

Communication and Household Adoption of Heating Products in Hungary

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Abstract: Existing studies of heating products have analyzed the adoption of energy-efficient heating technologies from diverse micro and macroeconomic aspects, such as diffusion of innovation, willingness to pay, business models, energy pricing, etc., but the analysis from a marketing management approach based on end customer insight is still lacking. Understanding the decision-making process of end customers, and the influence of social environment at the diverse stages of the purchase process leads to a focused market strategy, thereby contributes toward overcoming the multi-level segmentation challenge faced by the manufacturers of heating products. In this context, a two-step exploratory research was conducted in December 2013 with end customers of the residential heat market in Hungary. The end customers were found to be active decision-makers engaged in deliberate planning in the purchase of heating products. They start searching for information by turning mainly to online information sources and they actively integrate their social network in all stages of the decision-making process, which means that the role of the installer is relatively less influential along the whole purchasing process. Identified influencing communication channels at the diverse stages of the purchase process may support manufacturers to develop a user-centric marketing strategy by optimizing the communication instruments in their marketing mix by, for instance, including direct end customer communication via online channels and by de-emphasizing offline communication channels.

Keywords: end customers; adoption; diffusion; purchase process; social environment; installers

1. Introduction

The market environment of space heating appliances (hereafter heat market) is complex due to the varying customer segments and their needs. “The heat market refers to the part of the heating, ventilation, and air conditioning (HVAC) market, where manufacturers produce and sell heating technology to customers to ensure indoor temperature and warm water comfort. This paper refers to the residential heat market, where heating products (heat generator appliances or boilers) are sold to single-family households. In this study, all types of heat generating appliances are considered, regardless of fuel type and energy sources.” [1]. The varying purchase behavior of the end customers; the influence of installers and other professionals; the interest of manufacturers and trade partners; and diverse governmental, political, and legal measures regarding energy efficiency lead to a heterogeneous market operation. Due to the technical complexities of the heating products and the compulsory governmental regulations, installers and other professionals (e.g., retailers, planners, architects, energy consultants, etc.) play an intermediary role in the end customers’ purchase process. Consequently, heating manufacturers might typically address installers as a prime target group in their marketing strategies.

However, the heat market faces some challenges, which affect the marketing strategies of manufacturers. In the one hand, there is a skewed relation between installers and end customers, meaning that the recommendations of the installers do not always correspond to the requirement of the end customers [2]. The internal motivation of the installers (e.g., personal brand preferences due to associated incentives, lack of knowledge or perceived uncertainty with certain new technologies, etc.) may “mislead” the end customers with referrals that may not maximize the users’ utility [2]. If the end customers’ perception is that such behaviors of the installers exists, then that would affect the marketing of heating products through installers.

On the other hand, end customers do not consult with professionals in stores, but rather are searching the Internet to learn about the products and engage in social interactions with family, friends or other customers to assist in their purchase decisions [3]. Since the digital medium platforms offer a platform to share and exchange information around the world through online channels, such as blogs, social networks, etc., customers show a so-called social search behavior regarding decision-making, which is the “process of finding information online with the assistance of social resources” (e.g., friends, unknown persons) [4,5]. This means that end customers are willing to be more engaged in the information search and decision-making process by turning to online information sources along their purchase process.

The changing environment of the heat market leads to the consequence that the traditional market strategy of manufacturers (indirectly reaching out to end customers via focusing the installers and/or any other professionals) is facing a multi-level customer segmentation challenge [6]. Manufacturers may have to rethink the intermediary role of installers by directing their focus to the end customers in their sales and marketing strategic decisions. For this, there is a need for a better understanding of the decision-making process of the end-customers and how they are influenced by the surrounding environment.

There exist several theories on decision-making (see Section 2 on literature review) and they have been applied differently to understand the adoption process of specific energy-efficient heating technologies, such as micropower systems [6], wood-pellet systems [7–11], solar energy systems [11–26], and district heating [27], etc. However, only a minimal set of researchers studied the end customers’ decision-making process and only a few dealt with the influence of communication channels on various stages. However, there are diverging results regarding the influencing role of the communication channels and there is a lack of studies on the relative importance of different channels in different stages of the end customers’ purchase process. Furthermore, often communication channels are grouped together to online, offline, mass media, or interpersonal sources, which is not helpful for the manufacturers to utilize specific channels for marketing purpose. Moreover, the factors influencing the adoption decision may vary from country to country due to cultural, political, and societal conditions. Therefore, country-specific studies are needed, which is lacking in the case of Hungary.

Hence, the purpose of this paper is to better understand the end customers’ purchase process of heating products and the influence of communication channels, such as the social environment and installers, on the different stages of the purchase process. For this, we conducted a two-step exploratory empirical research, where data was collected through interviews and a questionnaire survey of homeowners in Hungary. The goal of the exploratory research is to have a deeper understanding of the customer behavior, find alternatives of decision-making and to possibly reveal new dimensions. This research method is typically used if there is less secondary information available to the research topic [28].

2. Literature Overview

The adoption process and the acceptance of energy efficient and innovative (heating) technologies has become a widely researched area. Existing research has identified a variety of factors fostering and/or hindering the adoption process and identified variables influencing environmentally significant decision-making [29]. Diffusion of innovation and technology acceptance [6–9,12,14,30–32], willingness to pay, spending motivation, and new business models, such as contracting and

leasing [11,15–17,33–39], diverse household preferences on renovation [33,40], sociodemographic factors [29,35,40], barriers of adoption [12,35,41], etc., are only some examples of the existing approaches. Furthermore, there are several theories or models relating to decision-making and energy use in dwellings. They include theories of utility maximization, diffusion of innovation theory, theory of planned behavior, value-belief-norm theory (see [42] for a review of various relevant theories), and practice theory [43].

Wilson and Dowlatabadi (2007) [42] suggested the categorization of decision-making models based on diverse perspectives. The utility-based decision models and behavioral economics deal with microeconomic theories of customer choice using the assumption that customers seek to maximize utility with given budget constraints that leads to the decision. Decision models in social and environmental psychology investigated the influence of personal values, beliefs, norms, and the incentives of external information on a particular action. Models of social construction in decision-making question the “individuality” of the decisions and argue for its “constructed” characteristic or where actions like to be determined by social systems. Finally, the technology adoption and attitude-based models investigated the diffusion of new heating technologies in which technological attributes and social networks played an influencing role. These models, based on the diffusion of innovation model of Rogers [44], seek to answer why and how innovations are adopted by the society, and how communication channels influence the adoption and diffusion process. These models agree that the adoption process starts with knowledge and understanding, based on prior conditions (e.g., perceived needs), and moves toward a behavior change (implementation). According to these models, confirmation plays an important feedback role through social communication, influencing prior conditions.

