FOSTERING SUSTAINABLE BEHAVIOUR THROUGH SOCIAL GAMES: ELEMENTS OF 'GAMIFIED BEHAVIOUR-CHANGE PROGRAMMES' CONTRIBUTING TO THE PROCESS OF BEHAVIOUR CHANGE FOR ENVIRONMENTAL BENEFIT

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Fostering Sustainable Behaviour through Social Games: Elements of 'Gamified Behaviour-Change Programmes' Contributing to the Process of Behaviour Change for Environmental Benefit

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Certificate of Originality

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Abstract

A positive change in consumption behaviour, both at individual and collective level, is required to realize the concept of a sustainable society. Recent recognition of the significance of behaviour change has inspired designers to make strategic use of design to induce a positive change in behaviour towards usage of products and resources to reduce the environmental impact. Although such design-led behaviour-based approaches have been quite effective, they have mostly been product- and action-specific and have not considered the social context, which also has an impact on individual behaviour. As a result, these interventions have received critical responses. On the contrary, a number of distinct approaches have emerged from the field of social psychology and sociology in the form of social innovations that have focused on social ways of encouraging sustainable behaviour. Some of these interventions have been quite effective, and thus have generated the interest of designers, social entrepreneurs and creative idealists towards the social dimension of behaviour change.

Gamified behaviour-change programmes (GBCPs) are one such example of social interventions that have been effective in inducing positive social change for environmental benefit. GBCPs are strategically-designed social engagements, which engage the participants in game-based tasks and activities and stimulate them to adopt sustainable actions, in a playful way, under the influence of a social setting. Although the impact of social influence on an individual's behaviour is well-recognized, its application through (social) game-based solutions in fostering sustainable behaviour is relatively new. There is less research available on how these social game-based interventions can foster sustainable actions and behaviour in a targeted social group, or the factors contributing to the process.

The research investigates the mechanics of GBCPs, particularly the process through which they prepare, motivate, transform and incubate behaviour under the influence of a social setting and using a game-based approach. It investigates the causal factors and conditions that influence the central phenomenon of behaviour change across all the examined cases of GBCPs. Its objectives are: 1) to identify the key constituting elements (incidences, phenomena, processes, activities, events, motivations and strategies) of GBCPs that play a role in the process of behaviour change or indirectly contribute to the process by facilitating an influential social environment that motivates participants to adopt desired sustainable actions, 2) to identify the roles that each of these elements plays in the process of change, and 3) to investigate the ways each of these elements is addressed or delivered across all the cases.

The research is explorative, qualitative and interpretative in nature, and adopts grounded theory as the main methodology, as well as strategic method for studying and analysing four effectively implemented cases of GBCPs. It uses a data triangulation approach, involving corroborating the data collected from three different sources. The study first examines the cases using a document analysis method, which involves thorough analysis of over fifty published documents including case studies, journal articles, magazines and newspaper articles, resource libraries, training materials, business reports, marketing and promotional material, manuals, customer feedback reports, website content, mobile application content, official blogs, policy manuals, strategic plans and structures, brochures and flyers, and communication between the programmes and participants. It uses line-by-line coding and constant comparison techniques, as well as open and axial coding procedure to analyse the documents. Thereafter, the study re-examines the cases using interview method, which involves interviews with the founders and organizers of these programmes and also with those who participated in these programmes. The study analyses the data from

the interviews and compares it with the findings from the document analysis, which helps in validating the findings as well as adding the missing information.

The study breaks down the entire process of change into its individual elements, (incidences, phenomena, activities, processes, events and motivations) and identifies how the elements, which collectively constitute an influential social environment, motivate participants to adopt desired sustainable actions in a playful way. The study identifies forty-one elements that directly or indirectly contribute to the process of behaviour change in the observed cases. It recognizes the role that each of these elements plays in the process and different ways in which each element is addressed or delivered across the cases. It also recognizes seven sub-processes to which the elements contribute.

The study provides useful insights into the mechanics of GBCPs. For designers, creative idealists and social entrepreneurs engaged in behaviour change for sustainability, this research provides essential touchpoints to consider while conceptualizing social game-based interventions that meet sustainability objectives. The research does not provide a procedure or finite steps for designing such programmes but, in the form of contributing elements, it does suggest aspects and strategies to consider when conceptualizing GBCPs. To some extent, the research should facilitate designers', social entrepreneurs' and creative idealists' engagement with social behaviour change for sustainability, by targeting collective social transformation through game-based social interventions. Overall, the research draws attention to the importance of such social game-based programmes and would encourage designers, creative idealists and social entrepreneurs to consider GBCPs as an approach when addressing sustainability objectives.

