Driving adoption
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Chapter 6

General discussion
6. General Discussion

6.1 Summary of the main findings and theoretical implications

6.1.1 Testing the ISE-model to explain the likelihood of adopting sustainable innovations

The environmental success of sustainable innovations depends heavily on the likelihood that consumers will adopt them. In this dissertation we argue that three types of motivations play a role in the likelihood of adopting sustainable innovations: the utility, environmental outcomes and symbolic value associated with the adoption of the innovation. More specifically, we propose that the acceptability of, interest in, intentions to, and actual adoption of sustainable innovations depends on how people evaluate the instrumental, symbolic, and environmental attributes of sustainable innovations (the ISE-model, see Figure 1). In this PhD thesis, we tested the ISE-model, thereby extending previous research in two important ways. First, the symbolic value of sustainable innovations has hardly been studied before, while evaluations of symbolic attributes may be particularly important for the adoption of sustainable innovations. Second, little is known about the relative importance of the evaluations of these three attributes for the adoption likelihood of sustainable innovations.

Figure 1: Conceptual model on the impact of evaluations of Instrumental, Symbolic, and Environmental attributes on adoption of sustainable innovations (ISE-model)
The research included in this thesis consistently revealed that, as hypothesized, more positive evaluations of the instrumental, environmental, and symbolic attributes enhanced adoption likelihood of sustainable innovations. First, bivariate correlations show that positive evaluations of instrumental attributes of sustainable innovations enhanced the likelihood of adopting sustainable innovations. More specifically, except for a non-significant correlation between evaluations of instrumental attributes and interest in electric cars in Chapter 2, we found that positive evaluations of instrumental attributes of sustainable innovations enhanced interest in and intention to purchase electric cars (Chapter 3) and acceptability of, interest in, and intention to adopt renewable energy systems (Chapter 2 and 4). Yet, interestingly, the evaluations of instrumental attributes appeared to be less strongly related to the likelihood of adopting sustainable innovations compared to evaluations of symbolic and environmental attributes. Notably, evaluations of instrumental attributes of sustainable innovations did not consistently predict adoption likelihood when controlling for the effects of evaluations of its symbolic and environmental attributes on adoption likelihood. In Chapter 3, which included a large sample, we found that more positive evaluations of instrumental attributes enhanced interest in and intention to purchase electric cars while controlling for the effects of evaluations of the symbolic and environmental attributes, and evaluations of instrumental attributes appeared to be the strongest predictor of intentions to purchase electric cars. In the other studies (with smaller samples) in Chapter 2, 4, and 5, we found no significant relationships between evaluations of instrumental attributes and adoption likelihood when effects of evaluations of the symbolic and environmental attributes on adoption likelihood were controlled for. Moreover, adopters of smart energy systems did not differ from non-adopters in their evaluations of the instrumental attributes of smart energy systems (Chapter 5). This suggests that evaluations of instrumental attributes are not a very strong unique predictor of adoption of sustainable innovations. Previous research suggests that the evaluations of instrumental attributes are strongly related to adoption likelihood of sustainable innovation (e.g. Chéron & Zins, 1997; Franke & Krems, 2013). However, these studies typically did not take into account evaluations of other attributes. Our studies suggest that people evaluate multiple attributes in their adoption decisions; studies on adoption behavior should therefore take multiple attributes of innovations into account.

Second, as expected, we consistently found that positive evaluations of environmental attributes increased the likelihood of adopting sustainable innovations. Evaluations of environmental attributes were positively correlated with all indicators of adoption likelihood.
of the different sustainable innovations included in our studies. Importantly, even when controlling for the effects of evaluations of instrumental and symbolic attributes on adoption likelihood, evaluations of environmental attributes predicted acceptability of, interest in, and intention to adopt sustainable innovations rather well, although evaluations of environmental attributes did not uniquely predict adoption likelihood of smart energy systems (Chapter 4 and 5). The unique predictive value of the environmental attributes is in line with findings of previous research that revealed that people engage in pro-environmental actions because they are motivated to benefit the environment (Steg and De Groot, 2012, for a review). Our studies show that evaluations of environmental attributes are also an important predictor of adoption of sustainable innovations such as electric vehicles and renewable and smart energy systems, even when controlling for evaluations of instrumental and symbolic attributes.

