



Review

Sufficiency transitions: A review of consumption changes for environmental sustainability



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ABSTRACT

It has been argued that halting environmental degradation requires an approach of sufficiency, which entails substantial changes in consumption patterns for high-consuming classes, including a reduction in consumption levels. This article reviews the literature on sufficiency, asking two main questions: What are the specific consumption changes that the sufficiency literature suggests to reduce ecological footprints, and how can such consumption changes be advanced? The article uses a combination of semi-systematic and integrative review methodologies. The article shows that sufficiency may entail four types of consumption changes: absolute reductions, modal shifts, product longevity, and sharing practices. It provides an overview of sufficiency practices across four consumption categories: housing, nutrition, mobility, and miscellaneous consumption. In addition, the article identifies barriers and actors that can prevent or advance sufficiency transitions. Barriers to sufficiency transitions include consumer attitudes and behavior, culture, the economic system, the political system, and the physical environment. Actors include businesses, policymakers, citizens, NGOs, and educators. The article advances our understanding of sufficiency as a concept and the multidimensionality of sufficiency transitions.

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1. Introduction

The human ecological footprint is currently about 1.6 times the amount that the natural environment can regenerate (WWF, 2020). Research has indicated that the limits for a safe operating space for humanity have been transgressed for four out of nine planetary boundaries, including the two core boundaries of climate change and biosphere integrity (Rockström et al., 2009; Steffen et al., 2015). The Intergovernmental Panel on Climate Change (IPCC) has estimated that human activities have caused an increase in global mean temperature of about 1 °C above preindustrial levels (IPCC, 2018), resulting in a range of adverse changes to the natural environment, including increased ocean acidification and diminishing ice sheets (IPCC, 2014). Equally, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) has estimated that around 1 million species are facing extinction; the global rate of biodiversity loss is thought to be tens to hundreds times higher than the average over the past 10 million years.

Scientists are united in their calls for urgent changes to human activities in order to halt the degradation of the natural environment (Ripple et al., 2017, 2020). One recent report (Institute for Global Environmental Strategies [IGES] et al., 2019) has forwarded global targets for carbon footprints per capita of 2.5 tons of carbon dioxide equivalent (tCO_{2e}) by 2030 and 0.7 tCO_{2e} by 2050. The carbon footprints of affluent countries in particular are far above these targets: 10.4 tCO_{2e} in Finland and 7.6 tCO_{2e} in Japan, for example (IGES et al., 2019). Globally, the most affluent 10% of the population reportedly accounts for just over half of all carbon emissions (Gore, 2020); research has estimated that carbon footprints in affluent countries need to be reduced by 80–93% (IGES et al., 2019). Lettenmeier et al. (2014), meanwhile, have suggested a sustainable material footprint—which considers not only carbon emissions but also other environmental impacts—of around eight tons, which would require a reduction of at least 80%.

Measures to reduce ecological footprints have focused mainly on efficiency improvements in production, technological innovations, and the “greening” of consumption (Lorek and Fuchs, 2013). Production-side changes such as clean energy transitions and shifts to electric vehicles are believed to allow consumption patterns and levels to remain largely unchanged. However, some

scholars have argued that this so-called efficiency approach is unlikely to halt environmental degradation. Extensive analyses of the environmental impact of efficiency measures can be found in the literature on degrowth (e.g., Kallis, 2017) and decoupling (e.g., Jackson, 2016). Historical data on carbon emissions and material footprints indicates that efficiency efforts have been unsuccessful in reducing the environmental impact of human activities (Jackson, 2016; Wiedmann et al., 2015). In addition, future efficiency improvements would need to take place at unprecedented rates to succeed: even the most conservative estimates point to a required rate of at least ten times what has been achieved historically (Jackson, 2016; Lorek and Spangenberg, 2014). In light of the empirical evidence, scholars have argued for complementing efficiency measures with a so-called sufficiency approach (e.g., Jackson, 2016; Lorek and Fuchs, 2013; Lorek and Spangenberg, 2014).

Alternatively referred to as strong sustainable consumption, sufficiency is an approach to sustainable consumption that argues that reducing ecological footprints requires high-consuming classes to change their consumption patterns and reduce their consumption levels (Lorek and Fuchs, 2013). Conceptually, sufficiency proposes a maximum level of consumption that is environmentally sustainable (Spangenberg, 2014; Spengler, 2016). Di Giulio and Fuchs (2014) have suggested that this level needs to be defined based on the historical and cultural context and to be re-evaluated over time. In Finland, for instance, Lettenmeier et al. (2014) have stated the need to reduce the material footprint of housing by 85%, of nutrition by 49%, and of mobility by 88%. Such reductions would require a combination of different changes to consumption patterns across all major consumption categories (IGES et al., 2019; Lettenmeier et al., 2014), whose specificities would vary between individuals and contexts. As such, rather than a one-size-fits-all solution, sufficiency may include different combinations of consumption changes to reach sustainable targets for ecological footprints.

The need to reduce consumption levels does not apply equally to everyone, but to groups of consumers—mainly in affluent countries—that currently have ecological footprints above the estimated sustainable targets (Ulvila and Wilén, 2017). Following the work of scholars such as Lorek and Fuchs (2013), this article focuses on the consumption patterns of these high-consuming classes, though it is

noteworthy that some scholars have extended the concept of sufficiency to include a minimum level of consumption that is socially sustainable and enables a good quality of life (Di Giulio and Fuchs, 2014; Spangenberg, 2014; Spengler, 2016).

The idea of reducing material consumption is not a new one. It has been present in various forms of consumption critique, ranging from the writings of Henry David Thoreau and Herman Daly to the seminal report *The Limits to Growth* (Daly, 1977; Meadows et al., 1972; Thoreau, 1854/2017). Conversely, the sufficiency approach to sustainable consumption has only recently started to gain greater research attention. This article reviews the growing literature on sufficiency. It asks two main questions: What are the specific consumption changes that the sufficiency literature suggests to reduce ecological footprints, and how can such consumption changes be advanced?

The review makes three main contributions to the existing literature. First, it has been noted that sufficiency as a concept lacks clarity (Spangenberg and Lorek, 2019; Spengler, 2016). Sufficiency is commonly conceptualized in contrast to efficiency (e.g., Lorek and Fuchs, 2013), with consumption-side changes associated with the former and production-side changes with the latter. However, while sufficiency has been defined as “changes in consumption patterns and reductions in consumption levels” (Fuchs and Lorek, 2005, p. 262), it is unclear which specific consumption changes fall under the concept. Any effort to reduce ecological footprints requires a proper understanding of the proposed actions. Thus, the first aim of the review is to clarify the concept of sufficiency by developing a typology that differentiates between the types of consumption changes that sufficiency may entail.

Second, much of the sufficiency literature to this point has been conceptual and abstract in nature (Geels et al., 2015), with a recognized need to shift the focus to the study of specific consumption practices (Speck and Hasselkuss, 2015). Various consumption practices have previously been studied to varying degrees, but the research is scattered across a multitude of streams of research with few established linkages to the sufficiency literature or between research streams. Bringing together this research can improve our understanding of consumption changes in different consumption categories. Thus, the second aim of the review is to consolidate previous research in these various streams of research and create a framework that provides an overview of sufficiency practices across different consumption categories.

Third, several scholars have called for emphasis on how to achieve transitions towards sustainability in general and sufficiency in particular (Akenji et al., 2016; Geels et al., 2015; Miller et al., 2014). A number of different perspectives on sufficiency transitions have been studied, but the literature is fragmented and lacks an integrated understanding of the multidimensionality of sufficiency transitions. Since many of the associated consumption changes are likely to be perceived as controversial and meet resistance, a better understanding of how sufficiency transitions could be advanced is crucial. Thus, the third aim of the review is to support an integrated understanding of the subject via an overview of the various identified barriers to and actors in sufficiency transitions.

The article is structured as follows. Section 2 describes the methodology for the literature review. The findings of the review are presented in the following three sections, corresponding to the three main contributions of the article: a typology of consumption changes (section 3), an overview of sufficiency practices (section 4), and barriers to and actors in sufficiency transitions (section 5). The article concludes with a discussion of the findings and directions

for future research (section 6).

