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Drivers of the consumers' intention to use repair services, repair networks and to self-repair

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ABSTRACT

Repair is a central component of a circular economy to extend the operational phase of products. Yet, the number of repair service providers as well as demand for repair have declined over the last decades, while more products than ever before were sold. Thus, for a successful transition from a linear to a circular economy the demand for repair services must be boosted to promote repair business. A starting point to achieve this goal is to increase knowledge about the end consumers' intention whether to repair broken products or not. An extensive literature research revealed a comprehensive set of drivers of the repair intention covering aspects related to environmental protection, social acceptance, and economic considerations as well as socio-demographic variables, past behaviour, and perceived repair difficulty. Those factors are not only relevant for a specific product category but for repairs of consumer goods in general. The aim is to evaluate the relevance of those drivers for three different repair intentions: (1) to make use of repair service providers, (2) to self-repair broken items, and (3) to use repair service providers incorporated in a repair network. A quantitative online survey was designed, and distributed in Styria, Austria. By means of a structural equation model the acquired data of 900 respondents was analysed. The results emphasise the trade-off between acting environmentally-friendly and economic aspects like repair cost and time, but also highlight the effect of government intervention – in the form of setting up a network and financial support for repair – on shaping this trade-off. Furthermore, past behaviour is found to strongly drive repair intention. Our research contributes to scientific literature by shedding light on the influence of diverse drivers on different repair intentions. It is also relevant for supporting repair companies' decision making with respect to repair service design, as well as public authorities interested in promoting repair.

1. Introduction

Repairing broken consumer products is a key factor for transforming the linear economy to a circular economy. Repair is considered to create local added value and to be beneficial for the environment (Stahel, 2016). It can be economically profitable for individuals (see, e.g., Brusselaers et al., 2019), and may boost social inclusion through, e.g., training long-term unemployed persons or improved accessibility to second-hand products for disadvantaged individuals (Lechner and Reimann, 2015; Zacho et al., 2018). Furthermore, even though determining the impact of repair on environment and thus, resource-efficiency is a complex analysis which requires the consideration of a plethora of parameters, extending the usage-phase by repairing and

reusing is generally performing better than product replacement (cf. Boldoczki et al., 2020; Bovea et al., 2020). In spite of all these potential positive effects, the number of repair service providers as well as the demand for repair services have decreased over the last few decades (McCollough, 2010; Sabbaghi et al., 2017). According to a survey from the European Commission only a share of 64% of EU-28 consumers actually repaired products (European Commission, 2018).

Manifold strategies with the objective to promote repair are considered at various levels to upend this development. The European Union introduced new regulations concerning sustainable product design, aiming for longer-lasting easier-to-repair products (European Commission, 2016). As the various movements dealing with the so-called 'Right

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  [1] https://www.indicereparabilite.fr/wp-content/uploads/2021/01/210107_Instructions-manual-repairability-index.pdf.

to Repair' point out, such measures should pave the way for easier repair by increasing accessibility to spare parts and related information (e.g., iFixit, 2021; Right to Repair Europe, 2021). In France, the recent introduction of the repairability index forces manufacturers of electric and electronic equipment to evaluate their products,[1] e.g., in terms of documentation, availability and price of spare parts, or disassembly and required tools, and provide the score to customers. Other administrative, economic, or informative policy instruments to promote repair have already been implemented, e.g., reduction of value added tax for selected repair services in Sweden, or supporting the establishment of reuse parks promoting repair activities in Spain (Dalhammar, 2019).

An approach targeting to strengthen suppliers can be observed in the city of Graz, which is the capital city of Styria, a federal state in Austria. The city administration initiated and operates a repair network covering diverse sectors. Membership is linked with strict quality standards. Regular exchange between the repair service providers facilitates the safeguarding of high-quality repair services as well as sharing of experiences and information, repair collaboration, and increased visibility of repair (GRAZ repariert, 2021; Lechner et al., 2021). Also, the city of Graz introduced a scheme which funds repairing electrical and electronic equipment. For obtaining this funding, customers must be residents of Graz, and the repair service provider needs to be a member of the repair network (Stadtportal der Landeshauptstadt Graz, 2021; Lechner et al., 2021).

While all of these initiatives aim at revitalising repair, an important aspect is to improve understanding of the demand-side, i.e., why or why not consumers decide to have their products repaired. Until a short while ago, activities related to repair were not often in focus of research and thus, remain underresearched (Rosa et al., 2019). Existing studies discussed influencing factors of the repair decision like barriers (Laitala et al., 2021; Tecchio et al., 2019), economic considerations (Cooper et al., 2017; McCollough, 2010; Wieser and Tröger, 2018) or attitudes, experiences and public perceptions (Rogers et al., 2021; Sabbaghi et al., 2016). In addition, research indicates that environmental aspects affect decision-making related to 'green consumption' (cf. Hansla et al., 2008; Kautish and Sharma, 2020), and social factors like peer groups have a significant effect on individual's (un)sustainable decisions (Lazaric et al., 2020). Very recently, a growing number of studies tackle the demand for repair (e.g., Jaeger-Erben et al., 2021; Laitala et al., 2021; Rogers et al., 2021). All of these studies focus on some aspects of repair drivers related to economic considerations, environmental protection, or social acceptance but do not provide a comprehensive examination of the impact of all three drivers on the repair intention.[2]

Beyond that, most studies focus on professional repair service providers by examining different aspects of the repair decision (see, e.g., McCollough, 2010; Pérez-Belis et al., 2017; Sabbaghi and Behdad, 2018), while some studies deal with do-it-yourself (DIY) movements (Laitala et al., 2021; Raihanian Mashhadi et al., 2016), and a recent paper analyzes the attractiveness of a repair network for customers (Lechner et al., 2021). This last study addresses issues of accessibility to and stringent quality of repair services as well as the impact of a public funding scheme to attract customers by financial incentives (Lechner et al., 2021). Conversely, concerning self-repairs also social settings are highlighted as relevant (Jaeger-Erben et al., 2021), while repair services studies focus on the impact of prices (King et al., 2006; McCollough, 2010). Thus it remains unclear, whether this framing (repair services, repair networks or self-repair) could have an effect on the impact of drivers on the repair intention, and consequently

whether the repair intention can be generalised across those repair settings.

Related to that, while socio-demographic characteristics have been shown to be crucial for activities in the context of circular economy (Kuah and Wang, 2020), their relevance may differ depending on the considered repair intention. Similarly, two more aspects deserve closer investigation. The first one is the *perceived difficulty of repair activities*. Specifically for DIY repair, lack of skills has been identified as a major barrier (Pérez-Belis et al., 2017; Sabbaghi and Behdad, 2018), while it is unclear how the *perceived difficulty of repair activities* affects the intention to use a repair service or network. The second aspect is *past repair behaviour*. Positive repair experiences related to self-repairs can lead to self-efficacy and a positive repair connotation (cf. Lauren et al., 2016). On the other hand, since the trust in repair service providers is another important influencing factor of the repair decision (McCollough, 2010), past behaviour might also affect the intention to use repair services (or to make use of a repair network).

In summary, to the best of our knowledge there is no joint consideration of drivers related to environmental protection, economic considerations, and social acceptance, and the relative importance of those drivers for repair services, DIY repairs, or depending on the context (like the existence of a repair network and a public funding scheme) has not been explored. Further, until now factors like age, gender, education, income, residence as well as perceived repair difficulty and past behaviour were not jointly analysed while considering different repair intentions, either. Summarising these findings, the following two research questions state our research interest:

Research question 1: (How) Does the type of repair intention (i.e., making use of a repair service provider, self-repair broken items, and to use repair service providers incorporated in a repair network) affect the relative importance of drivers related to environmental protection, economic considerations, and/or social acceptance of the repair intention?

Research question 2: To what extent do socio-demographic factors, past behaviour, or perceived repair difficulty influence different repair intentions (i.e., making use of a repair service provider, self-repair broken items, and to use repair service providers incorporated in a repair network)?

The research questions are investigated by using a quantitative online survey. The survey is based on established factors obtained by literature research. As a research novelty, we refine the intention to repair consumer goods[3] by differentiating between three different scenarios: (1) the intention to use a repair service provider (what we denote as *RIa* in the rest of the article); (2) the intention to self-repair a broken product in a do-it-yourself (DIY) manner (*RIb*); and (3) the intention to use a repair service offered by a company which is part of a repair network, accounting for the context of Graz (*RIc*). By structural equation modelling we transform the data of 900 participants into a network of constructs.

The research work primarily contributes to the understanding of consumers' repair intention, i.e., through assessing the impact of joint consideration of drivers related to environmental protection, economic considerations, and social acceptance on different repair intentions. The identification of further aspects which influence the individual's intention to repair – like past repair behaviour, perceived difficulty of repair, or gender – facilitates targeted interventions by public authorities to promote repair and reduce respective barriers, e.g., by subsidising repair services or initiatives like repair cafés. In addition, the findings of this study support repair service providers to improve the design of offered repair services.

