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CATCHWORD

# Robo-Advisory

## Digitalization and Automation of Financial Advisory

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## 1 Introduction

'Banking is necessary, Banks are not' is a famous quote from Microsoft founder Bill Gates, which characterizes the wide debate of the increasing digitalization of banking (Alt and Thomas 2016). The first wave of digitalization has changed many aspects of everyday life and existing business models have been challenged and partially replaced (Alt and Thomas 2016; Praeg et al. 2015). The second wave of digitalization has shifted the focus towards smart services based on algorithms and intelligent software to increase the degree of automation. Consequently, the interest of banks and insurances in digital financial advisory services (also referred to as "robo-advisory") is rising (Praeg et al. 2016, Jung et al. in press).

Robo-advisors are digital platforms comprising interactive and intelligent user assistance components (Maedche et al. 2016) that use information technology to guide customers through an automated (investment) advisory process (Sironi 2016; Ludden et al. 2015). In particular, robo-advisors differ from existing online investment platforms or online brokerage with respect to two different conceptual levels: customer assessment, and customer portfolio management. The term "Robo-advisor" is currently almost exclusively used in the context of financial investment advisory (hence the parentheses in the definition) where robo-advisory increasingly replaces the classic retail customer advisory process. However, the generic concept of robo-advisory could be transferred to other domains such as health care or the real estate industry. In this catchword, we focus on financial robo-advisory in accordance to the prevailing meaning of the term.

Considering the customer assessment, robo-advisors extend existing advisory solutions, because they aim to transform the complete traditional, human-to-human advisory process into a digital, human-to-computer process. Traditional investor profiling conducted during in-person interviews and bilateral interaction is replaced by online questionnaires and self-reporting processes. The customer's investment goals/purposes, risk affinity/aversion and return/risk expectations are quantified by algorithms and automated processes on digital platforms. The assessment is not limited to risk profiling but can also include ethical and sector specific preferences, for example, a preference for Islamic Banking. Hence, human interaction in robo-advisory is limited to situations which are not directly related to the assessment or investment process like IT-support or fraud management. Due to cost-savings by the automated customer profiling, and the management of the customer lifecycle, robo-advisors target the retail customer or non-professionals segment, regardless of the customer's actual wealth.

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In addition, the customer portfolio management of robo-advisors differs from existing approaches. Customer portfolio management is defined as the management of portfolios including one or more financial products, in accordance with mandates given by clients, on a discretionary client-by-client basis. Robo-advisory is predominantly based on products that require no or less active portfolio management like Exchange Traded Funds (ETFs). ETFs replicate indices and hence require no active decision making by portfolio managers regarding security selection and allocation. Cost structures are therefore often comparably simple and hence easier to communicate. The strategic asset allocation is based on the risk-profile of the customer and determined by a quantitative model. This combination of instrument and allocation selection can be fully automated and thus considerably reduce management costs. The provisioning of the whole service via an online platform additionally reduces personnel and asset costs while a higher number of customers can be served. The low complexity of these products makes them easier to explain to a wide range of customers, in addition to the portfolio management related advantages of ETFs.

With respect to customer portfolio management, robo-advisors can be further conceptualized into two distinct groups: active or passive regarding portfolio management, and dynamic or static regarding customer assessment. If the investment strategy and portfolio construction approach is determined after the initial adjustment to a customer's profile, we classify the approach as static robo-advisory. The robo-advisor only performs automated rebalancing if the portfolio composition deviates from optimum, for example, due to market developments. We further distinguish the rebalancing process. If the rebalancing is fully quantitative we classify it as passive, if the investor only receives rebalancing suggestions and decides self-directedly about actual execution we classify it as active.

In the case that the customer can adjust the overall strategy in a discretionary way at later points in time (e.g., change investment goals/volumes, reassess risk attitude), we classify the approach as dynamic robo-advisory. Furthermore, in contrast to previous digital services of online brokers or recommender systems, robo-advisors provide more sophisticated user interaction components (push notifications for market updates, opportunity/risk alerts, dashboards, periodic portfolio reviews) and automated execution while optionally allowing for self-directed, discretionary intervention by the customer (development of a financial plan, integration of external accounts, or comparison of fees). In summary, the level of automation is higher in comparison. Table 1 summarizes the previous conceptualization of robo-advisory.

Robo-advisory platforms target customers which cannot invest the amount of money traditional wealth managers expect as a minimum investment (Ludden et al. 2015). Moreover, as market leader platforms residing in the U.S. demonstrate, robo-advisors attract the targeted customers with increasing success: For instance, the start-up Wealthfront accumulated $1 billion assets under management in less than 2.5 years after its market entry (Vincent et al. 2015). The volume managed by robo-advisors is still growing and currently estimated to have exceeded $20 billion in globally investable assets (Vincent et al. 2015; Epperson et al. 2015). Optimistic forecasts predict that robo-advisors will manage 10 percent of the whole wealth management industry in 2020 (Kocianski 2016).