The technology adoption models treat the adoption process as a sequence of decision-making stages, which we intend to apply to better understand the influencing role of installers and the social environment on the end customers’ purchase of heating products. Hence, in Table 1 we summarize the decision-making stages, the underlying motivation for purchase, and the consulted information sources identified by former technology adoption models. It can be concluded that there is an agreed upon decision-making model for the purchase of heating products. Former studies considered the information search as one single stage of the adoption process, and did not assume if adopters may have consulted different information sources at the diverse stages of the adoption process. Regarding the underlying motivation behind the purchase, former studies found the influencing role of prior experience, technical parameters, and financial aspects to be most important.

Table 1. Identified influencing factors with the adoption of diverse energy efficient technologies including heating products: PV: photovoltaic.

Category	Variables	Impact on Decision-Making Process of Heating Products
Decision-making process and its stages	Faiers and Neame [12] investigated the PV systems considering five stages of adoption: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation, based on the model of Rogers (2003) [44]. Mahapatra and Gustavsson (2008) [45] used a different type of five stages from problem recognition to the selection stage to analyze the adoption of innovative heating technologies, while Kaezing and Wüstenhagen [6] differentiated six stages including the use and post purchase stages in the analysis of micropower systems.	
Communication channels, credible information sources	Information search and its costs	<ul style="list-style-type: none"> - End customers have limited knowledge on their annual energy costs [6] - Lack of information hindering adoption process [7] - Mass media communication sources are most important, e.g., TV, radio [46] - Adopters accrue information search costs to overcome barriers [20,47]
	Role of interpersonal communication	- Interpersonal communication channels as most important channel for information [6,13,19–25,32,35,36,41,45,48–50]
	Role of the professional	- Role of the installer as the most important channel for information [6,21,26,36,45,51,52]
Underlying motivation of the purchase	Previous experience	<ul style="list-style-type: none"> - Dissatisfaction of earlier adopters hindering adoption [7] - Positive post-purchase experience have a high influence on next buying decision [6] - Satisfaction with existing system hinder the adoption of new technology [41] - Experience of other users influence adaption process [49]; positive own experience influence continuous usage of the biomass technology [18]
	Fuel type and energy costs	<ul style="list-style-type: none"> - Economic aspects foster adoption [41,45] - Financial and economic characteristics hindering adoption [12] - Energy conservation measures are less cost-effective than a new heating system [53] - Higher fuel costs means the lack of flexibility, hindering adoption [49] - Heat pump runs on lower costs than boilers if coefficient of performance (COP) is above 3 [54]
	Investment costs	- Higher investment costs (compared to conventional products) are barriers of adoption [6,10,51,53,55,56]
	Lifecycle	- High annual operating costs barriers of adoption [7,10,41,51,55,56]
	Environmental factors	<ul style="list-style-type: none"> - Lower importance in adoption [41] - Willingness to take action for environmental considerations [33,34,53] - Heat pumps have less environmental impact than boilers if COP is above 3 [54]
	Availability of grants	<ul style="list-style-type: none"> - Government investment subsidy foster exchange of resistance heaters but not oil boilers [45] - Financial programs (grants) support retrofit [10,32,33,51,57]

The review of the technology adoption models specifically regarding the role of social environment and the influence of communication channels is summarized in Table 2. Earlier studies emphasized the role of mass media channels, while the later ones consider the influencing role of the Internet and social interactions. Many studies found that the role of the installer is important [45,57], while other findings indicate a diminishing role of the installers due to the emerging role of the Internet [36,58]. Some studies emphasized the importance of social interactions (peer effects) as they might result in social spillovers [23] as potential adopters of new technologies seek to reduce uncertainties by taking advantage of information from existing owners [20]. For example, Graziano and Gillingham [22] found a strong relationship between adoption of solar photovoltaic (PV) systems and the number of systems already installed in the neighborhood.

The diverging results of previous studies make it difficult to draw general conclusions regarding the influencing role of the communication channels, especially at the different stages of the end customers' purchase process. The relative frequency at which different channels are consulted and their relative importance may vary depending on the stage of the purchase process where end customers are located in. This is as a potential research area and the main objective of our paper.

Table 2. The influencing role of social environment and trusted information sources. WOM: word of mouth.

Year	Research	Product	Trusted information sources	Customer search behavior
1984	Curtis et al. [46]	Energy efficiency refurbishment measures incl. heating	Mass media (TV, newspaper, radio, magazines, government subsidies)	Due to the fact that in 1984, the Internet as an information source did not exist, the role of professionals and experts were still unremarkable; mass media was the most credible source of information.
1985	Stern [52]	Energy efficiency refurbishment measures incl. heating	Social interactions (family, friends, colleagues)	The opinion and experience of family members, friends and colleagues affect customers rather than experts. Customers are not seeking information actively, only when the decision for a new system is made.
1994	Brezet [59] cited in Dieperink et al. (2004) [60]	Energy saving innovations	Installer	Customers who actively searched for information were willing to adopt innovative heating solutions, while customers that relied on the installer opted for conventional solutions.
2007	Keirstead [26]	PV systems	Installer	Installer as a central person in the purchase and installation of PVs.
2008	Kaezing and Wüstenhagen [6]	Eco-innovations	Organizations (information centers, municipal utilities)	Public organizations are the most credible sources of information, rather than searching for information on one's own.
2008	Mahapatra and Gustavsson [45]	Innovative heating systems	Installer, interpersonal communication, magazines, Internet	Installers are found to be the most influencing actor in the information search of households. Family, friends, and neighbors stand in second place, Internet in the fourth place. Potential adopters start searching for information actively.
2010	Wallace et al. [31]	Energy efficiency refurbishment measures incl. heating	Direct marketing, color booklets, Internet consisting of basic websites and interactive websites	Respondents found that color booklets distributed through direct marketing channels the most credible information source to understand energy efficiency refurbishment,