2. Material and methods

This article approaches the sufficiency literature with a three-fold focus, in line with its three principal aims: (1) to develop a typology of consumption changes; (2) to provide an overview of sufficiency practices across different consumption categories; and (3) to identify barriers to and actors in sufficiency transitions. This section describes the review methodology and search strategy that was used in each part of the review.

2.1. Review methodology

The article uses a combination of semi-systematic and integrative review methodologies (Snyder, 2019), as shown in Table 1. The first part of the review develops a typology that differentiates between the types of consumption changes that sufficiency may entail. The purpose of this part of the review is classification, that is, to identify types of consumption changes. For this purpose, an integrative review methodology is appropriate. An integrative review is appropriate when the purpose of the review is to synthesize and combine various perspectives to create a new classification or theoretical framework (Snyder, 2019). The purpose of the review, therefore, is not to cover or assess every piece of research published on a given topic, but rather to create new conceptualizations of the phenomenon.

The second part of the review provides an overview of sufficiency practices across different consumption categories. The purpose of this part of the review is to bring together research from different streams of research and create a framework for the various sufficiency practices that have been studied previously. Again, the purpose here is not to cover every piece of published research, but to provide a classification and understanding of different sufficiency practices. As such, an integrative review methodology is appropriate.

The third part of the review identifies the different barriers to and actors in sufficiency transitions. The purpose of this part of the review is to identify different themes that have been addressed in the literature, specifically the different barriers and actors discussed in previous research. For this purpose, a semi-systematic review methodology is appropriate. A semi-systematic review is appropriate when the purpose of the review is to gain an overview of a research area and to map themes in the accompanying literature (Snyder, 2019). It synthesizes the literature through narratives and often employs qualitative techniques of analysis, such as thematic analysis. For the third part of the review, therefore, a semi-systematic review methodology was used to detect themes in the literature on sufficiency transitions.

2.2. Search strategy

Different search strategies were used for the three parts of the review (see Table 1). An overview of how the search for literature was conducted is given in Fig. 1. For the first part of the review, a systematic search strategy was used to identify research published on the topic of sufficiency. Keyword searches in the scientific database Scopus were used to identify relevant research (similarly to e.g., Det Udomsap and Hallinger, 2020; Malek and Desai, 2020; Modak et al., 2020). The keywords “sufficiency” and “strong sustainable consumption” were used to identify relevant research. As sufficiency is a term widely used in other contexts, search strings were used to limit the search to publications focused on sufficiency

Table 1
A summary of the methodology used to conduct the different parts of the literature review.

Part of review	Review methodology	Search strategy	Purpose
1) Consumption changes	Integrative review	Systematic	Classification
2) Sufficiency practices	Integrative review	Purposive sampling	Classification/Overview of research area
3) Sufficiency transitions	Semi-systematic review	Systematic	Themes in literature

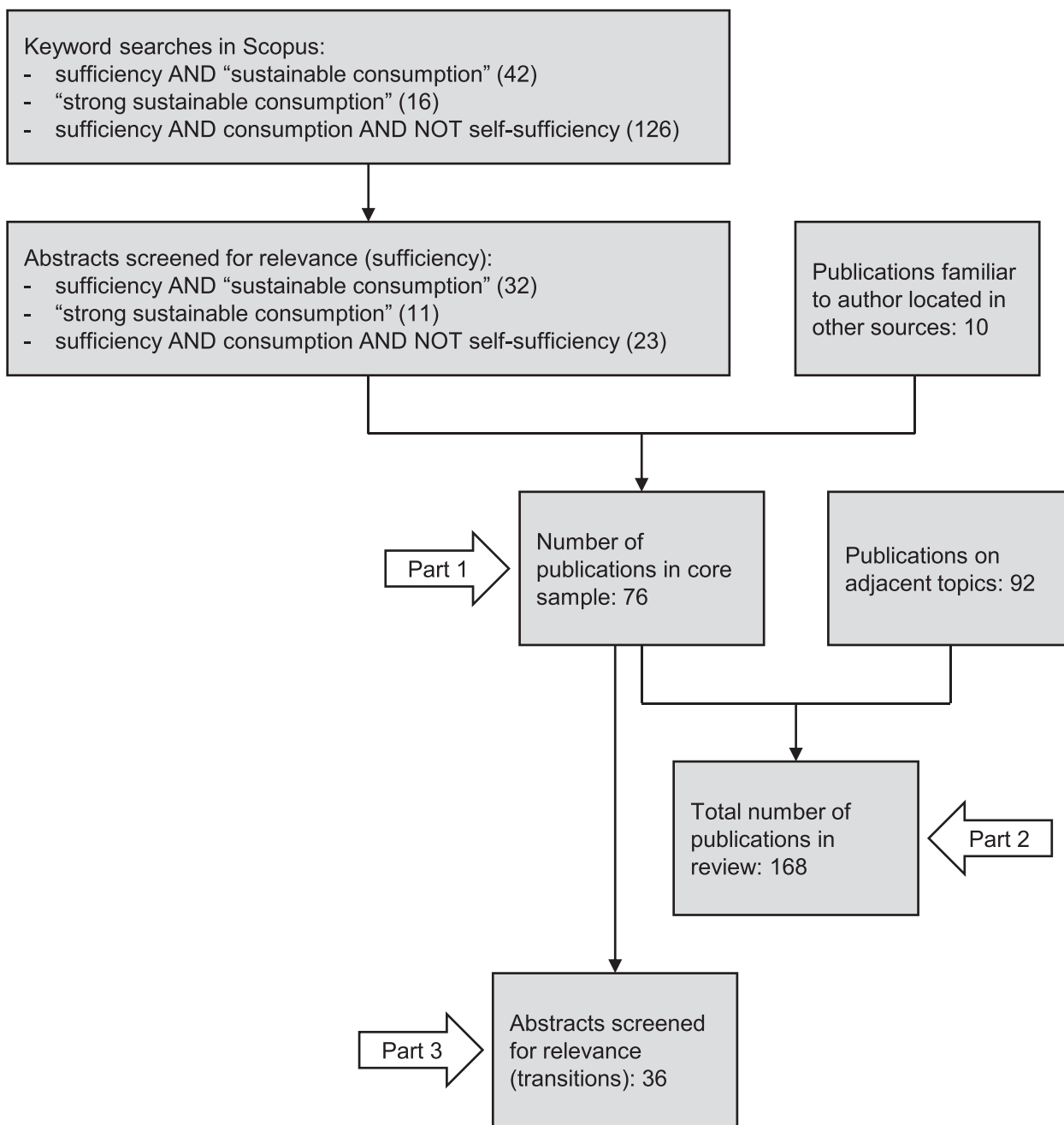


Fig. 1. Overview of the search for literature.

as an approach to sustainable consumption. Initially, the search string “sufficiency AND ‘sustainable consumption’” was used; this was later widened to “sufficiency AND consumption AND NOT self-sufficiency”. The negative keyword “self-sufficiency” was used to exclude a large body of work on self-sufficiency from the initial sample of literature. The search was limited to publications in the

social sciences. The number of hits for each search string used is listed in Fig. 1.

The abstracts of identified publications were screened for relevance, yielding a total of 66 publications to be included in the review. In addition, ten publications not identified in the keyword searches, but already familiar to the author were added to the

sample. This amounted to a total of 76 publications on sufficiency, which formed the literature for the first part of the review. This literature was analyzed with the purpose of identifying different types of consumption changes. This resulted in a typology that differentiates between the types of consumption changes that sufficiency may entail. This typology is presented in section 3.

For the second part of the review, it was necessary to complement the core literature with research on relevant related phenomena that are not overtly categorized within the concept of sufficiency. As the purpose of this part of the review was not to review every piece of research published, but rather to gain a broad overview of several streams of research, purposive sampling was used to identify references that could provide insight into the phenomena in question. These research streams were chosen based on extensive reading to identify the most relevant sufficiency practices in previous research. As a result, research on eleven different sufficiency practices was included in the review.

As the focus of the review was on breadth rather than depth, a series of key references from each relevant research stream were chosen for closer review, with a focus on studies of transitions. This amounted to 92 publications, bringing the total number of publications included in the review to 168. The purpose of this part of the review was to consolidate research from a large number of disparate research streams in order to provide a categorization and overview of sufficiency practices in different consumption categories. A framework of sufficiency practices was thus created, as presented in section 4.