The remainder of the paper is structured as follows: in Section 2, we develop the underlying theoretical framework of the study, and propose hypotheses. Section 3 provides an overview of the methodology. The results of the survey are presented in Section 4, followed by a discussion of the results in Section 5. We conclude the study with a summary, and discuss limitations and future research opportunities in Section 6.

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[2] Even though the repair intention is not a perfect proxy for the actual repair action, theories like the Theory of Planned Behaviour (Ajzen, 1991) propose that before action can take place, intention is a pre-condition. Hence, in this study we concentrate – as a first step – on intention to repair (referred to as repair intention) to gain a basic understanding of the repair decision.

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[3] In our study we consider consumer goods like daily domestic appliances, electronic equipment, jewellery, bicycle, musical instrument, cell phone, furniture and articles of clothing.

2. Theoretical framework and hypothesis development

In order to evaluate the influence of drivers related to environmental protection, social acceptance, and economic considerations on diverse repair intentions (*RIa/RIb/RIc*), we establish a theoretical framework rooted in existing research. For this purpose, we first identify constructs representing the drivers. These drivers depend on the perception of individuals, i.e., whether individuals perceive repairing as environmentally-friendly, economically reasonable, and/or socially accepted. Following this, on the basis of the theoretical framework we hypothesise related effects which can subsequently be tested. In summary, in hypotheses (*H1, H2, H3*, each split into sub-hypotheses *a, b, c*) we propose that the drivers related to environmental protection, social acceptance, and economic considerations influence the three different repair intentions (*RIa, RIb, RIc*). All remaining hypotheses (*H4, H5, H6, H7, H8, H9* and *H10*) are formulated based on the same concept and thematise perceived repair difficulty, past repair behaviour, and socio-demographic-factors.

2.1. Drivers related to environmental protection, economic considerations, and social acceptance concerning the intention to repair

Environmental considerations loom large regarding repair: specifically in comparison to purchasing new products, repairing is often assumed to be beneficial for the environment and resource-saving since the life of products is extended and waste is avoided (Boldoczki et al., 2020; Pini et al., 2019; Stahel, 2016). Also, repairing is usually considered as being less harmful to the environment than recycling as no secondary production stage is required (McCollough, 2009). Likewise, in comparison to remanufacturing and refurbishment it is in general the least environmentally harmful option to reuse an item (King et al., 2006). In order to investigate the driver related to environmental protection (EnvD), we root the theoretical framework on insights obtained from the Value-Belief-Norm-theory for pro-environmental behaviour (Stern et al., 1999): the theory states that awareness of consequences ('beliefs') are a determinant of behaviour. Hence, items regarding the awareness of consequences of inaction are included in the study. These items refer to the degree that a person is mindful of the (environmental) consequences of not repairing. Thus, this approach reflects the perception of individuals whether repairing is environmentally-friendly, what in turn facilitates to investigate the effect of potential environmental considerations on the repair decision. Supported by the fact that similar effects have been shown in various contexts related to research on green consumers (cf. Fornara et al., 2016; Steg et al., 2005), we propose that awareness of environmental consequences influences the intention to repair.

> *H1a/H1b/H1c:* The driver related to environmental protection (EnvD) 'Awareness of environmental consequences of inaction' influences *RIa/RIb/RIc*.

Second, there is evidence that economic considerations drive the repair decision. Especially, there is strong indication in scientific literature that repair price (King et al., 2006) and the repair time (McCollough, 2007) are main influencing factors of the repair decision. If the overall costs related to repairing a product are considered as being excessive, consumers do not see repair as sensible and consequently economic aspects may act as a main barrier regarding repair (Tecchio et al., 2019). To broaden the perspective, the expectation that a repair will be completed for a reasonable cost fairly quickly and accurately (Chang et al., 2013) and the expectation of the additional useful product life after repairing a product (McCollough, 2010) were identified in literature to influence the repair decision. Based on all these observations and findings we incorporate the economic driver

(EcoD) by evaluating the (economic) attitude towards repair, specifically the attitude of individuals whether repairing is rewarding (or a waste of money), useful (or a waste of time) and sensible.

> *H2a/H2b/H2c:* The driver related to economic considerations (EcoD) 'Economic attitude towards repair' influences *RIa/RIb/RIc*.

Third, there are also social acceptance drivers (SocD) which are related to social norms in the context of repairs. Normative influence is a key factor of several social-psychological models related to behavioural decision-making (Passafaro et al., 2019). For instance, social norms are determinants of waste-prevention-behaviour (Corsini et al., 2018). According to Wirtz and Lovelock (2015, p. 6) *'intangibility, heterogeneity (variability of quality), inseparability of production and consumption and perishability of output'* are frequently cited characteristics of services (including repair services) which pose distinct marketing challenges. It is this uncertainty about quality variability we focus on: an important influencing factor of the repair decision is the trust in a repair service provider (McCollough, 2010). One way for individuals to evaluate that trust (and hence aiming to decrease heterogeneity of output) is by making use of experiences and opinions of social groups (cf. Lazaric et al., 2020). Hence, due to the heterogeneity of output consumers might approach relevant peer groups whether to repair a product or not. In addition, repair can evoke a sense of shame due to lack of care or lack of financial capacities (Gregson et al., 2009), what emphasises that activities and opinions related to repairs of relevant social groups can be a driver. According to our described findings we hypothesise that social norms can drive the intention to repair. We address social norms by assessing the influence of relevant peer groups (Ajzen, 1991).

> *H3a/H3b/H3c:* The driver related to social acceptance (SocD) 'Social norm' influences *RIa/RIb/RIc*.

2.2. Refining the theoretical framework using perceived repair difficulty, past behaviour, and socio-demographic factors

In order to obtain a more differentiated view, we consider additional influencing factors on the repair intention in the study. One conclusion of Sabbaghi et al. (2016) is that – besides the usefulness of repair information – the complexity of repair is relevant. Perceiving repair activities as not feasible or very difficult can be an unsurmountable barrier (Tecchio et al., 2019). Hence, the *perceived difficulty of repair activities* is incorporated in the study. Jaeger-Erben et al. (2021) tackled the impact of *past repair behaviour* and emphasised its importance. Sabbaghi et al. (2017) could cluster types of consumer electronics based on the unsuccessful repair experiences of respondents. Therefore, also repair experiences in terms of past behaviour (*PB*) are considered in this study. Again, it is differentiated between the frequency of using repair services (*PBa*), DIY repairs (*PBb*) and making use of a repair network (*Pbc*).

> *H4a/H4b/H4c:* The perceived difficulty of repair activities influences *RIa/RIb/RIc*.

> *H5a/H5b/H5c:* Past behaviour (*PBa/PBb/PBc*) influences *RIa/RIb/RIc*.

Age can positively correlate with repair (McCollough, 2010) and according to literature, professional repair services are more likely hired by women (Rogers et al., 2021; Rosner and Ames, 2014). Therefore the respondent's *age* and *gender* were also taken into consideration. Furthermore, the role of *income* of consumers is evaluated: consumers
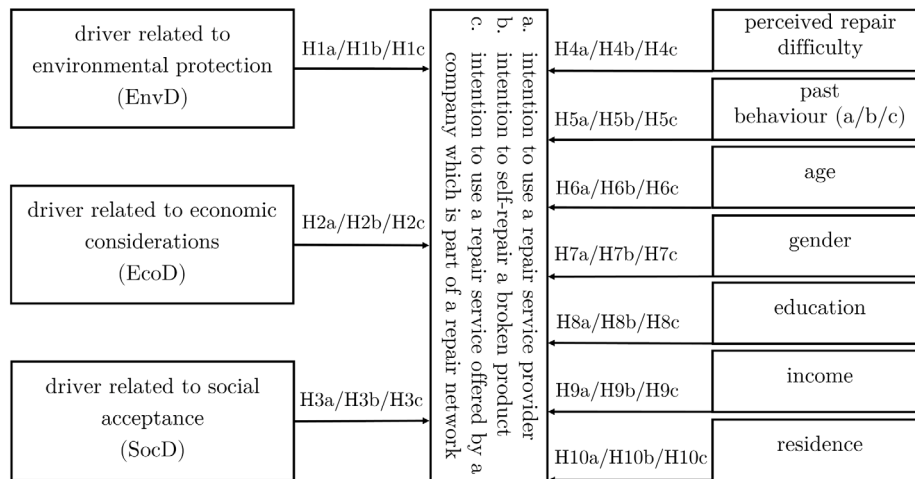
Fig. 1. Theoretical Framework of the impact of drivers of the consumers' intention whether to repair broken products or not.

seem to more likely replace their product instead of repairing it with increasing income (McCollough, 2007). Related, but somewhat contrary to this, Rogers et al. (2021) found that affordability is not a driving influencing factor if *education* is assumed as a proxy for income (Rogers et al., 2021). McCollough (2010) applied education as a proxy for environmental awareness and observed a positive effect of education, too. Also spatial accessibility of repair service providers is essential: since the travel distance to repair service providers and thus, the accessible infrastructure influences decision-making (Gerner and Bryant, 1980), differences depending on the *residence* – e.g., rural or urban areas – might occur. In addition, considering the city of Graz, a repair funding is available exclusively to the local, urban residents (Lechner et al., 2021).

