

A Review of Financial Nudging Energy Consumption Behaviors

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Abstract

Controlling energy consumption is a serious environmental issue due to global warming and pollution. This work aims to review some of the important studies, and contemporary achievements of Financial Nudging Energy Consumption that changes energy consumption. In addition, in this study, a useful theoretical data-driven Nudging framework by Burger and his colleagues is proposed.

Keywords: Nudge theory, Energy Consumption Behavior

1 Introduction and literature review

We divided this part into 3 sections: energy consumer behavior, sustainable consumption and financial behavior. We review many studies related to these field and finally introduce some empirical models.

1-1 Energy Consumer Behavior

To increase consumers' conservation of energy and other resources, government agencies, utilities, and energy-related businesses can complement regulatory and market-based policies with simple and effective behavioral interventions grounded in extensive behavioral science research (Yoeli et al., 2017). Controlling energy consumption is a serious environmental issue due to global warming and pollution. Public policies are developed in this context. One such policy is the nudge, a form of policy aimed at changing individual behaviors without using financial incentives nor orders, for example by providing information to individuals so as to conduct behaviors in the direction desired by the policymaker. Interestingly "private nudges" can be imagined for companies. Many economists and psychologists have studied the impact of nudges on households'

pro-environmental behaviors. Yet, studies focusing on nudging employees' energy use are rare (Charlier et al., 2019). Burger et al., (2015) stated that there are two main strategies: improving energy efficiency and enhancing sufficiency. So far, however, there is no great success story to be told regarding the aspired reduction. Despite many efforts, there is no clear evidence that the total energy consumption of individuals has been reduced substantially during the last decade. They cited that the first goal of "explaining ECB 2" implies answering the following two questions: what is ECB? Which factors determine ECB? Accordingly, and following the above made distinction between explanations, two further questions can be formulated: what is "change of ECB?" Which factors explain changes of ECB? While fossil fuel-based energy, consumption has generated great amount of greenhouse gas emissions that exacerbates climate change issues, smart meter feedback systems are expected to reduce households' energy consumption to mitigate this impact. Smart meter feedback systems are neither mandates nor incentives for households to reduce their energy use, the potential of it to save energy is therefore up for debate (Hu, 2017). Smart meter feedback nudges: salient information, social norms, and

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2 -Energy Consumption Behavioral

commitment are all proved to be effective in reducing households' energy consumption. In the meantime, the different forms and delivering methods of the three nudges in real context differ in their effects on changing households' energy consumption. Their triggered household behavioral changes to save energy differ as well. From the other perspective, smart meter feedback systems would change the current household energy consumption practices when introduced. Smart meter feedback manages to change the household energy consumption practices by changing its consisting elements: materials, competences & understandings, engagement and rules. Energy consumption information and unit price gives initial changes to materials and rules respectively. Social norms and commitment lead to initial changes in engagement. These initial changes are influenced by other elements in the energy consumption practices and, in the meantime, affect other elements. The initial changes also vary in themselves over time. This whole dynamic process of elements changing and influencing each other, determines sustainable change in the energy consumption practices to occur, fade, stabilize or never emerge after smart meter feedback systems being introduced (Hu, 2017).

Ghasemian et al., (2020) presents a novel comparative analysis on global energy scenarios and state that global energy driving forces which play significant roles in reshaping the world energy future by 2040 have been identified. The study applies mathematical principles to quantify the rational judgments of an expert panel in social, technological, economic, environmental and political framework through cross-impact analysis. Among the 10 global energy driving forces by 2040, population growth rate and climate change are identified as social and environmental driving forces, respectively. Investment in infrastructures, financial shocks, consumer behavior and energy efficiency are marked as economic driving forces, while global governance and geopolitical relationships are identified as the global energy market's political driving force. And finally, technological development in renewable energies as well as in oil and gas upstream sector is recognized as a technological driving force. They conclude that to address growing energy demands, oil and natural gas still will provide about two-third of total energy demand, however, due to upstream technology developments and being environment friendly natural gas grows with a steeper slope. As noted, environmental concerns are impressing energy policies, but nuclear power is still challenging. European countries are going to retire nuclear power plants referring to possible disastrous accidents, while India and China are planned to launch new plants. In all scenarios, electricity demand growth is an inevitable future due to transport electrification, growing urban lifestyles and rising incomes. All reviewed scenarios see a significant role of population growth and consumer behavior in future. Based on the comparative analysis of global energy scenarios, pursuing collaborative approach, renewable technologies developments and accelerating digitalization are the essential elements in the transition towards a global low-or zero carbon emissions energy future. All global energy scenarios direct attention to the need for coordinated action and policies on global climate change as the most important environmental driving force. According to the findings of this study, the realization of a desirable future with global economic growth and low emissions is achieved by good

global governance, a high level of investment in energy infrastructures and significant energy efficiency growth. Reviewed scenarios describe that developments in the global financial system and geo-political relationships and tensions can constrain or accelerate successful global energy transition. Though existence of a global shared vision is very valuable, national energy polices and outlooks should not be ignored. The international macro image, and corresponding policies, may contradict the national image, referring to countries challenges, capacities and potentials, especially in the case of energy supplier countries. Also, the mechanisms underlying long-run reductions in energy consumption caused by a widely studied social nudge. Our investigation considers two channels: physical capital in the home and habit formation in the household. Brandon et al., 2017 isolate the role of physical capital by comparing treatment and control homes after the original household moves, which ends treatment. We find 35 to 55 percent of the reductions persist once treatment ends and show this is consonant with the physical capital channel. Methodologically, our findings have important implications for the design and assessment of behavioral interventions (Brandon et al., 2017).

Here, Yoeli et al., (2017) propose 13 practical, cost-effective, and impactful behavioral interventions, or tools, those policymakers, utilities, energy-related businesses and other organizations could use to increase conservation by consumers. The recommendations all derive from academic research in behavioral science, including several recent reviews related to energy and the environment. These tools complement regulatory or market-based policies in two ways. First, they would provide additional incentives, other than simply financial ones, to change behavior. Second, they would strengthen regulatory or market-based policies by focusing on what information to present, how to present it, when to reach out with the information, and when to remind people of it. Broadly speaking, the behavioral tools we recommend can help meet four objectives: get people's attention; engage people's desire to contribute to the social good; facilitate accurate assessment of risks, costs, and benefits; and facilitate accurate assessment of risks, costs, and benefits. As shown in Figure 1, many of the tools contribute to more than one of these objectives.