The third part of the review consisted of a review of the research into sufficiency transitions. For this, a systematic search strategy was used. Abstracts of the previously identified 76 publications were screened to identify studies with a specific focus on transitions. In total, 36 relevant publications were identified. All 36 publications were then read and analyzed in order to identify the barriers to and actors in sufficiency transitions explored in each publication. The identified barriers and actors are presented in section 5.

Fig. 2 shows the yearly number of publications on sufficiency ($n = 76$), as well as the proportion that focuses specifically on sufficiency transitions ($n = 36$). The year 2020 includes publications up until March 2020. With the exception of one early work published in 1992 (not included in the graph), sufficiency as a research topic began attracting attention in the early 2000s, with interest in the topic growing since 2008.

3. A typology of consumption changes

This section presents the findings from the first part of the review, with the purpose of developing a typology that differentiates between the types of consumption changes that sufficiency may entail. More specifically, this part of the review clarifies the concept of sufficiency by differentiating between four types of consumption changes that can be made to reduce the environmental impact of consumption: absolute reductions, modal shifts, product longevity, and sharing practices. This typology is summarized in Table 2.

Consumption changes can take many forms, and the literature varies in the types of changes that are considered to fall under the concept of sufficiency. Sufficiency is often understood in terms of both absolute reductions and modal shifts (e.g., Fuchs, 2013; IGES et al., 2019; Lorek and Fuchs, 2013; Spengler, 2016). For example, one of the most influential early works in the field defined sufficiency as “changes in consumption patterns and reductions in consumption levels” (Fuchs and Lorek, 2005, p. 262). In addition, product longevity and sharing practices have occasionally been considered in the sufficiency literature (e.g., Cooper, 2005; Freudenreich and Schaltegger, 2020; Speck and Hasselkuss, 2015). Table 2 gives an overview of the resulting four types of consumption changes that sufficiency may entail.

Absolute reductions represent a reduction in the quantity that an individual consumes. A useful distinction has been made between absolute reductions and changes in consumption patterns in which an individual shifts from one mode of consumption to one that has a lower environmental impact; these have been defined as modal shifts (IGES et al., 2019). The example of reducing private car use can be used to illustrate the difference between absolute reductions and modal shifts. While both absolute reductions and modal shifts result in less distance being travelled by private car, a modal shift entails switching to a less resource-intensive mode of travel (such as public transportation or walking), whereas an absolute reduction reduces the distance travelled in absolute terms. As such, a modal shift still upholds the practice of mobility, albeit in changed form, while an absolute reduction reduces or completely eliminates the practice.

While absolute reductions and modal shifts both require the individual to make changes to their consumption patterns, product longevity and sharing practices address how existing products can be used more efficiently. Product longevity refers to an increase in a given product’s lifespan, whereby an individual extends the time a product is used and thus delays the purchase of a new product (Cooper, 2005). Sharing practices similarly increase product usage by sharing products among individuals, which has been seen to

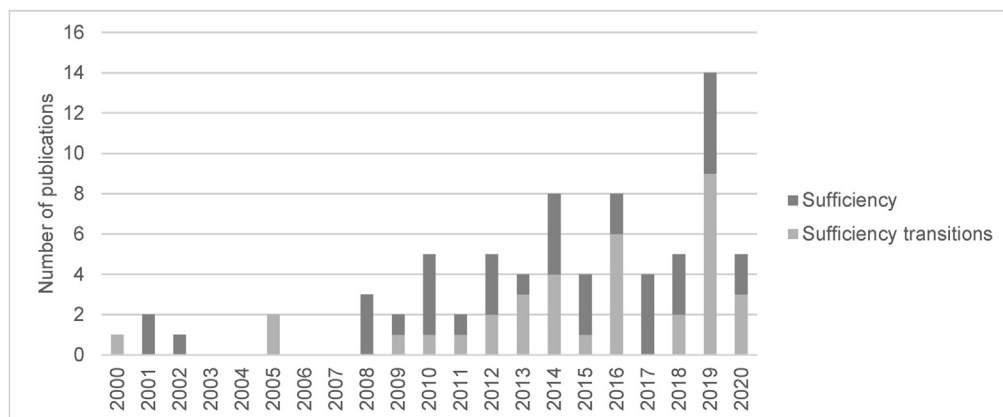


Fig. 2. Yearly distribution of publications on sufficiency (dark grey columns) and the share of publications focusing on sufficiency transitions (light grey columns).

Table 2
A typology of the four types of consumption changes that sufficiency may entail.

Type of consumption change	Definition	Example
Absolute reductions	Reducing the amount of consumption	Travelling shorter distances
Modal shifts	Shifting from one consumption mode to one that is less resource intensive	Shifting from private car use to public transportation
Product longevity	Extending product lifespans	Prolonging use of existing vehicles
Sharing practices	Sharing products among individuals	Car sharing among individuals

allow more efficient use of resources (Plewnia and Guenther, 2018), as what has been termed their idle capacity can be more fully utilized (Frenken and Schor, 2017). The main difference between product longevity and sharing practices is the user. While product longevity entails an individual extending their usage of a product, sharing practices expand its use to other individuals. In the example of private car use, product longevity would mean extending the lifespan of existing vehicles, thus reducing the number of new cars purchased. Sharing practices, meanwhile, would refer to the sharing of existing vehicles among individuals, thus reducing the total number of vehicles needed.

In this typology, absolute reductions entail a decrease in utility (Alcott, 2008), such as travelling less. In many cases, a reduction in consumption may in fact come about through extended product lifespans: consumers might, for example, avoid buying new clothes by continuing to wear those that they already own. Reductions in one mode of consumption may also entail increased consumption of something else, as is the case with modal shifts. As such, a useful distinction is to differentiate between the purchase and use of products: reductions in the purchase of products may not entail reductions in the use of products if compensated by modal shifts, product longevity, or sharing practices.

4. Sufficiency practices

This section presents the findings from the second part of the review, in which a broad range of existing research studies has been consolidated to provide an overview of sufficiency practices. In response to calls to move from conceptual discussions of sufficiency to the study of specific practices (Geels et al., 2015; Speck and Hasselkuss, 2015), a framework was created that maps out sufficiency practices in four consumption categories: housing, nutrition, mobility, and miscellaneous consumption (Table 3). The framework follows the typology of consumption changes presented in section 3.

The consumption categories with the highest environmental impact were chosen for the framework. Research has consistently shown that the categories of consumption with the most significant environmental impact are housing, nutrition, and mobility (IGES et al., 2019; Kotakorpi et al., 2008; UNEP, 2010). These three consumption categories account for approximately three quarters of carbon footprints, though variation can be observed between countries (IGES et al., 2019; UNEP, 2010). Likewise, their share of material footprints has been calculated to be as high as 85%, as in

Table 3
An overview of the most significant sufficiency practices in four key consumption categories.

	Absolute reductions	Modal shifts	Product longevity	Sharing practices
Housing	Reduce size of living space	Shift in housing type	–	Sharing living space
Nutrition	–	Shift to plant-based diets	Reduce household food waste	–
Mobility	Reduce private car use Reduce air travel	–	–	Car sharing
Miscellaneous consumption	Reduce consumption of various products	–	Extend lifespans of various products	Sharing of various products among consumers

the case of Finland (Lettenmeier et al., 2014). In order to achieve significant change, therefore, any efforts towards sufficiency should pay particular attention to consumption changes in these three categories. In addition, a fourth category of miscellaneous consumption was added to cover other consumption categories, including consumer goods, leisure activities, and services (IGES et al., 2019).

The framework includes a total of eleven sufficiency practices: three in housing, two in nutrition, three in mobility, and three in miscellaneous consumption. For each consumption category, the framework includes the practices suggested to have the highest potential to reduce ecological footprints, as discussed in sections 4.1 to 4.4.

4.1. Housing

Housing has been calculated to account, on average, for 26% of the carbon footprint and 44% of the total energy use of household consumption (UNEP, 2010). In Finland, housing has been identified as the consumption category with the second highest material footprint, accounting for 27% of the total material footprint (Lettenmeier et al., 2014). The largest contributor to the environmental impact of housing is energy use (IGES et al., 2019), including operational and embodied energy (Stephan et al., 2013). In countries with substantial need for indoor heating, heating accounts for the largest share of the material footprint of housing, over a third in the case of Finland (Kotakorpi et al., 2008).

