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RENOVATE FOR TOMORROW: EXPLORING BARRIERS AND DRIVERS FOR DIFFERENT TYPES OF ENERGY-EFFICIENT RENOVATIONS

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Abstract *In Flanders, 23,3% of the housing stock is in a moderate to bad condition and needs to be renovated to meet the energy efficiency requirements stipulated in the Renovation Pact by 2050. However, since 72% of Flemish households own their home, the Flemish government must fall back on houseowners' motivation to improve their houses' energy efficiency. Depending on the type of energy-efficient renovation, other barriers and facilitators are at play that motivate (or prevent) a homeowner to take action. This research explores the relevant barriers and facilitators for three types of energy-efficient renovations. We conducted a survey among 603 homeowners with the intention to renovate (i.e. people planning to perform a renovation within the next 3 years), assessing 19 barriers and 13 facilitators in relation to three renovation categories: (1) insulation improvements, (2) energy efficiency installations, and (3) extensions of the home. We conducted a series of one-way ANOVAs to assess how barriers and facilitators differ between the three renovation categories. Our results show that some barriers and facilitators are universal across all three types of renovations (e.g., the prospect of more comfort), whereas others come into play for a particular renovation category (e.g., the driver 'this type of renovation reduces my energy costs' is more important for energy efficiency and insulation renovations than for extension renovations). Policy recommendations are provided to increase the motivation of renovators considering specific energy efficiency renovation categories.*

1. INTRODUCTION

Climate scientists across the world agree that a reduction in greenhouse gas emissions (GHGE) is indispensable to reduce global warming (Pörtner et al., 2023). One of the major sources responsible for GHGE is the energy use in buildings (through the emission of CO_2). Indeed, buildings are responsible for 25% of GHGE globally and for 36% in Europe (Artola et al., 2016; International Energy Agency, 2019). To combat a further increase in GHGE, Europe is drafting legislations and policies such as the Energy Performance of Buildings Directive (2010) and the Energy Efficiency Directive (2012). In Belgium specifically, the Flemish Climate Strategy aims to reduce the GHGE of the residential housing stock by 75% by 2050. Therefore, the Flemish Government set a long-term goal with the Renovation Pact aiming to upgrade the Flemish housing market to energy label A by 2050 (Vlaanderen, 2022). As a result, there is a renovation obligation for houses with an energy label D or worse.

However, to reach its renovation goals, the Flemish government is highly dependent on the motivation of individual homeowners, as environmental changes are often related to the behaviour of people (Nielsen, 2017). Currently, 72% of Flemish households own their dwelling (Statistiek Vlaanderen, 2019), while only 14% of single-family homes have an energy label of B or higher (A, A+), and 65% of single-family homes and 29% of apartments have an energy label D or lower (Statistiek Vlaanderen, 2023). Thus, there is a substantial group in Flanders with energy-efficient renovation (EER) potential.

Subsequently, understanding what drives or hinders homeowners in their decision to undertake an EER has been a prominent topic in recent literature (Broers et al., 2019; Du et al., 2022; Ebrahimigharehbaghi et al., 2019; Klöckner & Nayum, 2016). However, the majority of research either treats EERs as an overarching category or focuses on one specific type of EER (e.g., insulation of walls), without considering heterogeneity in facilitators and barriers between different types of EER. Moreover, to our knowledge, no similar studies have been conducted in the context of Flanders. The aim of this study is to gain knowledge of the facilitators and barriers that boost or impede EERs and to identify differences in barriers and facilitators for three specific categories of EER, i.e., insulation renovations, energy renovations and extension renovations.

2. LITERATURE AND RESEARCH FRAMEWORK

To make a selection of relevant barriers and facilitators of energy-efficiency renovations, we conducted an exploratory literature review. We were able to group the most commonly identified facilitators and barriers into three main themes of commonly identified facilitators and six main themes of commonly identified barriers.