Third, in line with our expectations, evaluations of symbolic attributes appeared to be an important predictor of the likelihood of adopting different sustainable innovations. In fact, generally, evaluations of symbolic attributes of sustainable innovations appeared to be the strongest predictor of adoption of sustainable innovations. More specifically, positive evaluations of symbolic attributes consistently increased the likelihood of adopting sustainable innovations, including the acceptability of and interest in a sustainable innovation, the intention to adopt a sustainable innovation and the actual adoption of sustainable innovation (Chapter 2, 3, 4 and 5). Our results are in line with theories stating that people not only purchase and use products for their instrumental function, but also for what they represent and mean to us and others (e.g. Belk, 1988; Dittmar, 1992; McCracken, 1990). Notably, our results suggest that symbolic attributes are rather important for the adoption of sustainable innovations. Yet, people seem not to recognize this. Notably, in Chapter 2 we found that when asked directly, respondents indicated that symbolic attributes are not very important for them when they would consider the adoption of an electric car; they indicated that the instrumental attributes and environmental attributes were much more important factors influencing their adoption decision. These very same respondents were however more likely to adopt an electric car when they evaluated the symbolic attributes and environmental attributes more favorable, while evaluations of the instrumental attributes did not affect their adoption likelihood.

Taken together, our results suggest that the proposed ISE-model is successful in explaining the likelihood of adopting sustainable innovations. Evaluations of the symbolic attributes appeared to be the most important and consistent predictor of adoption likelihood when
controlling for evaluations of the instrumental and environmental attributes. Evaluations of environmental attributes were also a consistent predictor of the likelihood of adopting sustainable innovations (except for the likelihood of adopting smart energy systems). Yet, evaluations of the instrumental attributes did not always uniquely contribute to the explanation of adoption likelihood of sustainable innovations.

6.1.2 When will evaluations of symbolic attributes particularly predict adoption of sustainable innovations?

Symbolic attributes of sustainable innovations may be particularly important in the early introduction phase. In this phase sustainable innovations typically have some instrumental drawbacks and a low adoption rate. We argue that individuals who adopt a sustainable innovation under such conditions are likely to be seen as intrinsically motivated to do so, as these factors generally reduce rather than promote adoption. In other words: these characteristics are likely to strengthen the signaling value of adopting a sustainable innovation. People are more likely to attribute behavior to characteristics of the person than to situational factors when there are seemingly no clear external factors encouraging the relevant behavior (cf. Bem, 1972; Kelly, 1967). We argued that this also applies to the adoption of sustainable innovations, and that two typical discouraging characteristics of sustainable innovations, their relatively poor instrumental attributes and their (still) low adoption rate, could therefore increase the assumed signal strength. On the basis of this, we hypothesized that evaluations of symbolic attributes would be more strongly related to adoption likelihood when people evaluate the instrumental attributes of the sustainable innovation somewhat more negatively, and when they expect that few significant others would consider adopting the sustainable innovation (i.e., weak adoption norms). Results from Chapter 2, Chapter 3, and Chapter 4 partly confirmed our hypothesis. First, we found that the more people believe sustainable innovations have some instrumental drawbacks, the more strongly evaluations of symbolic attributes were related to the likelihood of adopting sustainable innovations. More specifically, evaluations of the symbolic attributes of an electric car were more strongly related to interest in an electric car (but not intention to buy an electric car) when people perceived the electric car to have relatively more instrumental drawbacks (Chapter 2 and Chapter 3). Likewise, the more instrumental drawbacks people perceived local renewable energy systems to have, the more strongly evaluations of symbolic attributes were related to interest in and acceptability of local renewable energy systems (but not intention to use renewable energy systems, Chapter 2). Second, Chapter 4 showed that evaluations of
symbolic attributes were more strongly related to both interest in electric cars and smart energy systems when people perceived relatively weak adoption norms, that is, when they believed that only few significant others would adopt or consider adopting these sustainable innovations. Moreover, evaluations of symbolic attributes were more strongly related to intentions to adopt smart energy systems (but not intentions to purchase electric cars) when people perceived relatively weak adoption norms. Taken together, these findings generally support our reasoning that when adoption of a sustainable innovation appears to be somewhat costly (i.e., has some instrumental drawbacks, or when significant others do not consider adopting it, suggesting others think adoption is not a sensible thing to do), adoption is more likely to be attributed to personal characteristics of the actor (and less likely to external factors), increasing the signaling strength of adopting a sustainable innovation (i.e., costly signaling effect), and strengthening the relationship between evaluations of symbolic attributes and adoption likelihood. Yet, intentions to purchase or use sustainable innovations were mostly not more strongly related to evaluations of symbolic attributes when people perceived some instrumental drawbacks or weak adoption norms; we will discuss this in more detail in Section 6.2.