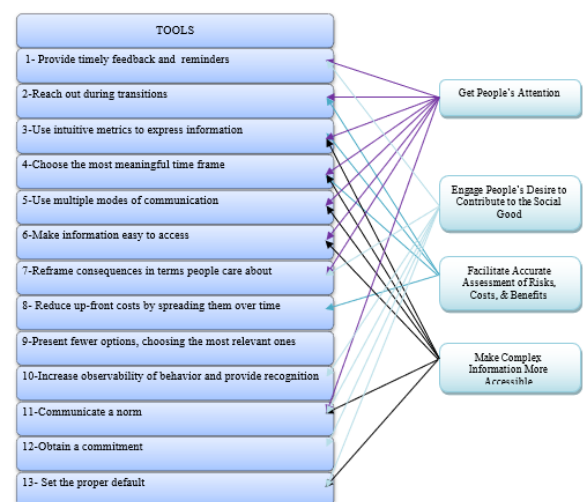


figure 1: Several overarching objectives to be achieved by the 13 behavioral science tools described in this article

1-2 Sustainable consumption:

However, information interventions and nudges fall short in terms of addressing natural resource consumption in its totality (for instance, strong sustainable consumption), whereas the promise of social practice theory to address escalating expectations in consumer society is still embryonic in terms of policy implications. We have outlined some bottom-up and top-down policy pathways that could be pursued in parallel, yet these would definitely require significant changes in how sustainable consumption policy is practiced (Heiskanen et al., 2019).

Klege et al. (2018) have contributed to this discussion by examining the essential rules related to nudge and boost policies, probing into the rationality between policy and theory, alongside skeptically bearing in mind the ethical implications. The core intent of this work was to try to optimistically improve the energy sector standard in Bangladesh as well as other countries as well, however minimal it is but effective none the less. These are remarkably the largest reductions in energy consumption to have been demonstrated using behavioral nudges (Klege et al., 2018).

Kácha & Ruggeri (2019) in their research cited that Public and private institutions implement behavioral insights into policies to manage risks associated with environmental and social challenges. However, many such policies rely on providing external incentives, which inhibits sustained behavior change. they propose that message framing can be used to leverage intrinsic motivation toward pro-environmental and pro-social behaviors. Designing messages to raise feelings of autonomous choice has been shown to catalyze intrinsic engagement in promoted activities. They compared effects between autonomy-supportive messages and messages that contained social norms. Outcomes focused on engagement in sustainable behaviors, such as limiting electricity consumption and opting for locally produced goods. There were no significant differences in intrinsic motivation, participation in sustainable behaviors, or well-being for those frames, yet we observed moderate-to-strong relationships between these variables. While this indicates the specific intervention was not effective at inducing change, it is clear that effective risk policies should leverage intrinsic motivation to act sustainably. Harnessing the power of intrinsic motives will have a great chance at inducing lasting social change as well as improving well-being. In the circumstances that Reducing energy use is a critical near-term strategy to mitigate climate change. Energy savings behaviors provide multiple benefits to the consumer and to society in addition to reducing greenhouse gas emissions: financial savings from lower energy bills, improved home comfort, fossil fuel resource conservation, energy independence, and improved local and indoor air quality, among others. Yet many policies to encourage reductions in energy use continue to focus on motivating behavior change with financial benefits, and little behavioral research has explored how these multiple benefits influence energy use decisions. Given the continued need for decreased energy use, more research is needed on how to leverage both financial and nonfinancial motivations to encourage energy saving behaviors (Hala, 2020). (38). In the

other hand, The worldwide transition to renewable wind and solar electricity generation leads to more complex and decentralized energy systems. It is no longer sufficient to centrally optimize large controllable units. As electricity systems cannot be controlled from a top-down perspective anymore, the consumer behavior movement is becoming an increasingly important factor in energy systems with a growing impact. However, behavioral science has traditionally been limited to very few research streams. In this paper we propose a framework for behavioral studies in electricity systems and suggest an according research process. We classify existing literature along the framework and provide four case studies to illustrate the importance of behavioral science in energy domain (Philipp et al., 2019).

If we focus on the energy domain, Abstract Human behavior is responsible for many of our greatest environmental challenges. The accumulated effects of many individual and household decisions have significant impacts on biodiversity and ecosystem health. Environmental psychology blends social psychology and environmental science to study how people respond to the context in which they live (e.g. who presents the information and how it is framed). Behavioral insights have informed new strategies to improve personal health and financial choices. However, the evidence is mixed on whether and how these insights can be leveraged for the environment (Byerly et al., 2019). In a series of 160 experimental interventions to influence energy-related decisions in which decisions have major environmental impacts: family planning, land management, meat consumption, transportation choices, waste production, and water use. The evidence suggests that social influence and simple adjustments to decision settings can influence pro-environmental decisions. Then Byerly et al., identify four important gaps in the evidence that provide opportunities for future research.

Maréchal & Holzemer, (2015) with considering on the insufficient results achieved so far by energy-saving policies, were drowning framework. The framework builds on the concept of habitual practices (HP). Its rationale is to provide a precise characterization of household energy-related practices allowing for a good understanding of their content together with a clearer picture of how they are formed and sustained over time. This constitutes a necessary step prior to reflecting on the type of interventions that could influence practices towards more sustainable configurations. From point of their views, The HP framework has been conceived in order to provide another way of looking at the issue of energy consumption and of reflecting on instruments to reduce it. The main rationale is to adopt a perspective that is more attuned and responsive to the dynamics of what practitioners undergo in their everyday life and of what is meaningful to them. Putting the theoretical HP framework into operational terms has led us to specify, as presented in Fig. 2, a sort of sequential reading grid with distinct grips to be activated for the whole process of change to be impacted.

Get People's Attention

Engage People's Desire to Contribute to the Social Good

Facilitate Accurate Assessment of Risks, Costs, & Benefits

Make Complex Information More Accessible

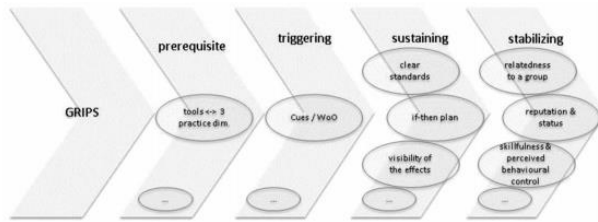


Figure. 2. A sequential list of grips for fostering a change in habitual practices.

The list of grips presented in this paper is neither exhaustive nor the only one which is valid. Through applying the same methodological approach (i.e., rooting the perspective in the literature on practices and habits and maintaining theoretical consistency), it is possible to extend the list of aspects to be integrated. Obviously, it also depends on the type of intervention that is to be designed or assessed through the generic sequential grid sketched in Fig. 2. The HP reading grid thus constitutes a flexible tool that can serve to design innovative instruments (or assess existing ones) aimed at reducing energy consuming practices. The relevance of the HP framework for policy-makers can be better grasped through discussing a well-documented energy-saving tool: feedback mechanisms. Also, a renewed perspective on existing policy tools and potential strategies for behavior change are entering public debate that have implications for behavior of individuals, but that also raise critical questions about the role of the government in the society and transition to sustainability. The guiding question is whether it is possible to help individuals make better decisions for themselves and society at large by overcoming limitations of human cognitive capacity and behavioral biases?