In comparison to nutrition and mobility, for which research is largely in agreement on which consumption changes are the most impactful, such certainty is lacking in the case of housing. Three main potential sufficiency practices can be identified. Reductions in the size of per capita living spaces have been suggested as a means of lowering the environmental impact of housing (e.g., Lettenmeier et al., 2014; Sandberg, 2018), and can be achieved through two alternative sufficiency practices: through absolute reductions in dwelling sizes or through sharing living space among a larger number of occupants. It has further been suggested that modal shifts in housing type—particularly from detached houses to higher density housing such as apartment buildings—produce environmental benefits (Duffy, 2009; Stephan et al., 2013). The existing research into each of these is discussed below.

4.1.1. Reduce size of living space

Studies have demonstrated that reducing dwelling sizes lowers

both the embodied energy associated with the construction of buildings and the operational energy used for heating, cooling, and lighting (Fuller and Crawford, 2011; Stephan et al., 2013; Wilson and Boehland, 2005). Despite this, the size of living space is rarely considered as a way to reduce the environmental impact of housing, and research on the topic is scarce (McKinlay et al., 2019; Sandberg, 2018), although some recent research has examined the perceived attractiveness of smaller-sized dwellings and how they relate to dominant cultural norms (Hagbert, 2016; Hagbert and Femenías, 2016; Sandberg, 2018).

In particular, a specific form of small-sized dwelling, the tiny house, has begun to attract research attention. The tiny house movement is a trend that has gained momentum since the early 2000s, particularly in the United States (Boeckermann et al., 2019). Though lacking an established definition, tiny houses have been suggested to be those smaller than 400 square feet (37 m²), including the more well-known mobile tiny houses as well as houses built on foundations (Evans, 2019; Shearer and Burton, 2019). A central theme identified in research on both tiny houses and small-sized dwellings in general is a concern for the affordability of housing (Mangold and Zschau, 2019; McKinlay et al., 2019; Sandberg, 2018); it may be the cost of living, rather than environmental concerns, that serves as the primary motivation for reducing the size of living spaces (Boeckermann et al., 2019).

4.1.2. Shift in housing type

It has been theorized that modal shifts in housing type—primarily from detached houses to apartments, but also to terraced and semi-detached houses—can reduce the operational energy use of housing, given that detached houses have a larger exposed external envelope than other housing types, which share walls with other dwelling units (Duffy, 2009; Heinonen and Junnila, 2014). Research, though not entirely conclusive (Heinonen and Junnila, 2014), seems to support this (Duffy, 2009; Stephan et al., 2013). However, the literature widely recognizes a preference among residents for detached houses over apartments (Newton et al., 2017; Senior et al., 2004). Discussions of modal shifts in housing type can be found in the urban planning literature on urban sprawl and the need to transition from low-density, suburban city development to more compact cities with higher levels of medium-density and apartment housing (Newton et al., 2017).

4.1.3. Sharing living space

Sharing living space among an increased number of occupants can be achieved in two ways: by increasing household size or by sharing living spaces between households in arrangements such as cohousing. Research has established the environmental benefits of larger households: per capita consumption of resources, including energy, water, and electricity, tends to decrease as household size increases (Klocker et al., 2016; Williams, 2007; Yu and Liu, 2007). However, household size has decreased historically (Bradbury et al., 2014), and this trend is projected to continue in the coming decades (Ürge-Vorsatz et al., 2015). Limited research has investigated alternative living arrangements to increase household size, though studies have touched upon the potential of extended family households (Klocker et al., 2012, 2016) and the problematic growth in one-person households (Williams, 2007).

Cohousing is a prominent example of households sharing certain living spaces. Cohousing communities are neighborhoods in which private residential spaces are complemented with extensive communal spaces that encourage social interaction and a sense of community (Lietaert, 2010; Williams, 2008). It is generally assumed that the availability of communal spaces allows for smaller private dwellings, as some functions of the home, such as dining areas, guest rooms, laundry, and office spaces, can be transferred to

communal spaces (Marckmann et al., 2012; Williams, 2008). However, although research indicates that cohousing is likely to reduce the environmental impact of residents (Daly, 2017), it is unclear whether this is due to the reduced dwelling sizes or to other factors, such as sharing of resources among residents or pro-environmental behaviors in general. While Williams (2008) has found cohousing dwellings to be significantly smaller in size, Marckmann et al. (2012) have highlighted a lack of concern for the size of living spaces and its environmental impact among cohousing residents. Furthermore, though research routinely refers to the environmental benefits of cohousing, the primary concern is often the social benefits of cohousing (e.g., Riedy et al., 2019; Wankiewicz, 2015).

4.2. Nutrition

Food production has been identified as the largest cause of environmental change globally, constituting the most significant driver of land use and land-use change, freshwater use, and biodiversity loss through habitat loss and fragmentation (Willett et al., 2019). On average, nutrition accounts for 27% of carbon footprints and 15% of total energy use of household consumption (UNEP, 2010). In Finland, nutrition is the consumption category with the third highest material footprint, amounting to 15% of the total material footprint of households (Lettenmeier et al., 2014). Despite large variation between individual countries, in the majority of cases, meat consumption is the largest contributor to the environmental impact of nutrition (IGES et al., 2019; Kotakorpi et al., 2008). For example, of the carbon footprint attributed to nutrition, meat has been calculated to account for 23% in Japan, 37% in Finland, 43% in Brazil, and 44% in China (IGES et al., 2019).

Studies have consistently found a shift from high levels of meat (and dairy) consumption to predominantly plant-based diets to have the highest potential to reduce the environmental impact of nutrition (IGES et al., 2019; Willett et al., 2019). Wynes and Nicholas (2017) have noted a shift to plant-based diets among the consumption changes with the highest potential to reduce greenhouse gas emissions. Similarly, IGES et al., 2019 found a shift to plant-based diets to be the consumption change with the highest potential to reduce carbon footprints of households' nutrition. The most comprehensive study of sustainable food systems to date, the EAT-Lancet Commission on healthy diets from sustainable food systems, also argues for reducing meat consumption (red meat in particular) and shifting to predominantly plant-based diets (Willett et al., 2019). A modal shift from meat (and dairy) consumption to plant-based diets thus represents the main sufficiency practice in the consumption category of nutrition. Reducing household food waste has been indicated as an additional consumption change (Willett et al., 2019), though research suggests its potential to reduce carbon footprints to be lower than that of a shift to plant-based diets (IGES et al., 2019). Both of these sufficiency practices are discussed below.

4.2.1. Shift to plant-based diets

The move toward plant-based diets entails a modal shift in which meat (and dairy) consumption is reduced and consumption of plant-based food is increased. Research has approached the topic of plant-based diets in various ways: studying vegetarian and/or vegan diets (Rosenfeld, 2018; Ruby, 2012), meat consumption (Chiles, 2017; Rust et al., 2020), plant-based foods and plant proteins (Manners et al., 2020; Niva et al., 2017), meat substitutes (de Bakker and Dagevos, 2012), and flexitarian diets (de Bakker and Dagevos, 2012; Rosenfeld, 2018). While shifts from meat consumption to plant-based alternatives have garnered considerable research attention, few studies have addressed the consumption of

dairy products (Bocken et al., 2020; Kristensen et al., 2011). A range of barriers to shifts to plant-based diets have been suggested in the literature, including individually focused factors such as enjoyment of meat, lack of knowledge and skills, and ingrained eating habits, as well as structural factors such as government subsidies and industrial clout (Beverland, 2014; Corrin and Papadopoulos, 2017; Graça et al., 2019; Ruby, 2012; Rust et al., 2020). The culturally perceived link between meat and masculinity, in particular, has attracted research attention (Beverland, 2014; Rosenfeld, 2018).