These findings support attribution theory (Jones & Davis, 1965; Kelley, 1967) and self-perception theory (Bem, 1972), but extends previous research as our findings suggest that people can anticipate that the adoption of a sustainable innovation is likely to be attributed to personal characteristics, both by themselves and by others, strengthening their motivation to adopt sustainable innovations when they evaluate their symbolic attributes favorably. Yet, we did not explicitly test whether attribution processes underlie our results; future research is needed to examine the processes through which instrumental drawbacks and weak adoption norms affect the strength of the relationship between evaluations of symbolic attributes and adoption likelihood of sustainable innovations, including the role of internal versus external attributions.

Results from Chapter 3 indicate that earlier adopters, in this case people who generally would consider adopting an innovative car relatively early, evaluate the symbolic attributes of an electric car more positively than later adopters, in this case people who generally would consider adopting an innovative car relatively late. In addition, the evaluations of the symbolic attributes of an electric car were more strongly related to interest in an electric car when earlier adopters (but not later adopters) evaluated the instrumental attributes somewhat
less favorable. This again suggests that symbolic attributes are important for the early adoption of sustainable innovations.

6.1.3 Generalizability

The relationship between evaluations of instrumental attributes, environmental attributes, and particularly symbolic attributes of sustainable innovations on the one hand and the likelihood of adopting sustainable innovations on the other hand seems to be robust as we conceptually replicated our findings in numerous ways. First, we found that evaluations of these three attributes affect the likelihood of adopting sustainable products that are noticeable to others (i.e., electric car, Chapter 2 and 3) as well as sustainable services that are less noticeable to others (i.e., local renewable energy systems and smart energy systems; Chapter 2, 4, and 5). This suggests that evaluations of symbolic attributes do not only affect the adoption of sustainable innovations that are clearly noticeable to others. Second, the relationships between evaluations of symbolic attributes and most indicators of the likelihood of adopting electric cars, local renewable energy systems and smart energy systems were stronger when adoption is somewhat costly, that is, when people perceive instrumental drawbacks and weak adoption norms, suggesting that the costly signal effect is not limited to a specific sustainable innovation. Third, as adoption of innovations can be conceived as a process that comprises of multiple stages involving not only the actual purchase and use of an innovation (e.g. Palda, 1966; Rogers, 2003), we included different indicators tapping into different stages of the adoption process in our studies, namely interest in, acceptability of, intentions to purchase or use a sustainable innovation as well as the actual use of a sustainable innovation. Our findings show that the evaluation of the symbolic attributes is the most consistent driver of all adoption indicators, suggesting that evaluations of the symbolic attributes of sustainable innovations are important throughout the entire adoption process. Fourth, we replicated our finding when using different conceptualization of the attributes, suggesting that the effects not depend on precise wordings of the concepts used.