Lehner et al., (2016) in order to answer these questions 1) analyses existing academic knowledge on nudging and choice architecture; 2) investigates lessons about effectiveness of applied nudging tools and approaches in consumption domains of energy use in the home, food and mobility; 3) discusses opportunities and limitations for devising more successful nudges in the three consumption domains; and 4) outlines critical issues concerning the legitimacy of nudging. The result of their research shows that lately applications of behavioral sciences and behavioral economics, such as nudge, have been helping policy makers in different countries and sectors to more systematically integrate behavioral insights into policy design and implementation. However, the size of the effects of policy interventions and the actual outcomes of interventions in different contexts are very diverse. Results from one experiment cannot be indiscriminately generalized to a different context or to a wider population. The problem is the complexity of human behavior and the diversity of factors that influence it. Despite that, nudging is a useful strategy for inducing changes in context-specific behavior. Nudge tools are seen as a complement to the traditional policy instruments rather than as a substitute for laws and regulations and economic tools.

1-3 Financial Nudging:

Informing about the role of nudging in the environmental worries is a better much more knowledge about this notion. “Nudge”-style interventions are often deemed successful if they generate large

behavior change at low cost, but they are rarely subjected to full social welfare evaluations. We combine a field experiment with a simple theoretical framework to evaluate the welfare effects of one especially policy-relevant intervention, home energy social comparison reports. In our sample, the reports increase social welfare, although traditional evaluation approaches overstate gains because they ignore significant costs incurred by nudge recipients (Allcott & Kessler, 2019). Unfortunately, as much as we may want to act in ways that would be best for us and for the environment, we often struggle to do just that due to cognitive biases. Nudge theory attempts to remedy this problem by helping us make the decision that would be in our best interest. There are several documented instances in which different nudging tools have been implemented effectively. Also, the discussion of the ethical issues surrounding the use of nudge theory—even is examined in situations in which nudge theory can be used. Based on Cooper (2017) findings, he recommends that the default option, a type of nudge, be set to the environmentally beneficial option wherever a default option is available. I also recommend creating a nudge unit to determine how nudges can be used in policies where other methods of behavior change (for example, tax incentives) may fail.

Nudges modify decision frameworks in order to steer people's choices in particular directions. Modifying energy consumption choices through nudging has shown significant promise for promoting sustainable consumption behaviors. However, policy makers have been reluctant to embrace nudges, due to concerns over potential ethical objections. Kasperbauer (2017) argues that the major ethical objections to nudging are not ultimately convincing when applied to energy production and consumption. The most common ethical objections claim that nudging is paternalistic and reduces human autonomy. It is argued here that energy production and consumption are “massively architecture,” which means that they are strongly influenced by factors external to individuals. The infrastructure and framework for producing and consuming energy is largely determined prior to human decision-making. As a result, it is not clear how nudging for sustainable energy consumption could be paternalistic or autonomy-reducing. Ethical objections should thus not be a deterrent for policy makers pursuing nudges for sustainable energy consumption (Kasperbauer, 2017).

Meanwhile, to promote ethical and pro-environmental behavior, hypocrisy sometimes is made salient to individuals: i.e., they are made aware that their past behavior does not conform to expressed norms. The fact that this strategy may backfire and may even reduce the likelihood of individuals performing the desired action has been largely overlooked. Gamma et al (2018) develops a theory of how hypocrisy stimulates two opposing heuristic processes: one that favors the former, positive outcome (the eco-citizenship effect) and one that renders hypocrisy non-effective (resistance-to-habit-change effect). They test the model and reveal important boundary conditions using the finding of a comprehensive field experiment (1377 consumers). Situational (public vs. private advocacy) and individual factors (low vs. high construal levels) determine which of the competing mechanisms

is activated. The results contribute a novel understanding to managers and scholars of how hypocrisy operates and illuminates the contingencies of when this strategy is beneficial (Gamma et al., 2018).

Many economists and psychologists have studied the impact of nudges on households' pro-environmental behaviors. Interestingly, "private nudges" can be imagined for companies. Yet, studies focusing on nudging employees' energy use are rare. The objective of Charlier et al (2020) is to explore this issue with the help of a field experiment conducted at 47 French companies' sites. Using a difference-in-difference methodology, the effects of three nudges on employees' energy conservation are tested. The first nudge, "moral appeal", stresses the responsible use of energy. The second one, "social comparison", informs employees on the energy consumption of other firms participating in the experiment. Finally, the third nudge, "stickers", alerts employees about good energy conservation practices. Our results stress the complementarity of these nudges. When implemented alone, the three nudges have no significant effects on energy consumption. However, when the moral appeal and social comparison nudges are combined with the stickers nudge, they become effective (Charlier et al., 2020). As well as, the public sector owns and manages approximately 90 million square meters of premises. One of the toughest challenges today is managing both climate-friendly and energy efficient buildings. For the landlords who facilitate these properties to reach national targets by 2020, they will need well thought out strategies. New technology and installations are not enough. Tenants also have to change their behavior. A relatively new way to influence behavior without changing values of people is nudging. The term nudging was coined by researchers Richard Thaler and Cass Sunstein. Situations are designed to encourage individuals to choose an individual and society-beneficial alternative. Nudging can be used to help people make choices that are better for the environment and their overall health. To be considered as a nudge the action, per the definition, does not allow the forbidding of options or change of economic incentives. Hence, it respects people's freedom of choice. Hanglund (2017) in his research tried to examine how nudging methods impact public tenants' daily energy consumption. This is explored by looking into what work has been done based on the nudging toolbox; (1) simplification and framing of information, (2) changes to the physical environment, (3) changes to the default option, and (4) the use of social norms (Haglund, 2017).

Success of strategies for solving problems of climate change, resource efficiency and environmental impacts increasingly depend on whether changes in public behavior can and will supplement the technical solutions available to date. A renewed perspective on existing policy tools and potential strategies for behavior change are entering public debate that have implications for behavior of individuals, but that also raise critical questions about the role of the government in the society and transition to sustainability. The guiding question is whether it is possible to help individuals make better decisions for themselves and society at large by overcoming limitations of human cognitive capacity and behavioral biases? In order to answer these questions, this article 1) analyses existing academic knowledge on nudging and choice architecture; 2) investigates lessons about effectiveness of applied nudging tools and approaches in consumption domains of energy use in the home, food and mobility; 3) discusses opportunities and limitations for devising more successful nudges