4.2.2. Reduce household food waste

Reducing household food waste can be understood as a prolonging of the product lifespan of food. Household food waste has attracted considerable attention in the literature. Research has investigated the potential to reduce household food waste in relation to a range of food-related practices, including planning, purchasing, storage, cooking, eating, and managing leftovers (Roodhuyzen et al., 2017; Schanes et al., 2018). A large variety of factors have been suggested as contributors to household food waste (Roodhuyzen et al., 2017). Much of the literature takes a psychological approach, with the theory of planned behavior commonly used as a theoretical framework (Schanes et al., 2018; Stöckli et al., 2018). To date, interventions to reduce household food waste have largely been informational (Schanes et al., 2018; Stöckli et al., 2018). However, research on interventions to reduce household food waste has been relatively scarce and lacks an evidence base for their effectiveness (Hebrok and Boks, 2017; Reynolds et al., 2019; Stöckli et al., 2018). Several scholars, in turn, have argued that reducing household food waste is a complex issue requiring a multifaceted approach (Schanes et al., 2018; Thyberg and Tonjes, 2016).

4.3. Mobility

Mobility accounts, on average, for 20% of the carbon footprint and 23% of total energy use of household consumption (UNEP, 2010). In Finland, mobility has been noted as the consumption category with the highest material footprint, accounting for 43% of the total material footprint of households (Lettenmeier et al., 2014). An overwhelming majority of the environmental impact of mobility stems from private car use, particularly in Western countries, where private car use has been calculated to account for 80% of the carbon footprint of mobility (IGES et al., 2019). Additionally, air travel accounts for around 10% of the carbon footprint of mobility in Western countries (IGES et al., 2019).

Avoiding private car use and air travel have been identified among the consumption changes with the highest potential to reduce greenhouse gas emissions (Wynes and Nicholas, 2017). In both cases, reductions can take the form of either an absolute reduction in distance travelled or a modal shift to alternative modes of transportation. In addition, car sharing has been suggested as a way to reduce the environmental impact of mobility. These three sufficiency practices are discussed below.

4.3.1. Reduce private car use

Reducing private car use has attracted considerable research attention, with several reviews synthesizing research on the topic (Arnott et al., 2014; Graham-Rowe et al., 2011; Lanzini and Khan, 2017). Reductions have been studied in terms of both absolute reductions in distances travelled (e.g., Waygood et al., 2019) and modal shifts to alternative modes of transportation (e.g., Lanzini and Khan, 2017), with both types of consumption changes often considered in combination. The literature has focused mainly on influencing individual decision-making regarding private car use (Barr, 2018; Marsden et al., 2014), with studies proposing various

intervention measures to prompt behavioral change (e.g., Gärling and Schuitema, 2007). Synthesizing reviews of these measures, however, have found that evidence of their effectiveness is limited and inconclusive (Arnott et al., 2014; Graham-Rowe et al., 2011). More recently, some scholars have suggested a greater focus on structural changes, targeting practices (Hasselqvist and Hesselgren, 2019), infrastructures (Barr, 2018), or systems (Dijk et al., 2019). Reducing private car use also correlates to the aforementioned literature on urban planning, since denser cities result in shorter distances travelled (Duffy, 2009; Newton et al., 2017).

4.3.2. Reduce air travel

By comparison, reducing air travel has attracted much less research attention (Barr, 2018; Morten et al., 2018). As with private car use, reducing air travel has been studied as an absolute reduction (Morten et al., 2018) and a modal shift to other modes of transportation (Jacobson et al., 2020), as well as a combination of reduced distance travelled and shifts in mode of transportation (Dickinson et al., 2011). Slow travel has been suggested as a relevant avenue of research (Barr, 2018), though the concept encompasses much more than a shift in mode of transportation (Dickinson et al., 2011). Slow travel challenges conventional tourism by emphasizing slowness in the travel experience and enjoyment of the journey itself, using modes of transportation other than air (and car) travel (Dickinson et al., 2011; Lumsdon and McGrath, 2011). Though the centrality of environmental concerns and the exclusion of air travel to the concept of slow travel is not entirely unambiguous, Dickinson et al. (2011) have argued for the potential of a shift to slow travel to reduce emissions.

4.3.3. Car sharing

Car sharing gives consumers access to vehicles without requiring car ownership, through either traditional car sharing services offered by businesses or through peer-to-peer schemes (Shaheen et al., 2012). Car sharing has been extensively studied, especially in the emerging literature on the sharing economy. The literature has documented the substantial potential for car sharing to reduce the environmental impact of car use not only through shared vehicle ownership, but also (and even more so) through absolute reductions in distance travelled and modal shifts to alternative modes of transportation resulting from adaptation of car sharing services (Chen and Kockelman, 2016; Shaheen et al., 2012). However, previous research into the environmental impact of car sharing has reported widely varying results (Chen and Kockelman, 2016; Shaheen et al., 2012), indicating uncertainty about the magnitude of its environmental impact. Car sharing may also increase, rather than decrease, car use for many consumers (Martin and Shaheen, 2011). Additionally, Chen and Kockelman (2016) have noted that only certain consumers are potential users of car sharing services, limiting its potential to reduce the wider environmental impact of mobility.

4.4. Miscellaneous consumption

As well as housing, nutrition, and mobility, several other types of goods and services can be the subject of sufficiency practices. These are discussed together here under a fourth category, labelled miscellaneous consumption. This category includes goods such as clothing and electronics, leisure activities such as sports and entertainment, and services such as communications and health-care (IGES et al., 2019). Clothing, in particular, has attracted a certain degree of research attention in the sufficiency literature (Freudenreich and Schaltegger, 2020; Joyner Armstrong et al., 2016; Kleinhückelkotten and Neitzke, 2019).

It is important to note that miscellaneous consumption accounts

for a relatively minor share of the total material footprint of households. In Finland, consumption other than housing, nutrition, and mobility accounts for only 15% of the total material footprint of households (Lettenmeier et al., 2014). For example, consumption of clothing only makes up an average of 4% of the carbon footprint and 4% of total energy use of household consumption (UNEP, 2010). As such, heavy emphasis on this consumption category is not advisable. It is nevertheless relevant to include this category in the framework of sufficiency practices in order to gain a more complete understanding of the variety of practices available. For the miscellaneous category of consumption, sufficiency practices mainly take the forms of absolute reductions, product longevity, and sharing practices, as discussed below.

4.4.1. Reduce consumption of various products

Sufficiency may be most straightforwardly imagined as absolute reductions in the consumption of various products. Several streams of research are potentially relevant to this sufficiency practice, including (post)materialism, anti-consumption, voluntary simplicity, and frugality. Research on materialism has studied values centered on the possession of consumption goods and discussed potential shifts away from materialism (Inglehart, 1977; Kasser, 2016; Richins, 2004). Anti-consumption, voluntary simplicity, and frugality represent various departures from materialistic values that may reduce absolute consumption levels. Anti-consumption has been defined as attitudes or reasons against, or a resistance to, consumption (Chatzidakis and Lee, 2013; Zavestoski, 2002). Voluntary simplicity is a lifestyle characterized by reduced consumption in favor of a higher quality of life (Alexander and Ussher, 2012; Elgin and Mitchell, 1977). Frugality refers to consumer restraint in the acquisition of products, as well as the resourceful use of products (Lastovicka et al., 1999), and is interlinked with the sufficiency practice of extending product lifespans.

4.4.2. Extend lifespans of various products

Cooper (2005) has argued for including considerations of product lifespans in discussions of sustainable consumption. Product lifespans can be extended through improved durability and increased maintenance (Cooper, 2005). Product durability addresses the physical, often planned obsolescence of products through improvements in quality (Cooper, 2005; Gossen et al., 2019), as well as psychological obsolescence due to changing trends (Ceschin and Gaziulusoy, 2016), which can be mitigated through timeless or versatile design, for example (Freudenreich and Schaltegger, 2020). Maintenance, meanwhile, can extend product lifespans via, for example, repairs or upcycling (Freudenreich and Schaltegger, 2020). Extending product lifespans has been explored in design research, especially in the field of emotionally durable design, which seeks to design products with long-lasting appeal (Ceschin and Gaziulusoy, 2016). In the context of clothing, extending product lifespans has been forwarded as one of the central tenets of the concept of slow fashion (Fletcher, 2010; Ozdamar Ertekin and Atik, 2015).