				followed by the Internet and telephone hotlines.
2012	Rai and Sigrin [17]	Diffusion of solar PV panels	Social interactions, peer effect (WOM)	The visibility of the solar panels and WOM leads to social interactions thereby to further adoptions.
2013	Rai and Robinson [20]	Residential PV market	Social interactions, peer-to-peer effects	Passive influence of adoption is by witnessing PV systems in the neighborhood, which increases confidence and motivation. Active influence by peer-to-peer communication.
2013	Harris [36]	Heating systems	Installer, friends, internet, yellow pages	The American baseline study in 2012 found the installers as the most relevant information factor, the follow-up survey in 2013 showed the increasing role of the Internet and the decreasing role of the installer and friends.
2013	Turpin [58]	Heating products	Internet and social media	Innovative customer who is gathering information actively through Internet and WOM.
2013	Richter [61]	Solar PV systems	Peer effects	Identified statistically significant neighbor effect of PV adoption at the postcode district level.
2013	Müller and Rode [62]	Solar PV systems	Peer effects	They found a relationship between former adoptions in the neighborhood diminishes with distance.
2014	Graziano and Gillingham [22]	Solar PV systems	Peer effect	Spatial neighbor effect conveyed through social interactions and visibility.
2016	Graziano et al. [63]	Solar PV systems	Spatial peer effects	They found an indirect impact of the built environment on the diffusion of PV systems, as the built environment limits the spatial peer effect.
2016	Snape [64]	Adoption of PV	Peer effect	Peers' adoption and the perceived social norm about ownership influences PV adoption.

3. Theoretical Framework

The purchase process is just one aspect of the customer's journey, in which end customers act based on diverse influencing factors from their social environment. Rogers [44] proposed an adoption–decision model where prior conditions, such as dissatisfaction with existing product, previous practices, culture and norms, trigger customer (passive) exposure to probable solutions (knowledge stage) to fulfill a perceived need. End customers actively search for information, compare the advantages/disadvantages of alternative solutions (persuasion stage) to make a decision, and then implement and confirm the decision. Earlier adopters are more likely to be influenced by mass media, while interpersonal communication channels influence late adopters [28,44].

Engel et al. [65] explained that the customer decision-making process consists of: (1) problem recognition, (2) information search, (3) evaluation of alternatives, (4) purchase decision, and (5) post-purchase evaluation. The Engel-model considers that the decision-making process is influenced by:

- (1) the stimuli from stored memory from prior experiences or external searches, which is similar to Rogers' [44] notion of past practices and active search of information;

- (2) the stimuli from the environment (e.g., culture, social class, family, etc.) or the individual differences (e.g., knowledge, attitude, personality, etc.), which are similar to Rogers' [44] notion of interpersonal communication and the different types of potential adopters, respectively.

Combining these most established models, we propose a schematic model (Figure 1) to analyze the process of purchasing heating products by focusing on the end customers, on their underlying needs and motivation, and the influencing role of their social environment. The purchase decision model consists of six stages that are influenced by various communication channels.

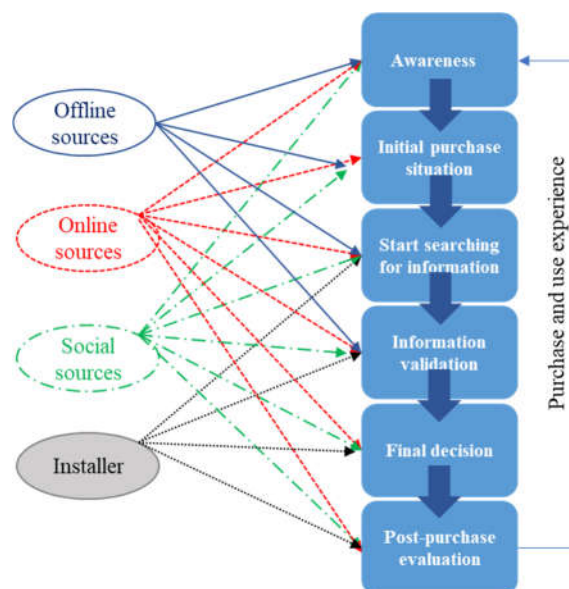


Figure 1. Proposed model of the purchase process of heating products and the influencing role of the social environment.

In the *awareness* stage, customers are open to learn about different heating products (e.g., new technical solutions, reliability, costs, etc.) from the surrounding environment. An eventually future need to replace the existing old heating system (even if there is no breakdown yet) and to learn about various attributes of a new product and uncertainties associated with the purchase may make the customers open to information from the surrounding environment. They can reach out to a variety of online platforms (blogs, forums, social networks, etc.) to share experiences of products and to interact with other customers. There are offline sources, such as TV and radio advertisements, magazines, etc., that shape the customers' openness to learn about heating products. The influence can also be sourced from the customers' social interactions, through common knowledge or word-of-mouth [36,66–68] and can be formed by internal influencers such as childhood memories (e.g., a wood burning stove reminds the customers their childhood). Common knowledge in our understanding is general information, mainly facts or data on a certain topic, widely known by nearly everyone. People share this information and talk about it in online and offline communities.

Initial purchase situation is not only about identifying and recognizing a problem (being aware of their current situation and existing heating system), but also analyzing the current situation of the end customer. Except for emergency breakdowns, end customers are likely to deliberately plan their next heating product purchase due to a variety of motivations such as extending an existing system, high-energy costs, or environmental considerations, e.g., increasing energy efficiency. We assume that neither online nor offline communication sources do not trigger purchase motivation by themselves. The social environment might encourage the end customers to have a desired lifestyle, which may influence the customer behavior [69]. Social influence could originate from personal connections (family, friends, and colleagues) as well as from peers in online communication channels. Additional external influences, such as common knowledge, word-of-mouth, and offline sources (e.g., visiting trade fairs, interior magazines, etc.), shape initial expectations of new heating products.

The information search is a process in itself consisting of multiple steps, where end customers turn to different information sources depending on the stage of the purchase process. They first *start searching for information* actively from diverse sources. In contrast to previous studies [6,26,31,36,45,46,52,58–60] that considered an information search as one stage in the decision-making process. We consider an information search as an iterative process consisting of more stages. Customers usually start searching for information internally, i.e., from recall memory such as experiences or previous searches [69]. At this stage, we believe that end customers also consult installers for information on suitable technology and brand experiences.

In the second stage, end customers *validate the gained information* by actively searching and crosschecking with credible information sources such as online and offline communication channels including their social environment and the installers. This may also be an iteration process where the gained information is validated several times and some communication channels may be consulted more frequently than others to arrive at the final decision. Offline sources might be less consulted and might not play a relevant role by the final decision.