in the three consumption domains; and 4) outlines critical issues concerning the legitimacy of nudging. The results of Lehner et al 's research shows that lately applications of behavioral sciences and behavioral economics, such as nudge, have been helping policy makers in different countries and sectors to more systematically integrate behavioral insights into policy design and implementation. However, the size of the effects of policy interventions and the actual outcomes of interventions in different contexts are very diverse. Results from one experiment cannot be indiscriminately generalized to a different context or to a wider population. The problem is the complexity of human behavior and the diversity of factors that influence it. Despite that, nudging is a useful strategy for inducing changes in context-specific behavior. Nudge tools are seen as a complement to the traditional policy instruments rather than as a substitute for laws and regulations and economic tools (Lehner et al., 2016). Zhou and Yang (2017) believed that understanding and changing household energy consumption behavior are considered as effective ways to improve energy efficiency and promote energy conservation. With the increasing penetration of conventional and emerging information and communication technologies (ICTs) in energy sector, traditional energy systems are being digitized. The energy big data provides a new way to analyze and understand individuals' energy consumption behavior, and thus to improve energy efficiency and promote energy conservation. We first propose a framework of the interdisciplinary research of energy, social and information science, which includes energy social science, social informatics and energy informatics. Then, different dimensions and different research paradigms of household energy consumption behavior are presented. Household energy consumption behavior can be analyzed in time dimension, user dimension and spatial dimension. The economic paradigm (including demand response) and the behavior-oriented paradigm (including intervention strategies) are two major research streams of household energy consumption behavior. Finally, the "4V" characteristics (i.e., volume, velocity, variety and value) of energy big data are discussed. Also, a systematic review of the nudge literature and an examination of its applications across different domains reveals that: (i) a nudge, in the sense of using choice architecture to push people to choose desired results, works well; and (ii) a nudge, in the sense of pushing people to choose desired results so that people will be better off, remains questionable. In financial markets, regulators and financial intermediaries currently use nudge theory to: (i) adjust how investment choices are presented to investors; and (ii) provide information in a selective way. Besides nudging investors, it is also possible for regulators to nudge financial intermediaries towards making more ethical decisions (Pe'er et al., 2019).

The authors review and discuss the drivers that affect sustainable consumption by focusing on behavioral interventions employed in public policies by private organizations and governments. They differentiate interventions that may promote intrinsic (pro-environmental or prosocially) motivation from those that consider extrinsic factors, such as financial incentives and reputational motivation. They also discuss how policy tools, called nudges, can affect behavior without a substantial change in the available choice set or its associated economic incentives. They find that the effect of providing financial incentives on sustainable consumption is mixed, and that financial incentives may mobilize non-economic drivers in a similar way to nudges. These

considerations invite a closer examination of what is considered intrinsic motivation in the domain of sustainable consumption and how it should be measured, as well as how green financial incentives can be structured and framed in a way that favour nudging effects as well as purely economic price effects (Schwartz et al., 2019).

Excess use of disposable to-go-cups constitutes a severe sustainability threat. Behavioral economics and economic psychology suggest various antidotes. In the present paper, we report two studies – a large-scale intervention field study and an experiment – that constitute independent, pre-registered, and open replication attempts of a recently-introduced intervention procedure: dynamic social norms. Loschelder et al., (2019) tested whether a dynamic norm, along the lines of “more and more customers are switching from to-go-cups to a sustainable alternative. Be part of this movement and choose a reusable mug” – can help café customers to avoid disposable to-go-cups. Data from a fourteen-week intervention experiment with a total of 23,946 hot beverages sold – 18,019 in disposable cups and 5927 in reusable mugs – suggest that a dynamic-norm intervention for sustainable consumption helps customers avoid disposable cups and increases their use of reusable alternatives by 17.3% (or 4.1 percentage points). A follow-up online experiment corroborates this pattern and shows advantageous effects of a dynamic norm relative to a no-norm control condition, a static norm, an injunctive norm, and a combination of static-and-injunctive norm. In light of inconsistent and, at times, failed or even reversed replication results for seminal social norms studies, the present pre-registered studies indicate that dynamic norms are an effective means to facilitate sustainable behavior. They discuss scientific and applied implications and avenues for future research (Loschelder et al., 2019).

According to the prediction of the Food and Agriculture Organization, food supply must increase by almost 70 percent by 2050, with tremendous consequences in terms of land depletion, natural resource use, and greenhouse gas emissions. The current agri-food system is incapable to cope with this raising demand meanwhile preserving the environment. There is urgent need to reorient the food system onto a more sustainable trajectory: producers should pursue more conscious and environmentally friendly practices and consumers should account for sustainability issues while making their daily food consumption decisions. Almost all studies on farmers as well as on consumers included in this review provide evidence that green nudging can be effective in leveraging more sustainable practices. Overall, we propose that green nudges should not be meant to replace stricter environmental and food policies, but rather they should be regarded as potential complements to be implemented with the aim of gradually moving society in a direction that might benefit all (Ferrari et al., 2019).

A systematic review of the nudge literature and an examination of its applications across different domains reveal that: (i) a nudge, in the sense of using choice architecture to push people to choose desired results, works well; and (ii) a nudge, in the sense of pushing people to choose desired results so that people will be better off, remains questionable. In financial markets, regulators and financial intermediaries currently use nudge theory to: (i) adjust how investment choices are presented to investors; and (ii) provide information in a selective way. Besides nudging investors, it is also possible for regulators to nudge financial

intermediaries towards making more ethical decisions (Cai, 2019).

Nudges modify decision frameworks in order to steer people's choices in particular directions. Modifying energy consumption choices through nudging has shown significant promise for promoting sustainable consumption behaviors. However, policy makers have been reluctant to embrace nudges, due to concerns over potential ethical objections. This paper argues that the major ethical objections to nudging are not ultimately convincing when applied to energy production and consumption. The most common ethical objections claim that nudging is paternalistic and reduces human autonomy. It is argued here that energy production and consumption are “massively architecture,” which means that they are strongly influenced by factors external to individuals. The infrastructure and framework for producing and consuming energy is largely determined prior to human decision-making. As a result, it is not clear how nudging for sustainable energy consumption could be paternalistic or autonomy-reducing. Ethical objections should thus not be a deterrent for policy makers pursuing nudges for sustainable energy consumption. This research Kasperbaure (2017) in his research cited three point that

- Major ethical objections to nudging are not persuasive in the context of energy consumption.
- Energy infrastructure strongly influences individual consumption habits.
- Policy-makers have good reasons to embrace nudging for sustainable energy consumption.