4.4.3. Sharing of various products among consumers

The sharing economy has gained much attention in recent years as a potential way to reduce aggregated consumption levels. Although definitions differ across the literature (Plewnia and Guenther, 2018), a key component of the sharing economy is the sharing of products among individuals, which is believed to reduce the use of natural resources, as fewer products are needed in total. The literature on sharing has quickly grown to encompass a large amount of research on a variety of practices, including swapping, renting, and second-hand markets (Iran and Schrader, 2017; Trenz et al., 2018). Although the origins of the sharing economy are

closely linked to environmental concerns (e.g., Heinrichs, 2013), and links to sustainability still routinely appear in the discourse, Martin (2016) has argued that corporate co-optation has eroded much of its original emphasis and potential for environmental benefits, in favor of establishing profitable business models around sharing practices. Research on the environmental impact of sharing practices remains limited (Frenken, 2017), making it difficult to ascertain their true potential. In this vein, Leismann et al. (2013) have argued that sharing practices should be evaluated on a case-by-case basis rather than generalizing the sustainability of sharing.

5. Sufficiency transitions

This section presents the findings from the third part of the review, in which the literature on sufficiency transitions was reviewed in order to identify both barriers to and actors in sufficiency transitions. Barriers to sufficiency transitions are aspects of society that currently prevent or inhibit the advancement of sufficiency transitions, and therefore need to change if sufficiency transitions are to be properly realized. By contrast, following Dellas et al. (2011), actors in sufficiency transitions are defined as the individuals, organizations and networks that participate in transition processes.

The literature on sufficiency transitions is summarized in Table 4, which lists the publications included in the review along with the barriers and actors addressed in each. Sections 5.1 and 5.2 present how the different barriers and actors have been studied in the literature.

Some preliminary notes on the presentation of the findings are warranted. First, individual consumers and policymaking are discussed as both barriers and actors. This is due to the different emphasis given to these factors in the literature, with some studies analyzing current consumer attitudes and policies as barriers to sufficiency transitions, while others portray them as agents of change. Additionally, though different barriers and actors are discussed separately here for the sake of clarity, some studies have recognized interlinkages between them (e.g., Alexander, 2013; Heikkurinen et al., 2019; Ziesemer et al., 2019). Studies that address more than one barrier or actor thus appear more than once in the discussion below.

5.1. Barriers to sufficiency transitions

This section presents five different barriers to sufficiency transitions identified in the sufficiency literature: consumer attitudes and behavior, culture, the economic system, the political system, and the physical environment. Table 4 shows the publications that have studied each barrier as well as the number of publications for each. Culture is the most frequently studied barrier to sufficiency transitions, followed by the economic system, then consumer attitudes and behavior; the political system and the physical environment have received less attention.

As seen in Table 4, the barriers to sufficiency transitions have mostly been studied in isolation, with the majority of publications focusing on a single barrier. Only six publications have simultaneously addressed more than one barrier: covering two (Gossen et al., 2019), three (Alexander, 2013; Joyner Armstrong et al., 2016; Spangenberg, 2014), four (Welch and Southerton, 2019), and even all five barriers (Spangenberg and Lorek, 2019).

5.1.1. Consumer attitudes and behavior

In both the literature on sufficiency (Spengler, 2016) and sustainable consumption more broadly (Fuchs, 2013), researchers have debated whether focus should be placed on targeting the behavior and attitudes of individual consumers or on changing societal

Table 4
A summary of the research on the different barriers to and actors in sufficiency transitions.

Literature	Barriers					Actors				
	Consumer attitudes and behavior	Culture	Economic system	Political system	Physical environment	Businesses	Policy-makers	Citizens	NGOs	Educators
Ahvenharju (2020)							x			
Alexander (2013)		x	x	x				x		
Bocken et al. (2014)						x				
Bocken et al. (2018)						x				
Bocken et al. (2020)						x				
Bocken and Short (2016)			x			x				
Boulanger (2009)							x			
Brown and Cameron (2000)		x								
Cherrier et al. (2012)		x								
Cohen (2019a)			x				x			
Cohen (2019b)							x			
Cooper (2005)	x					x				
de Bakker and Dagevos (2012)		x				x		x		
Freudenreich and Schaltegger (2020)						x				
Fuchs (2013)							x			
Fuchs et al. (2016)										
Fuchs and Lorek (2005)	x						x		x	
Gossen et al. (2019)		x	x			x				
Heikkurinen et al. (2019)				x		x				
Joyner Armstrong et al. (2016)	x	x	x							x
Kleinhüeckelkotten and Neitzke (2019)	x									
Lorek and Fuchs (2013)			x				x	x	x	
Lorek and Spangenberg (2014)							x	x	x	
Marchand (2009)										x
McGouran and Prothero (2016)		x								
Pettersen (2016)		x				x	x			
Sandberg (2018)		x								
Schäpke and Rauschmayer (2014)	x									
Spangenberg (2014)		x	x	x			x			
Spangenberg and Lorek (2019)	x	x	x	x	x		x			
Speck and Hasselkuss (2015)		x								
Spengler (2016)							x	x		
Swilling (2011)										
Tunn et al. (2019)							x			
Welch and Southerton (2019)		x	x	x	x		x			
Ziesemer et al. (2019)	x					x	x	x		x
Total number of publications	7	13	9	5	3	12	14	6	3	3

structures. While much of the research on sustainable consumption tends to foreground the study of individual consumers, the study of consumer attitudes and behavior is less prevalent in the sufficiency literature. These studies view consumer opposition to sufficiency (Fuchs and Lorek, 2005), as well as prevailing consumer attitudes (Kleinhüeckelkotten and Neitzke, 2019), needs (Joyner Armstrong et al., 2016), and motivations (Schäpke and Rauschmayer, 2014) as barriers to sufficiency transitions. Changing consumer attitudes and behavior hence becomes the aim of other actors, including businesses (Cooper, 2005) and policymakers (Schäpke and Rauschmayer, 2014; Spangenberg and Lorek, 2019), with education and communication suggested as sources of influence (Ziesemer et al., 2019).

5.1.2. Culture

The most prevalent barrier in the sufficiency literature is the need for cultural change. Scholars have argued for changes to consumerist culture (Gossen et al., 2019) and consumerist cultural values (Brown and Cameron, 2000), calling for a mainstreaming of sufficiency (Alexander, 2013; Spangenberg, 2014) and a normalizing of sufficiency practices (de Bakker and Dagevos, 2012).

In particular, research has addressed cultural norms as a barrier to sufficiency transitions (Sandberg, 2018), emphasizing the unease felt by consumers unable to meet cultural norms (McGouran and

Prothero, 2016) or standards for consumption (Cherrier et al., 2012). Consumers who diverge from cultural norms, for instance, may struggle due to internalized norms or a sense of not meeting the expectations of peer groups, thereby risking disapproval and marginalization (Cherrier et al., 2012; Joyner Armstrong et al., 2016; Spangenberg and Lorek, 2019). Several scholars have suggested interventions at the level of practices as a means to overcome these cultural barriers (Pettersen, 2016; Speck and Hasselkuss, 2015; Welch and Southerton, 2019).

5.1.3. Economic system

Several scholars have argued for the need for changes in the economic system, often as part of wider systemic change to advance sufficiency transitions (Alexander, 2013; Spangenberg and Lorek, 2019; Welch and Southerton, 2019). Scholars have argued that organizations struggle to adapt their business models to support sufficiency because the current economic system demands a focus on short-term shareholder value, maximizing sales, and low prices over quality and durability of products (Bocken and Short, 2016; Gossen et al., 2019). Similarly, consumers may struggle to adapt sufficiency practices due to their economic status (Spangenberg and Lorek, 2019) or the constant temptations of corporate marketing (Joyner Armstrong et al., 2016).

Scholars have suggested that sufficiency transitions are related

to transformations in the economic system, such as changing systems of provision (Cohen, 2019a), challenging the economic growth paradigm (Gossen et al., 2019), and suggesting degrowth as an alternative (Alexander, 2013; Lorek and Fuchs, 2013). Specific changes to the economic system in the sufficiency literature include redistribution of economic resources (Spangenberg, 2014; Welch and Southerton, 2019) and minimum and maximum incomes (Spangenberg, 2014).