6.2 Suggestions for future research

We found support for the ISE-model explaining the likelihood of adopting three different sustainable innovations: electric cars, local renewable energy systems, and smart energy systems. Particularly evaluations of symbolic attributes consistently explained adoption likelihood of these sustainable innovations. Future research is needed to replicate our findings for other sustainable innovations, in other countries and cultures, and for other types of
(sustainable) behavior that are already more widely adopted. This can reveal whether evaluations of symbolic attributes are specifically influential when not many have adopted a sustainable innovation yet, or whether symbolic attributes also affect the adoption of sustainable products that have been more widely adopted. Research could for example study how and to what extent evaluations of symbolic attributes affect the adoption of products that are owned and used by the majority of people, for instance energy efficient lighting or energy efficient refrigerators.

We reasoned that evaluations of symbolic attributes will be more strongly related to adoption likelihood of sustainable innovations when the innovation is expected to have some instrumental drawbacks, or is not expected to be common among significant others, as in this case adoption is more likely to be attributed to personal characteristics (i.e., internal attribution) enhancing the signaling strength of adoption. Future research could investigate whether perceptions of instrumental drawbacks and weak adoption norms strengthen the impact of evaluations of symbolic attributes on the likelihood of engagement in other (consumer) behaviors as well.

In the operationalization of the symbolic attributes we tried to capture the extent to which adopting the sustainable innovation was believed to help build and support one’s (desired) identity and status, but we did not specifically consider what someone assumes adoption would tell about him or her. Future studies could examine this. Our results suggest that sustainable innovations are not only perceived to signal one’s pro-environmental attitudes or values, as environmental attributes and symbolic attributes uniquely predicted the likelihood of adopting a sustainable innovation in most of our studies, suggesting that they reflect at least partly different motivations for adoption. Different sustainable innovations can also signal different characteristics of the owner. For instance, the adoption of (hybrid) electric cars can be associated with intelligence, independence of oil producers, uniqueness and caring for others (Heffner, Kurani, & Turrentine, 2007), while adopting a hydrogen-powered car may be associated with danger and recklessness. Someone’s adoption likelihood is driven by the symbolic signal this person thinks adoption sends out. Perceptions of what adopting a sustainable innovation says about a person could differ between individuals. For instance, people who are keen to be early adopters may associate sustainable innovations with innovativeness or uniqueness (Vandecasteelle & Geuens, 2010), while people who endorse environmental values may associate sustainable innovations with a ‘green image’. For policymakers and marketers it is interesting to find out to what extent the assumed symbolic
Our results suggest that instrumental drawbacks and weak adoption norms affect adoption likelihood in two different ways. On the one hand, they are likely to inhibit adoption at the early introduction stage, while on the other hand they are likely to boost the impact of evaluations of symbolic attributes on the likelihood of adopting the sustainable innovation. However, the latter effect was not observed for all adoption indicators included in our studies, and particularly explained interest in and acceptability of sustainable innovations, but not always intentions to purchase or use sustainable innovations. The latter are more proximate indicators of actual adoption, in which case people are more likely to actually face the costs of adoption. In such cases, these costs may outweigh the possible signaling effect of adopting a sustainable innovation that has some drawbacks. Future research could test this reasoning. For instance, an electric car with a driving range of only 5 kilometers per charge is not very functional and being the first and only person to adopt such an electric car may be rather maladaptive. In these cases the high costs associated with adopting the electric car may not enhance the relationship between evaluations of symbolic attributes and adoption likelihood of the electric car. Future research could investigate whether there is a certain range or a sweet spot of costliness where the impact of evaluations of symbolic attributes on adoption likelihood is strongest.

