associated with studies involving end-user samples to identify unique segments with defined characteristics for IS design and adoption. **Willingness-to-pay** was used mainly in the pricing, privacy trade-off, and decision-making studies where a price attribute is included. A different application of this technique was elaborated in the study by Baek, Song, & Seo (2004), where the price was the dependent variable determined by the study participant for different online games options. Finally, **market simulation** can also be employed in the context of a competitive market analysis. It was employed by seven design studies on the list (Abramova, Krasnova, & Tan, 2017; Choi et al., 2013; Daas et al., 2014; Fritz et al., 2011; Keen, Wetzels, De Ruyter, & Feinberg, 2004; Song, Jang, & Sohn, 2009; Weinreich & Schön, 2013) to predict the market shares of new products or modified existing products based on the preference models as well as to evaluate the contribution margin. In addition, the CA study on the preference structure for PaaS (Giessmann & Stanoevska, 2012) used the market simulation technique in the design of cloud business models.

5.6 Critical Assessment & Methodological Recommendations

While the existing CA studies in IS have thus far mostly used the basic techniques, there are many more options available to use CA in specific situations. Table 4 derives recommendations to broaden the narrow focus and enhance methodological support on "how" to apply CA. These recommendations can help researchers in setting up their future CA studies and can simplify the decision process along the different CA steps for optimal conditions. We also find that domain-specific adaptations could make the procedure more efficient when it comes to attributes and levels selection, and data analysis.

1. Attributes and Levels Selection: The success of the CA relies on choosing the most relevant attributes describing the study object. However, "little guidance is given in how to select them, other than to use qualitative research methods (one-on-one interviews, focus groups), and possibly open-ended survey items as a guide" (Bradlow, 2005). A mixed method approach to select attributes is common practice. In general, researchers rely on literature reviews to capture the most relevant attributes for the product class. However, the selection should also rely on two additional perspectives for a full coverage of product features and possible implementations, that is: users and experts. The users' perspective can mainly be captured using questionnaires, interviews and focus groups. The experts' perspective can be captured through interviews or through assessing existing products and features in the market for feasibility check. We thus recommend a three-stage selection process to get both experts' and users' perspectives (e.g., Giessmann & Stanoevska, 2012; Naous & Legner, 2019). As domain-specific adaptations, there is a need for supporting future CA studies in IS by creating user preference models for different domains. These preference models should describe relevant properties of the core system, represented by its functional and non-functional characteristics, but also include business model elements.

In addition to modeling the system itself, which can support IS concept definition and IS design iterations, other contextual and social aspects can be included in the user preference model to support IS evaluation.

2. Data Collection Method: The dominant use of traditional full-profile CA in IS represents a major shortcoming. In line with the methodological development (see 2.3), future CA studies in IS should opt for adaptive and choice-based methods for two reasons: number of attributes and response burden. In fact, adaptive and choice-based methods allow setting up CA studies with larger number of attributes (Johnson et al., 2003) and thereby remove the constraints for evaluating complex systems with multiple features and design aspects (e.g., Doerr, Benlian, Vetter, & Hess, 2010; Giessmann & Stanoevska, 2012; Choi et al., 2013). Moreover, these methods simplify the survey for users by decreasing the response burden. In the adaptive methods respondents can focus on relevant features, without taking into account unwanted or must-have features in the evaluation phase of the CA survey. Also, choice-based methods rely on the selection of a product thus reducing the cognitive load of ratings or rankings required in traditional CA.

3. Stimulus Set Construction and Presentation: For this step, studies rely mainly on verbal descriptions of the attributes and levels. However, we see a potential for prototypes (and mock-ups) in this area to simulate realistic choices by displaying the features of the actual product. In IS concept definition and IS design iterations scenarios, prototypes would allow illustrating the addition of features or removal of existing ones and thereby support comparison of design variants. This can specifically be helpful in the design of online services (e.g., Baek et al., 2004; Mahindra & Whitworth, 2005) and mobile applications (e.g., Brodt & Heitmann, 2004) where mockups can be built for realistic user evaluation.

4. Study Administration: Using specialized software packages that combine online data collection and data analysis facilitates CA studies. These packages (e.g., Sawtooth Software) allow for setting up the stimulus set construction and are suitable for adaptive and choice-based CA procedures. In terms of respondents, the sample size of CA studies in our discipline is restricted and relatively low in comparison to market research studies. We recommend using crowdsourcing platforms in order to obtain data from a large set of users such as MTurk (Pu & Grossklags, 2015; Naous & Legner, 2019). Moreover, the establishment of IS-specific online panels would enable the access to larger samples with specific interests and reduce the challenges of obtaining biased or convenient samples that might not be representative of the user population. These panels would facilitate the application of CA for IS design iterations where continuous feedback or user evaluations are required for release planning.

5. Data analysis: In the final step of CA, we recommend IS researchers to go beyond relative importance measures or trade-off analysis and explore the other data analysis techniques. While relative importance and trade-off analysis support selection of design features and propose weights in a decision-making context for IS evaluation, market segmentation can help in understanding varied preferences on different levels and market simulations can have a great impact for studying alternative designs and simulations. We argue that willingness-to-pay and variation analysis are two promising techniques that assist in the design of purposeful systems that are affordable to users and correspond to their preferences. For applying analysis techniques, we suggest following the recommendations for IS concept definition, IS design iterations and IS evaluation, as outlined in our framework in the following section (see Table 5).

Table 4. Critical Assessment of CA in IS and Recommendations

CA Procedure	*Current State & Limitations*	*Recommendations*	*Sample Studies*
1. Attributes and Levels Selection	Most studies use mixed methods in a multi-stage process for attribute selection	Three-stage selection process starting with literature review and integrating experts' and users' perspectives	Giessmann & Stanoevska, 2012; Naous & Legner, 2019
		Create domain-specific user preference models to support selection of attributes for typical categories of IS and study purposes	*not yet covered / area for future research*
2. Data Collection Method	Traditional CA is dominant, which constrains the number of attributes	Use adaptive and choice-based methods (ACA, CBCA and ACBCA) to deal with high numbers of attributes	Doerr et al., 2010; Choi et al., 2013; Giessmann & Stanoevska, 2012

3. Stimulus Set Construction and Presentation	Verbal and paragraph descriptions are mostly used; only a few studies relied on pictorial representations for websites	Develop prototypes and actual products (or mock-ups) to simulate realistic choices, specifically in IS concept definition and IS design iterations	Baek et al., 2004; Mahindra & Whitworth, 2005
4. Study Administration	Online surveys are mostly employed, and the subsequent analysis is based on statistical packages or commercial software Sample depends on the study purpose (e.g., students or managers); the sample size largely varies but is often too small	Explore software and packages to combine online data collection and analysis	Hu et al., 2012; Berger et al., 2015
		Use online panels and crowdsourcing platforms (e.g. MTurk) for a larger user reach	Pu & Grossklags 2015; Naous & Legner, 2019
		Establish IS-specific panels to increase sample sizes	*not yet covered / area for future research*
5. Data Analysis	IS studies do not exploit the full set of CA techniques; they mostly analyze the relative importance of estimated utilities	Apply the recommended data analysis techniques for the different suggested scenarios in a system lifecycle (IS concept definition, IS design iterations and IS evaluation)	see Framework for CA in IS (Section 6)

6 A Framework for CA Studies in IS

Based on our review and the identified purposes of CA studies, we derive a framework for applying CA in IS (Figure 3). The framework outlines opportunities for applying CA to complement existing techniques and methods in the different phases of an IS lifecycle, from ex-ante in IS conceptualization and IS design to ex-post in the evaluation of existing IS artifacts (see Table 5). The framework is meant to support both IS researchers as well as practitioners in identifying suitable CA applications and the relevant CA techniques. In the following we elaborate on the framework and provide recommendations for future research on "where" to apply CA for typical study purposes in IS, with the goal of promoting user involvement and data-driven approaches in user-oriented design.