Considering the insufficient results achieved so far by energy-saving policies, the stance of this paper is to depart from an ‘expert’ view and base the analysis on those energy-related practices that are meaningful to practitioners (e.g., showering, cooking, listening to music). The framework described in this paper builds on the concept of habitual practices. Its rationale is to provide a precise characterization of household energy-related practices allowing for a good understanding of their content together with a clearer picture of how they are formed and sustained over time. This constitutes a necessary step prior to reflecting on the type of interventions that could influence practices towards more sustainable configurations. The notion of ‘grips’ is then introduced with the aim of putting this characterization into a form that is more operational for policy-makers. Grips are elements that have to be ‘(de-) activated’ for supporting a targeted behavioral change. Identifying grips can enrich the characterization of consumption profiles and then be used as a dialogue interface between those profiles and the design of innovative energy-saving tools. This scheme is then applied within a dynamic perspective of the change process whereby a new practice has to be triggered, sustained and stabilized (Brüggen et al., 2017). With savings rates at record lows and inadequate long-term financial planning for retirement, financial wellbeing has become an important topic for individuals and households as well as for societies and countries. Research on the topic, however, remains scarce and scattered across disciplines. The present paper aims to consolidate and extend knowledge on financial well-being and makes a three-fold contribution to the discussion. First, we propose a new definition based on a perceptual perspective of financial well-being and link it to an individual's current and anticipated desired living standard and financial freedom. We then develop a framework that distinguishes key elements of financial well-being; namely, interventions and financial behaviors, consequences, contextual factors, and personal factors. We then present a research agenda

to guide future research on financial well-being. This work is designed to inspire researchers to continue expanding the knowledge so that financial institutions can take measures to increase financial well-being. Anderson et al., (2013) have described the lack of a clear definition of the construct 'financial well-being'. We have addressed this apparent gap in the literature by providing a comprehensive definition that could help bridge the different research streams on this topic. In so doing, we have added to the valuable new research stream of transformative service initiatives. The contribution of our manuscript is threefold. First, we have synthesized and compared the distinct definitions of financial well-being. This is worthwhile, as definitions guide the conceptualization and measurement of a specific construct. Providing a commonly accepted definition makes research outcomes more comparable and easier to grasp. We have delineated a definition that will form a common basis for future research in this domain. Our definition incorporates the relevant stakeholders as well as the time horizon covered by decisions that affect financial well-being. We decided to propose a very broad definition that recognizes the complex nature of an individual's financial well-being, including fundamentally different but supplementing elements such as cognition, emotions, and action and the relationships between these various elements. Therefore, in contrast with many previous studies, we have not stressed just the objective dimension of well-being, but have also discussed its subjective component. Furthermore, we have recognized the interdependence between the individual and society. This provides the additional advantage of a broader view, since the financial well-being of individuals is not disconnected from, but instead closely linked to, the societal context and the changes taking place in it. Second, we have synthesized and structured the current state of the literature. Based on this discussion, we developed a comprehensive framework showing the determinants and outcomes of financial well-being. Moreover, our framework shows the context factors and personal characteristics that might moderate these relationships. In doing this, we have informed academics about potential avenues for future research. We developed six research themes and a comprehensive set of research topics that could be addressed in future research in order to create knowledge on the antecedents, consequences, and influencing factors of financial well-being. In line with transformative service research, this paper addresses the individual as well as the collective level and the community. In addition, we have included other stakeholders and looked at organizational and societal consequences. Thus, we hope that this article contributes to theory development by stimulating research in this area, thereby enhancing our knowledge and understanding of financial well-being, the factors that influence it, as well as its consequences. We hope that this analysis consolidates and extends knowledge on financial well-being and encourages more research in this prominent field. Overall, this work may inspire marketing researchers to continue expanding our knowledge of financial well-being. From a managerial and public policy perspective, we provide the following insights. First, addressing the research themes proposed in this article will improve the financial well-being of individuals and families, which will have a positive impact on quality of life and happiness, general well-being and mental health, and the quality of interpersonal relationships. In the same vein, the suggested research will provide knowledge about how financial well-being can be improved in order to help avoid potentially negative effects on

consumption in the long run and increased reliance on social support. Financial service providers will learn more about how people behave financially and which interventions work, in order to facilitate financially sound behaviors. This knowledge can be used to improve their services so that financial well-being is increased.

Counter-intuitively, when weekly reports were augmented with monetary incentives rewarding electricity conservation, households no longer reduced consumption. Households receiving reports also show higher price elasticity relative to controls. These results provide new evidence identifying the response of developing country consumers to behavioral interventions while examining the interaction of prices, incentives and information (Sudarshan, 2017). Myers & Souza (2020) explore the mechanisms driving the effectiveness of a widely-used behavioral intervention that reduces energy consumption by repeatedly mailing social comparison-based home energy reports (HERs) to households. With a randomized controlled trial, we introduce HERs in a college residence, where tenants do not pay energy bills. Their results indicate that HERs induced almost no behavioral changes for heating demand, with precise estimates that allow us to rule out thermostat changes greater than 0.36°F. To the extent that our findings can be extrapolated to other non-dormitory residential contexts, this suggests that behavioral channels, such as competitiveness, social norms, or moral suasion, may not motivate conservation in the absence of direct monetary incentives.

Hossain et al., (2019) were assessed the effectiveness of behavioral science and nudge theory in developing an energy-conscious culture to save energy waste. The many examples of energy efficiency behaviors implemented around the world will be discussed in detail trying to find an approach appropriate for the country. The intent of this paper is to draw the attention of policymakers, engineering researchers and professionals towards such passive and low-cost approaches that has high potential to become successful on a microeconomic and macroeconomic scale.

Hausman & Welch that Nudges are ways of influencing choice without limiting the choice set or making alternatives appreciably costlier in terms of time, trouble, social sanctions and so forth. They are called for because of individual decision-making, and they work by making use of those flaws"(Sunstein, 2017).

Tom Goodwin argues, Why We Should Reject 'Nudge' (2010) how nudge is ineffective for sustainable and long-term changes to solve society's 'big problems' such as climate change and public health. Governments involved and as executors of such ideas, often can use their own agenda on people rather than using the behavioral science issues for the betterment of civilians (Goodwin, 2012). It can also be argued that "nudge is not enough", viewing people as an inefficient information processor and volatile to be exploited for the just reason preaches utilitarian consequentialism. Utilitarianism preaches "the greatest good for the greatest number" while Consequentialism preaches "ends justify the means" (Simon, 1978). Utilitarian consequentialism defines actions as ethical if they achieve a positive outcome for most people no matter what one must do to achieve those ends (Wiscrack, 2018). Such an approach has proven to be dangerous and historically used by fascist regimes. However, it should not

be confused with genuine discussions of utility or consequence, which is the approach to make the best out of available resources. This should be the approach to achieve productive ends through non-destructive means for the betterment of people (Gilovich et al., 2002). Costa & Kahn (2010) found out the energy company Opower employed the nudge approach in California, the USA which failed due to the resident political conservatives, who do not believe in global warming and actually increased their electricity consumption in reactance and resistance to the campaign. It shows that there can be many unforeseen and unrelated obstacles appearing in practicality. Adversities like this should be expected and sentiments should be considered to avoid similar backlash from the citizens.