Given the contemporary digitalization of banking in combination with the interaction between provider and customer in the financial context, robo-advisors are a promising research area that deserves more attention in the information systems (IS) field. Robo-advisory is a young and nascent business model, and research focusing on understanding and designing robo-advisors is still scarce. Existing (design) knowledge on related systems within the IS domain could be adapted and extended for robo-advisors. For instance, the robo-advisor "Anlage-Finder" operated by Deutsche Bank failed on his first attempt due to legal problems and a sub-optimal user-experience (Dohms and Schreiber 2017). Hence, research on decision support, decision aids, product configurators, and recommender systems provide a valuable foundation that can support researchers and practitioners to better understand and design robo-advisors.

In this catchword, we introduce this interesting research topic by conceptualizing (financial) robo-advisory from the perspective of IS researchers. We discuss the current state of the art and outline possible research directions that seem very interesting, especially for the BISE community.

## 2 Digitalization of Financial Advisory

In the context of service digitalization, human face-to-face banking encounters have been complemented by online (discount) brokerage and digital banking services (Sironi 2016). In the 1970s, financial service providers targeted the U.S. middle class by introducing discount brokers. In the first step of the digitalization of wealth management, discount brokers provided financial intermediation services at significantly lower fees than the traditional advisors. The downside of this approach was the lack of personal financial advisory and a small range of available products. Because they buy and sell instruments at reduced commissions, the stock market became accessible to a new segment of customers.

Due to the rise of the World Wide Web in the 1990s, online trading and digital platforms became available to a

**Table 1** Key characteristics of robo-advisors

| |
|---|
| Customer assessment |
| Retail customers as target segment |
| The target segment is independent of actual wealth |
| No customer screening or pre-selection process |
| Public online platform, simple registration process |
| Automated customer profiling |
| Self-reporting to quantify an individual's profile |
| Questionnaires to measure the risk attitude |
| Preferences, goals, special interests |
| Customer Portfolio Management |
| Automated investment process |
| The whole investment process of robo-advisors is automated and requires no human activity for profiling/portfolio management |
| Asset allocation is based on quantitative optimization |
| Portfolio rebalancing: active (client interaction)/passive (quantitative only) |
| Assessment: Dynamic (adjustments by customer)/static (fixed after initial process) |
| Passive investment products |
| No actively managed financial products to reduce costs |
| Instruments with transparent cost structure |
| Common choice: ETFs, ETCs |

much broader community. The service providers offered platforms ranging from networks for affluent investors, retail investors managing their own portfolios to Social Trading platforms where investors interact as in social networks and exchange trades as well as investment advice. This way, new customer segments have been developed. The current levels of digitalization in the context of financial advisory are digital service platforms like robo-advisors. According to Sironi (2016), the main goal of a robo-advisor is to support customers by translating their specific needs into an adequate portfolio of financial products and to subsequently manage the portfolio automatically. Especially the advisory effort to manage customers with a higher need for customized advice can thus be reduced.

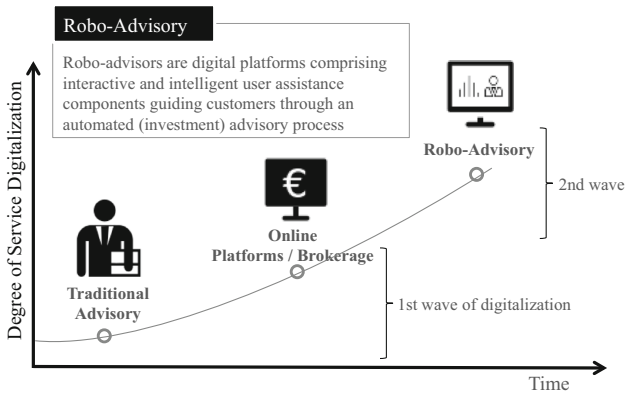


**Fig. 1** The digitalization of financial advisory services towards digital platform (based on Sironi 2016)

Nowadays (see Fig. 1), bank account management and other banking services are offered fully digitalized. However, digitalized advisory services-especially if they are not provided by incumbent banks-still struggle for acceptance by retails customers despite their substantial cost-saving benefits. Customers prefer hybrid solutions, allowing them to search for information and compare available products online, but still request human advisory before committing to an investment. Considering the bank and robo-advisor perspective, a combination of these services provides the opportunity to target the mass of less-wealthy customers, but also to generate additional revenue through separate fees (e.g., advisory in a branch is for free, but in robo-advisory phone support or additional features for security or access can be charged in relation to the caused effort). Furthermore, the robo-advisory business model is easily scalable, rendering the service an interesting business model from the service provider's perspective.