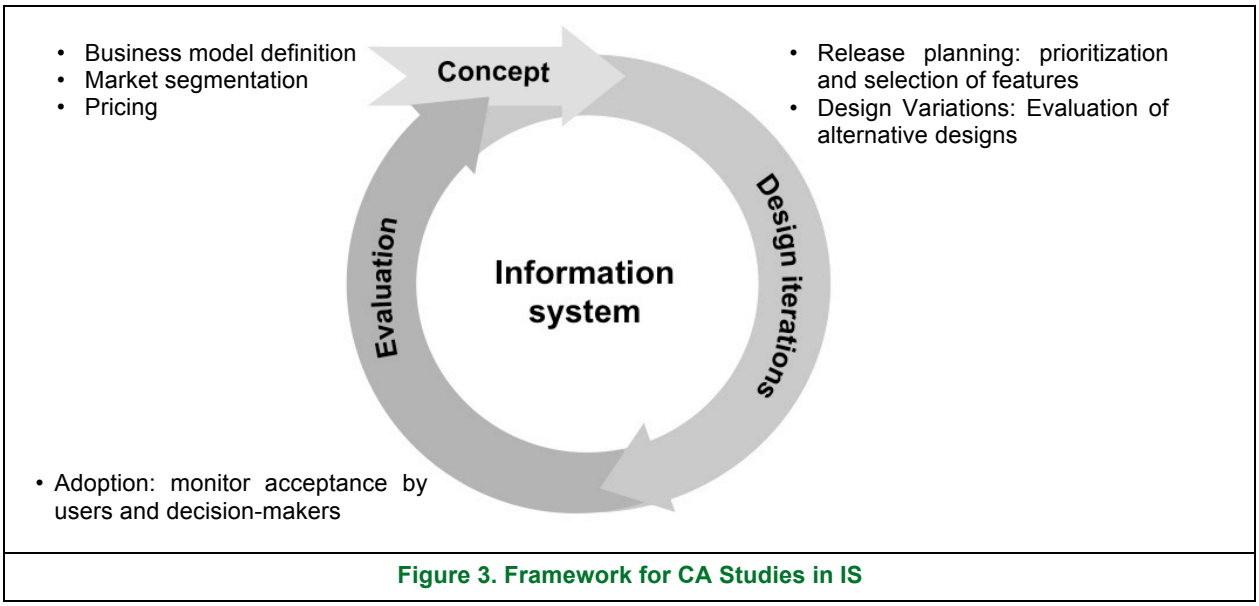

Figure 3. Framework for CA Studies in IS

6.1 CA for IS Concept Definition

CA is a well-suited methodology for preference elicitation. By offering a utility function as a quantitative measure, CA may be used to complement and validate qualitative feedback gained through direct interactions with target customers and users. It can support IS design in its initial phase through (ex-ante) evaluation of IS concepts, similar to the studies of Zubey, Wagner, & Otto (2002) on VoIP features and Giessmann & Stanoevska (2012) on cloud platforms. Unlike traditional requirements engineering methods that tend to evaluate individual features, CA allows to evaluate complete product configurations and obtain

user insights into an initial concept of the concerned product, including business model aspects. It can be used to compare mock-ups or prototypes saving time and financial resources in the early stage of IS planning and design. It also allows for design feedback from a large number of users to be integrated, which is a particular concern in mass-market IS (Jarke et al., 2011; Todoran, Seyff, & Glinz, 2013; Tuunanen et al., 2010).

Application 1.1 – Business Model Definition. CA studies extend beyond core system design to involve aspects of business model design. CA can be applied to study upfront commercial decision-making and user trade-offs with respect to different business model elements and, specifically, value propositions that play a central role in business model design (Mikusz & Herter, 2016). The CA method allows to evaluate the highly perceived value propositions of specific business models, as shown for IoT systems' value propositions (Derikx, Reuver, Kroesen, & Bowman, 2015). Moreover, channel selection could also benefit from this type of analysis. In an e-commerce example, CA investigates consumer decisions on the preferred format of information delivery (Berger et al., 2015). In addition, CA can be applied to measure preferences for partnership related characteristics; for instance, migration among PaaS providers (Giessmann & Stanoevska, 2012). CA's application to design business model elements can go as far as using CA as a method for scenario planning when designing business models, as suggested by Tesch (2016) for IoT business models.

Application 1.2 – Market Segmentation. CA does not only enable capturing individual and group preferences through relative importance of features, but also helps in identifying customer or user segments through application of user clustering techniques. This clustering based on user preferences for certain business model elements can serve as a reference for market segmentation applied in business model design (Osterwalder & Pigneur, 2010).

Application 1.3 – Pricing. As a particular relevant aspect in these early phases, CA can be applied to support pricing decisions based on the willingness-to-pay approach (e.g., Koehler, Anandasivam, Dan, & Weinhardt, 2010; Mann et al., 2008). In such scenarios, CA serves as an estimation method for consumer utilities for different price levels, which then enables the determination of attractive prices or bundle prices with respect to certain design alternatives. Moreover, CA can be used for market simulation and evaluation of market shares given the price strategy undertaken.

6.2 CA for IS Design Iterations

CA can support subsequent IS design iterations at different levels (e.g., Bouwman et al., 2008; Kim, 2005). It enables capturing individual and group preferences, and thereby supports requirements management for customer-oriented IS (Kabbedijk, Brinkkemper, Jansen, & van der Veldt, 2009). So far, in market-driven RE, requirements are either collected from representatives of market segments or invented by developers who come up with new system design (Dahlstedt, Karlsson, Persson, NattochDag, & Regnell, 2003). In later stages, new requirements are collected from user feedback and serve as an input to plan further incremental releases where an additional set of features is implemented. CA can help in understanding user preferences and trade-offs for product attributes when assessed simultaneously as an input for different design iterations. This could be done for assessing design variations of general system features or focusing on certain functional or non-functional requirements (e.g., Naous & Legner (2019) on the design of secure cloud storage services).