For the facilitators we found the following themes: firstly, enhancing life quality (1) considers repairing or replacing equipment and thereby increasing comfort (Azizi et al., 2019; Du et al., 2022; Ebrahimigharehbaghi et al., 2019; Pérez-Navarro et al., 2023). Economic benefits (2) relate to increasing the market value of one's home or reducing costs e.g., by lowering energy bills (Azizi et al., 2020; Du et al., 2022; Ebrahimigharehbaghi et al., 2019; Pérez-Navarro et al., 2023), and preserving the environment (3) alludes to a person's attitude towards the environment and motivation to act in a sustainable manner (Du et al., 2022;

Ebrahimigharehbaghi et al., 2019). For the barriers, we identified the following themes: first of all, informational barriers (1) relate to the reliability, comprehensiveness and trustworthiness of information on EERs (Azizi et al., 2019; Du et al., 2022; Ebrahimigharehbaghi et al., 2019), while financial barriers (2) relate to the uncertainties of return on investment, cost-effectiveness and access to capital (Azizi et al., 2019; Du et al., 2022; Ebrahimigharehbaghi et al., 2019). Barriers related to inconvenience to routine (3) include the hassle of dirt, stress, and having other priorities (Azizi et al., 2019; Ebrahimigharehbaghi et al., 2019), while social barriers (4) are linked to e.g., a lack of support from family or friends (Ebrahimigharehbaghi et al., 2019). Lastly, institutional barriers (5) relate to building protection regulations and a lack of incentives or standards (Ebrahimigharehbaghi et al., 2019; Hesselink & Chappin, 2019), and technical barriers (6) refer to the limitations of dwellings or technological systems (Broers et al., 2019; Du et al., 2022).

To our knowledge, there is no study that covers all categories presented in this literature overview, nor takes into account the particularity of the Flemish context and the heterogeneity across different renovation categories. Since the study of Klöckner & Nayum (2017) on upgrading the energy standard of homes in Norway is the most comprehensive study to date, their list of 14 barriers and 10 facilitators serves as the basis for our study. Additionally, we extended this list with three facilitators and five barriers, which were uncovered in our literature review after the study by Klöckner & Nayum (2017).

Firstly, recent research on barriers shows that people who struggle with the maturity of technologies or struggle to adopt novel technologies, are less likely to install that technology (Azizi et al., 2019; Broers et al., 2019). Thus, we added two barriers, being '*the technology available for this type of renovation has yet to improve*' and '*starting to use energy efficient technologies is not that important to me*'. Subsequently, we found that people are often not aware of or have little interest in what causes energy loss in their home. Indeed, literature identifies unawareness of energy consumption as another barrier for energy renovations (Du et al., 2022; Pelenur, 2018). Therefore, we formulated two barriers: '*I don't really know how much energy I use*' and '*I don't really care how much energy I use'*. Lastly, as identified in the six main themes of barriers, structural limitations of the property can prevent people from starting an EER (Broers et al., 2019; Du et al., 2022). Thus, we formulate a fifth additional barrier: '*technical limitations of my home make it difficult to implement energy efficiency measures*'.

In terms of facilitators, our exploratory literature review showed that environmental concern could motivate people to undertake a renovation (Azizi et al., 2019; Du et al., 2022; Ebrahimigharehbaghi et al., 2019). Thus, an additional facilitator for environmental concern was added: '*this type of renovation reduces my carbon footprint*'. Additionally, social pressure and social norms were also identified as a possible driver for EERs (Du et al., 2022; Ebrahimigharehbaghi et al., 2019; Schleich et al., 2019). Thus, a second facilitator was added: '*I try to renovate as much as people in my neighbourhood*'. Lastly, Azizi et al. (2019, 2020) found that being interested in energy efficiency and technological novelties also motivates end-users to undertake an EER, resulting in a third facilitator: '*I am interested in energy-efficiency renovations'*. A complete overview of the 19 barriers and 13 facilitators is presented in Table 5 and Table 6.

3. METHODS

3.1 Procedure and measures

An online survey was administered among a total of 603 Dutch-speaking participants living in Flanders, the northern part of Belgium. Participants were recruited in March 2023. The survey consisted of three major themes: (1) person-related aspects (sociodemographic characteristics, user-building interactions), (2) contextual aspects (location, dwelling type) and (3) facilitators and barriers for energy-efficient renovations. Three types of energy-efficient renovations were included, namely (1) insulation renovations, (2) energy renovations and (3) extension renovations.

In the original study, we distinguished between renovators and non-renovators by asking participants to indicate whether 'I intend to carry out one or more renovations within three years (between 2023 and 2026)'. All persons who answered 'Agree' or 'Fully agree' were categorized as renovators, with the remaining participants being categorized as non-renovators. Given space limits within this paper, we only focus on the renovators for this study. Additionally, a filter was applied asking whether participants own or rent their dwelling. Only participants who own a dwelling (that they live in or sublet) were kept for the entirety of the survey.