> *H6a-10a/H6b-10b/H6c-10c*: Age/Gender/Education/Income/ Residence influence *RIa/RIb/RIc*.

2.3. Resultant theoretical framework

In Fig. 1, the theoretical framework including the factors described in Section 2.1 and in Section 2.2 is shown. The relevance of these repair drivers and influencing factors is not limited to a specific product category but can be used for repairs of consumer goods in general. To address the different repair intentions in our study, the framework is applied for *RIa*, *RIb* and *RIc*.

2.4. Additional aspects surveyed in this study

Complementing the structural model described above, several additional aspects are taken into account. On the one hand, they can quantitatively benchmark the situation in Graz against results from previous studies. For example, it had been found that consumers are willing to pay between 19% and 30% of the purchase price for a product repair (Adler and Hlavacek, 1976; European Commission, 2018; McCollough, 2007). Thus, we added the *maximum accepted repair price* into our analysis. Since repairing can be economically rewarding if it costs less than replacing the product (King et al., 2006; McCollough, 2009), the maximum accepted repair price was identified in percent of the purchase price. Similarly, *maximum accepted repair time* (in days), waiting time (McCollough, 2007), as well as *travel time* (Gerner and Bryant, 1980; McCollough, 2007) to the repair office were also included.

On the other hand, these additional aspects should help to provide a richer insight into the shaping of consumer intentions for repair. Further, those factors can be used to gain a deeper understanding of the outcomes related to the hypotheses. We complement the driver related to environmental protection with *environmental concern* of individuals in order to contrast the perceived awareness of environmental consequences of inaction – which is directly related to repair – with the more general environmental concern. Even though environmental concern was identified as an influencing factor of the repair decision (McCollough, 2010), repair is not necessarily perceived as being environmentally sound even for individuals with a high environmental concern.

Contributing to the understanding of aspects related to social acceptance, *recommendations of social groups* are evaluated to reveal information sources utilised by consumers for supporting their repair decisions. Furthermore, since changing fashions or the loss of status (Cooper et al., 2017) are presumed to be barriers of repair, the *attitude towards new (fashionable) products* is integrated in this study. Finally, *trust in the repair service provider* (McCollough, 2010) has been discussed in literature to be important within the repair decision and is therefore included.

3. Methodology

In this section, we clarify the scope of the study, detail survey development, and provide insights into applied methods used for data analysis.

3.1. Scope of study

The focus of this study is on consumer goods. Further, the specific situation in Styria (Austria) facilitates to integrate different repair intentions (*RIa, RIb and RIc*) in the study. The location of the University in Graz as well as the collaboration with the local repair network allows to obtain precise information about regional repair initiatives and organisations, easing interpretation of results. Thus, we decided to design a questionnaire survey including specific characteristics – as for example the awareness of the local repair network – and distribute the survey across the whole of Styria. The study does not focus exclusively on repair networks but is primarily dedicated to the effect of drivers on different repair intentions. Further, some aspects also investigated in other studies (e.g., maximum accepted repair price, socio-demographic factors, cf. European Commission (2018), Rogers et al. (2021)) are included in the survey to be used for validation whether the findings of this Styrian study can be transferred to other regions.

3.2. Survey development

The questionnaire survey was developed with the objective to investigate the constructs of the theoretical framework presented in Section 2, thus being able to answer the research questions. The items of the questionnaire mainly employ a five-point Likert scale, where one indicates strong disagreement concerning repairs and five a positive view. Beyond this, different scales were used and the order of questions was mixed to avoid common method bias (cf. Podsakoff et al., 2003). Most items were adapted from literature, for a detailed description and further information please refer to Tables A.7 and A.8 in the Appendix.

To emphasise during the survey that the focus is not on one single product category but on several different consumer goods, *perceived repair difficulty* and *maximum accepted repair price* are incorporated in the study in the following way: for *perceived difficulty of repair activities* we examine whether respondents categorise statements like 'make the brewing group (coffee machine) functional again', 'replace the bicycle chain', or 'replacement of a smartphone display' as simple repair/medium repair/difficult repair/no repair (please refer to Fig. A.3 in the Appendix). Also, for the evaluation of maximum accepted repair costs/time, references were made to different product categories[4].

Finally, items to survey major assumptions in terms of guarantee/warranty and emotional aspects were included. First, as we assume that most individuals would decide to repair if there is a guarantee/warranty – what would impede the investigation of the trade-off between drivers related to environmental protection, social acceptance, and economic considerations – we ask for the willingness to repair products under guarantee/warranty. Second, concerning repair reasons like sentimentality or nostalgia (Page, 2014) it was assumed that respondents with an emotional attachment to their products get these products mended anyway. This was reflected by the question whether respondents do/partly/don't repair due to emotional reasons.

The study was launched with the pre-test (n = 20) of the survey questions between the 1st and 26th of April 2020. The online questionnaire was spread (in German language) through the market research agency Marketagent.com between the 3rd and 13th of August 2020[5]. Styrian citizens older than eighteen years were addressed to participate in the questionnaire. The study does not focus on a specific product type or consumer group – e.g., with certain repair knowledge – but aims to reflect the variety of Styrian citizens. Thus, apart from a requested variety of participants regarding age, gender and education, potential respondents were randomly chosen from the panel by Marketagent.com.

3.3. Applied methods for data analysis

Unless otherwise stated all analyses were conducted applying SPSS 26 and AMOS 27 software packages. Initially, extensive data plausibility checks facilitated to overview the data quality. Apart from descriptive statistics, general validity checks (e.g., missing values, invalid data) and respective data cleaning ensured a meaningful dataset. As a result, only respondents who fully completed the survey were included. In some cases, respondents did not respond to certain items. These values were filled by data imputation: using Random Forest-based imputation implemented in *R*'s mice-package (van Buuren and Groothuis-Oudshoorn, 2011) we tackled the problem of missing data. Applying different imputation methods (as the method integrated in

AMOS, deletion, mean imputation, etc.) did not change the general structure of results. Apart from *perceived difficulty of repair activities*, all other variables included in the study consist of predefined levels, which were already used within the survey. For the former factor, respondents categorised different statements covering a wide variety of products and repair activities (see Fig. A.3 in the Appendix). In order to examine if certain groups of respondents assess these statements similarly and hence share a similar perception of difficulty concerning repair, a *k*-means cluster analysis was conducted: the analysis revealed that it is possible to cluster respondents in four different groups. These groups differ in terms of their interpretation of the difficulty of the stated activities. Based on these insights, the variable *Perceived difficulty of repair*, consisting of four levels of difficulty ('Not/Less/More/Very difficult'), was introduced to differentiate between the clusters. After obtaining a complete dataset, exploratory factor analysis and confirmatory factor analysis helped to test reliability and validity of data through factor loadings, t-values, composite reliability, and average variance extracted (AVE). Cronbach's α uncovers internal consistency among grouped items. Data was also analysed for common method bias, using the single-method-factor approach in AMOS. Covariance-based structural equation modelling was applied to test the hypotheses given in Section 2. Descriptive statistics and statistical tests for comparing means were used for further analysis based on additional surveyed aspects to complement the theoretical framework.

4. Modelling and results

We start with a description of the sample to obtain a general understanding of the respondents, followed by the results from the exploratory/confirmatory factor analysis. Finally, we present the results from our structural equation model.

4.1. Sample description

In total 1,170 respondents participated in this study, from which 270 respondents completed the survey only partially. Hence, there is a total of n = 900 valid responses.

In order to assess the different repair intentions, participants have to be aware of the repair options: since not every respondent knew the repair network *GRAZ repariert*, the dataset was split into two samples. The first sample exclusively contains respondents who are not aware of the repair network (n = 736). Thus, analyses are constrained to repair intentions *RIa* and *RIb*. Conversely, 164 respondents (18.2%) know *GRAZ repariert*. For this dataset (n = 164), all three repair intentions (*RIa, RIb, RIc*) are considered for analyses.

The overview of all socio-demographic factors, past repair behaviour, and perceived repair difficulty – using the split datasets – is provided in Table 1. It turns out that in general the variables are well-distributed among the attributes. However, there is an overproportional share of respondents with a residence in Graz. These residents are significantly more aware of the Graz-based repair network than others. We interpret this expected result as a positive signal concerning data accuracy, as the focus of the repair network is on Graz. In addition, the table also contains an indication of past behaviour: most of the respondents have at least once used a repair service or carried out a DIY repair by themselves. While a large share of respondents have self-repaired broken products very often (39.3%), the number of respondents using a repair service very frequently is rather limited. Furthermore, even though 164 respondents are aware of *GRAZ repariert*, about three out of four have not yet used it.