Publications Arising from the Thesis

Sharma, S., & Siu, K. W. M. (2017). Facilitating design to engage in social behaviour change for environmental benefit. *Journal of Design, Business & Society* (pp. 125-143). Doi: 10.1386/dbs.3.2.125_1

Sharma, S., & Siu, K. W. M. (2017). Gaming as a driver for social behaviour change for sustainability. In T. Ahram & C. Falcao (Eds.), *Advances in Human Factors in Wearable Technologies and Game Design* (pp. 258-266). Doi: 10.1007/978-3-319-60639-2_27

Siu, K. W. M., & Sharma, S. (2017). Challenges in leading and managing design teams. In V. C. X. Wang (Ed.) *Encyclopedia of Strategic Leadership and Management* (pp. 799-809). DOI: 10.4018/978-1-5225-1049-9.ch055

Sharma, S., & Siu, K. W. M. (2016). Incubating and nurturing sustainable practices through staged social engagements. In J. Charytonowicz (Ed.), *Advances in Human Factors and Sustainable Infrastructure* (pp. 27-38). Doi: 10.1007/978-3-319-41941-1_3

Sharma, S., & Siu, K. W. M. (2015). Social interventions-a means for designers to foster sustainable behaviour. In *Sustainable Innovation & Design 2015: 20th International Conference*, University for the Creative Arts (UCA), Epsom, Surrey, United Kingdom. Retrieved from http://hdl.handle.net/10397/6786

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Chapter 1 Introduction

1.1 INTRODUCTION

1.1.1 Importance of Behaviour Change in Sustainability

Sustainability refers to the possibility that life will flourish on the earth forever (Ehrenfield, 2008). And, this concept of a sustainable society is only possible if there is a 90–95% reduction in the consumption of resources (Gardner, Sampat, & Peterson, 1998; Gardner & Stern, 2002). However, in order to achieve this level of reduction in resource consumption, it requires: 1) technical considerations (design, materials and processes) in the design of products to make them less resource-intensive, and 2) a positive change in the consumption behaviour of individuals (Clune, 2010; Ehrenfield, 2008). While technical considerations in design can deliver more eco-efficient products, the major obstacles to achieving this hopeful vision are lifestyle habits, alongside patterns of action and consumption which are deeply linked to unsustainable behaviour. Therefore, in order to realize a hopeful vision of a sustainable society, positive changes in behaviour are required both at individual and collective level (Ehrenfield, 2008; Clune, 2010; Jakson, 2005; Belz, 2009).

1.1.2 Advent of Design-led Approaches to Behaviour Change

Since the significance of behaviour change in achieving a sustainable society was recognized, it has become worthwhile for the discipline of Design to explore ways in which it can contribute (Clune, 2010), which has led to the advent of multidisciplinary fields of design research and practice, known as ‘design for sustainable behaviour’ and ‘design for behaviour change’ (Lilley, 2007). These disciplines make strategic use of design to induce positive changes in behaviour in the use of products and resources to reduce environmental impacts (Lilley,

2009; Wever, Van Kuijk & Boks, 2008; Pettersen & Boks, 2008). These strategies include user-centred and behaviour-based design approaches such as design scripts, persuasive design, design of affordances and intelligent technologies. These design-driven behaviour-change approaches draw heavily on cognitive and environmental psychology and, therefore, they mainly focus on the design and interactions of specific products that encourage a positive change in usage behaviour (Shove, Watson, Ingram, & Hand, 2008; Scott, Bakker & Quist, 2012).

1.1.3 Limitations of Design-led Approaches

Although design-led approaches to behaviour change have been quite effective in inducing positive change in environmental behaviour, they are mostly product and action-specific and seldom consider the social context in which behaviour evolves, nurtures, persists, changes and defects (Sharma and Siu 2016; Shove et al., 2008; Scott, Bakker & Quist, 2012). The social context and nature of social interaction is treated as somewhat stagnant, supposing that behaviour and needs do not change when they interact with elements of social life (Shove et al., 2008; Scott, Bakker & Quist, 2012). As a result, these design-led behaviour-change approaches to sustainability have received critical responses (Shove et al., 2008; Almquist & Lupton, 2010; Pettersen & Boks, 2008; Verganti, 2009).

1.1.4 Social Approaches to Behaviour Change

On the contrary, a number of distinct approaches have emerged from the field of social psychology and sociology in the form of social innovations that have focused on social ways of encouraging sustainable behaviour. These approaches target social dimensions of behaviour change, referring to responsible behaviour change as a consequence of social actions and interactions (Niedderer, 2013). They rely on factors such as social image concerns, self-identify concerns and the establishment of social norms. Some of these interventions have been

moderately effective in encouraging positive change in environmental behaviour, and thus have generated interest towards the social dimension of behaviour change from designers and creative idealists. These interventions aim to achieve long-term societal change by initiating a conscious collective social movement of good choices (Network for Business Sustainability, 2013).

They are based on the assumption that human behaviour is socially grounded and deeply embedded in the social context, meaning that surrounding influences, including the social group or community, play an important role in influencing choices made by one individual (Du Nann & Koger, 2004; Gardner, & Stern, 2002; Steg & Vlek, 2009; Sharma & Siu, 2016; Sharma & Siu, 2015; Network for Business Sustainability, 2013). These interventions are founded on the belief that, rather than addressing an individual, targeting a unified social group is an effective way of achieving collective social change (Steg & Vlek, 2009). Although the significance of social dimensions to behaviour change is well recognized (Lockton, 2012), the field has largely remained ignored and under-researched (Clune, 2010; Chick, 2012; Niedderer, 2013); despite significant contributions made by research in the field of 'design for behaviour change' and 'design for sustainable behaviour', there is a substantial gap between design-led approaches and the consideration of social context in influencing behaviour (Chick, 2012; Niedderer, 2013).