Some models [33,49] partially considered the post-purchase stage and identified the importance of a positive user experience without analyzing the resulting action. However, in the *post-purchase evaluation* stage, end customers may be willing to express their feelings (both positive and negative) to their social environment, depending on product satisfaction along the purchase process and the use phase. Post-purchase behavior may include recommending the brand and/or the technology to others, re-purchasing the same technology [50], or selecting the same manufacturer for the future [6]. End customers might also give feedback, e.g., to the installer. The purchase and use experience reinforce the role memory has in the awareness stage, thereby for future purchase decisions.

Figure 1 illustrates how end customers can consult different communication channels along the adoption process. This will be analyzed and verified in the paper.

4. Methodology

In the first step, a limited set of focus group interviews were carried out with selected respondents in order to make a qualitative assessment of the complexity of the purchase process and the influencing role of the social environment. The focus group interview is a focus group market research technique, in which interviewees are selected because they are known to have been involved in a particular situation. This technique emphasizes a specific theme or topic that is explored in depth in contrary to other group interview techniques, where the discussion might span very widely [70]. The findings of the interviews contributed to the second step, which was an online questionnaire survey to make a quantitative assessment.

The focus group interviews were carried out separately with 10 couples (the sampling unit was the household members, participating in the decision-making of the household) owning apartments and/or houses in west Hungary. We selected the respondents by using the non-probability snowball sampling technique, which ensured candidates owned a property and purchased the heating product. However, this interview method might have unintentionally overlooked the views of people with a different purchase situation, which we consider as the limitation of the interview technique. The respondents were interviewed at home, which ensured a more pleasant atmosphere. The couples were between the ages of 32 to 70 years, four couples were first-time purchasers and six couples had former purchase experience. One couple owned a flat and the other nine couples were owners of single-family houses with diverse heating technologies (conventional and condensing gas boiler, solid fuel boiler, tile stove, etc.) and diverse purchase situation (first and second time renovation, new built). A moderator (the person, who runs the focus group sessions) conducted the interviews with questions based on an interview outline. Interview notes were made and analyzed with the program Nvivo 10.

Based on the key findings of the focus group interviews, a structured questionnaire was prepared and an online survey was conducted in December 2013 with a completely different set of residents in Hungary than those interviewed. The aim was to generalize the findings of the focus group interview with responses from a broader sample. The respondents received an email with a

web link to access the online questionnaire. The cross-sectional sample was provided by the company Ipsos Interactive Services, which maintains a list of individuals or households that agreed to take part in online market research surveys [71]. The members of the sample included people over the age of 18 years and with access to the Internet. This means the sample used in our survey included many people who did not own a house or flat and were not potential purchasers of heating products in Hungary. Respondents that did not meet our requirements of (1) owned a house/flat, and (2) changed the heating product in the past 18 months or intend to change in coming 18 months were filtered out before starting the questionnaire. This was necessary to find the right target group that fits the research topic (e.g., respondents in rentals would have been an irrelevant target group as the purchase decision is made by their landlord). Even with the above-mentioned filter, it was not possible to ensure respondents were a true representative for the heating product market for Hungary because the survey omitted customers who relied on offline sales channels or did not have access to the Internet. This we consider as a limitation of our online survey.

In total, 1163 respondents opened the questionnaire, however due to not meeting the requirements we had to filter out 643 respondents. Furthermore, 103 participants left the questionnaire without fulfilling it, probably due to its length (about 12–15 min). In the end 417 respondents finished the questionnaire ($N = 417$) of which 130 ($N_1 = 130$) recently bought a heating product (18 months) and 287 ($N_2 = 287$) were planning to do so within the next 18 months. This means that the sample consists of respondents in the diverse stages of the purchase process: adopters (already purchased in the past 18 months) and those, who are at the diverse stages of the planning process (plan to purchase in the coming 18 months).

The answer alternatives to the questions were nominal in nature and were analyzed as percentage frequencies. The title of each figure (in the results section) shows the specific question and the percentage of the frequencies shows the responses to different answering alternatives. In order to have a broader comparison of the role of the communication channels, the percentage frequencies of specific communication channels were clustered into a broader level as follows. Please note that some communication channels were clustered into two categories, e.g., because “Internet blogs and forums” can be understood as an online source, and as a “social environment sources” at the same time.

- Online sources: manufacturers’ websites, Internet—social media, Internet—blogs and forums, Google search/ads, other Internet sources, Internet newsletters, Internet—general information portals.
- Offline sources: TV, magazines, consultation at professional stores, DIY stores, radio, exhibitions and trade fairs.
- Social environment sources: Internet social media, Internet blogs and forums, parents, family, friends, colleagues, husband/wife, neighbors, opinion leaders.

5. Results

5.1. Focus Group Interviews

Respondents of the focus group interviews all own a house or flat and made the purchase decision on their own, which means that all respondents were active decision-makers in the purchase process instead of, for example, assigning an installer to purchase and install any kind of heating product that fits the budget. Results showed that respondents could recall information and memories on the purchase process, which lasted between 3 and 6 months. Results confirmed that respondents perceived the decision-making as a continuous process, where they iterated between stages and crosschecked the information that led to the final decision. One of the most mentioned words was “relations” in context with the purchase refers to the decision that was made within the family. As a couple said “In our family the joint decision-making with our parents is an essential step, as it affects the common household.” Interviewees could not always recall detailed information at every process stage, e.g., in the case of validation they could name some of the sources but not all of them they used for crosschecking.

In the awareness phase, respondents were open to learn about innovative heating technologies that they could relate to “childhood experiences” or that they believed were “sustainable.” For example, one couple mentioned, “as an alternative solution we thought about the wood heating technology because the feeling of crackling fire reminded us of our childhood.” Energy efficiency and conscious energy consumption (regarding energy use, costs, and the environment) was characterized in the heating habits of respondents. As energy prices rose, respondents were looking for an alternative heating solution, either to extend or to refurbish their existing gas system (which is common in Hungary) with alternatives (e.g., wood burning stoves). The influence of the social environment prevailed in common knowledge at this stage, as one couple mentioned, “There is a common knowledge about heating products, just as everybody knows that German cars are the most reliable, beware of Italian heating brands.”[72].