Application 2.1 – Release planning. Prioritization is a central activity that supports decisions regarding product releases. It results in implementing preferential requirements of stakeholders. To prioritize requirements, users and designers have to compare requirements to determine their relative weights of importance in the implementation of a software product (Achimugu, Selamat, Ibrahim, & Mahrin, 2014; Karlsson & Ryan, 1997). Traditional techniques for requirements prioritization including sorting and pair-wise comparisons (such as Analytic Hierarchy Process (AHP) and the cost-value approach) (Karlsson & Ryan, 1997; Karlsson, Wohlin, & Regnell, 1998) allow users to assess features individually to derive their relative importance. However, with the increasing number of requirements and stakeholders this process becomes more and more complex. Moreover, handling a large set of requirements would create a burden and might be tedious for the customers and engineers performing it. In modern agile software development approaches, CA can be a fundamental method for release planning and selecting relevant features based on user choices. CA combines human intuition with a systematic approach that quantifies preferences for feature selection. In modern agile software development approaches, CA could therefore become a fundamental method for release planning and selecting relevant features based on user choices. This could be achieved by presenting existing products or service combinations to users in order

to evaluate and enhance their design. The CA method allows users to assess a complete product offering and rate it based on their stated preference. By measuring preferences for attributes and varied levels, this method provides quantifiable input for prioritizing and selecting features for future releases. During these iterations, CA can be also used to determine target segments with group preferences for optimal bundling.

Application 2.2 – Design variations. Another application area where CA is a venue for enhancing initial designs is testing design variations. This can be achieved through market simulations' predictions based on estimated preferences. Giessmann & Legner (2013) illustrate the use of market simulation techniques, based on a previous CA study on PaaS (Giessmann & Stanoevska, 2012). They show that CA helps with evaluating alternative designs through attribute variation analysis. By quantifying the effects of varying attributes on market shares, one can identify which of the attributes could be refined or should be changed for better outcomes. Thus, software vendors can get data-driven insights on the business model elements and system features that have significant impact on users' choices. Market simulations based on CA also allow obtaining benchmarks for competitive analysis. They can be used to compare product combinations and their overarching business models and to generate virtual market shares for multiple vendors reflecting user preferences. Individual and group utilities derived from CA studies can inform the creation of product or service bundles in the presence of contrasting preferences.

6.3 CA for IS Evaluation

Besides the concept and design aspects, CA can be useful in the ex-post evaluation of systems by users or organizations. CA can extend established judgment models for IS success and technology acceptance and use, including the Diffusion of Innovation (DOI) Theory (Rogers, 1995) and the Technology Acceptance Model (TAM)/ Unified Theory of Acceptance and Use of Technology (UTAUT) (Davis, 1989; Venkatesh et al., 2003). All these models rely mostly on traditional, questionnaire-based survey methods to examine a set of user beliefs or perceived values. CA could bring into the picture more detailed product attributes and external factors that surround them (such as vendor-related aspects). CA thereby provides insights into the relationship between tasks, technologies, and context (Schaupp & Bélanger, 2005).

Application 3.1 – Willingness-to-accept. CA proved to be useful in understanding how systems are adopted. This includes decision-making for the strategic purchasing of commercial IS in organizations (Benlian & Hess, 2011, 2010; Keil & Tiwana, 2006) as well as individual adoption of mass-market IS by individual users. These studies determine factors that drive software system selection in an organizational context at a managerial level. They mainly reflect the weights of evaluation criteria governed by attribute trade-offs to help assess the selection of existing systems or purchasing decisions. CA could involve studying typical evaluation criteria of packaged systems (such as functionality, cost, ease of use, implementation, customization, and integration) and extending that to domain-specific and vendor-related criteria. From a user perspective, CA makes it possible to measure adoption and predict consumers' intention to use IS products (e.g., Chen et al., 2010, 2008) based on relative importance of attributes. It provides a valid and more realistic model of consumer judgments on the basis of consumer preference estimation and allows identifying user groups based on these estimations.

Table 5. CA Role and Applications in the IS Lifecycle

Phase	*Role of CA*	*Applications (A) of CA*	*CA Supporting Techniques (see section 3.1)*	*Sample Studies*
IS concept definition	Validation of new IS concepts and business models	*A1.1* – Business model definition	Define business model and value proposition - Relative importance/ Trade-off analysis	Derikx et al., 2015; Giessmann & Stanoevska, 2012
		A1.2 – Market segmentation	Define target segments - Market segmentation	Giessmann & Stanoevska, 2012; Krasnova et al., 2009
		A1.3 – Pricing	Define revenue model and pricing - Willingness-to-pay - Market simulation	Koehler et al., 2010

IS design iteration	Complement existing requirements engineering techniques	*A2.1* – Release planning	Prioritize & select features - Relative importance/ Trade-off analysis - Market segmentation	Bouwman et al., 2008; Naous & Legner, 2019
		A2.2 – Design variation	Evaluate alternative designs - Market segmentation - Market simulations - Variation analysis	Giessmann & Legner, 2013
IS evaluation	Extend IS success and adoption models	*A3.1* – Willingness-to-accept	Monitor acceptance and adoption by users and decision-makers - Relative importance - Market segmentation	Benlian & Hess, 2011; Chen et al., 2010

7 Conclusion

7.1 Summary and Contributions

Market research techniques are popular for new product development but have not been fully embraced in IS research. Following Bajaj's (1999) call, CA has been used by IS researchers to study user preferences from multiple perspectives. However, we observe inconsistencies in applying CA and no cumulative research on its applications. With the increasing number of studies, a fundamental discussion on integrating CA in the IS field is necessary. By conducting a comprehensive review of 21 years of IS literature and analyzing 70 CA studies, we aim at synthesizing and accumulating knowledge about CA's applications in IS. Through our review, we identify patterns and trends in the application of CA in the IS field to guide future research applying this method. In our study, we illustrate that CA has advantages for understanding user preferences and can be adapted to several application areas in IS covering the different phases of an IS lifecycle. We also have seen that CA, through its techniques, could support and complement other existing methods in the design and evaluation of IS.

In the design phase, CA can be used for IS concept definition to facilitate the construction of early system features for further prototyping. Through concept definition, users can assess a complete product offering and can rate it based on their stated preferences, leading to a design process with initial product preferences. It can also support the design of business models through scenario planning by incorporating contextual and economic elements that need to be considered for the design of commercialized systems. In further stages, CA can support IS design iterations in release planning by providing quantitative insights into most valued features. It thereby combines human intuition with a systematic approach that quantifies preferences (via a relative importance measure) for further feature selection from a defined set of attributes and attribute levels. In addition, we discuss how the market simulation techniques advance a new proposition that can support the refinement of existing systems.

For IS evaluation scenarios, we show that CA allows deriving decision models for user selection and adoption patterns. CA, unlike a simple survey tool, estimates a preference model and thereby provides a detailed understanding of the main system characteristics and external factors that drive user's intentions to use and acceptance. Through this preference model, the conjoint methodology complements and extends IS theories and models on user adoption to study other acceptance variables than perceptions and attitudes. Thus, CA gives a nuanced assessment of main drivers of user adoption and also provides input to IS design.

Our findings are of interest to both IS theory and practice. For academics, we make two primary contributions: First, our review critically assesses the methodological setup or method variants from previous CA studies in IS. We find that CA studies in the IS field do not fully leverage CA developments and techniques and outline recommendations for improving the study setup. Second, we provide guidance for future studies by proposing a reference framework for applications of CA in IS. Our framework suggests scenarios for applying CA in IS concept definition, IS design iterations, and IS evaluation starting from the core system and involving business model elements. In addition, we suggest domain-specific adaptations as future research avenues to support IS researchers applying CA. We see empirically validated user preference models as a prerequisite for leveraging CA in the design and evaluation of

mass-market IS. For practitioners, we show that CA could be employed in specific scenarios to support the user-oriented design of IS – mainly in requirements elicitation and prioritization for the development of new systems, applications, and service offerings. We find that CA complements and enhances existing techniques for collecting user feedback and is of particular interest for software providers.