1.1.5 Gamified Behaviour Change Programmes (GBCPs)

Gamified behaviour-change programmes (GBCPs) are but one example of social intervention that has been effective in inducing positive social change for environmental benefits (Sharma & Siu, 2017). GBCPs are strategically-designed social engagements, which engage participants in game-based tasks and activities and stimulate them to adopt sustainable actions under the influence of

a (gamified) social setting (Sharma & Siu, 2016; Grossberg, Wolfson, Mazur-Stommen, Farley, & Nadel, 2015). They require the player to compete, either individually or in teams, and motivate them to adopt and perform sustainable actions in a playful way. Game mechanics is at the core of these programmes, as it adds fun and excitement to the process and keeps participants immersed in the process. Game elements, such as points, rewards, recognition, social comparison, challenges and feedback, make these programmes highly engaging, which motivates participants to perform the actions inscribed into the process by the designers (Grossberg et al., 2015).

GBCPs target the social and systemic nature of behaviour to achieve positive social change and to establish a culture of sustainability within a social group. Through game-based activities, they provide a playful, yet influential, social environment for learning and practicing pro-environmental actions in the real world (Sharma & Siu, 2016; Grossberg et al., 2015). This influential social setting also helps incubate the newly-adopted behaviour by encouraging participants to perform the desired actions consistently, so replacing (unsustainable) habitual behaviour (Sharma & Siu, 2016). Consistent performance of the new behaviour (sustainable actions) eventually establishes social norms and a culture of sustainability within the social group (Grossberg et al., 2015; Sharma & Siu, 2017).

GBCPs have promoted a wide range of sustainable actions pertaining to resource consumption and waste generation, and the programmes have been adopted by various online social groups, communities, organizations and university campuses. Some of these programmes have been quite effective in inducing positive change in environmental behaviour and have eventually established a culture of sustainability within those social groups. For instance, 'JouleBug', a playful mobile application that encourages its users to perform sustainable

actions, compete with friends and win rewards, has estimated that each of its users saved an average of US $200 on their energy bills (JouleBug, 2015). Similarly, the campaign called 'Big Energy Race', which engaged participants in energy-saving challenges, has saved participants up to £117 each on their energy bills, and saved 484,259 kilowatt hours (kWh) of energy (Global Action Plan, 2015).

1.2 JUSTIFICATION

Although the importance of social influence on an individual's behaviour is well recognized, and expounded by various theories and models in behavioural and social sciences, its application through (social) game-based solutions for fostering sustainable behaviour, is relatively new. Less research is available on how these game-based social interventions can be used to foster sustainable behaviour in a social group, in particular the overall mechanics and the factors that contribute to this process. For designers and social entrepreneurs engaged in behaviour change for sustainability, there are no guidelines or frameworks available to help them when conceptualizing such game-based interventions for achieving sustainability objectives.

1.3 RESEARCH OBJECTIVE AND QUESTIONS

The research intends to develop an in-depth understanding of the mechanics of GBCPs, specifically, the process through which they transform the behaviour of a social group by using social games. By investigating some effectively implemented cases of GBCPs, it intends to study how these game-based programmes motivate a targeted group to adopt sustainable behaviour and heighten their awareness of the environmental impact of their day-to-day actions. It expects to gain insights into the process of GBCPs through examining how they prepare, motivate, transform and incubate the behaviour of the

participants, initiate social change and establish a culture of sustainability within the targeted group.

The research is explorative in nature, and does not intend to test a hypothesis. It rather focuses on identifying the key elements of GBCPs that directly contribute to the process of behaviour change or indirectly contribute by facilitating an influential social environment that motivates participants to adopt desired sustainable actions. It also expects to identify the role that each of these elements plays in the process and different ways in which these elements are addressed or delivered. These elements include various constituents of GBCPs such as phenomena, processes, activities, events, strategies and motivations, which encourage participants to associate with the program, stimulate them to adopt sustainable actions in their day-to-day routine, motivate them to perform the actions consistently, retain engagement with the programme over a longer period, and contribute to effective functioning and implementation of the programme.

1.3.1 Research Questions

The central questions posed by this research are as follows:

1) What are the key elements (incidences, phenomena, processes, activities, events, strategies and motivations) of GBCPs that play a role in the process of encouraging positive change in behaviour for environmental benefit?
2) What role does each of these elements play in the process of change, and how are these elements addressed or delivered across GBCPs?

1.4 RESEARCH OUTCOME AND SIGNIFICANCE

The research should provide useful insights into the mechanics of GBCPs through analysing their key contributing elements and sub-processes. The findings should help in understanding how these elements collectively constitute an influential social environment that can foster sustainable behaviour and nurture a sustainability culture in a social group. The findings should also help in understanding the role of each individual element involved in the process, and different ways in which it is addressed or delivered across the GBCPs. For designers, social entrepreneurs, and creative idealists engaged in behaviour change for sustainability, this research would provide (at least some) essential touchpoints to consider when conceptualizing game-based behaviour-change programmes for fostering sustainable behaviour. It would also facilitate the process of targeting collective social transformation in order to achieve sustainability objectives using game-based interventions. Overall, the research would add another dimension to how design can contribute more towards building a sustainable society.

1.5 SCOPE OF THE STUDY

The study focuses on social behaviour change that occurs as a consequence of social phenomena and actions through GBCPs. Social behaviour change differs from conventional design-led behaviour-change approaches, which focus on product-user interaction to influence the use behaviour. Although behaviour change occurs in many ways, the study is restricted to behaviour change through social game-based interventions (GBCPs), which aim to foster sustainable behaviour within a social group. These GBCPs are different from video games as they target a social group rather than an individual, and they encourage the participants to perform sustainable actions in the real, rather than virtual, world. The study considers that 'behaviour change occurred' when the participants

involved in GBCPs have taken actions in the real world in a way that the impact of those actions reflects in terms of reduction in resources (energy, water, fuel) consumption or savings on utility bills.