In the phase of “initial purchase situation” stage, respondents were aware of the situation where a new heating product was needed. Interviewees said that they deliberately planned the purchase (9 of 10 interviewees) in which the influence of social environment was not relevant. Suggested social environment sources were: family, friends, neighbors, colleagues, other customers in the same situation from social media, blogs and forums, etc. They mentioned the economic factor “rising energy costs” as the main motivation for purchase. Surprisingly, the governmental financial support program did not motivate a new purchase due to the unfamiliar application process and uncertainty in the amount of subvention.

Results confirmed that the information search stage consisted of more steps (start searching for information, validation in more steps) and respondents showed diverse search behaviors. As respondents started searching for information, the social environment had an influencing role as presented in Figure 2. Before starting the external search, three couples said that they also conducted internal searches by recalling memories on common knowledge and on childhood memories before turning to any other external sources. For the external search, the most mentioned were manufacturers’ website, brand neutral information portals, blogs, and forums. Four couples turned to other people around them and three of them consulted an installer for suggestions/advice. Only one couple mentioned that they consulted with friends, as they said, “we prefer to ask them in the first place because they are very up-to-date in many topics and their opinion is trustworthy to us.”

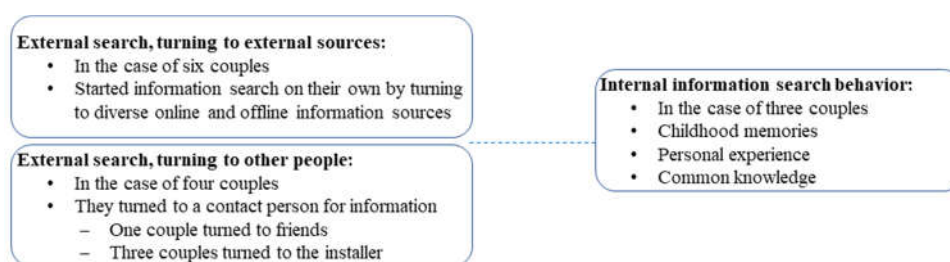


Figure 2. Information search behavior.

In the next step, respondents validated the gained information by crosschecking it four to six times with different information sources. The most-mentioned validation sources were online portals, friends, installers, and blogs. The following respondents’ statement indicated the influencing role of the social environment has on the whole information search process: “we informed ourselves first of all (options) on the Internet, looking for general and neutral information about possible technologies. For us it was important to give a defined orientation to the installer. After the installer proposed a few solutions, we talked with our friends and colleagues about their experiences with the recommended products and checked the experiences of other customers in different blogs and forums on the Internet. After that, we could cut down the decision to two brands. We checked the prices once again on the Internet and talked to the installer about our final decision”.

The influence of the social environment factored in the final decision and in the post purchase evaluation as well. Three couples said that they bought the product and chose the place of purchase after the recommendation from the installer and three couples bought the product after professional

consultancy, which they thought was the most suitable. In both cases, the ease of purchase was preferred over a possibly cheaper price. However, a different set of four couples said that they bought the product where they got the most affordable offer, which means they were actively searching for the place of purchase with the lowest price.

In the post-purchase evaluation stage, respondents recalled feelings of both satisfaction and dissatisfaction. Except for one couple, all interviewees were satisfied with their purchases, and the product fulfilled their functional expectations. The experience of one couple demonstrates how the influence of the social environment affected their product choice and their past purchase behavior: “Our neighbors were very satisfied with the heating product that they purchased last year. They recommended to us not only the technology and the brand but also a competent installer who installed the boiler. As we were about to renovate the heating system, we contacted this installer and finally bought the same condensing gas boiler as the neighbor did. We had no luck; it broke down many times during the three years after purchase. We had warranty problems and the spare parts were not available. We were frustrated and were continuously reading blogs and forums if other customers also had the same problem. We found out that this product had a serial defect. We will definitely not buy the same product or any other products from the same brand again! We also wrote to the manufacturer about why they did not communicate the serial problem to us, furthermore we wrote negative product reviews on the Internet everywhere we could. We don’t want other customers to make the same mistake and to be handled like that.”

5.2. Online Questionnaire Survey

The results are presented for each stage of the purchasing process. At each stage, the graphs show the action/attitude/behavior of the respondents and the corresponding communication channel at the same time.

5.2.1. Awareness

Respondents were asked if they could recall anything about heating products and express their opinion in a few words (open question). Please note that this question was general with regard to heating products, regardless of the time of the actual purchase. Out of the 417 respondents, 251 responded (60% of all respondents), but only 149 answers could be usefully categorized into six different categories. Results presented in Figure 3 show that respondents were open to learn and recall information from common knowledge regarding product attributes such as reliability, efficiency or quality of a variety of heating technologies, fuel types, and heating brands. Furthermore, respondents could recall memory on the country of origin of the heating product in the context of quality. Respondents did not recall the installer in any context at this stage of the purchase process.

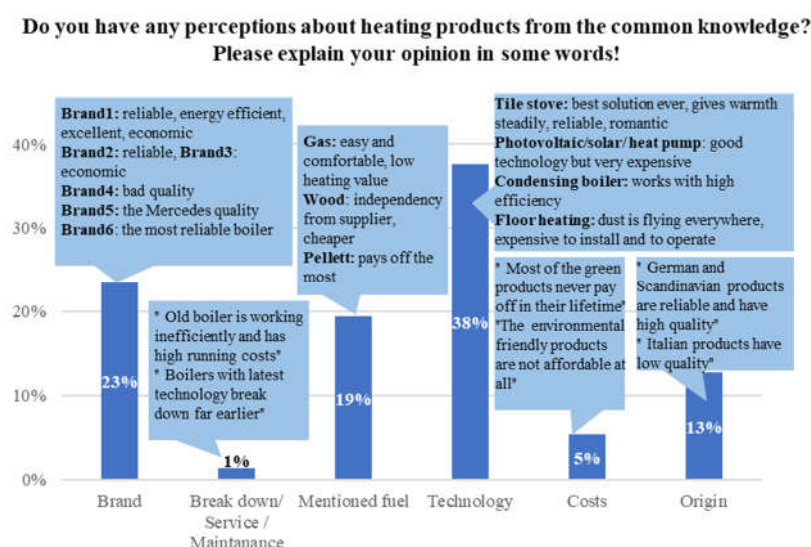


Figure 3. Common knowledge of heating products.