7.2 Limitations and Implications for Future Research

While this paper presents a comprehensive analysis of CA studies in IS, we acknowledge certain limitations. Authors' subjectivity is a main limitation when conducting literature reviews. Different search keywords could have been used, and different categorization for the domains and purposes of the studies could have been derived. To ensure quality and validity of our analysis, we followed a systematic process for the selection and coding of the studies, and the results were cross-checked by two authors. Another limitation is constraining the analysis to the presented IS domains for feasibility reasons. We set the scope of our literature search on articles in main IS outlets for complete coverage of the IS domains. Excluding some articles was due to restrictive coverage of the specified field and the need for addressing outlets in other research areas. However, CA's use in neighboring domains such as health IS could be an interesting area for future research and bring additional insights. Finally, our analysis of the literature focuses on methodological and procedural aspects in applying CA, but did not further analyze the nature of attributes and levels and their reusability. Our suggestions for domain-specific adaptations can guide future research in this specific area.

In general, our goal was to provide an overview of CA studies in IS and highlight application areas for guiding future IS research. Since CA studies in IS have mostly been one-time efforts, we outline interesting research opportunities for methodological contributions and the domain-specific adaptation of CA. More specifically, our findings open up a new area of research integrating CA into IS design and evaluation. We foresee a particular opportunity of integrating CA into software product management and agile development approaches (Naous, Giessmann, & Legner, 2020). Future research can also focus on the domain-specific adaptation of the CA method to complement existing models/theories on IS adoption and determine influential factors in human behavior and decision-making.

Another interesting research opportunity is the development of user preference models for typical categories of IS solutions as domain-specific adaptations of CA. The choice of attributes is often considered the most demanding phase in CA, and the success depends on selecting the right attributes and levels. To address this issue for CA studies in IS, researchers could further refine the suggested user preference models in existing studies by proposing validated catalogs of attributes and attribute levels for the related domain-specific area, thereby increasing the practicality of the CA method. This would allow researchers and practitioners to construct their conjoint studies rapidly and avoid the time-consuming task of constructing attributes and levels from scratch. Besides domain specificity, these user preference models could be also categorized based on the study purpose to reflect methodological applications of CA. For instance, technology acceptance research on enterprise systems can benefit from previous TAM-based evaluation studies (e.g., Mahindra & Whitworth, 2005) to develop future reference models involving technology and vendor-related aspects.

References

Abramova, O., Krasnova, H., & Tan, C.-W. (2017). How much will you pay? Understanding the value of information cues in the sharing economy. In *Proceedings of the 25th European Conference on Information Systems (ECIS 2017)*, Guimarães, Portugal.

Achimugu, P., Selamat, A., Ibrahim, R., & Mahrin, M. N. (2014). A systematic literature review of software requirements prioritization research. *Information and Software Technology*, *56*(6), 568–585.

Baek, S., Song, Y.-S., & Seo, J. (2004). Exploring Customers' Preferences for Online Games. In *Proceedings of the Special Interest Group on Human-Computer Interaction (SIGHCI 2004)*.

Bajaj, A. (1999). Conjoint Analysis: A Potential Methodology For IS Research. In *Proceedings of the 5th Americas Conference on Information Systems (AMCIS 1999),* Milwaukee, Wisconsin, United States.

Bajaj, A. (2000). A Study of Senior Information Systems Managers' Decision Models in Adopting New Computing Architectures. *Journal of the Association for Information Systems*, *1*(1), 1–57.

Bano, M., & Zowghi, D. (2015). A systematic review on the relationship between user involvement and system success. *Information and Software Technology*, 58, 148–169.

Benlian, A., & Hess, T. (2011). Comparing the relative importance of evaluation criteria in proprietary and open-source enterprise application software selection – a conjoint study of ERP and Office systems. *Information Systems Journal*, *21*(6), 503–525.

Berger, B., Matt, C., Steininger, D. M., & Hess, T. (2015). It Is Not Just About Competition with "Free": Differences Between Content Formats in Consumer Preferences and Willingness to Pay. *Journal of Management Information Systems*, *32*(3), 105–128.

Bouwman, H., Haaker, T., & Vos, H. de. (2008). Mobile Applications for Police Officers. In *Proceedings of BLED 2008*.

Bouwman, H., & van de Wijngaert, L. (2009). Coppers context, and conjoints: a reassessment of TAM. *Journal of Information Technology*, *24*(2), 186–201.

Brinton Anderson, B., Bajaj, A., & Gorr, W. (2002). An estimation of the decision models of senior IS managers when evaluating the external quality of organizational software. *Journal of Systems and Software*, *61*(1), 59–75.

Brodt, T., & Heitmann, M. (2004). Customer Centric Development of Radically New Products - A European Case. In *Proceedings of the 10th Americas Conference on Information Systems (AMCIS 2004),* New York, NY, USA.

Baum, K., Meißner, S., Abramova, O., and Krasnova, H. (2019). Do They Really Care about Targeted Political Ads? Investigation of User Privacy Concerns and Preferences. In *Proceedings of the 27th European Conference on Information Systems (ECIS 2019)*, Stockholm & Uppsala, Sweden.

Buck, C., Stadler, F., Suckau, K., & Eymann, T. (2017). Privacy as a Part of the Preference Structure of Users App Buying Decision. In *Proceedings of Wirtschaftsinformatik 2017*.

Burda, D., & Teuteberg, F. (2014). Understanding the Benefit Structure of Cloud Storage as a Means of Personal Archiving - A Choice-Based Conjoint Analysis. In *Proceedings of the 22nd European Conference on Information Systems (ECIS 2014)*, Tel Aviv, Israel.

Burda, D., & Teuteberg, F. (2015). Exploring consumer preferences in cloud archiving – a student's perspective. *Behaviour & Information Technology*, *35*(2), 89–105.

Chen, Y.-H., Hsu, I.-C., & Lin, C.-C. (2010). Website attributes that increase consumer purchase intention: A conjoint analysis. *Journal of Business Research*, *63*(9), 1007–1014.

Chen, Y.-H., Tsao, C.-Y., Lin, C.-C., & Hsu, I.-C. (2008). A Conjoint Study of the Relationship between Website Attributes and Consumer Purchase Intentions. In *Proceedings of the 12th Pacific Asia Conference on Information Systems (PACIS 2008),* Suzhou, China.

Choi, J. Y., Shin, J., & Lee, J. (2013). Strategic demand forecasts for the tablet PC market using the Bayesian mixed logit model and market share simulations. *Behaviour & Information Technology*, *32*(11), 1177–1190.

Constantinescu, M., Onur, E., Durmus, Y., Nikou, S., de Reuver, M., Bouwman, H., ... & Glatz, P. M. (2014). Mobile tethering: overview, perspectives and challengess. *info*, *16*(3), 40-53

Cwiakowski, P., Giergiczny, M., & Krawczyk, M. (2016). Pirates in the Lab: Using Incentivized Choice Experiments to Explore Preference for (Un) Authorized Content. *MIS Quarterly*, *40*(3), 709–715.

Daas, D., Keijzer, W., & Bouwman, H. (2014). Optimal Bundling and Pricing of Multi-Service Bundles from a Value-based Perspective A Software-as-a-Service case. In *Proceedings of BLED 2014*.