Although various social game-based interventions are implemented across different sectors such as healthcare and well-being, education, entertainment and others, the study is restricted to investigation of programmes that focus on encouraging sustainable actions and behaviour such as minimizing resources (energy, fuel, water) consumption and waste generation. As guided by the research questions, the scope of the study is limited to identifying key elements (phenomena, processes, activities, events, strategies and motivations) and their roles in the process of behaviour change, and different ways in which these elements are addressed or delivered across GBCPs. Although there are other factors, such as investment, stakeholders and financial models that contribute to effective functioning and implementation of the programmes, the study does not take these into account and restricts itself to identifying the core elements that contribute to the process of behaviour change.

Findings from the study, in the form of the key elements of GBCPs, offer useful understanding of the mechanics of GBCPs and provide essential touchpoints to consider while devising such programmes. The scope of application of these findings are restricted only to GBCPs; specifically, to GBCPs that focus on inducing sustainable actions and behaviour. Although the findings provide useful insights into factors contributing to social behaviour change through GBCPs, they cannot be generalized nor applied within other contexts or to other forms of behaviour change interventions.

In addition, the study here is restricted to identifying only the key elements and their roles in the process of behaviour change in GBCPs. Although it does provide useful understanding of the mechanics of GBCPs, it does not offer a complete framework, procedure or steps for conceptualizing GBCPs. Besides this, the scope of the study is limited to identifying the contributing elements and their roles in the process of change, and does not intend to investigate the level or the degree of contribution that each element makes, nor which elements are more important than others.

1.6 THESIS OUTLINE

The thesis is structured in a logical and comprehensible manner so that it is easier for readers to understand the thought process and flow of the study. This section provides a brief outline of the way the chapters are structured.

Chapter 1 introduces the research, provides background and justification of the project and an overview of the current situation. It describes the gap that the research intends to address, its objectives, research questions, scope, significance, and also provides a brief outline of the study.

Chapter 2 provides an in-depth review of the literature. It discusses the key motivators of behaviour, behaviour-change techniques, design-led approaches to behaviour change, and theories and models from behavioural science and social psychology. The chapter highlights the importance of theoretical constructs and how they are relevant to this research in providing a foundation for understanding the cases.

Chapter 3 introduces some of the implemented cases of GBCPs. These programmes have encouraged a wide range of sustainable actions, and claim to

have established a culture of sustainability within the social groups. This chapter briefly introduces some of the cases of GBCPs, which have been effective in encouraging adoption of sustainable behaviour. It briefly describes the scope and objectives of these programmes, and also their impact in terms of resource consumption and savings on energy bills.

Chapter 4 outlines the research strategy, framework, and the methodology adopted in this study. It explains the epistemological stance and theoretical perspective adopted, and the reasons behind selecting specific methods for data collection and analysis. The chapter also discusses how acquiring data from different sources helped in triangulating and validating the findings, which improved the validity and reliability of the research. Finally, it also discusses the advantages and limitations of each method adopted in investigating the cases.

Chapter 5 presents the findings of the study. It discusses the overall mechanics of GBCPs in the form of elements and sub-processes. It defines forty-one key elements, identified from the study of four GBCPs using tables to describe the roles that each element plays in the process of behaviour change. It also discusses different ways in which these elements are addressed or delivered across the observed cases. The chapter introduces seven sub-processes that were common across the observed cases and lists how various elements contribute to these processes. Finally, it discusses the role of game elements in the process of behaviour change across the cases of GBCPs.

Chapter 6 presents the conclusions of the study. It first summarises the answers to the research questions formulated in Chapter 1, then explains the significance of the findings and how this research contributes to the knowledge of design. It further discusses how the findings from this research address the gap between

design and social approaches to behaviour change for meeting sustainability objectives. It also explains how the findings from this research provides useful insights for designers and social entrepreneurs. Finally, the chapter also discusses the limitations of the study and possible directions for future research in this area.

Chapter 2 Behaviour Change Theories and Gamification

Behaviour change is a complex phenomenon because there are several factors that influence human behaviour (Jackson, 2005). The complexity of human behaviour and motivations make it difficult to predict with certainty the impact of interventions on human behaviour (Jackson, 2005). However, behaviour-change theories and models do provide an understanding of various factors and motivations that influence behaviour and provide a basis for outlining techniques and strategies commonly used in behaviour-change interventions. This chapter highlights some of these theories, models, and techniques from the field of behavioural science, cognitive and environmental psychology, and social psychology. These theoretical constructs provide a foundation for understanding multiple concepts and phenomena of GBCPs and outline the strategies used. The chapter also highlights various design-led approaches to behaviour change.