Allowing for the research objective to include various intentions to repair, we base our research on the split datasets, representing individuals who are/are not aware of the repair network. In total, we create five different model variations to be examined in the modelling phase:

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[4] Categories cover: daily domestic appliances, electronic equipment, jewellery, bicycle, musical instrument, cell phone, furniture and articles of clothing. These product categories are motivated by the product categories which are promoted on the webpage of GRAZ repariert (https://grazrepariert.at/).

[5] Note that the quantitative online survey was carried out in the scope of a Master Thesis (Fachbach, 2020).

Table 1
Sample description.

	Variables	Attribute	Repair network not known (n = 736)		Repair network known (n = 164)	
			n	%	n	%
Socio-demographic factors	Gender	Male	370	50.30	76	46.30
		Female	366	49.70	88	53.70
	Age	18–29	137	18.60	18	11.00
		30–39	124	16.80	34	20.70
		40–49	141	19.20	25	15.20
		50–59	154	20.90	42	25.60
		60+	180	24.50	45	27.50
	Income	Very low	74	10.10	8	4.90
		Below average	131	17.80	30	18.30
		Average	380	51.60	85	51.80
		Above average	119	16.20	30	18.30
		Very high	32	4.30	11	6.70
	Education	Compulsory School	47	6.40	7	4.30
		Apprenticeship	330	44.80	59	36.00
		A-Level	199	27.00	42	25.60
		University	160	21.80	56	34.10
	Residence	Graz	272	37.00	105	64.00
		Rest of Styria	464	63.00	59	36.00
Difficulty	Perceived repair difficulty	Not difficult	166	22.60	45	27.40
		Less difficult	217	29.50	39	23.80
		More difficult	236	32.00	53	32.30
		Very difficult	117	15.90	27	16.50
Past repair behaviour	PBa - using repair services	Never	25	3.40	6	3.60
		1-5x	308	41.80	66	40.20
		6-10x	213	28.90	47	28.70
		10-20x	100	13.60	19	11.60
		More than 20x	90	12.30	26	15.90
	PBb - DIY repairs	Never	37	5.00	5	3.00
		1-5x	188	25.50	56	34.20
		6-10x	140	19.00	27	16.50
		10-20x	82	11.20	11	6.70
		More than 20x	289	39.30	65	39.60
	PBc - make use of a repair network	Never	–	–	120	73.20
		1-5x	–	–	36	22.00
		6-10x	–	–	4	2.40
		10-20x	–	–	3	1.80
		More than 20x	–	–	1	0.60

1a Respondents are not aware of 'GRAZ repariert' (n = 736), tested repair intention is *RIa*.

1b Respondents are not aware of 'GRAZ repariert' (n = 736), tested repair intention is *RIb*.

2a Respondents are aware of 'GRAZ repariert' (n = 164), tested repair intention is *RIa*.

2b Respondents are aware of 'GRAZ repariert' (n = 164), tested repair intention is *RIb*.

2c Respondents are aware of 'GRAZ repariert' (n = 164), tested repair intention is *RIc*.

4.2. Results related to the exploratory factor analysis

To investigate factor validity, exploratory factor analysis based on principal component analysis was applied. Promax rotation was chosen due to the intercorrelation of components (Weiber and Mühlhaus, 2014). The Kaiser–Meyer–Olkin-Measure was greater than the suggested value of 0.6 in all model variations (Kaiser and Rice, 1974) (1a: 0.84; 1b: 0.82; 2a: 0.80; 2b: 0.76; 2c: 0.71). Considering the factor loadings of model variations 1b, 2b, and 2c, there are four distinct components (EnvD, EcoD, SocD, RIb/RIc) with factor loadings exceeding 0.7. In model variations 1a and 2a, there are three distinct components. The items of EnvD and RIa are allocated to the same component. However, the factor loadings differ (EnvD between 0.77 and 0.93 and RIa between 0.40 and 0.46) and both constructs can also

be clearly distinguished based on content. Since confirmatory factor analysis (see Section 4.3) proposes the reliability and validity of the constructs, too, also for model variations 1a and 2a all four constructs are clearly separated. Furthermore, in the Appendix (Table A.7 and Table A.8) Cronbach's α is provided: all values exceed 0.7, and most even 0.8. Hence, Cronbach's α is within the range proposed by literature, suggesting internal consistency (cf. Nunnally, 1978).

4.3. Results of the confirmatory factor analysis

To test reliability and validity of the data, a confirmatory factor analysis was conducted. Table 2 presents the respective results: since (1) almost all index factor loadings are significant and at a minimum of 0.5,[6] (2) composite reliability values exceed 0.7 and in most cases 0.8, and (3) average variance extracted (AVE) exceeds 0.5, data and measures are considered as being adequate (as indicated in Bagozzi and Yi, 1988; Fornell and Larcker, 1981). In addition, as the square root of AVE is larger than the correlations between the constructs, discriminant validity is successfully evaluated (cf. Fornell and Larcker, 1981; Hair et al., 2014). A common latent factor was introduced in

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[6] Even though the factor loadings of the second item of SocD in model variations 2a, 2b and 2c are 0.42/0.43 (and hence below 0.5), we decide to include the item in the model to make fair comparisons among models possible.

Table 2

Confirmatory factor analysis; Scale: 1 = 'do not agree at all'; 5 = 'totally agree'; [a] refers to *RIa*; [b] refers to *RIb*; [c] refers to *RIc*; (1) refers to 'Participants do not know the repair network (n = 736)', (2) refers to 'Participants know the repair network (n = 164)'; C.R. = Critical ratio.

Construct	Item	Factor loading (1)	Factor loading (2)	C.R. (1)	C.R. (2)	Composite reliability (1)	Composite reliability (2)	Avg. variance extracted (1)	Avg. variance extracted (2)
EnvD	I1.1	0.83[a] 0.83[b]	0.84[a] 0.83[b] 0.83[c]	–	–				
	I1.2	0.79[a] 0.78[b]	0.79[a] 0.79[b] 0.80[c]	23.32[a] 23.12[b]	10.68[a] 10.38[b] 10.41[c]	0.87[a,b]	0.84[a,b,c]	0.69[a,b]	0.64[a,b,c]
	I1.3	0.87[a] 0.87[b]	0.77[a] 0.78[b] 0.78[c]	25.64[a] 25.49[b]	10.27[a] 10.21[b] 10.15[c]				
EcoD	I2.1	0.77[a] 0.77[b]	0.80[a] 0.79[b] 0.79[c]	–	–				
	I2.2	0.73[a] 0.73[b]	0.64[a] 0.64[b] 0.64[c]	19.70[a] 19.68[b]	8.16[a] 8.11[b] 8.08[c]	0.84[a,b]	0.82[a,b,c]	0.65[a,b]	0.61[a,b,c]
	I2.3	0.90[a] 0.91[b]	0.89[a] 0.90[b] 0.90[c]	22.48[a] 22.49[b]	10.77[a] 10.53[b] 10.49[c]				
SocD	I3.1	0.72[a] 0.71[b]	0.74[a] 0.77[b] 0.76[c]	–	–				
	I3.2	0.57[a] 0.57[b]	0.42[a] 0.43[b] 0.43[c]	13.44[a] 13.35[b]	4.92[a] 4.94[b] 4.97[c]	0.76[a,b]	0.74[a,b,c]	0.52[a,b]	0.50[a,b,c]
	I3.3	0.84[a] 0.85[b]	0.89[a] 0.86[b] 0.86[c]	15.68[a] 15.30[b]	6.31[a] 6.63[b] 6.51[c]				
RIa	I4.1	0.78[a]	0.74[a]	–	–				
	I4.2	0.74[a]	0.86[a]	14.51[a]	7.70[a]	0.73[a]	0.78[a]	0.57[a]	0.64[a]
RIb	I4.3	0.80[b]	0.63[b]	–	–				
	I4.4	0.83[b]	0.92[b]	14.48[b]	4.02[b]	0.80[b]	0.76[b]	0.66[b]	0.62[b]
RIc	I4.5	–	0.85[c]	–	–				
	I4.6	–	0.83[c]	–	3.16[c]	–	0.83[c]	–	0.70[c]

the AMOS model to check the models on common method bias. By including a marker variable, a potential common variance can be reduced/controlled (Podsakoff et al., 2003).

4.4. Results of the structural equation modelling

For analysing the proposed hypotheses we apply structural equation modelling using the AMOS module in SPSS. Again, the five different model variations (1a, 1b, 2a, 2b, 2c) are created to test the impact of the drivers on different repair intentions.