Traditional human advisory services are structured in four (Cocca 2016) to six major phases (Nueesch et al. 2016, 2014), there exists no established advisory process for digital service systems like robo-advisory. Different aspects of robo-advisory have been discussed in the literature (Kilic et al. 2015; Nussbaumer and Matter 2011; Nussbaumer et al. 2012b), which can be synthesized into the following three-phase approach. Based on Kilic et al. (2015) and Nussbaumer et al. (2012a), we suggest to condense the human advisory process to the following three phases of robo-advisory: Configuration, Matching and Customization, Maintenance.

In the first phase, the configuration phase, the information asymmetry between customer and advisor is reduced (Kilic et al. 2015). This phase corresponds to the initiation, profiling, and concept and assessment phases of human advisory. In the next phase, the matching and customization phase, the gathered information is transformed into an investment recommendation. Customers receive, with the help of appropriate algorithms, recommendations that fit their needs best. The customers then decide to which of these offers they want to commit to. If no recommendations meet their perceived needs, customers can reconfigure their profiles to receive alternative investment recommendations. Compared to other product configuration tools (like car configuration or clothing configuration), the characteristics of financial products can change unexpectedly (e.g., value or risk). Hence, during the Maintenance phase, the difference between the actual needs and the recommendation needs to be revised regularly, and reconfigurations of the product (rebalancing) need to be

initiated in case of a substantial deviation due to economic developments or the changes of customer needs. Figure 2 depicts the process of a robo-advisor.

With respect to the last phase, the existing robo-advisors differ in the way they allow to reconfigure or specify the portfolio. In general, they are classified into two groups: The first group allows the customers to adjust the portfolio suggested by the robo-advisor in detail to address particular needs and requirements. The second group of robo-advisors does not permit to adjust the portfolio in such an individual manner. Instead, they choose from a set of assets only considering the measured preferences in the configuration step. Put differently, the robo-advisor invests in a set of pre-defined investment products and fits the customer into one of the products.

## 3 State-of-the-Art of Robo-Advisory Research

Few researchers in IS and Finance have addressed robo-advisory so far. Thus, there is a huge opportunity for the IS community to investigate this contemporary and important topic. Before discussing the research opportunities in more detail, we briefly review a selection of the existing research on robo-advisory.

Previous research mostly focuses on the design of portable or mobile financial advisory: Nussbaumer and Kilic (Kilic et al. 2015; Nussbaumer and Matter 2011; Nussbaumer et al. 2012b) provide design knowledge for establishing a required level of transparency in a dynamic advisory context. They identify transparency as a key requirement of robo-advisors (at least in the first phases). Kilic et al. (2015) examine how process rigidity during the information collection phase affects the relationship between the customer and the advisor. Nussbaumer et al. (2012a) investigate transparency issues in context of it supported financial encounters, which are of relevance in the first two phases of the robo-advisor process (see Fig. 2). The study shows that 'process', 'information' and particularly 'cost transparency' are relevant design factors for an IT artefact, and that a highly transparent design leads to improvements in customer satisfaction and willingness to pay.

Based on previous research, Ruf et al. (2016) derive design principles for a prototypical mobile advisory application, with a focus on the three main design requirements 'quality of the service', 'trust building' and 'balancing of information asymmetries'. The evaluation of the designed artefact is carried out in focus groups with experts and shows that the investigated principles have mainly positive influence on the service quality (Ruf et al. 2016).

Other work from Nueesch et al. examines how the human advisory process can be complemented with mobile services like tablet-supported advisory (Nueesch et al. 2014, 2016). Ruf et al. (2016) identify customer-based design requirements for digitalized advisory services, and validate them in the context of an iPad-application. Their findings suggest that especially quality, trust, and information asymmetries are key factors in the design of robo-advisory. In another study in the context of mobile advisory, the same authors identify the key factors of proactivity of the advisor service, social presence, access to experts, and privacy concerns (Ruf et al. 2015). Taken together, their findings indicate that intuitive and trustful communication with the advisor is at least as important as the offered investment recommendations. Table 2 summarizes a sample of existing research on robo-advisory.