2.1 DESIGN–LED APPROACHES TO BEHAVIOUR CHANGE

2.1.1 Design and Sustainable Behaviour

Simon (1969) first acknowledged the potential of design to create change by "*devising courses of action to change existing situations into preferred ones*". This potential of design to bring desired change is being practiced by designers across diverse sectors including healthcare, sports, built environment, and resource consumption (Niedderer, 2013; Lockton, Harrison, & Stanton, 2010). Traditionally, designers have relied upon technological considerations such as the selection of raw materials, processes and product disposal in the design of products to meet sustainability objectives (Vallet et al., 2013). These technical considerations in design have certainly delivered more eco-efficient products

but, since the associated use-behaviour also plays an important role in deciding the impact a product has on the environment, the focus has shifted in recent years towards encouraging more efficient product-usage behaviour (Lilley, 2007; Lockton, Harrison, & Stanton, 2008; Bhamra, & Lofthouse, 2007; Lockton, Harrison, & Stanton, 2012; Lilley, & Wilson, 2013; Daae, & Boks, 2014). Designers make strategic use of design to induce a positive change in behaviour towards usage of the products. This is achieved through thoughtful design of products and their interactions, wherein the product informs and (or) guides the user towards adoption of more sustainable actions while using it (Jelsma, & Knot, 2002; Bhamra & Lofthouse, 2007; Lockton et al., 2008; Wever, Van Kuijk, & Boks, 2008; Lockton et al., 2012; Lilley, & Wilson, 2013; Daae, & Boks, 2014).

Past research in this field has highlighted the potential of design in encouraging adoption of more sustainable actions and behaviour (Jelsma, & Knot, 2002; Lockton et al., 2010; Lilley, Bhamra, & Lofthouse, 2006). Jelsma and Knot (2002) stated that the responsibility of a designer is not only to design the way people interact with the product, but also to guide the way the product is used, in order to limit its environmental impact. In recent years, a number of approaches have evolved that are frequently used by designers to induce positive change in environmental behaviour. Some of the most commonly used design-led behaviour-change approaches are discussed in this section.

2.1.2 Behaviour Change Techniques Used by Designers

Design-led approaches seeking to influence behaviour through strategic use of design, are applied across diverse sectors such as health, sports, entertainment and environment. These design-led approaches and techniques that target use-behaviour can be grouped under the umbrella of ‘strategic use of design’ to influence behaviour. These approaches extend from ‘informing’ and ‘persuading’

to gentle 'nudging' and 'forceful' actions (Neidderer, 2013; Lockton et al., 2010). While the selection of an approach depends upon the product and its context of use, its application is mostly at the point of interaction between the user and product. For instance, 'feedback' incorporated at the point-of-interaction between user and the product, provides information about the product's running conditions and the impact of the user's actions on the environment. It also guides the user towards the most suitable actions that can be taken to reduce environmental impact and, in turn, the actions are influenced by the way the choices and 'defaults' are presented to the users.

A number of strategies, models, frameworks and toolkits have emerged to help designers in the process of encouraging positive changes in use-behaviour. Most of these design-led interventions rely on psychological principles to induce a positive change in behaviour. Design of product layout, interactions, goal-setting, and the use of feedback are some of the most commonly used techniques through which users are motivated to perform certain desired actions, and are discouraged from performing less desired ones. In recent years, a number of strategies have emerged for focusing on energy-saving behaviour (Abrahamse, Steg, Vlek, & Rothengatter, 2005). These either include antecedent strategies, such as commitment, goal setting, information and modelling, or consequence strategies such as feedback and rewards. Some of these strategies are discussed in this section.

Feedback

Feedback (also termed as eco-feedback) is one of the most commonly used techniques for making people adopt new habits (Wilson, Bhamra, & Lilley, 2010). It is used to provide various kinds of information to the user such as the consequence of their habitual behaviour on the environment and energy bills,

the benefits of adopting desired actions, and specific changes that the user needs to make in order to achieve desired outcomes (Fischer, 2008). Feedbacks also strategically guide the users through appropriate actions that they need to take in order to achieve the desired outcome. The overall purpose of the feedback is to develop new habits. On one side, it might be left to chance that a feedback will develop new habitual patterns among users, whereas, on the other side, it could be a built-in part of the design strategy. Strategically-designed feedback, which fits perfectly into people's daily life, would encourage the user to employ it regularly and would eventually develop new habits (Fischer, 2008; Van Dam, Bakker, & Van Hal, 2010).

The application of feedback is vast, and several strategies exist around psychological factors used to motivate a change in behaviour. These strategies differ from each other in terms of type of feedback, technology, mode of presentation, instruments for feedback, and the context of application. Feedback could be in the simplest (raw) form, such as the 'speed indication' in a vehicle, an 'energy meter' showing consumption (in units), or could be in a more complex (indirect) format: providing processed information such as comparative historical data, comparison with average, showing consumption with its associated cost (money), or comparison with other users. All these forms of feedback, and more, have been effective in encouraging consumers to adopt more efficient practices. Darby (2006) compared multiple forms of feedback and concluded that, with effective feedback design, energy consumption can be reduced by up to 10%–20%. And, with technological advancements, the use of feedback would further improve, so providing the user with more comprehensive and customizable information.

Goal-setting and Commitment

Furthermore, 'goal-setting and commitment' (McCalley & Midden, 2002) is one of the techniques commonly used by designers to engage and stimulate users to perform certain actions. It establishes engagement through competition and challenge so that, once engaged, the user performs the task diligently and thoroughly in order to attain a certain level. This phenomenon can commonly be seen in games where players are continuously challenged, either to reach a certain level or to set and break a record.