4.4.1. Assessing the quality of the models

As stated in Section 3.3, we applied various methods for dealing with missing data, thereof the method implemented in AMOS and Random Forest (using *R*) for imputation of missing data which performed best. Even though the results of the method included in AMOS provide slightly superior results in terms of significance related to hypotheses compared with the imputation based on Random Forest, we opted for the latter due to the option to compare the models based on Goodness-of-Fit-indices.

In Table 3, various fit indices are provided as quality indicators related to the five different model variations obtained from structural equation modelling. The recommended values are in accordance with Kline (2011) and Tabachnick and Fidell (2007). It is obvious that the models based on the dataset where respondents are aware of *GRAZ repariert* are of inferior quality. Specifically, the Normed-Fit-indices (NFI) are not within the proposed range. However, as the sample size of the underlying dataset is less than 200, this index may underestimate the fit (Bentler, 1990). Furthermore, all other indices (χ^2/df, GFI, CFI, RMSEA) are close to or within the recommended range of values. Thus, we account the respective models as being sufficiently meaningful.

4.4.2. Findings related to EnvD, EcoD, and SocD

The results of hypotheses testing (*H1*, *H2* and *H3*) are outlined in Table 4 and Fig. 2. It turns out that for the dataset containing respondents who are not aware of the repair network all hypotheses can be accepted. Hence, although the path coefficients are at different levels, all drivers were identified as influencing factors concerning the different intentions to repair (1a/1b). Nevertheless, for both 1a and 1b the driver related to environmental protection has the highest influence. The analysis based on respondents who are aware of the

Table 3

Goodness-of-fit indices: model variations 1a/1b/2a/2b/2c; GFI: Goodness-of-Fit Index; CFI: Comparative-Fit-Index; NFI: Normed-Fit-Index; RMSEA: Root Mean Square Error of Approximation.

Fit indices	Recommended value	Result value 1a/1b/2a/2b/2c
χ^2/df	2< χ^2/df<5	2.85/3.40/1.62/1.95/1.98
GFI	≥0.9	0.95/0.94/0.88/0.86/0.86
CFI	≥0.9	0.94/0.93/0.91/0.86/0.86
NFI	≥0.9	0.91/0.90/0.79/0.75/0.76
RMSEA	≤0.08	0.05/0.06/0.06/0.08/0.08

repair network shows similarities: the structural patterns remain unchanged, as all drivers have a positive impact on the repair intention *RIa* and *RIb*. However, the respective level of significance holds only partially true. For none of the tested model variations (2a/2b/2c), all three drivers are significant factors. While in model 2a the driver related to environmental protection and to economic considerations show significant loadings, the driver related to social acceptance is the only significant one in model 2b. Model 2c emphasises the impact of economic considerations, which is the only significant factor.

4.4.3. Findings related to socio-demographic factors, past behaviour, and perceived repair difficulty

Further analyses based on socio-demographic factors, past behaviour, and perceived repair difficulty refine the study results. Fig. 2 and Table 5 summarise the results of the structural equation models and the hypotheses results related to those variables (*H4-H10*) for all three different repair intentions.

Based on the first dataset we found that the factor 'perceived repair difficulty' has a (partly significant) negative impact on the (self-)repair intention (H4), independent from the model. On the contrary, past behaviour has a – apart from the second dataset for model RIa – highly significant positive influence on all three intention-types (H5). The impact of other variables is less clear: interestingly, neither age (H6), nor education (H8) nor income (H9) provide (significant) conclusive results in general with only positive or negative contributions. Only for the general repair intention (1a), age has a significant positive impact, which suggests that older respondents get products mended by repair service providers more often.
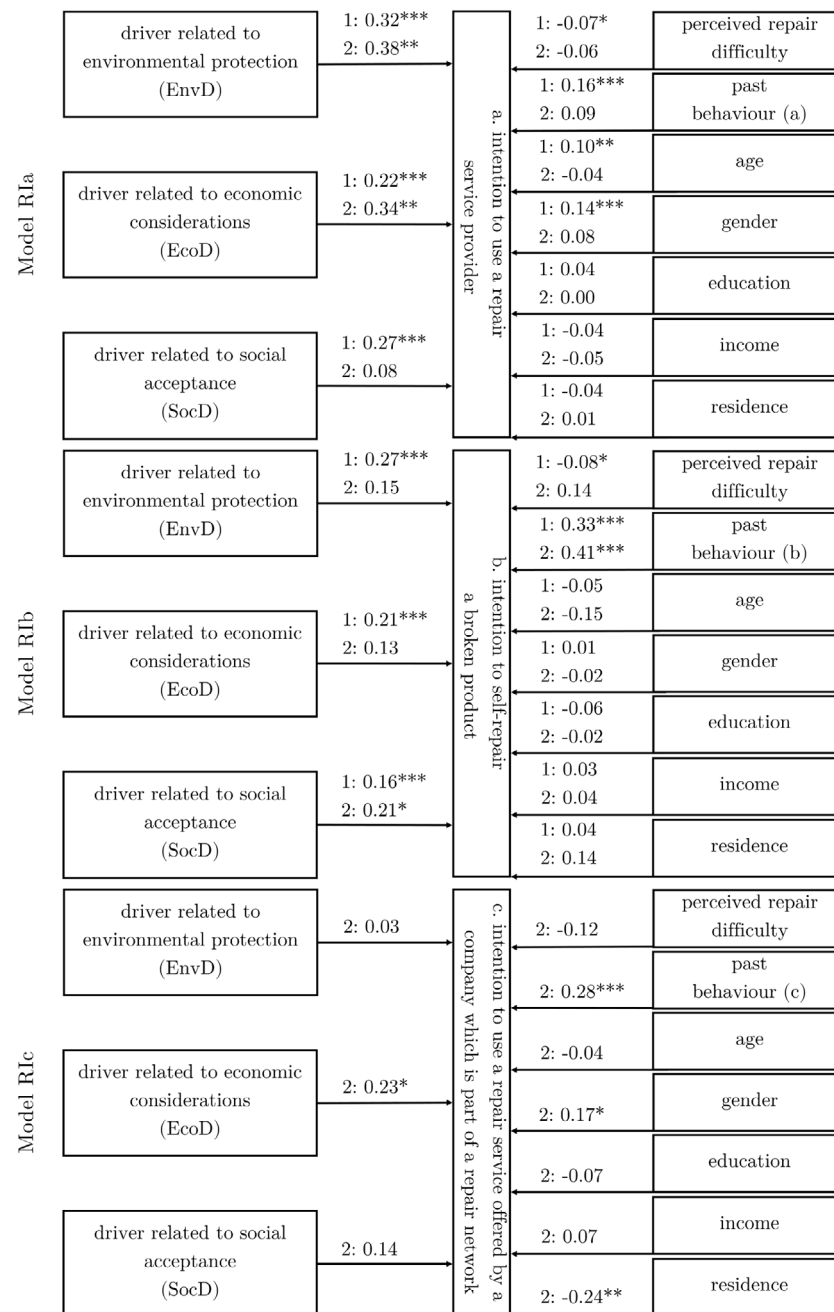
Fig. 2. Structural equation model results; 1: dataset 1 (repair network not known), 2: dataset 2 (repair network known); Sig: *** $p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$; perceived repair difficulty (0 = not difficult); past behaviour (0 = never); age (0 = 18–29); gender (0 = male); education (0 = compulsory school); income (0 = very low); residence (0 = Graz).

According to the analysis concerning gender (H7; 0 = men, 1 = women), in terms of self-repair no differences could be observed. Yet, this may be related to the finding that no significant difference between men and women could be observed regarding the perceived repair difficulty (men mean = 1.39; women mean = 1.42; t-value: −0.35; Sig: n.s.). On the other hand, women rather tend to make use of a repair service provider or a network compared with men. The positive correlation is significant for 1a and 2c and insignificant for 2a. Here, further analyses revealed two potential influencing factors: women (mean = 3.83) have a significantly (t-value: −2.42; Sig:*) higher trust in repair service providers than men (mean = 3.69). Additionally,

female respondents have a significantly higher environmental concern (women: mean = 4.04; men: mean = 3.82; t-value: −4.17; Sig:***).

Finally, the significant negative correlation for residence (H10) substantiates our study: as some respondents who are aware of *GRAZ repariert* are not residents in Graz (0 = resident in Graz, 1 = resident outside of Graz), they will less likely utilise the local repair network. This is emphasised by the surveyed travel time to the repair service providers: respondents who live in urban areas (mean = 3.02) indicate a better accessibility of repair service providers than respondents who live in rural areas (n = 2.79), expressed by a significant difference (t-value: 2.91; Sig:**).

Table 4
Hypotheses results — EnvD, EcoD, and SocD (***$p \leq 0.001$, **$p \leq 0.01$, *$p \leq 0.05$, n.s.: not significant); S.E. = Approximate standard error; C.R. = Critical ratio.