5.1.4. Political system

Similarly to economic change, changes in the political system have often been framed as one aspect of the systemic change required for effective sufficiency transitions (e.g., Spangenberg and Lorek, 2019; Welch and Southerton, 2019). Scholars have suggested a need for changes in legislation (Alexander, 2013) and governance structures (Welch and Southerton, 2019), as well as the need for a strengthening of democracy (Spangenberg, 2014). Changes have been suggested to be achieved through pressure from social movements (Alexander, 2013) or through the lobbying activities of businesses (Heikkurinen et al., 2019), though it has also been suggested that corporate lobbying powers should be limited (Spangenberg, 2014). The role of policymakers is further discussed in section 5.2.2.

5.1.5. Physical environment

Different aspects of the physical environment can act as barriers to sufficiency transitions, such as the limitations of existing infrastructure (Barr, 2018) and housing stock (Sandberg, 2018). These barriers, however, have only rarely been recognized in the sufficiency literature. Spangenberg and Lorek (2019) as well as Welch and Southerton (2019) have included the physical environment as one dimension of the systemic change they argue is needed to advance sufficiency transitions. The only study among the reviewed literature to focus purely on the physical environment is that of Swilling (2011), who has argued for the need to reconfigure city infrastructures.

5.2. Actors in sufficiency transitions

This section presents how various actors in sufficiency transitions have been studied in the sufficiency literature. Different actors have different power to hinder or drive sufficiency transitions (Fuchs et al., 2016). Although the sufficiency literature has focused on how various actors can drive sufficiency transitions forward, it is important to note that actors can also attempt to hinder transitions, for example, by lobbying against regulation (Fuchs et al., 2016).

Five actors have been explored in the sufficiency literature: businesses, policymakers, and the civil society trio of citizens, nongovernmental organizations (NGOs), and educators. Table 4 shows the publications that have studied each of the five actors, as well as the number of publications devoted to each. Businesses and policymakers have attracted the most research attention, followed by citizens. NGOs and educators have only occasionally been mentioned in the sufficiency literature.

As with the research on barriers, the majority of research into actors has focused on a single actor. Seven publications cover more than one actor, mostly two (de Bakker and Dagevos, 2012; Fuchs and Lorek, 2005; Pettersen, 2016; Spengler, 2016) or three actors (Lorek and Fuchs, 2013; Lorek and Spangenberg, 2014), with one study covering four actors (Ziesemer et al., 2019).

5.2.1. Businesses

Researchers studying the role of businesses in sufficiency transitions have been particularly interested in how business model innovations can advance transitions. This body of work has been

driven mainly by Bocken and colleagues, including both conceptualizations of business model innovations for sufficiency (Bocken et al., 2014; Bocken and Short, 2016) and empirical studies in various contexts, including plant-based diets (Bocken et al., 2020), clothing (Tunn et al., 2019), and washing machine use (Bocken et al., 2018). Several different frameworks have been suggested to categorize business model innovations that companies can implement to advance sufficiency through, in particular, increased product longevity and support for sharing practices (see Bocken et al., 2014; 2020; Bocken and Short, 2016; Freudenreich and Schaltegger, 2020; Tunn et al., 2019).

The literature also points to the need for design (Cooper, 2005; Pettersen, 2016) and product innovations (de Bakker and Dagevos, 2012), as well as the role of marketing (Cooper, 2005; Gossen et al., 2019). Additionally, Heikkurinen et al. (2019) have underlined the role of businesses in lobbying for pro-sufficiency policy change, while Ziesemer et al. (2019) have noted that advances in sufficiency are not confined to commercial enterprises, but can also encompass non-commercial entrepreneurship.

5.2.2. Policymakers

The most prevalent actor in the sufficiency literature is policymakers. In particular, the role of policymakers in advancing sufficiency transitions has been the subject of a significant body of research by Fuchs, Lorek, and Spangenberg (Fuchs, 2013; Fuchs and Lorek, 2005; Lorek and Fuchs, 2013; Lorek and Spangenberg, 2014; Spangenberg, 2014; Spangenberg and Lorek, 2019). At the local level, policy changes by local authorities (Cohen, 2019b) and support from municipalities (Ziesemer et al., 2019) have been suggested as enablers of sufficiency transitions. Nationally, the need for governments to introduce policies in support of sufficiency has been especially emphasized by Lorek and colleagues (Lorek and Fuchs, 2013; Lorek and Spangenberg, 2014). On the international level, Fuchs and Lorek (2005; see also Fuchs, 2013) have discussed global forms of governance for sufficiency, calling for a strengthening of the role played by international governmental organizations, such as the United Nations Commission on Sustainable Development (CSD) and the United Nations Environmental Programme (UNEP).

The literature suggests a range of policy changes. Lorek and colleagues (Lorek and Fuchs, 2013; Lorek and Spangenberg, 2014; Spangenberg and Lorek, 2019) have argued for the need for hard policies in the form of regulation and economic instruments. Specific policy measures offered include the introduction of a basic income (Boulanger, 2009) and progressive property taxation (Cohen, 2019b). The most comprehensive account of different measures is given by Ahvenharju (2020), who has identified 14 different policy interventions, including enabling and informative measures, as well as disabling measures such as different types of taxes and quotas. In addition, Welch and Southerton (2019) have provided an overview of existing policy measures, distinguishing between policies that target individual behavior and those designed to foster systemic change.

5.2.3. Civil society actors: citizens, NGOs, educators

The role of civil society actors in sufficiency transitions has received scattered attention in the sufficiency literature. Citizens have been suggested to advance sufficiency transitions through the roles of individual consumers and activists, as well as collectively through social movements and social innovations. Appointing responsibility for change to individual consumers has been increasingly criticized (Spengler, 2016), though de Bakker and Dagevos (2012) have argued that consumers are important change agents in transitions. In addition to their role as consumers, citizens can also advance sufficiency transitions as activists (Ziesemer et al.,

2019) or as part of social movements (Alexander, 2013), attempting to influence policymaking (Ziesemer et al., 2019) or drive cultural change (Alexander, 2013). Social innovations have been suggested as a way for citizens to drive local, grassroots-level initiatives that can advance sufficiency transitions (Lorek and Fuchs, 2013; Lorek and Spangenberg, 2014; Ziesemer et al., 2019).

Finally, NGOs and educators have been mentioned in the literature as possible enablers of sufficiency transitions. Lorek and colleagues (Fuchs and Lorek, 2005; Lorek and Fuchs, 2013; Lorek and Spangenberg, 2014), in particular, have argued for strengthening the role of NGOs as catalysts for change through, for example, building coalitions and fostering societal debate. Several scholars have argued for the importance of education in the success of sufficiency transitions, including consumer education (Ziesemer et al., 2019) and higher education (Joyner Armstrong et al., 2016; Marchand, 2009).

6. Discussion

This section discusses the theoretical contribution that the present review makes to the literature on sufficiency as well as implications for practitioners. In addition, it recognizes some limitations of the review and suggests directions for future research.

6.1. Theoretical contribution

This article makes three main contributions to the sufficiency literature. First, it clarifies our understanding of sufficiency as a concept. The article develops a typology that differentiates between four types of consumption changes that sufficiency may entail: absolute reductions, modal shifts, product longevity, and sharing practices. Sufficiency as a concept has previously been noted to lack clarity (Spangenberg and Lorek, 2019; Spengler, 2016). It has been defined as changes in consumption levels and patterns (Fuchs and Lorek, 2005), without the precision as to what exactly this entails. The typology of consumption changes developed in this article contributes to the sufficiency literature by clarifying what is meant by changes to consumption levels and patterns. The typology shows that sufficiency can take four main forms and provides clear definitions for each (Table 2). Sufficiency is thus a more complex proposition than simply reducing consumption levels. The typology offers a more nuanced understanding of the different types of consumption changes associated with sufficiency and acts as a useful theoretical tool for understanding the variety of consumption changes that can be made to reduce ecological footprints.

Second, the article shows the specific forms that sufficiency can take in different consumption categories. It consolidates literature from various research streams to provide an overview of sufficiency practices across four consumption categories: housing, nutrition, mobility, and miscellaneous consumption. Much research has been conducted on a variety of sufficiency practices, as discussed in section 4. However, much of this research has not been noted in the sufficiency literature. Different sufficiency practices have been studied in isolated streams of research, with few theoretical linkages to the concept of sufficiency. This article contributes to the sufficiency literature by synthesizing these research silos and creating a framework that shows the most significant sufficiency practices across the four consumption categories of housing, nutrition, mobility, and miscellaneous consumption (Table 3). The framework shows that not every type of consumption change is relevant to each category. In particular, absolute reductions may be difficult to achieve in nutrition and mobility; rather, it may be more relevant to focus on modal shifts. The framework, therefore, underscores the importance of considering how sufficiency takes different forms in different consumption categories.