Design of Product Layout

Besides the design of product interactions, designers also consider devising thoughtful product layout and configuration to facilitate the selection of desirable actions. Products are configured in such a way that favourable actions are easier to perform, whereas less desirable actions are comparatively difficult (Jelsma, & Knot, 2002). Similarly, when 'forced functionality' is incorporated in the design, it guides the user to perform desired actions in a more or less forceful way or it takes control and automatically adapts to changing circumstances, so preventing unsustainable behaviour. The objective is to make the user perform actions in the way that complies with the designer's intentions. For example, 'forced functionality' can be seen in hybrid cars, in order to store kinetic energy; when the driver applies the brakes to reduce speed, the kinetic energy automatically gets stored. In the same way, in order to minimize electricity consumption, computer monitors automatically reduce the brightness-and-contrast when not in use.

Scripting

Jelsma and Knot (2002) proposed the idea of 'scripting' in product design to influence the way the product is used. They defined 'scripting' as the design of

product configuration or layout that guides users to perform sustainable actions in a relatively forceful way. It enables the user to act in accordance with the values and intentions inscribed into the product by the designer. Jelsma and Knot (2002) applied this concept of scripting to sustainable service systems, in particular, clothing care systems. They suggested that a 'smart design' encourages the adoption of more sustainable behaviour and discourages the unsustainable.

2.1.3 Lilley's Model

Debra Lilley (2009) defined 'design for sustainable behaviour' as the application of design strategies that attempt to influence use-behaviour associated with the product. In her model, she defined three approaches for product-led interventions targeting behavioural change, based upon different levels of power in decision making (Figure 2.1).

1. Eco-Feedback: feedback incorporated at the point of interaction between the user and the product, informing the user about the environmental impact of actions, and how a change in action can help minimize the consumption.
2. Behaviour Steering: strategically designed product layout, affordances and constraints, encouraging the users to behave in a certain way.
3. Persuasive Technology: intelligent products and systems that persuade or control the predetermined use-behaviour, sometimes automatically.

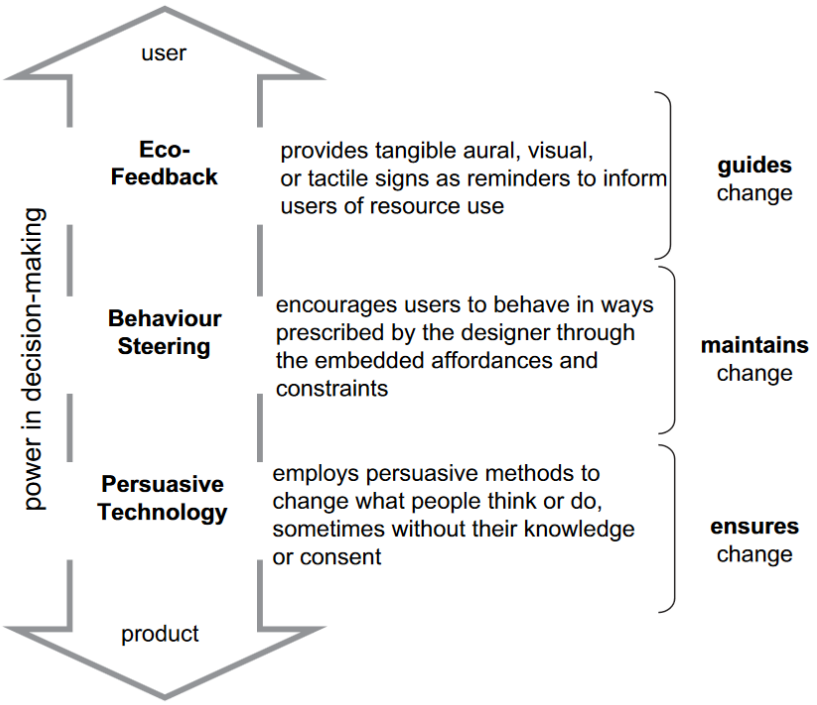

Figure 2. 1 Lilley's (2009) model based on power in decision making

2.1.4 Lockton's Design with Intent Toolkit

Dan Lockton et al., (2008) developed the Design with Intent Toolkit for designers, which is based on behaviour-change theories and the application of persuasive technologies. In order to motivate inspiration, the toolkit provides access to a wide range of identified behaviour-change solutions (Lockton et al., 2010). It provides a list of tools and techniques for motivating or constraining a user's behaviour. The toolkit proposes six lenses, each consisting of several design patterns and examples. The Architectural Lens provides techniques used to influence behaviour in architecture, urban planning and related disciplines. The Error Proofing Lens depicts examples of how design can help in avoiding errors by making it easier for a user to work without making errors or by making mistakes impossible in the first place. The Persuasive Lens highlights the use of persuasive technologies such as mobile phones, computers and other systems

that might be used to persuade users through feedback and guidance. The Visual Lens refers to how users perceive patterns and meanings, including metaphors, as they interact with systems around them. The Cognitive Lens focuses on heuristics and biases, and how they influence the process of decision making thereby influencing choices and actions. Finally, the Security Lens focuses on examples of how undesired behaviour can be avoided through incorporating countermeasures into the design of products and systems (Lockton et al., 2008; Lockton et al., 2010).

2.2 BEHAVIOUR CHANGE THEORIES, MODELS AND TECHNIQUES

2.2.1 A General Discussion

Broadly speaking, behavioural science is considered as a systematic study of human behaviour, which has its roots in psychology, neuroscience and economics (Michie, Van Stralen, & West, 2008). It encompasses a large number of models and theories pertaining to behaviour change. These theories are based on a wide range of psychological, social and contextual factors such as emotions, habits and routines (Darnton, 2008). They outline underlying factors that influence behaviour, and assist change interventions by suggesting how behaviour develops and changes over time (Darnton, 2008).