Subsequently, participants that were identified as renovators had to select the types of renovations they intend to perform from a list of nine types of renovations. These nine types were divided into three renovation categories, which can be found in Table 1. Then, all participants were presented with a list of barriers and facilitators related to a selected renovation category. Participants were asked to indicate their level of agreement with the respective barrier or facilitator on a Likert scale (ranging from 1 'Strongly disagree' to 5 'Strongly agree'). A full list of all barriers and facilitators can be found in Table 5 and Table 6. Lastly, sociodemographic variables were gathered, i.e., gender, year of birth, education and occupation.

Renovation category	Renovation type
1. Insulation renovations	a. Additional quick post-insulation such as cavity wall, cellar ceiling or attic floor insulation
	b. Larger works such as exterior or interior insulation (façade insulation)
	c. Installing new windows (high-performance glass)
2. Energy renovations	a. Replacement heat delivery system (radiators, convectors, underfloor heating …)
	b. Replacement heat source (fuel oil boiler, gas boiler, heat pump, solar boiler ...)
	c. Installing a ventilation system
	d. Installation of solar panels and/or solar collectors
3. Extension renovation	a. Extension of the house (for example at the back or by placing an extra floor)
	b. Thorough reorganization of interior spaces, including making attics habitable

Table 1: Renovation categories and types

3.2 Sample

The survey was started by 2178 respondents, with 1065 respondents completing the survey and fulfilling all quality criteria (i.e., agreed informed consent, owner of a dwelling, correct quality

control questions, quota of max. 60% renovators). As noted earlier, for this study we only withheld homeowners with an intention to renovate, resulting in a final sample of 603 participants. An overview of distributions per renovation category of our final sample can be found in Table 2.

Renovation category	Frequency	Percent
Insulation	224	37.15%
EE installation	292	48.42%
Extension	87	14.43%

Table 2: Frequencies for renovation categories (n=603)

3.3 Analysis strategy

To assess differences between barriers and facilitators on the level of renovation categories, a series of one-way ANOVAs was performed with the barriers and facilitators as dependent variables using the three renovation categories as fixed factors. Tukey post hoc tests were performed to identify which categories differed significantly from one another. Given the sufficiently large size of our sample, we set our level of statistical significance at $p < 0.01$.

4. RESULTS

4.1 Preliminary analysis and sample description

Variable	Category	*n* (total *n*=1065)	Percent
Age	Mean = 44.39, Median = 44		
Gender			
	Male	263	43.62%
	Female	339	56.30%
Education			
	Lower secondary education or lower	63	10.45%
	Higher secondary education	224	37.15%
	Bachelor	203	33.66%
	Master or higher	113	18.74%
Occupation			
	Fulltime employee	356	59.04%
	Parttime employee	68	11.28%
	Student/intern	27	4.48%
	Incapacitated	19	3.15%
	Retired	71	11.77%
	Other	62	10.28%

Table 3: Sociodemographic variables, i.e., age, gender, education, occupation

The final sample of our study, as can be seen in Table 3, consists of a larger share of women (56.30%) than men (43.62%). Nearly half the sample has obtained higher secondary education, and more than 30% has obtained a bachelor's degree or equivalent. A large share (70.32%) of our sample is a fulltime or parttime employee.

Looking at the mean values of all facilitators and barriers, as shown in Table 4, it can be noted that the facilitators structurally score higher than the barriers for all renovation categories, with

insulation having the highest facilitators' mean value. One-way ANOVAs were conducted to compare the mean value scores of facilitators and barriers between renovation categories. The facilitators are scored significantly different depending on the considered renovation category ($F(2, 600) = 19.724$, $p < 0.01$). A Tukey post hoc test revealed that the mean value of facilitators in the insulation category ($M = 3.671$, $SD = 0.484$) is significantly higher than the mean value of facilitators in the energy efficiency ($M = 3.515$, $SD = 0.437$) and extension ($M = 3.312$, $SD = 0.494$) category.