Hypothesis	Patch coeff.	Path coeff.	S.E.	C.R.	p	Accept / Reject
Repair network not known (n = 736)						
Model 1a/RIa						
H1a	EnvD → RIa	0.32	0.05	6.27	***	Accept
H2a	EcoD → RIa	0.22	0.07	4.42	***	Accept
H3a	SocD → RIa	0.27	0.06	5.47	***	Accept
Model 1b/RIb						
H1b	EnvD → RIb	0.27	0.05	5.40	***	Accept
H2b	EcoD → RIb	0.21	0.08	4.32	***	Accept
H3b	SocD → RIb	0.16	0.06	3.47	***	Accept
Repair network known (n = 164)						
Model 2a/RIa						
H1a	EnvD → RIa	0.38	0.12	3.02	**	Accept
H2a	EcoD → RIa	0.34	0.15	2.88	**	Accept
H3a	SocD → RIa	0.08	0.08	0.93	n.s.	Reject
Model 2b/RIb						
H1b	EnvD → RIb	0.15	0.13	1.20	n.s.	Reject
H2b	EcoD → RIb	0.13	0.16	1.08	n.s.	Reject
H3b	SocD → RIb	0.21	0.10	2.15	*	Accept
Model 2c/RIc						
H1c	EnvD → RIc	0.03	0.15	0.22	n.s.	Reject
H2c	EcoD → RIc	0.23	0.20	1.98	*	Accept
H3c	SocD → RIc	0.14	0.11	1.58	n.s.	Reject

Table 5
Hypotheses results — perceived repair difficulty, past repair behaviour and socio-demographic factors (***$p \leq 0.001$, **$p \leq 0.01$, *$p \leq 0.05$, n.s.: not significant); S.E. = Approximate standard error; C.R. = Critical ratio.

Hypothesis	Patch coeff.	Path coeff.	S.E.	C.R.	p	Accept/ Reject
Repair network not known (n = 736)						
Model 1a/RIa						
H4a	Perceived difficulty → RIa	−0.07	0.03	−1.94	*	Accept
H5a	PBa → RIa	0.16	0.02	4.43	***	Accept
H6a	Age → RIa	0.10	0.02	2.73	**	Accept
H7a	Gender → RIa	0.14	0.05	4.01	***	Accept
H8a	Education → RIa	0.04	0.03	0.93	n.s.	Reject
H9a	Income → RIa	−0.04	0.03	−1.03	n.s.	Reject
H10a	Residence → RIa	−0.04	0.06	−1.00	n.s.	Reject
Model 1b/RIb						
H4b	Perceived difficulty → RIb	−0.08	0.03	−2.35	*	Accept
H5b	PBb → RIb	0.33	0.02	8.83	***	Accept
H6b	Age → RIb	−0.05	0.02	−1.46	n.s.	Reject
H7b	Gender → RIb	0.01	0.06	0.19	n.s.	Reject
H8b	Education → RIb	−0.06	0.04	−1.55	n.s.	Reject
H9b	Income → RIb	0.03	0.03	0.70	n.s.	Reject
H10b	Residence → RIb	0.04	0.06	1.14	n.s.	Reject
Repair network known (n = 164)						
Model 2a/RIa						
H4a	Perceived difficulty → RIa	−0.06	0.05	−0.82	n.s.	Reject
H5a	PBa → RIa	0.09	0.04	1.18	n.s.	Reject
H6a	Age → RIa	−0.04	0.04	−0.47	n.s.	Reject
H7a	Gender → RIa	0.08	0.10	1.18	n.s.	Reject
H8a	Education → RIa	0.00	0.06	0.05	n.s.	Reject
H9a	Income → RIa	−0.05	0.05	−0.67	n.s.	Reject
H10a	Residence → RIa	0.01	0.10	0.15	n.s.	Reject
Model 2b/RIb						
H4b	Perceived difficulty → RIb	0.14	0.05	1.81	n.s.	Reject
H5b	PBb → RIb	0.41	0.05	4.32	***	Accept
H6b	Age → RIb	−0.15	0.04	−1.92	n.s.	Reject
H7b	Gender → RIb	−0.02	0.10	−0.21	n.s.	Reject
H8b	Education → RIb	−0.02	0.06	−0.31	n.s.	Reject
H9b	Income → RIb	0.04	0.06	0.48	n.s.	Reject
H10b	Residence → RIb	0.14	0.12	1.79	n.s.	Reject
Model 2c/RIc						
H4c	Perceived difficulty → RIc	−0.12	0.06	−1.55	n.s.	Reject
H5c	PBc → RIc	0.28	0.11	3.33	***	Accept
H6c	Age → RIc	−0.04	0.05	−0.52	n.s.	Reject
H7c	Gender → RIc	0.17	0.13	2.30	*	Accept
H8c	Education → RIc	−0.07	0.08	−0.85	n.s.	Reject
H9c	Income → RIc	0.07	0.07	0.94	n.s.	Reject
H10c	Residence → RIc	−0.24	0.15	−2.94	**	Accept

4.5. Group comparisons

Referring to Section 2.4, we detail the results concerning respondents who are (or are not) aware of the repair network to obtain a deeper understanding of consumers in different contexts. For this purpose, certain comparisons of these groups – which are summarised in Table 6 – provide more insights.

First, consumers who know the repair network have a higher environmental concern than respondents who are not aware of the network. On the contrary, no significant difference could be investigated regarding the attitude towards new (fashionable) products.

Detailing the insights regarding economic aspects reveals that the maximum accepted repair time is between four and nine days depending on the product type (see Table A.10 in the Appendix). Regarding the perception of travel time to the repair service providers no significant difference could be identified between groups (not) aware of the *GRAZ repariert*. In terms of cost, respondents who know the repair network of Graz accept higher maximum repair costs (21%–35% of the purchase price depending on the product type) in comparison to respondents who do not know the repair network (18%–31% of the purchase price depending on the product type).[7]

The further analysis concerning social aspects targets at peer groups and trust. Respondents were asked to categorise different social groups according to their impact on decision-making, i.e., whether they consider them as an important source of recommendation for their repair decision (see Table A.11 in the Appendix). No matter if respondents know the repair network of Graz or not, family, experts, and friends have the greatest influence, whereas social media and distant relatives are non-essential.

Additionally, the investigation of trust in repair service providers shows that there is a significant difference between both groups: respondents who do not know the repair network have a lower trust than respondents who know the repair network.

5. Discussion

5.1. Impact of drivers related to environmental protection, economic considerations, and social acceptance on RIa, RIb and RIc (research question 1)

Previous research showed that – individually – drivers related to environmental protection, economic considerations, or social acceptance are important (cf., e.g., McCollough, 2010; Sabbaghi et al., 2016; Tecchio et al., 2019). The results in Section 4.4 (see Table 4) demonstrate that for diverse repair intentions (*RIa/RIb/RIc*) the intention to repair can be influenced differently by the drivers, i.e., the loadings of the drivers differ: the models with respondents who do not know the repair

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[7] For a product-specific breakdown we refer to Table A.9 in the Appendix.

Table 6
Group comparison of individuals who are (not) aware of the repair network; [a] refers to mean-value based on the Scale 1 = 'do not agree at all' and 5 = 'totally agree'; [b] refers to Table A.9; [c] refers to Table A.10; [d] refers to Table A.11.

	Repair network not known	Repair network known	t-value	p-value
Environmental concern	3.90[a]	4.07[a]	2.50	*
Attitude towards new (fashionable) products	2.33[a]	2.23[a]	−1.33	n.s.
Max. accepted repair price	18%–31% of purchase price[b]	21%–35% of purchase price[b]	–	–
Max. accepted repair time	4–9 days[c]	4-9 days[c]	–	–
Travel time to repair service provider	2.86[a]	3.01[a]	1.46	n.s.
Trust in repair service provider	3.73[a]	3.90[a]	2.23	*
Recommendation of social groups (Top 3)	Family, experts, friends[d]	Family, experts, friends[d]	–	–

network revealed that all three drivers have a significant impact on the intention to use a repair service as well as on DIY repair. Yet, the environmental aspects seem to have the strongest effect. Looking at the smaller sample of respondents who are aware of the network *GRAZ repariert*, a more diverse picture can be observed. First, environmental considerations are still the strongest influencing factor for the intention to use a repair service provider in general. Second, the intention of self-repairers is mainly shaped by social norm. In contrast to that, economic considerations drive the decision to have a company within the repair network perform the repair, while the relevance of environmental aspects almost completely disappears. This is interesting, since we found that respondents knowing *GRAZ repariert* not only have a higher willingness to pay for repair, but also show greater environmental concern (see Table 6). For self-repairers this may imply that their DIY capability defines a formative characteristic of their social network with respect to the operationalisation of their (high) environmental concern in terms of repair, which is in line with findings on the impact of social norms on pro-environmental behaviour in general (see, e.g., Farrow et al., 2017). For those respondents utilising *GRAZ repariert* one possible explanation is that the presence of economic incentives reduces impact of social/environmental aspects. This finding, in conjunction with the rising number of applications for funding (see Lechner et al., 2021), suggests that public funding is an effective way for policy-makers to promote repair service providers through direct economic interventions (cf. Dalhammar, 2019). Such an approach is in turn expected to soften the issue of early replacement of (some types of) products – induced, e.g., by great labour cost for services and low prices of new goods – by improving price competitiveness of repair and thus, striving for making repair the economically best option (King et al., 2006; Tecchio et al., 2019; Wieser and Tröger, 2018).