Respondents were asked a specific question on if they could recall any advertisement about heating products ($N = 416$). Results presented in Figure 4 shows that only 26% of the respondents ($N = 107$) could recall some kind of advertisement despite the fact that they bought a new heating product in the past 18 months or are willing to buy during the coming 18 months. Among the 107 respondent who could recall an advertisement, 54% quoted offline sources, such as TV, a wide range of magazines, consultation at professional stores, and 46% quoted online sources, such as manufacturers' websites or social media. Social environment sources, such as blogs and forums or social media, were mentioned only by 11% of the respondents.

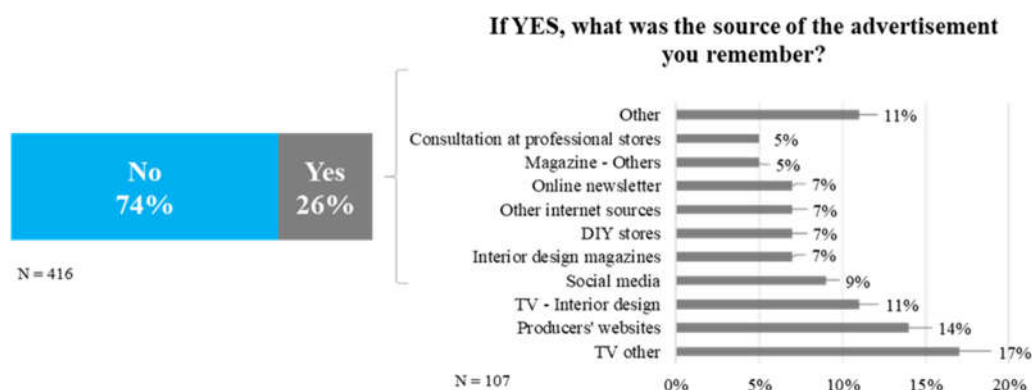


Figure 4. Influencing role of social environment in the stage of awareness.

5.2.2. Initial Purchase Situation

Respondents were asked about their underlying motivation to start the purchasing process. Results presented in Figure 5 shows that 53% of all respondents ($N = 417$) were motivated by financial factors such as an existing system being too expensive to operate (29%), rising energy costs (20%), or availability of subsidies (4%). Only 8% referred to an emergency breakdown of the existing heating system where immediate action was required. This means most of the respondents deliberately plan their purchase. Influencing factors from the social environment, such as the suggestion of family members, friends, or an opinion leader, were not the trigger.

Respondents were asked about the source of information at this stage of the purchase process (see the graph on the right side of Figure 5). A total of 61% and 46% of the respondents agreed that their previous personal experiences and the opinion of other people around them (information from people they personally know), respectively, were the source of information in the initial purchase situation. Influence of the social environment prevailed as common knowledge (37%) and as word-of-mouth (18%, meaning in general people are talking about, e.g., peers).

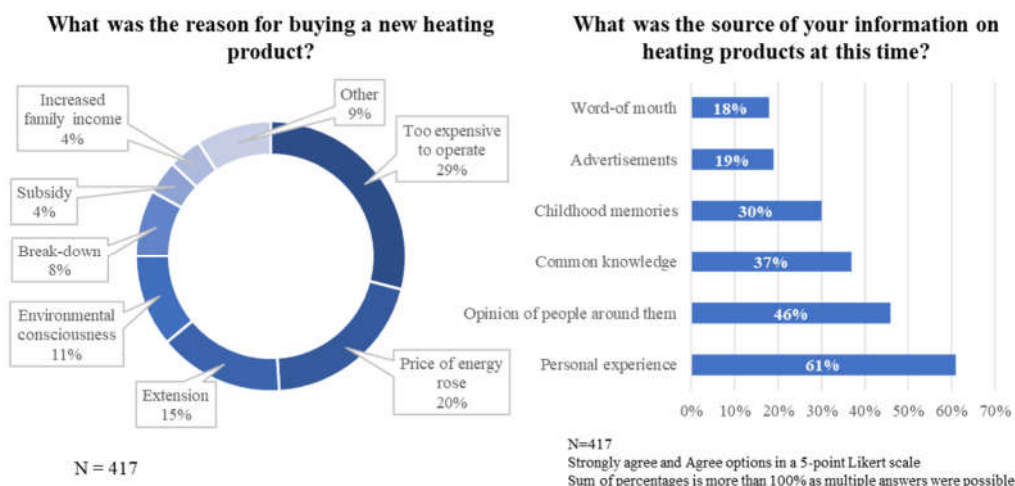


Figure 5. The customers initial purchase situation and the influence of sources of information.

5.2.3. Start Searching for Information

Respondents were divided into three categories according to their responses on how they started looking for information. The majority of respondents (59%, presented in Figure 6) started to search for information actively by turning to external sources. Of these 245 respondents, 67% started the information search using online sources (e.g., manufacturers' websites 25%, Google search 15%, information portals 4%, etc.), while 32% turned to offline sources (e.g., consultation at professional stores 15%, exhibitions and trade fairs 4%, DIY stores 6%, etc.).

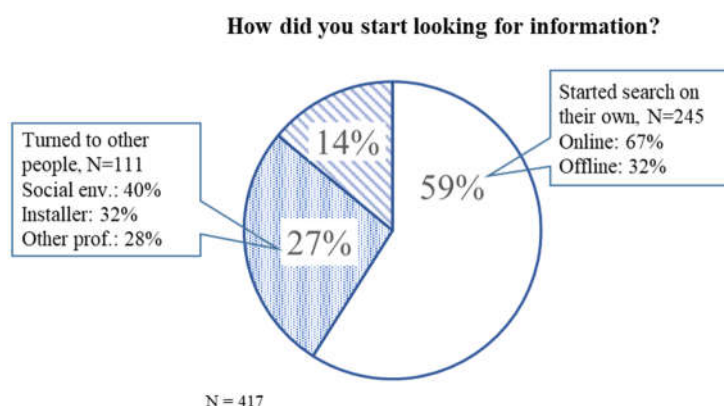


Figure 6. Information search behavior and sources of information.

Those respondents who relied on a personal interaction also indicated who they contacted for information. A total of 40% of the respondents turned to their social environment versus 32% turning to installers, or to any other professionals (planners, architects, etc., was mentioned by 28%). We assume that respondents turn to these professionals only with specific questions in the certain phase of the purchase process, such as quality of execution, building energy consumption, and energy level or placing of radiators in the living space.

The role of this influencing contact, presented in Figure 7, was to make a recommendation (quoted by 47%, for technology, brand, and some sort of professional), to exchange information (18%), and to contribute to the next step (18%). The influencing contact person of the social environment neither initiated the purchase (6%) nor made the final decision (2%) at this process stage.