Category	Mean value barriers	Mean value facilitators
Energy-efficiency	2.299	3.515
Insulation	2.407	3.671
Extension	2.494	3.312

Table 4: Mean scores of facilitators and barriers per renovation category

In general, the highest rated facilitators are mostly linked to economic benefits and quality of life. The top two facilitators, i.e., '*this type of renovation increases the market value of my home*' and '*this type of renovation reduces my energy cost'*, both relate to gaining financial benefits, either through increasing the value of the home (with the aim of selling the home in the future) or reducing the financial costs of energy consumption through home optimisation. Additionally, two of the top five facilitators relate to the quality of life within the home, i.e., '*this type of renovation makes my house more pleasant to live in*' and '*this type of renovation offers more comfort*'. Thus, renovators across the three renovation categories are generally motivated by the prospect of improving their daily comfort and the domesticity of their homes. In terms of barriers, the top five relates mostly to a sense of uncertainty. '*The right time to do this type of renovation is yet to come'* embodies uncertainty about timing, while '*I am unsure about the savings in energy costs after this type of renovation'* and '*it's hard to know if I can trust the information I find about this type of information'* are related to uncertainty about the return of investments and the trustworthiness of information on EERs. In addition, the high ranking of '*the technology available for this type of renovation has yet to improve*' confirms that technological maturity is a barrier for people when deciding to renovate. Lastly, '*this type of renovation requires a lot of supervision from contractors'* also scores quite high, showing that disturbance of the daily routine is a considerable impediment.

	Facilitator Description	Mean value	Source
fac_2	This type of renovation increases the market value of my home	4.023	Klöckner & Nayum
fac_1	This type of renovation reduces my energy costs	3.934	Klöckner & Nayum
fac_13	I am interested in energy efficient renovations	3.927	New
fac_6	This type of renovation makes my house more pleasant to live in	3.851	Klöckner & Nayum
fac_7	This type of renovation offers more comfort	3.765	Klöckner & Nayum
fac_11	This type of renovation reduces my carbon footprint	3.741	New
fac_3	The investment in this type of renovation pays for itself within a reasonable time	3.493	Klöckner & Nayum

fac_8	I can quickly and easily find information about the practical approach to this type of renovation	3.444	Klöckner & Nayum
fac_4	This type of renovation has positive health effects	3.415	Klöckner & Nayum
fac_10	Subsidies are available for this type of renovation	3.380	Klöckner & Nayum
fac_9	I trust the information about this type of renovation that I get from officials	3.373	Klöckner & Nayum
fac_5	My current insulation is not energy efficient	3.090	Klöckner & Nayum
fac_12	I try to renovate as much as people in my neighborhood	2.632	New

Table 5: Overview of facilitators, ranking based on mean values for all renovation categories

	Barrier Description	**Mean value**	**Source**
bar_5	The right time to do this type of renovation is yet to come	3.083	Klöckner & Nayum
bar_1	I am unsure about the savings in energy costs after this type of renovation	2.829	Klöckner & Nayum
bar_15	The technology available for this type of renovation has yet to improve	2.803	New
bar_13	This type of renovation requires a lot of supervision from contractors	2.801	Klöckner & Nayum
bar_10	It's hard to know if I can trust the information I find about this type of renovation	2.771	Klöckner & Nayum
bar_11	This type of renovation causes a lot of distractions in my life (e.g. dirt)	2.763	Klöckner & Nayum
bar_7	There are no financial resources (savings or loan) available to carry out this type of renovation	2.721	Klöckner & Nayum
bar_18	Technical limitations of my home make it difficult to implement energy efficiency measures	2.624	New
bar_3	I can't decide which type of energy efficient renovation to do first	2.602	Klöckner & Nayum
bar_12	It is difficult to find relevant information about this type of renovation	2.519	Klöckner & Nayum
bar_16	I don't really know how much energy I use	2.426	New
bar_17	Starting to use energy efficient technologies is not that important to me	2.307	New
bar_8	Contractors who could carry out this type of renovation are inexperienced or incompetent (lack of knowledge)	2.244	Klöckner & Nayum
bar_14	I have previous negative experiences with this type of renovation	2.113	Klöckner & Nayum
bar_19	I don't really care how much energy I use	1.798	New
bar_9	I depend on approval from my neighbors to do this type of renovation	1.793	Klöckner & Nayum
bar_6	Monument preservation guidelines prevent me from doing this type of renovation	1.662	Klöckner & Nayum
bar_2	I plan to move to another place soon, so there is no point in renovating my current home	1.604	Klöckner & Nayum
bar_4	I do not own the property, so I will not invest in this type of renovation	1.514	Klöckner & Nayum

Table 6: Overview of barriers, ranking based on mean values for all renovation categories

4.2 Differences in barriers and facilitators across renovation categories

To assess differences between barriers and facilitators across the three different renovation categories, a series of one-way ANOVAs was performed. The results, as can be seen in Table 7, show both the *F*-value and the *p*-value. We only report the statistically significant facilitators and barriers ($p < 0.01$).