The following are some suggestions learned through historical examples that are fit to be applied for Bangladesh's current scenario, however, should not be limited to as there could be many aspects that can be explored for further impact.

a) Alternative to social marketing campaigns: Government's throughout the world has used social marketing as a preferred tool of choice to persuade citizens to move away from old habits. Oftentimes new laws are introduced to support such campaign results. In the 1990s, the Irish government tried to persuade people to reuse plastic bags but not until government-imposed levied tax on the sale, they found success (Collins et al. 2003: 37). Researchers have noticed the inadequacy of social-marketing campaigns often fails to change customs (Cialdini et al. 1991) which are attributed to several psychological factors. Psychologists learned shock tactics can reduce the effectiveness of a message as recipients tend to focus more on developing psychological coping mechanisms to handle their fears than on removing the actual danger (Witte & Allen 2000). It has been proven, social marketing campaigns can be ineffective if a message mistakenly destabilizes personal self-esteem by stigmatizing behavior (Maio et al. 2007) or introducing a sense of shame and guilt (Brennan & Binney 2010).

Hossain & Raisul Islam (2019) the scope of this work was to point out the significance of introducing behavioral science to improve upon consumer's attitude to reduce power consumption on a macroeconomic and microeconomic scale. Many successful examples and various ways to approach the issue under multiple frameworks have been discussed. The users based on their background and identity need to be sorted in groups and Smart grid systems are the best ways to observe such data. The additional significance of the approach has been demonstrated through real-life examples and failing approaches currently in operation.

The primary goal of this article is to instigate a comparative discussion of the pros and cons of introducing such a policy in the country's current situation. Further debates based on empirical evidence on the ongoing workings as well as possible side-effects of nudge and boost policies will improve this discussion in the future. Presently, many arguments are unavoidably conceptual.

Non-price interventions have been shown to be valuable instruments in reducing energy use among rate paying customers, but their effect on non-ratepayers have received less attention. This study uses a randomized controlled trial research design to examine the effect of feedback and a social nudge on energy consumption of non-rate paying households. Empirical findings are based on 218,387 hourly observations from 62 households gathered over a period of 21 weeks. Our results suggest that neither feedback on energy use or a social nudge in the form of

peer comparison are effective instruments to reduce the energy usage of non-rate paying households. The average treatment effect masks heterogeneous effects among households that are low and high users of energy in the pre-treatment period: both interventions increase energy use for high users while feedback decreases usage among low users. The effect of the social nudge among low users depends on their relative usage in the previous period, with above-average users decreasing consumption, and vice versa. We discuss these empirical results in the context of a model of utility that incorporates moral utility and preferences for conformity (Crago et al., 2017). Based on Lieb et al.'s research, the impact of non-monetary incentives on energy consumption and green-energy uptake in the household sector remains unclear. Studies often only provide tests for combinations of measures and consider short time intervals. We provide a systematic review of the literature, point to several shortcomings in existing published studies and make recommendations for future research aiming to inform policy and other decision makers (Liebe et al., 2018). Gillingham & Tsvetanov's research (2018) results show that a low-cost carefully-crafted note card can increase the probability of a household to follow through with an already scheduled audit by 1.1 percentage points on a given day. The effect is very similar across individuals with different political views, but households in rural areas display a substantially greater effect than those in urban areas. Our findings have important managerial and policy implications, as they suggest a cost-effective nudge for increasing energy audit uptake and voluntary energy efficiency adoption. Lutzenhiser, (1992) in his paper, we consider the development of demand-side research, from an early interest in conservation behavior to a later focus on physical, economic, psychological and social models of energy consumption. Unfortunately, none of these models account satisfactorily for measured energy consumption in the residential sector. Growing interest in the end-uses of energy (e.g., in support of load forecasting, demand-side management and least-cost utility planning), increasing international studies of energy use, and continuing work in the energy and lifestyles research tradition now support an emerging cultural perspective on household energy use. The ecological foundations of the cultural model and its applications in energy research are discussed, along with some of the analytic consequences of this approach.

Also, Gomez & Rodriguez, (2019) believed that to satisfy human needs and desires, it is necessary to produce goods and services that require the use of some production factors, such as labor, capital, and energy, among others. Nowadays, energy is a key production factor for economic activity in all countries. The main objective of this paper is to analyze the relationship between energy, economic growth, urbanization, and financial development in the country-members of the North American Free Trade Agreement (NAFTA) during the period of 1971–2015. Panel data Econometric methods are applied in this research, namely cross-section dependence (Pesaran test), unit root (Cross-sectional Augmented Dickey Fuller and Cross-sectional Im, Pesaran, and Shin tests), cointegration (Kao and Fisher–Johansen tests), and heterogeneous causality (Hurlin and Dumitrescu test). The results achieved in this research demonstrate that the variables of this model are characterized by a cross-section dependence, and they are integrated in order one. An equilibrium or long-term relationship between them exists. By means of the Fully Modified OLS and Dynamic OLS estimators it this demonstrated that there is a positive relationship between GDP

and EC, while there is a negative relationship between FD, CPI, URB, and TO and EC. The economic policy recommendations drawn from this investigation are that financial development promotion, urbanization, and trade openness may contribute to reducing energy consumption in these countries.

Viscusi, (2019) outlines benefit-cost criteria for nudges and behavioral norms for a wide range of policy situations. The principal benefits from well-designed policies usually derive from promoting efficient behaviors, but counterpart costs may also be generated by discouraging efficient behaviors. The distinguishing economic characteristic of nudges is not only that they are less intrusive interventions that nudge rather than mandate behavior, but that they exploit additional policy dimensions other than financial incentives. Policies utilizing financial incentives have a cost advantage over nudges to the extent that they involve transfers, which are not net social costs. Failure to understand this cost distinction has led to overestimation of the cost-effectiveness of nudges compared to financial incentives. Financial incentives are flexible and can be varied continuously on a single dimension. Nudges usually involve indivisible components, but their stringency sometimes can be varied by utilizing nudges on multiple policy dimensions. Garcia & Vilab, (2020) analyzed that whether nudging has a relevant effect on financially literate individuals, even if these individuals are professionals with extensive experience of finance and pensions. The paper presents the results of a field experiment with employees of a leading life and pensions company in Spain. The results of the experiment show that financial literacy and awareness of the importance of saving are not enough for individuals to act. Even with pension plan experts, the combination of two types of instruments is necessary: rational instruments, such as financial literacy and awareness of the economic implications of retirement, and nudging, which moves individuals to action in a meaningful way. In this case, an effective approach is to use the default option to increase long-term saving patterns.