Dahlstedt, A., Karlsson, L., Persson, A., NattochDag, J., & Regnell, B. (2003). Market-driven requirements engineering processes for software products–a report on current practices. In *Proceedings of the International Workshop on COTS and Product Software RECOTS, Held in Conjunction with the 11th IEEE International Requirements Engineering Conference*.

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly, 13*(3), 318–340.

Derikx, S., Reuver, M. de, Kroesen, M., & Bowman, H. (2015). Buying-off privacy concerns for mobility services in the Internet-of-things era: A discrete choice experiment on the case of mobile insurance. In *Proceedings of BLED 2015*.

Doerr, J., Benlian, A., Vetter, J., & Hess, T. (2010). Pricing of Content Services–An Empirical Investigation of Music as a Service. In *Proceedings of the 16th Americas Conference on Information Systems (AMCIS)*, Lima, Peru.

Dwivedi, Y. K., Wastell, D., Laumer, S., Henriksen, H. Z., Myers, M. D., Bunker, D., … Srivastava, S. C. (2015). Research on information systems failures and successes: Status update and future directions. *Information Systems Frontiers*, *17*(1), 143–157.

Fagerstrøm, A., & Ghinea, G. (2011). On the motivating impact of price and online recommendations at the point of online purchase. *International Journal of Information Management*, *31*(2), 103–110.

Fölting, J., Daurer, S., & Spann, M. (2017). Consumer Preferences for Product Information and Price Comparison Apps. In *Proceedings of Wirtschaftsinformatik 2017*.

Fritz, M., Schlereth, C., & Figge, S. (2011). Empirical Evaluation of Fair Use Flat Rate Strategies forMobile Internet. *Business & Information Systems Engineering*, *3*(5), 269–277.

Giessmann, A., & Legner, C. (2013). Designing Business Models for Platform as a Service: Towards a Design Theory. In *Proceedings of the 34th International Conference on Information Systems (ICIS 2013)*, Milan, Italy.

Giessmann, A., & Stanoevska, K. (2012). Platform as a Service – A Conjoint Study on Consumers' Preferences. In *Proceedings of the 33rd International Conference on Information Systems (ICIS 2012)*, Orlando, Florida, USA.

Green, P. E. (1984). Hybrid Models for Conjoint Analysis: An Expository Review. *Journal of Marketing Research*, *21*(2), 155–169.

Green, P. E., Krieger, A. M., & Wind, Y. (2001). Thirty Years of Conjoint Analysis: Reflections and Prospects. *Interfaces*, *31*(3_supplement), S56–S73.

Green, P. E., & Rao, V. R. (1971). Conjoint measurement for quantifying judgmental data. *Journal of Marketing Research*, *8*(3), 355–363.

Green, P. E., & Srinivasan, V. (1978). Conjoint Analysis in Consumer Research: Issues and Outlook. *Journal of Consumer Research*, *5*(2) 103–123.

Green, P. E., & Srinivasan, V. (1990). Conjoint analysis in marketing: new developments with implications for research and practice. *The Journal of Marketing*, *54*(4), 3–19.

Haaker, T., Vos, H., & Bouwman, H. (2006). Mobile Service Bundles: The Example of Navigation Services. In *Proceedings of BLED 2006*.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson. R. E. (2010). Multivariate Data Analysis. *New Jersey, Pearson Prentice Hall*.

Hann, I.-H., Hui, K.-L., Lee, S.-Y. T., & Png, I. P. L. (2007). Overcoming Online Information Privacy Concerns: An Information-Processing Theory Approach. *Journal of Management Information Systems*, *24*(2), 13–42.

Hann, I.-H., Hui, K.-L., Lee, T., & Png, I. (2002). Online Information Privacy: Measuring the Cost-Benefit Trade-Off. In *Proceedings of the 23rd International Conference on Information Systems (ICIS 2002),* Barcelona, Spain.

Head, M., & Ziolkowski, N. (2010). Understanding Student Attitudes of Mobile Phone Applications and Tools. In *Proceedings of the 18th European Conference on Information Systems (ECIS 2010), Pretoria, South Africa*.

Ho, K., See-to, E., & Xu, X. (2010). The Impacts of Information Privacy, Monetary Reward, and Buyers' Protection Excess on Consumers' Utility Using E-payment Gateways: A Conjoint Analysis. In *Proceedings of the 21st Australian Conference on Information Systems (ACIS 2010),* Brisbane, Queensland University of Technology.

Hu, H., Moore, W., & Hu, P. (2012). Incorporating User Perceptions and Product Attributes in Software Product Design and Evaluation. In *Proceedings of the 33rd International Conference on Information Systems (ICIS 2012)*, Orlando, Florida, USA.

Jarke, M., Loucopoulos, P., Lyytinen, K., Mylopoulos, J., & Robinson, W. (2011). The Brave New World of Design Requirements. *Information Systems*, *36*(7), 992–1008.

Johnson, R., Huber, J., & Bacon, L. (2003). Adaptive choice-based conjoint. *Sawtooth Software, Sequim, WA*.

Johnson, R. M. (1974). Trade-off analysis of consumer values. *Journal of Marketing Research*, *11*(2), 121–127.

Johnson, R. M. (1987). Adaptive Conjoint Analysis. *Sawtooth Software Conference on Perceptual Mapping, Conjoint Analysis, and Computer Interviewing*, 253–265. Sun Valley, Idaho, USA: Sawtooth Software Ketchum, ID.

Kabbedijk, J., Brinkkemper, S., Jansen, S., & van der Veldt, B. (2009). Customer involvement in requirements management: lessons from mass market software development. In *Proceedings of the 17th IEEE International Requirements Engineering Conference (RE 2017)*.

Karlsson, J., & Ryan, K. (1997). A cost-value approach for prioritizing requirements. *IEEE Software*, *14*(5), 67–74.

Karlsson, J., Wohlin, C., & Regnell, B. (1998). An evaluation of methods for prioritizing software requirements. *Information and Software Technology*, *39*(14–15), 939–947.

Keen, C., Wetzels, M., De Ruyter, K., & Feinberg, R. (2004). E-tailers versus retailers: Which factors determine consumer preferences. *Journal of Business Research*, *57*(7), 685–695.

Keil, M., & Tiwana, A. (2006). Relative Importance of Evaluation Criteria for Enterprise Systems: a Conjoint Study. *Information Systems Journal*, *16*(3), 237–262.

Kim, Y. (2005). Estimation of consumer preferences on new telecommunications services: IMT-2000 service in Korea. *Information Economics and Policy*, *17*(1), 73–84.

Koehler, P., Anandasivam, A., Dan, M., & Weinhardt, C. (2010). CUSTOMER HETEROGENEITY AND TARIFF BIASES IN CLOUD COMPUTING. In *Proceedings of the 31st International Conference on Information Systems (ICIS 2010), St. Louis, Missouri, USA*.

Krasnova, H., Hildebrand, T., & Guenther, O. (2009). Investigating the value of privacy in online social networks: conjoint analysis. In *Proceedings of the 30th International Conference on Information Systems (ICIS 2009),* Phoenix, Arizona, USA.

Lee, E., & Rhim, H. (2014). An application of conjoint analysis to explore user perceptions on management information systems: A case study. *Management Research Review*, *37*(1), 69–88.