Summarising these findings, our study emphasises that the impact of drivers related to environmental protection, economic considerations, and social acceptance for self-repairers and consumers of repair services may vary for different repair intentions, constituting a novelty in repair-related literature (cf. Jaeger-Erben et al., 2021). Hence, focusing exclusively on one of the three examined drivers might not be sufficient to promote both using repair services and self-repair. Expanding on this, taking a closer look at the perceived repair difficulty, past repair behaviour, and socio-demographic factors reveals indicators for a more differentiated strategy to influence the (self-)repair intention.

5.2. Impact of perceived repair difficulty, past behaviour, and socio-demographic factors on RIa, RIb and RIc (research question 2)

The first main observation concerns the usage of repair services: according to our study, women are more likely to use a repair service than men (see Table 5). Rogers et al. (2021) argue that this could be due to the fact that women have a higher trust in the repair service provider. This argumentation is supported by our study, as such a difference in trust could also be identified. Nevertheless, the observed higher environmental concern of women – a well-studied phenomenon (see,

for example, Chan et al., 2019; Mueller and Mullenbach, 2018) – might also affect the intention to make use of repair services. Interestingly, no gender-related difference in the perception of repair difficulty could be found. As this is in contrast to former research which highlighted a diverse perception of males and females regarding repair skills (e.g., Rogers et al., 2021), more studies which include a refined set of potential impact factors are required to shed light on these findings.

In comparison, the residence has to be particularly considered with respect to the trade-off between consumption of repair services and DIY repair (see Table 5). In urban areas the intention to use a repair service is higher while in rural areas a (non-significant) increased intention to DIY repair was identified. One explanation for this might be the travel time to the repair service provider based on the density of repair infrastructure, impacting the accessibility of repair services (cf. Gerner and Bryant, 1980; McCollough, 2007). Hence, citizens who live in urban areas have a lower travel time to the repair service provider and thus, face lower economic barriers than consumers who live in rural areas. Together with the greater choice of repair service providers in urban compared to rural areas, this may exclude large parts of the population from utilising repair services, thereby reducing demand. Potential solution approaches might alleviate these infrastructural problems, for example by bringing the repair services to customers, or easy and cost-efficient transport of broken products to repair service providers. Another strategy could target at enabling individuals to self-repair through repair cafés, where individuals repair products on their own under the guidance of experts.

The two aspects 'perceived repair difficulty' and 'past behaviour' contribute to promotion of repair in general (see Table 5). Concerning perceived repair difficulty, even though model 2b is an insignificant exception, the results show that an increased perceived difficulty decreases the intention to (self-)repair. This provides an indication that the feasibility barrier discussed in literature (Tecchio et al., 2019) actually exists. Information about repairability of products might contribute to reduce the barrier related to the perceived repair difficulty. As mentioned in the introduction, the repairability index recently introduced in France is a step in that direction.

In addition, the outcome that past behaviour has a significant impact on the intention to repair is important especially in terms of promoting repair: the effort should be on motivating consumers to repair at least once, then they are likely to repeat repair. Potential explanations for this effect are different for self-repair and consumption of repair services. On the one hand, according to literature on do-it-yourself activities, accomplishment, control, and enjoyment can lead to (hedonic) DIY motivation (Halassi et al., 2019; Wolf and McQuitty, 2011). Thus, in the case of self-repair, this effect might be caused by positive repair experiences, leading to self-efficacy and a positive repair connotation (cf. Lauren et al., 2016). On the other hand, regarding repair services the effect that service experiences impact trust in the service provider is known from various studies in different contexts (e.g., Ho and Wei, 2016; Suh et al., 2006).

Trust is also an important aspect related to the repair network: in our study there is evidence that respondents who know the repair network have a higher trust in the repair service provider (see Table 6). This trust might be affected by the network which tries to increase trust by introducing quality criteria for member companies (Lechner et al., 2021). Nevertheless, trust can also be increased by social groups, since it is easier to trust a (repair) service provider if relevant social groups also trust the service provider (cf. Suh et al., 2006). Most respondents mentioned that they know *GRAZ repariert* from the newspaper, acquaintances/friends/family, social media and/or television. On the contrary, for the actual (self-)repair behaviour, recommendations of families, experts, and friends are the most important ones. Social media, distant relatives/acquaintances, public authorities, blogs/forums, radio, TV, newspapers, club colleagues and internet sources are considered as not that important (see Table A.11). Hence, even though people know the repair network from the classic media, the actual repair behaviour is mainly affected by word-of-mouth-communication with the close social network (friends, family), and experts. These findings are in line with research on social influence on sustainable consumption (Lazaric et al., 2020) and the impact of social norms on pro-environmental behaviour (see, e.g., Farrow et al., 2017).

Age positively impacts the utilisation of repair service providers (see Table 5), what also corresponds to results of former studies (see McCollough, 2010). Interestingly, no significant results concerning the impact of income and education on the repair intention could be identified (see Table 5), although the influence of these variables on repair behaviour could be found in previous studies (see Section 2.2). While the sample included both variables, a potential explanation is the different focus of this analysis on the impact on repair intention. To examine these contradicting results, more research on these variables is required.

5.3. Relevance of outcomes for other regions

Despite the restriction of the study to a single region, some results related to findings of other research works indicate that the basic outcomes can also be relevant for other regions with similar contexts, norms, and values. This is specifically true since the study does not focus exclusively on repair networks – which is a characteristic in Graz – but is dedicated to the effect of drivers on different repair intentions in general. For the purpose of validation, for instance, the outcome of the analysis regarding the maximum accepted repair price (see Table A.9 in the Appendix) is perfectly aligned with previous studies, showing that consumers are willing to pay between 19% and 30% of the purchase price for a product repair (Adler and Hlavacek, 1976; European Commission, 2018; McCollough, 2007). Further results are in line with insights from other studies, as for example the observation that women are more likely to utilise a repair service provider than men, or that age positively impacts the usage of repair service providers (see Fig. 2). These results build confidence that major parts of our study are relevant for other (European) regions and thus, transferable to regions with similar socio-economic and demographic background.

6. Conclusion, limitations and further research

In this study we determined drivers related to environmental protection, economic considerations, and social acceptance, and further socio-demographic factors, past behaviour, and perceived repair difficulty which are relevant for the repair intention of consumers. By means of a questionnaire we obtained data from Styrian citizens, what facilitated to demonstrate that the impact of the investigated drivers also depends on the considered repair intention. To the best of our knowledge, this is the first work investigating these effects. A variety of recommendations for policy-making as well as organisations dealing with repair can be deduced from our research. First, the focus on one aspect – e.g., environmental messages and appealing to green consumers – is not sufficient to efficiently boost repair in general, but all of the drivers related to environmental protection, economic considerations, and social acceptance must be addressed. Nevertheless, depending on whether demand for repair services or self-repair should be promoted, the intensity of measures should be adapted. This is emphasised by the observation in the context of the repair network *GRAZ repariert*, where indications for the effectiveness of public funding of repairs could be identified: even decision-making of consumers with a high environmental concern is mainly driven by economic considerations. With regard to the plethora of considerations related to financial policy instruments to boost repair, this finding is particularly important.

Furthermore, repair service consumption seems to be affected by the superior accessibility to repair services in urban areas compared with rural areas, what also affects the potential repair demand. This directly influences the emergence of a circular economy, as a successful transformation of the linear economy to a circular economy requires the contribution of as many individuals as possible. In that context we could see that if individuals have contributed and chosen to repair before, then they are likely to engage in repair activities. Two further findings are mainly relevant for repair service providers: besides the observation that maximum accepted prices/times for repair are in rather well-defined ranges, we found that word-of-mouth-communication through experts and the closer social network have a decisive influence on repair behaviour.

Of course, the study also has some limitations, which can be improved in future work. In terms of methodology, the use of paper-and-pencil questionnaires instead of, or in addition to the online questionnaire reduces the risk to exclude digitally disadvantaged groups and thus, avoiding sampling bias. Also extending the research approach by actual behaviour seems to be worthwhile in order to examine a potential intention-behaviour-gap, well-known in the context of pro-environmental consumer behaviour (Grimmer and Miles, 2017). Qualitative research methods could be applied to investigate the underlying motivations of consumers when they are exposed to situations with a specific trade-off between the drivers, as for example if they perceive drivers related to environmental protection and social acceptance to be pro-repairing but economic considerations to be against repairing. In that context, qualitative research could help to determine why the intention to use the repair network is mostly driven by economic considerations whereas the intention to use a repair service in general is driven by all three drivers. Finally, even though the maximum accepted repair price is a good estimator for pricing repair, further analyses – i.e., conjoint analysis – would allow to determine a more precise willingness-to-pay for repair, conditioned on the framing of the decision situation.