Crowd funding as a specific type of crowd sourcing is a method of collecting many rather small monetary contributions to finance or capitalize an enterprise or a particular product. In our paper, we focus on social and affective factors influencing peoples' behavior in the environment of crowd funding financing. We model a probability of getting funds from Kick starter depending on factual characteristics of individual projects and social and affective nudges. We use data set that is based on selected characteristics and information drawn from the Kick starter webpage. Our dataset of Kick starter crowd funding projects collected from April 2009 to July 2017 contains 259,574 projects from the United States, Australia, Canada and the United Kingdom. Our empirical analysis uses logistic regression model and Maximum Likelihood (ML) estimation technique. We predominantly focus on the textual characteristics of Kick starter projects' description and attributed comments, including sentiment and emotions contained in them. We suppose that human decision-making can be largely affected by images (or words) that carry positive or negative markers. To determine the overall sentiment of the text in terms of positive or negative impression, we use the VADER algorithm. The emotional categories covertly manifested in the text are discovered using the linguistic resource Wordnet Affect. We find out that both social and affective variables (nudges) have a significant impact on the success of crowd funding projects besides the traditional "neoclassical" determinants. We hereby confirm that CF

investors' decisions are not influenced solely by cognition. We argue that another important component of human judgment and decision-making – an affect has to be added to the mosaic of human decision-making (Janku et al., 2019).

1-4 Financial behavior

Prosad et al. (2015) reviewed and explored the evolution of modern behavioral finance theories from the traditional framework. It focuses on three main issues. First, it analyzes the importance of standard finance theories and the situations where they become insufficient. Second, it signifies the role of behavioral finance in narrowing down the gaps between traditional finance theories and actual market conditions. This involves the substitution of standard finance theories with more realistic behavioral theories like the prospect theory (Kahneman & Tversky, 1979). In the end, it provides a synthesis of academic events that substantiate the presence of behavioral biases, their underlying psychology and their impact on financial markets. This chapter also highlights the implications of behavior biases on financial practitioners like market experts, portfolio managers and individual investors. They concluded with providing the limitations and future scope of research in behavioral finance. In this regard, Czap et al., (2018) stated that environmental policy traditionally relies on financial incentives and direct regulation to achieve desirable outcomes in terms of conservation and pro-environmental behavior. Empirical research has shown that market-based approaches are more cost-effective than direct regulation. However, experimental research has demonstrated that a combination of financial and non-financial incentives (specifically empathy nudging) is, on average, even more effective than a financial nudge, or empathy nudge, individually. The current study looks at environmental policy, specifically financial and empathy nudging, in the agricultural context. The increase of the number of farms headed by females raises the question whether previous findings of the effectiveness of these nudges are gender specific or gender neutral. We investigate this question using data from a framed laboratory experiment in the context of farmers' conservation behavior. Specifically, we compare the change in conservation efforts of females and males in response to financial incentives and empathy nudging applied separately and at the same time. Our findings show that both females and males are moderately affected by financial nudges, but only females are affected by empathy nudges separately. The combination of both nudges is economically and statistically significantly higher than each nudge individually, and substantially higher for females than for males. This implies that policy makers could increase the effectiveness of environmental policy by accounting for these genders specific differences in the policy design.

Drewsa et al., (2020) declared that should policy-makers combine price incentives with behavioral nudges to encourage sustainable energy behavior? Available evidence from various behavioural sciences is scarce and inconclusive about synergy of the two instruments. This is partly due to methodological limitations. We offer a framework to overcome such limitations in future research and to guide policy-making. It includes four cases: no synergy, positive synergy, weak negative synergy, and strong negative synergy or backfire. The adoption of a policy mix is recommended in the first two cases, and may be pursued in the third case. To clarify the underlying mechanisms of the synergy, a distinction is made between crowding (in/out) of intrinsic

motivations by incentives and crowding (in/out) of extrinsic motivations by nudges. This distinction turns out to be especially relevant in the case of weakly negative synergy, as here behavioral and temporal spillover effects require consideration from the policy-maker as well. We end with broader reflections regarding other policy criteria for the design of an adequate energy policy mix. Also, they cited that 4 point in this research included: •focusing on synergy between incentives and nudges is scarce and inconclusive. •There is little evidence for positive policy synergy. •Multiple crowding out/in effects can be at work simultaneously. •A policy mix may be justified even in the case of weak negative synergy. •Examining behavioral spillover effects is important under weak negative synergy.

With savings rates at record lows and inadequate long-term financial planning for retirement, financial wellbeing has become an important topic for individuals and households as well as for societies and countries. Research on the topic, however, remains scarce and scattered across disciplines. The present paper aims to consolidate and extend knowledge on financial well-being and makes a three-fold contribution to the discussion. First, we propose a new definition based on a perceptual perspective of financial well-being and link it to an individual's current and anticipated desired living standard and financial freedom. We then develop a framework that distinguishes key elements of financial well-being; namely, interventions and financial behaviors, consequences, contextual factors, and personal factors. We then present a research agenda to guide future research on financial well-being. This work is designed to inspire researchers to continue expanding the knowledge so that financial institutions can take measures to increase financial well-being.

The contribution of Brügggen et al., (2017) manuscript is threefold. First, they have synthesized and compared the distinct definitions of financial well-being. This is worthwhile, as definitions guide the conceptualization and measurement of a specific construct. Providing a commonly accepted definition makes research outcomes more comparable and easier to grasp. We have delineated a definition that will form a common basis for future research in this domain. Our definition incorporates the relevant stakeholders as well as the time horizon covered by decisions that affect financial well-being. They decided to propose a very broad definition that recognizes the complex nature of an individual's financial well-being, including fundamentally different but supplementing elements such as cognition, emotions, and action and the relationships between these various elements. Therefore, in contrast with many previous studies, they have not stressed just the objective dimension of well-being, but have also discussed its subjective component. Furthermore, they have recognized the interdependence between the individual and society. This provides the additional advantage of a broader view, since the financial well-being of individuals is not disconnected from, but instead closely linked to, the societal context and the changes taking place in it. Second, they have synthesized and structured the current state of the literature. Based on this discussion, we developed a comprehensive framework showing the determinants and outcomes of financial well-being. Moreover, their framework shows the context factors and personal characteristics that might moderate these relationships. In doing this, we have informed academics about potential avenues for future research. They developed six research themes and a comprehensive set of research topics that could be addressed in future research in order to create knowledge on the antecedents, consequences, and

influencing factors of financial well-being. In line with transformative service research, this research addresses the individual as well as the collective level and the community. In addition, we have included other stakeholders and looked at organizational and societal consequences. Thus, we hope that this article contributes to theory development by stimulating research in this area, thereby enhancing our knowledge and understanding of financial well-being, the factors that influence it, as well as its consequences. They hope that this analysis consolidates and extends knowledge on financial well-being and encourages more research in this prominent field. Overall, this work may inspire marketing researchers to continue expanding our knowledge of financial well-being. From a managerial and public policy perspective, they provide the following insights. First, addressing the research themes proposed in this article will improve the financial well-being of individuals and families, which will have a positive impact on quality of life and happiness, general well-being and mental health, and the quality of interpersonal relationships. In the same vein, the suggested research will provide knowledge about how financial well-being can be improved in order to help avoid potentially negative effects on consumption in the long run and increased reliance on social support. Financial service providers will learn more about how people behave financially and which interventions work, in order to facilitate financially sound behaviors. This knowledge can be used to improve their services so that financial well-being is increased (figure 3).