Figure 7. Role of the most relevant contact person.

5.2.4. Information Validation

Similar to the results of the focus group interviews, the online survey showed that in the information validation phase, respondents searched for information and crosschecked it with different sources. Results presented in Figure 8 show that 85% of respondents crosschecked the

gained information during the whole purchase process. For the 130 respondents, the whole process included the actual purchase of a heating product in the past 18 months. For 287 respondents, the process was up to the stage before an actual purchase (i.e., intention to purchase) in the coming 18 months, so they finished the questionnaire at this point. The 130 respondents who actually bought a new heating product were further asked about how often they crosschecked the gained information. The right side of Figure 8 shows that 47% of them crosschecked at least 1–3 times and 30% did so 4–6 times. These results indicate a conscious information search behavior of the respondents.

During the whole purchase process, did you cross-check the information with different sources?

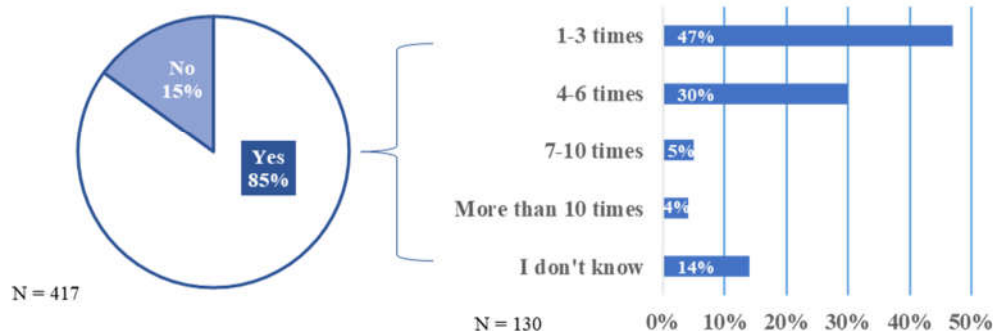


Figure 8. Information validation.

Regarding the source of information for validation, presented in Figure 9, 41% of the respondents crosschecked the gained information with an online source versus 19% with an offline source, 11% turned to the installer versus 27% to the social environment for validation. Manufacturers' websites, and blogs and forums were the most credible online sources.

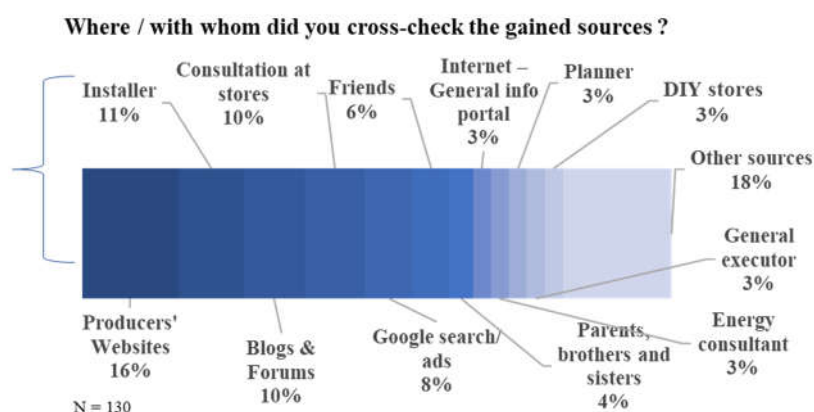


Figure 9. Sources of information at the stage of validation.

5.2.5. Final Decision

Respondents ($N = 130$) were asked to choose the three most influential sources from those mentioned in Figure 9 that led them to the final decision. As presented in Figure 10, 44% of the respondents quoted online sources versus offline source (13%). Influencing information sources from the social environment were quoted by 30% of the respondents versus the installer (14%).

Which of the above chosen cross-checking sources do you consider the most relevant that led to the final decision? Please choose the TOP 3 sources!

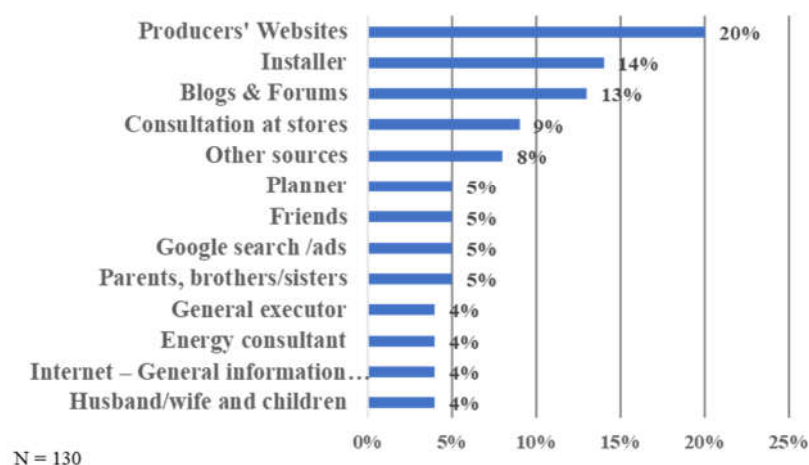


Figure 10. Final decision.

5.2.6. Post-Purchase Evaluation

Figure 11 shows that 97% of the respondents were satisfied as the product fulfilled their requirements; only 3% said that they were not satisfied with the purchase. Among the satisfied respondents, 19% were willing to recommend the technology, 35% would recommend the brand, and 32% would express their satisfaction with other people. Only 12% did not want to take any action (Figure 12).

After the purchase, how does the product fulfill your needs?



Figure 11. Post-purchase evaluation.

As you were satisfied with your purchase, what did you do?

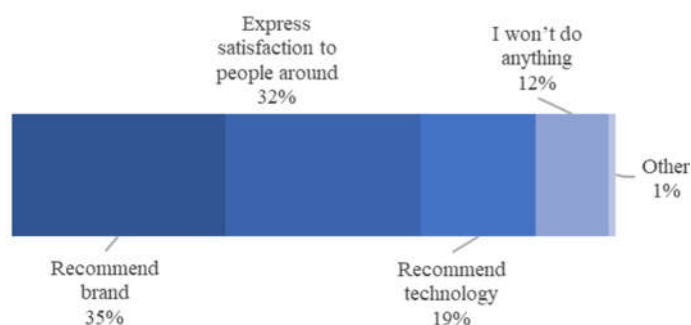


Figure 12. Post-purchase attitude in case of satisfaction.