Lowry, P. B., Gaskin, J., Humpherys, S. L., Moody, G. D., Galletta, D. F., Barlow, J. B., & Wilson, D. W. (2013). Evaluating journal quality and the association for Information Systems senior scholars' journal basket via bibliometric measures: Do expert journal assessments add value? *MIS Quarterly*, *37*(4), 993–1012.

Luo, X. (Robert), Warkentin, M., & Li, H. (2013). Understanding Technology Adoption Trade-Offs: A Conjoint Analysis Approach. *Journal of Computer Information Systems*, *53*(3), 65–74.

Mahindra, E., & Whitworth, B. (2005). The Web of System Performance: Extending the TAM Model. In *Proceedings of the 11th Americas Conference on Information Systems (AMCIS 2005),* Omaha, Nebraska, USA.

Mann, F., Ahrens, S., Benlian, A., & Hess, T. (2008). Timing is Money - Evaluating the Effects of Early Availability of Feature Films via Video on Demand. In *Proceedings of the 29th International Conference on Information Systems (ICIS 2008),* Paris, France.

Mihale-Wilson, C., Zibuschka, J., & Hinz, O. (2017). About User Preferences and Willingness to pay for a Secure and Privacy Protective Ubiquitous Personal Assistant. In *Proceedings of the 25th European Conference on Information Systems (ECIS 2017)*, Guimarães, Portugal.

Mikusz, M., & Herter, T. (2016). How Do Consumers Evaluate Value Propositions of Connected Car Services? In *Proceedings of the 22nd Americas Conference on Information Systems (AMCIS 2016),* San Diego, California, USA.

Mueller-Lankenau, C., & Wehmeyer, K. (2005). Mobile Couponing - Measuring Consumers, Acceptance and Preferences with a Limit Conjoint Approach. In *Proceedings of BLED 2005*.

Naous, D., & Legner, C. (2019). Understanding Users' Preferences for Privacy and Security Features–A Conjoint Analysis of Cloud Storage Services. In *Proceedings of the International Conference on Business Information Systems (BIS 2019) Workshops*, Seville, Spain. Springer.

Naous, D., Giessmann, A., & Legner, C. (2020). Incorporating the voice of the customer into mass-market software product management. In *Proceedings of the 35th Annual ACM Symposium on Applied Computing (SAC 2020)*.

Netzer, O., Toubia, O., Bradlow, E. T., Dahan, E., Evgeniou, T., Feinberg, F. M., … Rao, V. R. (2008). Beyond conjoint analysis: Advances in preference measurement. *Marketing Letters*, *19*(3–4), 337–354.

Nevo, D., Benbasat, I., & Wand, Y. (2012). Understanding Technology Support for Organizational Transactive Memory: Requirements, Application, and Customization. *Journal of Management Information Systems*, *28*(4), 69–98.

Nikou, S., Bouwman, H., & Reuver, M. de. (2014). A Consumer Perspective on Mobile Service Platforms: A Conjoint Analysis Approach. *Communications of the Association for Information Systems*, *34*(1), 1409–1424.

Nikou, S., Bowman, H., & Reuver, M. de. (2012). Do Consumers Care about Mobile Service Platforms? A Conjoint Analysis on Consumer Preference for Mobile Platforms. In *Proceedings of the International Conference on Mobile Business (ICMB 2012)*.

Nuseibeh, B., & Easterbrook, S. (2000). Requirements Engineering: a Roadmap. In *Proceedings of the Conference on The Future of Software Engineering*, ACM.

Odekerken-Schröder, G., & Wetzels, M. (2003). Trade-offs in Online Purchase Decisions:: Two Empirical Studies in Europe. *European Management Journal*, *21*(6), 731–739.

Orme, B. (2002). Formulating attributes and levels in conjoint analysis. *Sawtooth Software Research Paper*.

Orme, B. (2009). Which conjoint method should I use. *Sawtooth Software Research Paper Series*.

Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers* (1st ed.). Wiley.

Paré, G., Trudel, M.-C., Jaana, M., & Kitsiou, S. (2015). Synthesizing information systems knowledge: A typology of literature reviews. *Information & Management*, *52*(2), 183–199.

Penttinen, E., Halme, M., Lyytinen, K., & Myllynen, N. (2018). What Influences Choice of Business-to-Business Connectivity Platforms? *International Journal of Electronic Commerce*, *22*(4), 479–509.

Pu, Y., & Grossklags, J. (2015). Using Conjoint Analysis to Investigate the Value of Interdependent Privacy in Social App Adoption Scenarios. In *Proceedings of the 36th International Conference on Information Systems (ICIS 2015),* Fort Worth, Texas, USA.

Rao, V. R. (2008). Developments in Conjoint Analysis. In B. Wierenga (Ed.), *Handbook of Marketing Decision Models* (pp. 23–53).

Rogers, E. M. (1983). *The Diffusion of Innovations*. 3rd (eds.) New York. NY: The Free Press.

Rollin, R., Steinmann, S., Schramm-Klein, H., Neus, F., & Nimmermann, F. (2017). Drivers of Market Success for Mobile Gaming Apps - Results of a Choice-Based Conjoint Experiment. In *Proceedings of the 38th International Conference on Information Systems (ICIS 2017), Seoul, South Korea.*

Rossnagel, H., Zibuschka, J., Hinz, O., & Muntermann, J. (2014). Users' willingness to pay for web identity management systems. *European Journal of Information Systems*, *23*(1), 36–50.

Ruhe, G., & Saliu, M. O. (2005). The art and science of software release planning. *IEEE Software*, *22*(6), 47–53.

Salipante, P., Notz, W., & Bigelow, J. (1982). A matrix approach to literature reviews. *Research in Organizational Behavior*, *4*, 321–348.

Schaupp, L. C., & Bélanger, F. (2005). A Conjoint Analysis of Online Consumer Satisfaction1. *Journal of Electronic Commerce Research*, *6*(2), 95.

Schomakers, E.-M., Lidynia, C., & Ziefle, M. (2019). All of me? Users' preferences for privacy-preserving data markets and the importance of anonymity. *Electronic Markets*, *30*(3), 1–17.

Schuth, M., Brosi, P., & Welpe, I. (2018). Recruiting Women in IT: A Conjoint-Analysis Approach. In *Proceedings of the 51st Hawaii International Conference on System Sciences (HICSS 2018)*.

Schwarz, A., Jayatilaka, B., Hirschheim, R., & Goles, T. (2009). A Conjoint Approach to Understanding IT Application Services Outsourcing. *Journal of the Association for Information Systems*, *10*(10), 748-781.

See-To, E. W. K., & Ho, K. K. W. (2016). A study on the impact of design attributes on E-payment service utility. *Information & Management, 53*(5), 668-681.

Siegfried, N., Koch, O., & Benlian, A. (2015). Drivers of App Installation Likelihood–A Conjoint Analysis of Quality Signals in Mobile Ecosystems. In *Proceedings of the 36th International Conference on Information Systems (ICIS 2015),* Fort Worth, Texas, USA.

Song, J., Jang, T., & Sohn, S. Y. (2009). Conjoint analysis for IPTV service. *Expert Systems with Applications*, *36*(4), 7860–7864.