Recent recognition of the importance of behaviour change in meeting sustainability objectives has drawn attention towards the application of behaviour-change theories, models and techniques (Prager, 2012; Darnton, 2008). Yet, behaviour-change theories and models cannot induce a change in behaviour, nor they can predict with certainty what changes will occur in behaviour due to an intervention (Prager, 2012). However, they do provide useful insights to interventionists, policy makers and implementers about the likely success of an intervention based on these theoretical constructs. They

provide useful insights into the factors and conditions that drive behaviour (Michie et al. 2008; Prager, 2012). Michie et al. (2008) suggested that though behaviour change theories and models provide a basis for design interventions, they offer little guidance on how to achieve the desired result. Researchers use these theoretical constructs as a foundation for defining behaviour change techniques and strategies. The following sections discuss some of the key motivations, theories, models and techniques.

2.2.2 Motivators of Behaviour Change

There are a wide range of personal, social and environmental factors that influence behaviour. In the light of theory and evidence from many contexts, researchers have broadly classified the motivators of behaviour change into three levels: personal, social and environmental (Table 2.1).

Personal
• Values (e.g. social or environmental responsibility) • Beliefs (e.g. health, nature, humanity, emotional) • Knowledge (e.g. consequences, awareness, educational) • Attitudes • Skills • Personal benefits (e.g. money, time, resources)
Social
• Social interaction (e.g. with family, friends, community) • Social status • Social proof • Compliance with social norms
Environmental or Contextual
• Contextual constraints (e.g. school, work place, local shops and facilities) • Geographical factors (e.g. climatic conditions and location) • Facilities (e.g. resource availability, economic factors, technological limitations)

Table 2.1 Key motivations to behaviour change. Source: EUFIC (2014)

On the other hand, Bonsall et al., (2009) classified the key motivators of behaviour change into five levels. These are:

1. Desire for personal gain (money, time, resources)
2. Desire for approval by peers (conformity with social norms, kudos)
3. Desire for self-approval (conformity with personal values and self-image)
4. Concern for societal values (altruism, justice, obligation, environmental concern)
5. Fear of adverse consequence if change is not made (personal security, safety, loss of money or resource).

2.2.3 Behaviour Change Strategies

Witte (1996) suggested that a complex web of personal, societal and contextual factors contribute to the development and persistence of a particular behaviour. He defined these factors and motivators as key elements that form the core of various behaviour-change models and theories. He also defined strategies used for addressing these core elements. Table 2.2 provides a comprehensive list of these elements and strategies.

Key Elements	Definitions	Strategies for Behaviour Change
Threat	A negative consequence of action of which people may or may not be aware	Raise awareness about possible consequences of actions
Fear	Caused by personally relevant threat	Fear encourages people to seek more information
Response Efficacy	A perception that a new behaviour would prevent the threat from happening	Provide proof that a recommended response would avert the threat
Self-Efficacy	An individual's perception of his ability to perform a desired behaviour	Raise individual's confidence that s/he can perform the desired behaviour
Barriers	Obstructions that hinder adoption of new behaviour	Remove barriers. These could be related to context, availability of resources and technology, or ability
Benefits	Positive consequences of performing a desired behaviour	Communicate the benefits of performing the desired behaviour
Subjective Norms	Expected behaviour from an individual in a social group	Understand with whom individuals are likely to comply
Attitudes	An individual's beliefs about a new behaviour	Understand existing beliefs before attempting to change them
Intentions	An individual's plan to perform the desired behaviour	Understand if the intentions are genuine or proxies of actual behaviour
Cues to Action	Factors that help an individual in decision making about the desired behaviour	Provide tips that trigger individuals to make decisions
Reactance	When an individual reacts against a desired action	Individuals should not feel that they have been manipulated or are unable to avert the threat

Table 2.2: Key elements of behaviour change. Source: Witte (1996)

2.2.4 Overview of Behaviour Change Theories and Models

Emphasizing attitude, norms, personal benefits and communication

The theory of planned behaviour (Ajzen, 1991), which has evolved from the theory of reasoned action, is one of the most popular and widely applied behaviour theories (Armitage, & Conner, 2001; Hardeman et al., 2002; Webb, Joseph, Yardley, & Michie, 2010). It posits that behaviour is based on an individual's attitudes and beliefs and that an individual is more likely to adopt new behaviour if he believes that the consequences of performing the new behaviour will be more positive than negative (Ajzen, 1985; Ajzen, & Madden, 1986; Ajzen, 1991). It adds that individual behaviour is also influenced by subjective norms (beliefs about whether other people approve or disapprove of the behaviour), and perceived behaviour control (Ajzen, 1991; Morris, Marzano, Dandy, & O'Brien, 2012). Perceived behaviour control refers to the perceived ease with which an individual is able to perform the behaviour (Morris et al., 2012). The theory of reasoned action also emphasizes that subjective norms and attitude are predictors of behaviour, stating that attitude towards a behaviour, together with subjective norms, shape both an individual's behaviour intentions and their behaviour (Ajzen, & Fishbein, 1980). It is noticeable that both theories indicate the importance of persuasive (logical and convincing) communication in any intervention (Bonsall et al., 2009).