CRediT authorship contribution statement

Ines Fachbach: Conceptualization, Methodology, Investigation, Formal analysis, Visualization, Data curation, Writing – original draft. **Gernot Lechner:** Conceptualization, Methodology, Validation, Writing – review & editing. **Marc Reimann:** Conceptualization, Methodology, Writing – review & editing , Supervision.

Appendix
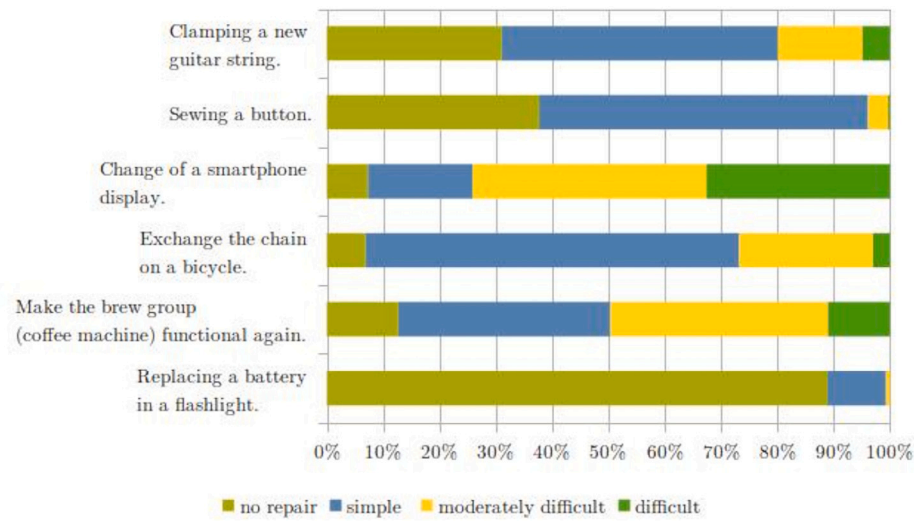
See Fig. A.3 and Tables A.7–A.11

Fig. A.3. Categorisation of (repair) activities.

Table A.7

Description of variables; Scale: 1 = 'do not agree at all'; 5 = 'totally agree'; x: Spearman–Brown-coefficient; SD = standard deviation; (1) Participants do not know the repair network (n = 736), (2) Participants know the repair network (n = 164); [1]adapted from Corsini et al. (2018); [2]adapted from Tonglet et al. (2004); [3]adapted from Bortoleto et al. (2012); The original questionnaire was in German, hence the items in this table have been translated into English.

Variable	Item		Mean		SD		Cronbach's α	
			(1)	(2)	(1)	(2)	(1)	(2)
EnvD[1,2]	I1.1	Repairing is more environmentally friendly than buying a new product.	4.25	4.41	0.81	0.75	0.87	0.84
	I1.2	Repairing reduces the amount of waste that goes into landfill.						
	I1.3	Repairing allows saving natural resources.						
EcoD[1,2]	I2.1	Repairing is useful/a waste of time.	4.38	4.44	0.68	0.68	0.83	0.80
	I2.2	Repairing is rewarding/a waste of money.						
	I2.3	Repairing is sensible/not sensible.						
SocD[2,3]	I3.1	Friends, relative, people around me, are repairing their products/have their products repaired.	3.22	3.25	0.77	0.79	0.73	0.71
	I3.2	It is important to my friends, relative, people around me to repair their products/have their products repaired.						
	I3.3	Most people think I should repair/have my products repaired.						
RIa	I4.1	I will have my next broken product repaired (if repairing is possible).	3.75	3.95	0.89	0.84	0.73x	0.78x
	I4.2	I plan to have my broken products repaired on a regular basis (if repairing is possible).						
RIb	I4.3	I will repair my next broken product by myself (if repairing is possible).	3.88	3.73	0.95	1.00	0.80x	0.73x
	I4.4	I plan to repair my broken products by myself on a regular basis (if repairing is possible).						
RIc	I4.5	I will have my next broken product repaired in a company, which is part of the GRAZ repariert network (if repairing is possible).	–	3.23	–	1.07	–	0.83x
	I4.6	I plan to have my broken products repaired in a company, which is part of the GRAZ repariert network on a regular basis (if repairing is possible).						

Table A.8

Further factors in the survey; Scale: 1 = 'do not agree at all'; 5 = 'totally agree'; SD = standard deviation; [1]adapted from Chan et al. (2019); [2]adapted from Goldsmith and Newell (1997); The original questionnaire was in German, hence the items in this table have been translated into English.

Factor	Items	Mean	SD	Cronbach's α
Environmental concern[1]	I am concerned about climate. I am concerned about waste generation. I have to save the environment for future generation. Balance of nature is easily destroyed by human activities. I help the environment even if it cost me more money or takes more time.	3.93	0.80	0.86
Attitude towards new fashionable products[2]	In general, I am among the first in my circle of friends to buy a new fashion product when it appears. If I heard that a new fashion product was available in the store, I would be interested enough to buy it. I do not mind paying more to buy new fashion products. I prefer to own a new product sooner than later.	2.32	0.89	0.82
Trust in the repair service provider	I generally trust the mechanics and technicians who carry out the repairs.	3.76	0.88	–
Travel time to the repair office	I can as easily reach repair shops as shops, where I can buy new products.	2.88	1.18	–
Emotional	I repair my broken products because I care a lot about my products and I do not want to replace them.	3.70	1.04	–
Guarantee/ warranty	If there is a guarantee/warranty on my broken product, then I will have my product repaired.	4.51	0.83	–

Table A.9

Maximum accepted repair price in % of the purchase price; SD = standard deviation; (1) Participants do not know the repair network (n = 736), (2) Participants know the repair network (n = 164).

Product type	(1)		(2)					
			Styria		Graz (n = 105)		Outside Graz (n = 59)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Bicycle	29.32	19.41	33.17	21.20	34.30	21.26	31.15	21.12
Cell phone	26.29	18.28	27.31	18.57	27.44	18.59	27.08	18.70
Musical instrument	28.51	24.50	35.15	27.20	34.03	26.89	37.15	27.88
Home appliances	30.72	17.66	34.38	18.29	34.71	18.41	33.78	18.21
Electronic equipment for leisure time	29.94	17.42	34.11	20.03	33.19	20.00	35.75	20.16
Electronic equipment for the job	27.53	20.09	30.30	22.21	29.60	22.42	31.56	21.98
Furniture	24.54	20.22	26.64	19.76	27.13	19.44	25.76	20.47
Articles of clothing	17.72	18.11	21.16	19.76	21.24	19.61	21.02	20.18
Jewellery	29.64	23.42	34.06	25.36	33.17	24.39	35.64	27.16

Table A.10

Maximum accepted repair time in days; SD = standard deviation; (1) Participants do not know the repair network (n = 736), (2) Participants know the repair network (n = 164).

Product type	(1)		(2)	
	Mean	SD	Mean	SD
Bicycle	5.01	11.04	5.11	8.37
Cell phone	4.21	5.68	4.16	4.71
Musical instrument	6.97	9.00	8.03	12.05
Home appliances	4.35	5.09	4.67	4.31
Electronic equipment for leisure time	5.79	14.16	5.57	4.43
Electronic equipment for the job	5.05	25.28	4.31	4.08
Furniture	8.51	22.18	8.33	7.19
Articles of clothing	6.23	25.89	5.62	4.70
Jewellery	9.01	34.31	8.91	12.34

Table A.11

Importance of repair recommendations of different information sources; Scale: 1 = 'not important at all'; 5 = 'very important'; (1) Participants do not know the repair network (n = 736), (2) Participants know the repair network (n = 164).

Information source	(1)		(2)	
	Mean	SD	Mean	SD
Family	3.71	1.11	3.85	1.00
Experts	3.60	1.06	3.72	1.05
Friends	3.42	1.13	3.60	1.10
Colleagues	3.06	1.06	3.33	1.02
Internet sources	2.95	1.08	3.13	0.95
Club colleagues	2.74	1.08	2.98	1.09
Newspaper	2.67	1.06	2.96	1.04
TV	2.64	1.05	2.98	1.00
Radio	2.64	1.08	2.94	1.06
Blogs/forums	2.58	1.15	2.80	1.18
Ministry	2.49	1.11	2.84	1.10
Distant relatives/ acquaintances	2.48	1.08	2.65	1.12
Social media	2.34	1.09	2.53	1.09

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