We argued that instrumental drawbacks and weak adoption norms strengthen the impact of evaluations of the symbolic attributes on the adoption of sustainable innovations as people may anticipate that adoption is more likely to be attributed to their personal characteristics. Future research could examine which other factors may enhance the signaling strength of sustainable innovations. One relevant factor may be the level of autonomy of adopting sustainable innovations, as behavior that is performed voluntary (e.g. purchasing one’s own electric car) is more likely to be attributed to personal characteristics than behavior that is more or less forced upon a person (e.g. using an electric car from an “all electric” carpool at work). Future research can test whether perceiving adoption of a sustainable innovation as an autonomous decision will strengthen the relationship between evaluations of symbolic attributes and the likelihood of adopting a sustainable innovation.

Signals can be directed towards others and towards the self. Our studies revealed that evaluations of what adopting a sustainable innovation communicates to self and others were
strongly correlated. Moreover, our results suggest that evaluations of symbolic attributes are related to both the adoption of electric cars and the adoption of smart energy systems, again suggesting that both signals to self and others are likely to play a role, as the former is more noticeable to others and therefore suitable for signaling to others and self while the latter is less noticeable to others and therefore particularly suitable for signaling to the self. Future research can investigate the distinctness and relative importance of self-signals and signals to others in the adoption of sustainable innovations and other (consumer) behaviors.

In Chapter 3 we applied a novel method aiming to identify earlier adopters and later adopters ex-ante. The method seems promising as our conceptualization of adopter segments for adopting innovative cars correlated with the likelihood of adopting an electric car and the distribution of participants over the segments corresponded with theorized segment sizes (Rogers, 1962). Future research can test the validity of this measure further, and examine whether the measure is able to identify adopter segments of other innovations ex ante and whether different adopter segments differ in their motivation for adopting different types of innovations. Such information is highly valuable for marketing (sustainable) innovations.

We found a small but interesting difference in the evaluation of symbolic attributes between typical earlier adopters and later adopters of innovative cars, which suggests that they differ in the extent to which they believe that adoption would signal something positive about the owner. Specifically earlier adopters were positive about the symbolic attributes of electric cars, and the relationship between the evaluation of the symbolic attributes and adoption was stronger when earlier adopters evaluated the instrumental attributes less favorably. Yet, our studies focused on innovations in an early introduction stage. Future studies could examine whether results can be replicated when studying the adoption of sustainable innovations at different moments in the diffusion of a sustainable innovation. For example, it would be interesting to monitor how evaluations of the different attributes predict adoption of a sustainable innovation from introduction to “maturity” and test our (extended) model during various adoption stages. This would reveal whether evaluations of the attributes and their predictive power changes across adoption stages.

6.3 Practical implications

For promoting adoption of sustainable innovations it is crucial to understand which attributes influence adoption and how individuals evaluate these attributes of sustainable innovations. Our findings support the ISE-model, and reveal how sustainable innovations can be promoted.
The most straightforward advice is to stress the environmental attributes as sustainable innovations typically have very favorable environmental attributes, and positive evaluations of environmental attributes enhance adoption likelihood. When the sustainable innovation replaces a less environmental friendly product, this difference can be made salient. Marketers of electric cars can for instance stress that electric cars emit no greenhouse gases while driving, unlike cars with an internal combustion engine.

Besides, importantly, marketers could emphasize the symbolic value of sustainable innovations. This route is often not acknowledged by practitioners, while our results suggest this may be a very effective way promoting the adoption of sustainable innovations. Symbolic attributes may be enhanced or stressed through marketing campaigns emphasizing positive outcomes of owning and using sustainable innovations for one’s identity and status. Marketing campaigns can display innovative, environmentally-friendly, or successful persons who have adopted sustainable innovations, thereby communicating that adopting such innovations enhance one’s status and identity (see also Heffner et al., 2007). Similarly, campaigns could demonstrate that adopters of sustainable innovations are perceived by others as for example likable, successful, or innovative persons, or persons who care for others. Future research is needed to examine which strategies would be most effective and credible to achieve this. Research suggests that linking identities to adopting a sustainable innovation could best be done in a subtle and implicit manner in order to keep consumers’ perceptions of agency in identity expression in tact (Bhattacharjee, Berger, & Menon, 2014). For example, rather than stating that adopters have high status and are successful, it may be wiser to portray models using sustainable innovations that are successful and treated with much respect by others.