## 4 Research Opportunities

Considering the existing research, we summarize that there is a basic understanding of robo-advisory usage, outcomes, and initial design knowledge available. However, we argue that there are plenty of opportunities for research addressing both the design of robo-advisory and the behavioral outcome of robo-advisory usage. To address the proposed opportunities, researchers can draw on existing knowledge from other application domains. Within the IS domain, there is plenty of knowledge available addressing related concepts such as decision guidance and explanatory theory regarding decision support systems (for an overview see Morana et al. 2017). Furthermore, research addressing the adoption of and trust in recommendations (Benbasat and Wang 2005; Wang and Benbasat 2009) also promises to be a good starting point for understanding human behavior on robo-advisory platforms. We propose that researchers can use, apply, and adapt as well as extend existing (design) knowledge to investigate the design and the behavioral perspectives of robo-advisory. Despite the opportunity to draw on existing knowledge, we argue that there is research required to take into the account the unique characteristics of the financial advisory process (Schwabe and Nussbaumer 2009; Nussbaumer et al. 2012b), especially in its digitalized form. Moreover, researchers should consider the customer and provider perspective as well as their co-creation of value from the financial services (Peters et al. 2016). Against the backdrop of our previous considerations, we propose the following areas of research opportunities:

- Service and user interface design: Research addressing the design of robo-advisor from a customer as well as a provider perspective. For example, the design of

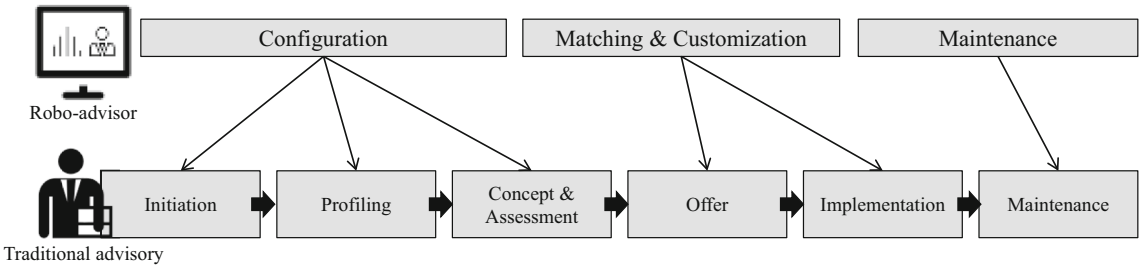


**Fig. 2** Iterative process of robo-advisory

interactions between the customer and the robo-advisor, the storage and implementation of the financial knowledge for advisory, and the implementation of the three phases of financial robo-advisory. In particular, research on the interaction between the customers (ratings, reviews, comments, C2C recommendations, etc.) of a robo-advisor or, more generally, the digitalized financial service from a service science perspective focusing on the financial value co-creation.

- Customer Behavior: Investigation of behavioral outcome with a lense on the customer. That is the customers' acceptance, adoption and trust into the provided financial advice. In particularly, there is a need to investigate the effect of different design features on customer acceptance and behavior.
- Risk measurement and modelling: Research targeting the financial and informal modelling of the customers' needs with regard to automated investment decisions. The next generation of robo-advisors could capture more customer data and situational information; Recent robo-advisors often use over-simplified preference measurement approaches (Tertilt and Scholz 2017). Lastly, the formal modelling of investment decisions and risk profiles based on the algorithms of the robo-advisors is also relevant topic.

## 5 Conclusion and Outlook

Digitalization affects most industries, including the financial services sector. In this particular context, it transforms the human financial advisory process into digital solutions commonly referred to as robo-advisory. In this catchword, we introduce the topic robo-advisory, provide a delineation to traditional financial advisory and highlight opportunities for the BISE community.

The automation and digitalization of investment and financial advisory is an ongoing process that unfolded alongside the rise of the World Wide Web. What distinguishes robo-advisory platforms is that they expand financial service offerings to the currently underdeveloped segment of retail customers. The current generation of robo-advisors provide cost minimal solutions and simplistic wealth management (Sironi 2016). The next generation of robo-advisors could establish more elaborate solutions to model the customers' preferences take behavioral peculiarities into account and enable higher customization of investment portfolios while keeping the process fully automated. Nevertheless, the success of robo-advisors indicates the need for digitalized financial services that are easy to use and do not discriminate customers based on their financial resources. Robo-advisory provides a novel way to assist users in their financial decision making processes, and transform existing person-to-person services into digital service platforms. Consequently, we are convinced that robo-advisory is an important research topic

**Table 2** Overview of the key concepts addressed by existing robo-advisory IS research

| Research focus | Key concepts | Sources (sorted by year) |
|---|---|---|
| Behavior | Understanding the robo-advisory process: How do robo-advisors evaluate the preferences of private investors, and how does financial advisory benefit from robo-advisor support? | Tertilt and Scholz (2017), Nueesch et al. (2014, 2016), Ruf et al. (2015), Musto et al. (2015a), (b), Lopez et al. (2015), Moewes et al. (2011), Schwabe and Nussbaumer (2009) |
| Interface design | Understanding the robo-advisor as an interface to new investors: Which are the relevant requirements considering both provider and customer perspective in the design of robo-advisors? | Ruf et al. (2016), Kilic et al. (2015), Nussbaumer et al. (2012b), Nussbaumer and Matter (2011), Schwabe and Nussbaumer (2009) |

providing a plethora of opportunities and are looking forward to contributing to the knowledge on this interesting type of digital platform.

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