Tamimi, N., & Sebastianelli, R. (2015). The relative importance of e-tailer website attributes on the likelihood of online purchase. *Internet Research*, *25*(2), 169–183.

Templier, M., & Paré, G. (2015). A Framework for Guiding and Evaluating Literature Reviews. *Communications of the Association for Information Systems, 37*(1), 112–137

Todoran, I., Seyff, N., & Glinz, M. (2013). How Cloud Providers Elicit Consumer Requirements: An Exploratory Study of Nineteen Companies. In *Proceedings of the 21st IEEE International Requirements Engineering Conference (RE 2013)*.

Tuunanen, T., Myers, M. D., & Cassab, H. (2010). A Conceptual Framework for Consumer Information Systems Development. *Pacific Asia Journal of the Association for Information Systems*, *2*(1), 47–66.

van de Wijngaert, L., & Bouwman, H. (2009). Would you share? Predicting the potential use of a new technology. *Telematics and Informatics*, *26*(1), 85–102.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly, 27*(3), 425–478.

Venkatesh, V., Chan, F. K., & Thong, J. Y. (2012). Designing e-government services: Key service attributes and citizens' preference structures. *Journal of Operations Management*, *30*(1–2), 116–133.

vom Brocke, J., Simons, A., Riemer, K., Niehaves, B., Plattfaut, R., & Cleven, A. (2015). Standing on the shoulders of giants: Challenges and recommendations of literature search in information systems research. *Communications of the Association for Information Systems*, *37*(9), 205–224.

Webster, J., & Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, *26*(2), 13–23.

Weinreich, H., & Schön, C. (2013). Customer Preferences for Service Process Automation and Implications for Optimal Service Design – A Case Study from the Unified Communications Market in Germany. In *Proceedings of Wirtschaftsinformatik 2013*.

Wessels, N., Gerlach, J., & Wagner, A. (2019). To Sell or not to Sell–Antecedents of Individuals' Willingness-to-Sell Personal Information on Data-Selling Platforms. In *Proceedings of the 40th International Conference on Information Systems (ICIS 2019),* Munich, Germany.

Yusuf Dauda, S., & Lee, J. (2015). Technology adoption: A conjoint analysis of consumers′ preference on future online banking services. *Information Systems*, *53*, 1–15.

Zibuschka, J., Nofer, M., Zimmermann, C., & Hinz, O. (2019). Users' preferences concerning privacy properties of assistant systems on the internet of things. In *Proceedings of the 25th Americas Conference on Information Systems (AMCIS 2019),* Cancún, México.

Zubey, M. L., Wagner, W., & Otto, J. R. (2002). A conjoint analysis of voice over IP attributes. *Internet Research*, *12*(1), 7–15.

Appendix

Table 6. Overview of CA Studies in IS

Study	*Study Objectives (as stated by authors)*	*Domain*	*Purpose*	*Type*	*Sample*	*Subjects*
(Bajaj, 2000)	Identify the factors that senior IS managers across mid- to large-size organizations would consider when making decisions regarding the adoption of a new architecture for their organization	ES	DM	TCA	23	Managers
(Brinton Anderson et al., 2002)	Study the relative values of these factors in the decision models of senior IS managers, when evaluating software for use by their organization	ES	DM	TCA	24	Managers
(Zubey et al., 2002)	Suggest those VoIP technology attributes that best meet users' needs	MC	D	TCA	254	Customers
(Odekerken-Schröder & Wetzels, 2003)	Examine the trade-offs end-consumers are willing to make when making online purchases (1) in terms of choice-related attributes and (2) in terms of convenience-related attributes	O	D	TCA	(1) 323 (2) 282	Customers
(Baek et al., 2004)	Examining customers' WTP (willingness-to-pay) for online games	O	P	TCA	179	Customers
(Brodt & Heitmann, 2004)	Drills down to the importance of service attributes (mobile multicasting)	MC	D	ACA	103	Students
(Keen et al., 2004)	Investigate the structure for consumer preferences to make product purchases through three available retail formats—store, catalog, and the Internet	EC	D	TCA	290	Customers
(Kim, 2005)	Build descriptions of hypothetical mobile service packages	MC	D	CBCA	1000	Customers
(Mahindra & Whitworth, 2005)	A conjoint analysis of the contribution of these factors in a proposed corporate software purchase of browser	O	DM	TCA	28	Students
(Mueller-Lankenau & Wehmeyer, 2005)	Gathering first insights into consumers' preferences for mobile couponing	MC	D	TCA	125	Students
(Schaupp & Bélanger, 2005)	Examining the role of several technology, shopping, and product factors on online customer satisfaction	EC	A	TCA	188	Students
(Haaker, Vos, & Bouwman, 2006)	Assess which combination of services and price is the most attractive for users	MC	P	TCA	156	Customers
(Keil & Tiwana, 2006)	First empirical investigation of the relative importance that managers ascribe to various factors that are believed to be important in evaluating packaged software	ES	DM	TCA	126	Managers
(Hann et al., 2007, 2002)	Estimate the individual's utility for the means to mitigate privacy concerns	O	D	TCA	268	Students
(Tiwana & Bush, 2007)	Examine the relative importance that IT managers ascribe to various factors from three complementary theories−transaction cost economics, agency theory, and knowledge-based theory−as they simultaneously consider them in their project outsourcing decisions.	ES	DM	TCA	(1) 55 (2) 33	Managers

(Mann et al., 2008)	How consumer utility and willingness-to-pay within one specific channel may be correlated with time of availability	O	P	ACA	489	Customers
(Bouwman & van de Wijngaert, 2009; Bouwman et al., 2008)	What are the relevant context-related, individual and technological characteristics that play a role in the use of mobile technologies by police officers, and where do they conflict with the requirements identified by police stakeholders?	MC	D	TCA	23	Stakeholders
			A	TCA	106	Customers
(Krasnova et al., 2009)	First attempt to assess the value of privacy in monetary terms (in the context of social networks)	O	D	ACA	168	Students
(Schwarz, Jayatilaka, Hirschheim, & Goles, 2009)	Provide theoretical rationalizations on the confluence of pertinent attributes when selecting an external source for an application service	ES	DM	TCA	84	Managers
(Song et al., 2009)	Estimate customer preferences and the relative importance of service factors	MC	D	TCA	-	Students
(van de Wijngaert & Bouwman, 2009)	Obtain insight into the factors that influence the use of wireless grid applications before a given technology is actually introduced on the market	MC	A	TCA	257	Students
(Doerr et al., 2010)	Examines from a customer perspective, the importance of the different features of premium offers	C	P	ACA	132	Customers
(Head & Ziolkowski, 2010)	Provides insights into how students value various mobile phone applications and tools	MC	A	ACA	188	Students
(Ho, See-to, & Xu, 2010)	Find out the level of trade-offs between monetary rewards provided by the E-payment Gateways and the buyers' protection excess imposed by the E-payment Gatewas	EC	D	TCA	1795	Customers
(Koehler et al., 2010)	Analyze the customer preferences for Cloud services	C	P	CBCA	60	Customers
(Lilienthal, Messerschmidt, & Skiera, 2010)	Compare the overall technology perceptions with particular attributes of product realisations with respect to their importance.	C	A	CBCA	412	Customers
(Ying-Hueih Chen, Hsu, & Lin, 2010; Ying-Hueih Chen, Tsao, Lin, & Hsu, 2008)	Understand what factors influence consumer purchase intention and the relative importance among these factors	EC	A	TCA	1567	Students
(Benlian & Hess, 2010, 2011)	The first empirical investigation to compare the relative importance of evaluation criteria in proprietary and open-source EAS selection	ES	DM	ACA	358	Managers
(Fagerstrøm & Ghinea, 2011)	Expand our understanding of approach/avoidance behavior by examining the motivating impact of price relative to online recommendation at the point of online purchase	EC	A	TCA	270	Customers
(Fritz et al., 2011)	Empirically estimate consumers reaction to the offer of fair use flat rates	MC	P	CBCA	263	Students
(Giessmann & Stanoevska, 2012)	Empirical investigation on the essential and necessary characteristics of PaaS from the perspective of third-party developers	C	D	ACBCA	103	Customers
(Hu et al., 2012)	Provide fuller conceptualization of technology design and advance our understanding of the impacts of essential design factors individually and jointly	MC	D	CBCA	105	Students