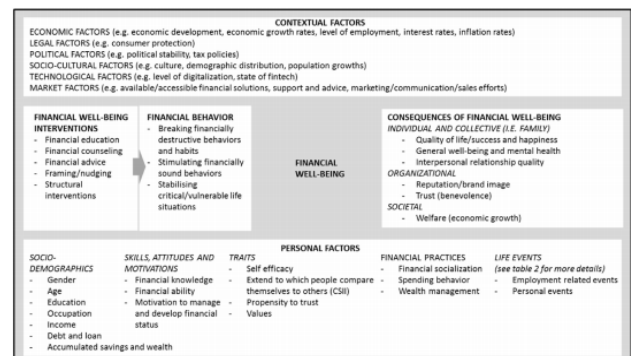


Fig. 3 Pictorial representation of five elements their interrelationships of a new financial well- being framework.

2 Methodology and models

Based on research studies in previous section, Energy science is no longer an independent or separate discipline. Energy science, social science, and information science intersect one another, thus forming some new crossed research areas or interdisciplinary fields such as energy, social and information science (Fig 4).

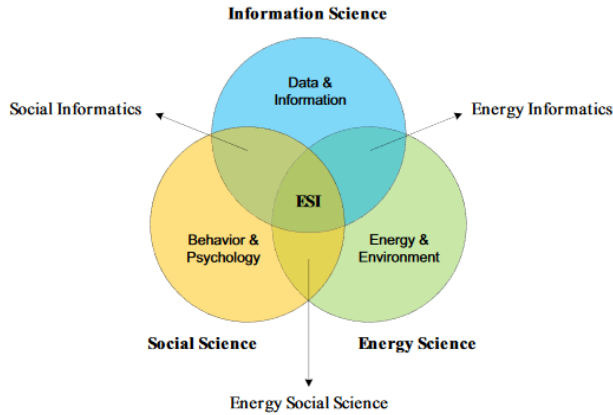


Fig 4. Interdisciplinary research areas of energy, social and information science (Source: Zhou and et al., 2016)

This figure shows the intersection of energy, social and information science, as well as the positioning of interdisciplinary academic research areas, including energy social science, social informatics, energy informatics and energy social informatics.

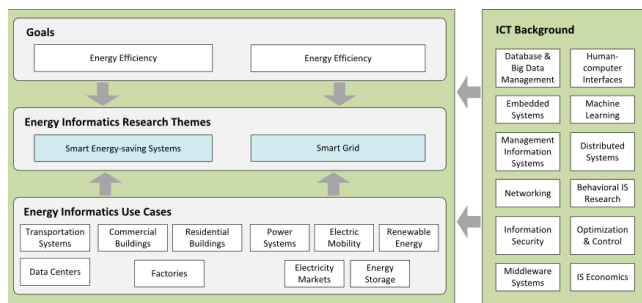


Fig 5. Research scope of energy informatics (Source:Goebel and et al., 2014)

In Fig 5. We can find some research scopes of energy informatics. House hold energy consumption is a significant part of nudging energy consumption behavior. In Fig 6. We can find some of dimensions in this area.

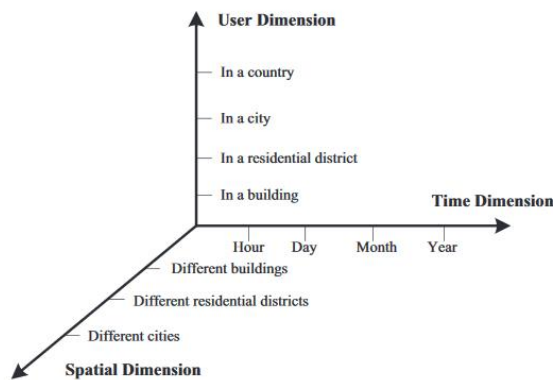


Fig 6. Different dimensions of household energy consumption behavior

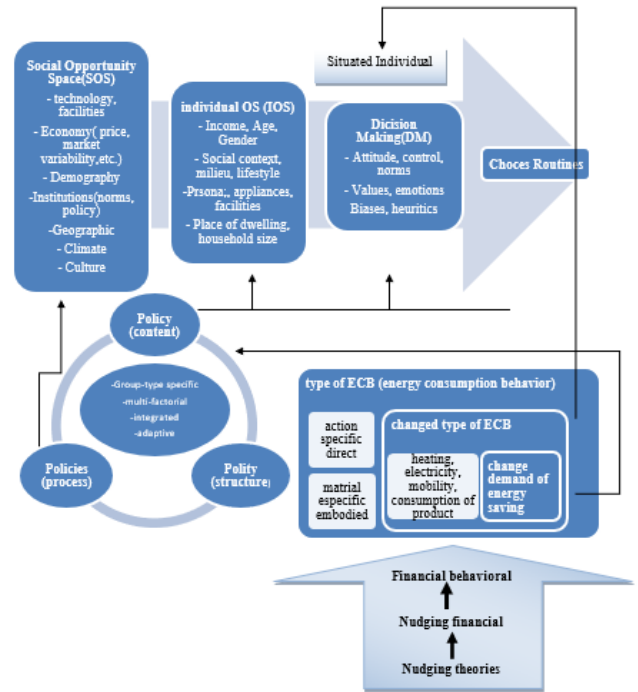


Fig 7. Model of Financial Nudging Energy Consumption Behaviors (Burger and et al., 2015)

In this model we can use nudging theories to change people’s financial behaviors. For improving saving energy behavior government and all businesses should set some policies to do it well.

3 Conclusion

In this study, we applied the Nudge theory for energy consumption behavior. Many studies focus on energy consumption behavior such as researches by Yin and et al. (2013), Perri, and et al. (2020), Sütterlin, and et al. (2014), Liu and et al. (2015), Abreu and et al. (2016), Xiang and et al. (2018), Geiger, and et al. (2018), Froemelt and et al. (2018), and so on. Burger et al., (2015) framework display a linkage between behavioral financial nudging with focusing on energy consumption. Initially stated questions and links the three analytical aspects. It systematically distinguishes the two explanatory perspectives and offers an integrated approach to understand and explain energy consumption behavior and its changes. Based on the best available disciplinary and interdisciplinary knowledge and aggregated over the different subsectors of consumption, this framework provides an interdisciplinary basis for linking different aspects in empirical settings. The framework – not model or theory – does not offer explanations or evidence about sequenced relations. Moreover, they certainly do not claim that an empirical research design has to pay attention to all elements addressed by the framework. To conclude, according to the framework presented by Burger reviewing the research literature, the involvement of financial behavior as well as the impact of Nudging theories on it can affect the foundation of energy consumption behavior.

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