	Variable description	***M(SD)* energy-efficiency**	***M(SD)* extension**	***M(SD)* insulation**	***F* Score (2, 600)**	***p* value**
fac_1	This type of renovation reduces my energy costs	4.021(0.812)	3.069(1.139)	4.156(0.744)	55.049	< 0.01
fac_11[1]	This type of renovation reduces my carbon footprint	3.808(0.856)	3.080(0.955)	3.911(0.826)	30.905	< 0.01
fac_5	My current insulation is not energy efficient	2.897(1.037)	2.655(1.170)	3.509(1.016)	30.251	< 0.01
fac_6	This type of renovation makes my house more pleasant to live in	3.599(0.878)	4.299(0.749)	4.004(0.801)	29.774	< 0.01
fac_10	Subsidies are available for this type of renovation	3.404(1.006)	2.724(1.042)	3.603(0.857)	26.410	< 0.01
bar_11	This type of renovation causes a lot of distractions in my life (e.g. dirt)	2.490(1.053)	3.207(1.069)	2.946(1.147)	19.515	< 0.01
fac_7	This type of renovation offers more comfort	3.568(0.865)	4.138(0.702)	3.875(0.880)	18.095	< 0.01
fac_3	The investment in this type of renovation pays for itself within a reasonable time	3.599(0.893)	3.080(1.014)	3.513(0.888)	10.996	< 0.01
bar_9	I depend on approval from my neighbours to do this type of renovation	1.682(0.955)	2.126(1.159)	1.808(1.126)	6.035	< 0.01
bar_17	Starting to use energy efficient technologies is not that important to me	2.229(0.930)	2.632(1.080)	2.281(0.955)	6.001	< 0.01
bar_5	The right time to do this type of renovation is yet to come	2.925(1.081)	3.195(1.150)	3.246(1.095)	5.962	< 0.01

Table 7: Statistical differences for barriers/facilitators across all renovation categories (One-way ANOVAs, threshold of statistical significance: $p < 0.01$)

Generally, it is notable that only four out of 19 barriers differ significantly between renovation categories, while seven out of 13 facilitators differ significantly between renovation categories. Thus, the majority of barriers are similar across renovation categories, while the majority of facilitators are of greater or lesser importance depending on the renovation category.

For the insulation category, we find that five of the seven significant facilitators have the highest score in this category. Interestingly, these facilitators are either linked to financial concerns ('*this type of renovation reduces my energy costs*' and '*subsidies are available for this type of renovation*'), environmental concerns ('*this type of renovation reduces my carbon footprint'* and '*my current insulation is not energy efficient*), and an improvement of the quality of life

(‘*this type of renovation offers more comfort’*). Moreover, most significant differences exist between the insulation category and the extension category, whereby facilitators in the insulation category have significantly higher scores than in the extension category. This is the case for ‘*this type of renovation reduces my energy costs*’, ‘*subsidies are available for this type of renovation*’, ‘*this type of renovation reduces my carbon footprint*’, ‘*my current insulation is not energy efficient*’ and ‘*the investment in this type of renovation pays for itself within a reasonable time*’. The barrier with the highest score in the insulation category is ‘*the right time for this type of renovation is yet to come*’, with a significantly higher score compared to the energy-efficiency category.

When looking at the extension category, we see that two of the statistically significant different facilitators score the highest in the extension category. They score significantly higher than the energy-efficiency category, and are related to improving the quality of life (‘*this type of renovation makes my house more pleasant to live in*’ and ‘*this type of renovation offers more comfort*’). In terms of barriers, three of the significantly different barriers score the highest in the extension category and also score significantly higher than the energy-efficiency category, i.e., ‘*starting to use energy efficient technologies is not that important to me*’, ‘*this type of renovation causes a lot of distractions in my life*’ and ‘*I depend on approval from my neighbours to do this type of renovation*’.