(Nevo, Benbasat, & Wand, 2012)	Understand the relative importance of meta-memory in the transactive memory processes in order to fit the best technology support for each process	ES	D	TCA	180	Customers
(Venkatesh, Chan, & Thong, 2012)	Examine key service attributes that affect citizens' pre-use intentions and subsequent use of transactional e-government services, as well as citizens' preferences across service attributes	O	A	TCA	2465	Customers
(Choi et al., 2013)	Assumes a consumer utility function for tablet pcs that reflects the variety of consumer preference	MC	D	CBCA	389	Customers
(Luo, Warkentin, & Li, 2013)	Identify a hierarchy of importance with regard to the critical factors influencing the adoption of mobile office	MC	A	CBCA	101	Customers
(Weinreich & Schön, 2013)	Analyze customer preferences for automation of service processes in the Unified Communications (UC) industry and derive managerial implications for optimal service design	ES	D	TCA	34	Customers
(Constantinescu et al., 2014)	Understand the user's perspective on tethering and motivations for sharing	MC	A	TCA	74	Customers
(Daas et al., 2014)	Determine the reservation prices of the services and to assess what price-bundle combinations are most attractive	C	P	TCA	47	Customers
(Klein & Jakopin, 2014)	Examines users perception of the utility of mobile service bundles	MC	D & P	TCA	116	Customers
(Lee & Rhim, 2014)	Investigate user preferences for the information systems in order to achieve user satisfaction	ES	A	TCA	55	Customers
(Nikou et al., 2014, 2012)	Determine the most important characteristics of the mobile platforms	MC	A	TCA	166	Customers
(Rosnagel, Zibuschka, Hinz, & Muntermann, 2014)	Measure the impact of various aspects of the design of FIM solutions on users' WTP	O	D & P	CBCA	249	Customers
(Berger et al., 2015)	Explore differences in consumer preferences and WTP between offline and online formats	O	D & P	CBCA	506	Customers
(Böhm, Adam, & Farrell, 2015)	Identify the relative importance of the mobile OS on the purchase decision	MC	A	CBCA	102	Customers
(Burda & Teuteberg, 2015, 2014)	Uncovering the preference structure and trade-offs that users make in their choice of storage services when employed for the purpose of archiving	C	A	CBCA	340	Students
(Derikx et al., 2015)	Studies if and how privacy concerns for connected car services can be compensated financially	IoT	D	CBCA	55	Customers
(Pu & Grossklags, 2015)	Quantify the monetary value people place on their friends' personal information in a social app adoption scenario	O	D	TCA	201	Customers
(Siegfried, Koch, & Benlian, 2015)	Provides a nuanced analysis of platform and environment signals that drive app installation and also contributes towards a better understanding of the underlying decision	MC	A	TCA	121	Customers

	process					
(Tamimi & Sebastianelli, 2015)	Estimate the effects of selected e-tailer and product related attributes on a consumer's likelihood of making a particular online purchase	EC	A	TCA	122	Students
(Yusuf Dauda & Lee, 2015)	Analyze the technology adoption pattern regarding consumers' preference for potential future online banking services in the Nigerian banking industry	O	A	CBCA	1291	Customers
(Cwiakowski, Giergiczny, & Krawczyk, 2016)	Measure willingness-to-pay (WTP) for legal rather than illegal content as it compares to valuation of other features of the product	O	P	CBCA	228	Customers
(Mikusz & Herter, 2016)	Investigate how consumers evaluate value propositions of connected car services with a high option and/or indirect value-in-context	IoT	D	TCA	70	Customers
(See-To & Ho, 2016)	Investigate the impacts of six design attributes of an E-payment service	O	D	TCA	1795	Customers
(Abramova et al., 2017)	Differentiate among distinct influences produced by discrete trust-enhancing cues and derive a monetary value for each of these cues as evaluated by consumers	O	D & P	CBCA	450	Customers
(Albani, Domigall, & Winter, 2017)	Understanding the customer value perceptions of smart meter services and the conditions under which customers are willing to change their behavior in order to increase the efficiency of the electricity use.	IoT	A	CBCA	1594	Customers
(Buck, Stadler, Suckau, & Eymann, 2017)	Targets users' preference structures when downloading apps	MC	A	CBCA	111	Students
(Fölting et al., 2017)	Measure consumers' preferences regarding product information search apps	MC	D	ACBCA	330	Students
(Mazurova, 2017)	Consider the level of influence of three different factors, brand, colour and the position of the product on the screen in the conditions of simultaneous perception by the customers	O	D	CBCA	60	Customers
(Mihale-Wilson et al., 2017)	Assessing the users' preferences and willingness to pay for a highly secure and privacy stringent UPA	IoT	D & P	CBCA	274	Customers
(Rollin, Steinmann, Schramm-Klein, Neus, & Nimmermann, 2017)	Investigate which attributes of a mobile gaming app have an impact on users' choice decision	MC	A	CBCA	503	Customers
(Mikusz, 2018)	Examine how customers concurrently consider several features of digitized, connected products in assessing usefulness and product intelligence	IoT	D	TCA	139	Customers
(Penttinen, Halme, Lyytinen, & Myllynen, 2018)	Understanding which features companies value in selecting among platforms	ES	DM	CBCA	282	Decision makers
(Baum, Meißner, Abramova, & Krasnova, 2019)	Explore the magnitude of user privacy concerns and preferences in the con-text of targeted political advertisement	O	D & P	CBCA	262	Customers

(Naous & Legner, 2019)	Explore users' preferences and willingness-to-pay for privacy preserving features in personal cloud storage	C	D & P	ACBCA	144	Customers
(Schomakers et al., 2019)	Trade-offs between decisive attributes that shape the decision to share data are analyzed	O	D	CBCA	126	Customers
(Wessels, Gerlach, & Wagner, 2019)	Investigate the antecedents of users' willingness-to-sell information on data-selling platforms and their relative importances	O	D	CBCA	250	Customers
(Zhou, Waltenrath, & Hinz, 2019)	We examine the role of refund policies for mobile app purchase decisions	MC	A	CBCA	52	Customers
(Zibuschka et al., 2019)	Explores users' privacy preferences for assistant systems on the Internet of Things and ultimately quantifies the willingness to pay for various privacy functions of such assistance system	IoT	D & P	CBCA	293	Customers

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