Up until now, most policies to enhance the acceptability and uptake of sustainable innovations focused on the instrumental attributes and environmental attributes of sustainable innovations. The fact that instrumental attributes are often the focal point in policy is not surprising as consumers believe that instrumental attributes of sustainable innovations are highly important to them in their adoption decisions (see Chapter 2). Likewise, a recent study on the adoption of electric vehicles showed that people give many instrumental reasons for adopting or not adopting an electric vehicle, while adopting an electric car for symbolic purposes are not among the twelve most important listed reasons for adopting an electric vehicle (ANWB, 2017). Yet, evaluations of instrumental attributes appeared not to be the strongest predictor of adoption likelihood. Nonetheless, improving the instrumental attributes is needed to take
away key barriers for adoption. For instance, investing in extending the driving range of electric vehicles or investing in the charging infrastructure of electric vehicles may boost adoption of such innovations. Also, enhancing the user experience of smart energy feedback systems by for example introducing easy to use apps and user-interfaces can increase interest and uptake of these systems. Improving instrumental attributes is likely to be a more long-term strategy as improvements take time. Yet, merely focusing on the instrumental attributes of sustainable innovations at the early introduction stage may not be wise as evaluations of symbolic attributes and environmental attributes appeared to be (more) strongly related to the adoption likelihood of sustainable innovations. Our findings suggest that especially at the early introduction stage of sustainable innovations stressing and enhancing symbolic attributes may be a particularly effective strategy for promoting adoption because innovations are believed to have some instrumental drawbacks and adoption norms are believed to be weak, as evaluations of symbolic attributes are more strongly related to adoption likelihood under these conditions. In this case, strategies to promote sustainable innovations could particularly target these symbolic attributes. Besides, downplaying the obvious weak instrumental attributes and weak adoption norms in communication may not be a wise strategy. Such an approach is not likely to enhance adoption likelihood via increasing the evaluations of instrumental attributes and adoption norms, and may actually backfire as for instance trivializing instrumental drawbacks can undermine the positive effects of evaluations of symbolic attributes on the likelihood of adopting sustainable innovations. Moreover, our findings suggest that earlier adopters are particularly positive about the symbolic attributes and also particularly sensitive to its signaling function, which further suggest the potential of promoting sustainable innovations by emphasizing its symbolic attributes at the early introduction stage.

6.4 Conclusions

This PhD thesis proposes and tests a theoretical model proposing that the adoption of sustainable innovations depends on the evaluations of its instrumental, symbolic, and environmental attributes (ISE-model). Results from 6 studies suggest that people are more likely to adopt sustainable innovations when they evaluate its instrumental attributes, symbolic attributes, and environmental attributes more positively. Notably, evaluations of symbolic attributes were the most important and consistent predictor of adopting sustainable innovations, and were even more strongly related to adoption likelihood when people perceive some instrumental drawbacks and weak adoption norms, which both are characteristic to
sustainable innovations at the early introduction stage. Yet, people seem not to be aware of the importance of symbolic attributes for their adoption decision: when asked directly, people indicated that symbolic attributes would hardly affect their adoption decisions. Marketers and practitioners could use the ISE-model as a diagnostic framework for understanding important drivers of adoption of a particular sustainable innovation, by assessing how target audiences evaluate the instrumental, symbolic, and environmental attributes of the sustainable innovation, and which of these attributes is strongly related to adoption likelihood. Our findings suggest that what people think adopting a sustainable innovation says about them as a person is rather strongly related to adoption likelihood, especially if they believe that this signal ensuing from adopting a sustainable innovation is strong, which is more likely to occur when adoption is perceived to be somewhat costly or uncommon. The successful adoption of sustainable innovations thus depends, more than we think, upon what the sustainable innovation says about a person.

“Driving adoption: The symbolic value of sustainable innovations”