6. Discussion

The results of the two-step exploratory research show numerous unique findings that helps participants of the heat market to understand end customers, their needs, and underlying motivation behind their actions along the purchase process.

The social environment sources and online communication channels played a role in the purchase process since end customers deliberately planned their purchase and searched for specific information according to their situation. They were aware of and were open to learn about heating products. Their memory from past behavior and experiences influenced this stage. The majority of the participants could recall information on heating technologies, fuel types, and brands (origin), but not classic marketing advertising elements that would be activated in the initial purchase situation. The social environment also did not trigger the purchase but was used for consultation.

In contrast to former models [6,12,45], we found that the search for information was not a single stage but a process in itself within the purchase process. Our survey respondents started searching for information on their own and consulted diverse online sources. This supports former theories that the costs of information acquisition influence the decision-making and motivates end customers consulting online sources instead of professionals [3,46,50]. The initial search for information was followed by crosschecking and validating information leading to a final decision.

Table 3 gives a summary of the relative frequencies of different sources that the respondents consulted during the purchasing process. The relative frequency of the quoted installer source was compared with social environment sources and the quoted online sources were compared with offline sources. N/A stands for non-available information due to the fact that some of the questions targeted the customer behavior (e.g., willing to express feeling at the stage of post-purchase evaluation) instead of the source of information. In the search for information phase respondents showed two different search behaviors (started the search on their own, $N = 245$, and turned to other people around them, $N = 114$); results are visually separated based on behavior and the sample.

Results in Table 3 show that social sources were consulted more frequently than installers at all stages of the decision-making process, particularly at the validation stage where respondents crosschecked information. While “starting the search for information,” installers were contacted less frequently (32%) than the social environment despite the fact that heating products are technically complex and need to be configured with other system elements. In addition, at the information validation and the final decision stages, more than the half of end customers relied on their social environment than the installers. This may be due to customers’ lack of trust in installers and the importance given to other customers’ experience and recommendations. In the post-purchase evaluation, the majority of respondents (who were satisfied with their purchase) were willing to contact their social environment to express satisfaction and make recommendations to the people around them. The installer did not play an influencing role.

Except for the awareness stage, online sources were more frequently consulted than offline sources, and the relative frequency increased as respondents got closer to the final decision. Online sources were consulted at the final decision with the highest relative frequency (3.38 times more) compared to the offline sources, which was reasonable since digitalization enables customers to get specific information tailored to their situation in the purchase process.

Our results corroborate previous studies that emphasized the influencing role of the interpersonal communication and social interactions in the innovation adoption process [17,20,22,45,52,58,61,62,64]. Additionally, our study revealed that this influencing role was stronger than the influencing role of the installers (with an increasing tendency) while nearing to the final decision along the purchasing process.

Table 3. Summary of results: relative frequencies and the role of the social influence in the decision-making.

Decision-making stages	Awareness <i>N</i> = 107	Initial situation <i>N</i> = 417	Start searching for information		Validation <i>N</i> = 130	Final decision <i>N</i> = 130	Post-purchase evaluation <i>N</i> = 129
			Turn to people <i>N</i> = 114	Start on own <i>N</i> = 245			
Installer	N/A	N/A	32%	-	11%	14%	N/A
Social environment	11%	1%	40% (i.e., mentioned 1.25 times more than installers)	-	27% (i.e., mentioned 2.55 times more than installers)	30% (i.e., mentioned 2.14 times more than installers)	86% (of the 97% of satisfied customers)
Online sources	47%	N/A	-	67% (i.e., mentioned 2.09 times more than online source)	41% (i.e., mentioned 2.16 times more than offline source)	44% (i.e., mentioned 3.38 times more than offline source)	N/A
Offline sources	54% (i.e., mentioned 1.15 times more than online source)	N/A	-	32%	19%	13%	N/A

Former studies that emphasized that the installers have a significant influence in the adoption process [26,36,45,59] were strongly supported by our empirical results. This may be because we did not ask the respondents to respond to a specific heating technology but all heating products in general. However, we found that respondents turned to the installers at more stages of the purchasing process, but this followed a decreasing trend from the awareness stage to the final decision. Comparing our results to the former studies, we think that the reason installers were identified as the most important information source by many former models is that the investigation of these adoption processes focused on specific heating technologies. We think that the recommendation, planning, and sales of new heating solutions required more intense support from the installers to end customers along the purchasing process.

Installers have an essential supporting role in technical questions, system planning (e.g., size of hot water tank, number of radiators, necessity of other system components, etc.), clearance of regulation and boundaries, installation and commissioning, etc. However, when it comes to reliability, efficiency, investment questions, satisfaction of use, end customers will consult peers. Our results show that both installers and social environment sources are participants of the purchase process with a different importance depending on the stage in question.

7. Conclusions and Recommendations

The results of this study suggest that the heating product manufacturers, who are facing the multi-level segmentation challenge, should include direct end-customer communication as an essential element in their sales and marketing strategies. We suggest the following measures to support mixed marketing decisions. Manufacturers should de-emphasize the share of classic, cost intensive offline communication instruments in the marketing mix (TV and radio campaigns, ads in magazines, trade fairs, etc.) and increase the share of innovative, measurable, and integrated online communication channels (e.g., Google AdWords, content marketing, search engine optimization, etc.) to reach end customers directly. These communication measures enable tailored messages and communication during each purchase process stage.

End customers used social searching actively along the whole purchasing process. Usually they look for peer-to-peer reviews of products, installers, and service. On the other hand, satisfied customers were willing to express their satisfaction to the people around them. Based on these findings, we believe manufacturers with satisfied customers not only have repeat customers, but also “convincing voices” for recommending brand and technology to the people around them. Online marketing communication channels, such as blogs, forums, social media marketing, online PR, etc., are appropriate.

Due to the complexities of heating technologies, end customers consult installers to some extent, particularly at the stage of starting to search for information. We suggest that installers should be included into the sales and marketing strategy as they still play an influencing role. Installers have the technical and product knowledge, and are in direct contact with the customers in the installation process. Manufacturers can provide special training and planning support for new technologies to installers to help overcome the insecurity of recommending, planning, installing, and commissioning energy efficient heating technologies. The improved confidence with complex heating technologies may make the installer to recommend such technologies to their end customers.

Our results indicate that end customers’ own prior experience affect their decision to purchase heating products. The influence of prior experience on future purchase decisions of energy efficient products, actions, and behavior is a potential research area in future.

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