Lastly, for the energy-efficiency category, we note that four of the statistically significant different facilitators scores significantly higher in this category compared to the extension category, and are mostly linked to financial or environmental concerns (‘*this type of renovation reduces my energy costs*’, ‘*this type of renovation reduces my carbon footprint*’, ‘*subsidies are available for this type of renovation*’ and ‘*the investment in this type of renovation pays for itself within a reasonable time*’). For three of the statistically significant different facilitators, the energy-efficiency category scores significantly lower than insulation, i.e., ‘*My current insulation is not energy efficient*’, ‘*this type of renovation makes my house more pleasant to live in*’ and ‘*this type of renovation offers more comfort*’, which are all related to improving the quality of life. In terms of barriers, ‘*this type of renovation causes a lot of distractions in my life*’ scores significantly lower here compared to the other two renovation categories.

5 DISCUSSION AND CONCLUSION

The goal of this study was to identify and understand the differences in barriers and facilitators in three renovation categories. Before elaborating on the results, there are some limitations to address. First, due to space limitations, we solely focused on people categorized as renovators in this study. However, our complete sample also included non-renovators. Including these in our analyses might provide a more nuanced and comprehensive understanding. Moreover, in this study renovating was treated as a one-time decision, while the decision process often comprises different stages and is not necessarily linear (Klöckner & Nayum, 2016). Therefore, iterating this study with a stage model might give us more insights in which barriers and facilitators apply to different stages in the decision-making process. Additionally, our model considered an individual’s decision, disregarding the shared practices of life at home, which might influence decision-making (Wilson et al., 2015). Lastly, because of limitations in the

initial setup of this study, we are unable to regress facilitators and barriers on an outcome variable measuring intent, and thus cannot provide any conclusions on how predictive barriers and facilitators are for the intention to renovate.

Of the newly added barriers and facilitators, we see that only '*this type of renovation reduces my carbon footprint*' significantly differs between categories. Surprisingly, the social influence facilitator was the lowest scoring facilitator. Earlier research in the context of Flanders showed that social relationships were significant barriers to perform an energy-efficient renovation or build a zero-energy dwelling (Camarasa et al., 2021; Souaid et al., 2020). However, social influence seems to not be present as a driver of energy-efficient renovations.

When looking at which themes are most prevalent in the highest-rated facilitators and barriers, it is clear that renovators are mainly motivated by financial facilitators and by facilitators related to improving their quality of life, which is in line with earlier research (Broers et al., 2019; Du et al., 2022; Ebrahimigharehbaghi et al., 2019). In terms of high-rated barriers, renovators are discouraged by uncertainty on the financial, time-related and informational level, as well as by practical impediments (e.g., the impact of hassle on daily life and technical limitations).

When looking at the differences between the three categories, we see that generally, for the barriers, there are only four barriers with differences between the renovation categories, of which 3 have a relatively low *F*-score, indicating that the reasons to not renovate transcend the specific renovation categories. Thus, when addressing potential renovators, for most barriers it seems superfluous to develop different communication strategies depending on the renovation category.

Most facilitators linked to financial concerns score significantly higher in the insulation and the energy-efficiency category. The higher scores of availability of subsidies for insulation and energy-efficiency renovations might be explained by the fact that there are primarily subsidies and support measures available for renovations such as the installation of renewable energy systems or insulation improvements (Vlaanderen, 2023). Similarly, the higher scores of returns of investment for the insulation and energy-efficiency category could be attributed to the tangibility of reducing your energy costs and a return of investment through improving your insulation or becoming more energy-independent by installing e.g., PV panels.

Additionally, the energy-efficiency and insulation category score significantly higher on environmental concerns compared to the extension category, suggesting that energy efficiency and insulation renovations are performed with a certain environmental awareness that is not as present for extension renovations. Thus, policy makers could use both the impact on the financial situation as well as the environment as leverage to convince potential renovators.

Lastly, insulation and extension score significantly higher than the extension category for the facilitators related to improving the quality of life. This might be explained by the fact that the goal of insulation is to better regulate the flow of heat and coolness in one's home, which can be associated with an improvement in comfort and a more pleasant living experience. Moreover, extension renovations often result in a bigger living space, which is correlated with a higher level of perceived comfort during relaxation at home (Torresin et al., 2022). Hence, when targeting potential insulation or extension renovators, it might be productive to focus on the increase in the quality of life in the home.

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