Third, the article shows the many dimensions of sufficiency transitions. It identifies barriers and actors that can prevent or advance sufficiency transitions. Five barriers have been examined based on the literature: consumer attitudes and behavior, culture, the economic system, the political system, and the physical environment. By contrast, businesses, policymakers, citizens, NGOs, and educators have been suggested as key actors in sufficiency transitions. Previous research on sufficiency transitions has been somewhat fragmented, with various barriers and actors having been studied mostly in isolation. This article contributes to the sufficiency literature by bringing together these research efforts in order to advance a more integrated understanding of barriers to and actors in sufficiency transitions. The findings underline the complexity and multidimensionality of sufficiency transitions: a plethora of systemic changes are required, involving a multitude of different actors in the process. An understanding of the interplay between these various barriers and actors is essential.

6.2. Practical implications

The findings of the review can support practitioners working to advance sufficiency transitions. The findings show the variety of consumption changes that can be made to reduce ecological footprints. Rather than a unified phenomenon or simply a question of reducing consumption levels, sufficiency can take many forms and requires different changes in different consumption categories. Absolute reductions in consumption levels may not always be possible; rather, shifts to alternative modes of consumption, increasing product lifespans, or sharing products among individuals may be ways to change consumption patterns. Consumption changes in housing, nutrition, mobility, and other consumption categories may look very different and require different practical approaches.

The findings identify the actors that have in the literature been suggested as key change agents in sufficiency transitions. Businesses, policymakers and civil society actors are all needed to advance sufficiency transitions. Interplay and collaboration between different actors are likely to be more impactful than actors working in isolation. In addition, for significant change to be achieved, actors need to be aware of and address the different barriers that currently prevent sufficiency transitions. Actors should not only target consumer attitudes and behavior, but work to address structural barriers, including changes to culture, the economic system, the political system, and the physical environment. Successful sufficiency transitions are likely to require changes across all of these dimensions.

6.3. Limitations and directions for future research

This article points to directions for future research that can strengthen our understanding of sufficiency transitions. Rather than studying sufficiency as a general concept, research could benefit from a greater empirical focus on specific sufficiency practices, as argued by Speck and Hasselkuss (2015). This article has highlighted the many different types of consumption changes and practices that sufficiency may entail. The focus of this review was on those practices suggested to have the highest potential to reduce ecological footprints. Though some work has been conducted to calculate this reduction potential (e.g., IGES et al., 2019; Laakso and Lettenmeier, 2016; Wynes and Nicholas, 2017), further quantitative analyses of how various sufficiency practices can reduce ecological footprints would bolster the sufficiency literature. In particular, strong empirical evidence for the reduction potential of different sufficiency practices in housing is lacking; more research is needed to determine which practices to prioritize in this consumption category. In

addition, the framework of sufficiency practices (Table 3) may point to potential gaps in the literature that merit further investigation.

While vast amounts of research have been carried out on specific sufficiency practices in various streams of research, the literature would benefit from considering both the potential interlinkages and disparities that exist between them. Consumption changes may indeed have ripple effects that magnify the environmental impact of the initial change. For example, modal shifts from detached houses in semi-urban and rural locations to apartments in more central locations with better public transport links may both reduce private car use and increase use of public transportation (Duffy, 2009). Similarly, reductions in dwelling size have been shown to reduce the amount of furniture and appliances in use (Khajehzadeh and Vale, 2017). Both cohousing and increased household sizes have been seen to increase the sharing of various consumption goods; cohousing has also been linked to increased car sharing (Klockner et al., 2016; Williams, 2008).

Different sufficiency practices may also exhibit different barriers to change or involve different actors. For example, land use policies have been identified as particularly relevant barriers to sufficiency transitions in the context of housing (Evans, 2018a, 2018b), while the need for supporting infrastructure may be of particular importance in reducing private car use (Barr, 2018; Hasselqvist and Hesselgren, 2019). Thus, research would benefit from considering sufficiency not as a single unified phenomenon but in terms of a multiplicity of transitions with their own different characteristics.

Many of the sufficiency practices suggested in the literature are controversial and difficult to implement. This underlines the importance of understanding how sufficiency could best be advanced. More research is needed to better understand sufficiency transitions. While the literature has recognized a broad array of potential barriers and actors, more empirical studies of each across different contexts could provide a better understanding of their role in sufficiency transitions. The relative significance of different barriers to different sufficiency practices in diverse contexts needs to be better understood; the potential of changes to the physical environment is a particularly underdeveloped topic. The power of different actors to advance or hinder transitions also needs more attention, as argued by Fuchs et al. (2016). Ultimately, empirical work that recognizes the need for different solutions in different contexts would contribute to a more nuanced, contextualized understanding of sufficiency transitions.

In particular, a systemic understanding of barriers and actors is needed to better understand the complexity of sufficiency transitions. Though several scholars have highlighted the need for cultural, economic, and political change (e.g., Alexander, 2013; Spangenberg and Lorek, 2019; Welch and Southerton, 2019), and some have considered multiple actors (e.g., Lorek and Fuchs, 2013; Pettersen, 2016; Ziesemer et al., 2019), the literature lacks emphasis on the complex interplay of different barriers and actors. Examples of such links that the literature has touched upon include social movements driving cultural change (Alexander, 2013), businesses influencing policymaking (Heikkurinen et al., 2019), and municipalities supporting local, grassroots-level innovations (Ziesemer et al., 2019). Further systemic analyses that recognize and map such links could provide new insights into how networks of actors could work to overcome the various barriers to sufficiency transitions.

The current review is not without its limitations, in particular regarding the search strategy used. The search for literature was limited to the Scopus database. Despite its expansive coverage of the literature, it remains possible that some relevant literature was not captured by this search strategy. The use of the keywords “sufficiency” and “strong sustainable consumption” to identify relevant research may also have been restrictive, since this

terminology is not consistently used in the literature, meaning that studies using alternative terminology were not included in the review. In addition, the review of literature on sufficiency transitions (section 5) was limited to the sample of articles on sufficiency, excluding research on specific sufficiency practices: the amount of literature on all discussed sufficiency practices was simply too large to include in a single review article. Future research could build on this review by comparing how sufficiency transitions have been investigated specifically in housing, nutrition, and mobility and identifying the barriers and actors that are particularly relevant to different sufficiency practices.

The focus of this article has been sufficiency as a response to environmental degradation. Future research would benefit from considering the social and economic dimensions of sufficiency transitions. Though this review has foregrounded consumption changes, it is important to remember the interconnectedness between consumption and systems of provision (Lebel and Lorek, 2008). Further analysis of production-consumption systems and the changes required on both sides would thus add to a fuller understanding of sufficiency transitions.

6.4. Conclusions

This article has clarified what sufficiency means as an approach to sustainable consumption and advanced our understanding of the multidimensionality of sufficiency transitions. The article has identified the specific consumption changes that the sufficiency literature suggests to reduce ecological footprints. It has identified four different types of consumption changes that sufficiency may entail: absolute reductions, modal shifts, product longevity, and sharing practices. It has also shown the different types of consumption changes that are required in different consumption categories, providing an overview of specific sufficiency practices with a focus on the three consumption categories with the largest environmental impact: housing, nutrition, and mobility. In addition, the article has provided an integrated understanding of how sufficiency can be advanced. It has identified barriers to sufficiency transitions, including consumer attitudes and behavior, culture, the economic system, the political system, and the physical environment. It has also identified actors that can play a role in advancing sufficiency, mainly businesses, policymakers, citizens, NGOs, and educators.

This article is a useful resource for researchers and practitioners alike who seek a better understanding of sufficiency. It shows the types of consumption changes that sufficiency may entail. It brings together a number of streams of research, providing a quick overview of existing research across various sufficiency practices. It also highlights the complexity and multidimensionality of sufficiency transitions and can serve as a platform for future work to advance sufficiency in both research and practice.

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Declaration of competing interest

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