Likewise, the importance of persuasive communication in behaviour change interventions is highlighted by the rational choice or choice theory. It provides an understanding of the social and economic behaviour and posits that personal benefit is the key determinant of behaviour. It is based on an economic principle that individuals always make careful and logical decisions that provide them with greatest benefits and that are in their highest self-interest (Durlauf, & Blume, 2008; Blume, & Easley, 2008). These choices are influenced by anticipated

pleasure, profit, potential costs and benefits. This is supported by behavioural economics, which relates decision making to economic thinking and believes that decisions are based on economic benefits, profits, and loss (Frederiks, Stenner, & Hobman, 2015). Therefore, communication regarding the benefits of performing a desired behaviour plays a key role in motivating people to adopt that behaviour.

The importance of communication in behaviour change is further emphasized by the information-motivation-behavioural skills model (Fisher, Fisher, Williams, & Malloy, 1994)**,** particularly in the context of health. It emphasizes that information such as risks or the likely (positive or negative) consequence of behaviour is the critical determinant. It highlights how the 'information' component targets an understanding of the concepts leading to behaviour change, and ways of achieving it (Fisher et al., 1994). The importance of threat on behaviour is, moreover, highlighted in the health belief model, which asserts that in order for behaviour change to occur, people must feel personally vulnerable to a health threat (Janz, & Becker, 1984; Rosenstock, 1974; Becker, 1974; Sharma, & Romas, 2012).

The importance of persuasive communication in achieving behaviour change is again stressed in the elaboration likelihood model of persuasion (Petty, & Cacioppo, 1984). But, in addition to the content of the information, this places emphasis on the credibility of the information, speaker and source. The model proposes two routes to persuasion. The first route is thoughtful consideration of the true merit of information, and the second is the logical quality of the stimulus, such as credibility of both the source and message (Petty, & Cacioppo, 1984). It implies that the credibility of source, speaker, and information is critical in persuasion and the message should be logical, convincing and relevant.

In addition to credibility of the source, the way the information is framed is also significant in behaviour change. The importance of framing information in a persuasive format is highlighted by the theoretical perspective of 'framing' (Druckman, 2001), which explains that the way information is framed and presented also influences people's choice. The manner in which something is presented to an audience ('the frame') influences the choice they make about how to process the information. Therefore, in order to influence choices, the information should 1) be logical and convincing, 2) explain the consequences and benefits of the behaviour, and 3) explain ways of avoiding a loss. It is noticeable that the majority of the above-mentioned theories underscore the importance of information (including its source, content, and format) as the key determinant of behaviour.

Influencing decision making by controlling choices

Besides the information, the presentation of choices has an impact on a consumer's decision-making process. It is particularly emphasized by the choice architecture model, which states that consumers' decision-making process is influenced by the way in which choices are presented to them (Scheibehenne, Greifeneder, & Todd, 2010). It accentuates how the elements of a system nudge an individual's choices, particularly, the potential of selecting a 'default' option (Sunstein, & Reisch, 2013; Niedderer et al., 2014). Both the way the attributes are presented to the consumer and the presence of a 'default' option, influence their choices (Niedderer et al., 2014). This model is widely used in the design of products and services (Sunstein, & Reisch, 2013). Choice architecture model is widely applied in design interventions targeting behaviour change. Thaler et al. (2014) mention that choice architecture has the potential to encourage more socially responsible behaviour but it poses certain ethical challenges concerning

people's rights and control (Mori, 2008). The concept of nudging is based on this theory and widely used in the design of products and systems. Nudging approach, based on behavioural economics and behavioural science (Wilk, 1999), is commonly used to encourage sustainable behaviour in the design of products and interactions. It aims to nudge people's choices by making less desired options more difficult and desired behaviour simple for the user.

Another behaviour-change theory frequently used by designers to encourage sustainable action is goal-setting theory. Goal-setting theory states that an inductive relationship exists between goal setting and improved performance. It stresses that desire and intention to reach a goal is the key source of motivation (Locke, & Latham, 2002) and involves setting clear targets and establishing levels of performance in order to achieve a desired outcome (Locke, & Latham, 2006).

Emphasizing the stages of change

While the above-mentioned theories and models illustrate key elements and factors that influence behaviour, the trans-theoretical model guides interventions by providing important steps for uninterrupted behaviour change. The trans-theoretical model (also referred to as the 'stages of change' model), is a widely accepted cognitive model that defines five stages through which an individual goes during the course of behaviour change (Prochaska, & DiClemente, 1982; Prochaska, DiClemente, & Norcross, 1992; Prochaska, & Norcross, 2013). These stages represent milestones or 'levels of motivational readiness' (Heimlich, & Ardoin, 2008) for an uninterrupted behaviour change, and comprise 1) *pre-contemplation* (not ready and uninformed), 2) *contemplation* (getting ready), 3) *preparation* (intending to take action in the immediate future), 4) *action* (adoption of new behaviour) and 5) *maintenance* (working to prevent relapse)

(Prochaska, 1982). These descriptions are helpful in planning the appropriate activities of intervention.

Emphasizing intrinsic factors (altruism and selfless behaviour)

In addition to external factors such as information, persuasive communication and presentation of choices, there are several other intrinsic factors such as self-efficacy (self-confidence) that influence the choice made by an individual. Bandura (1977) in his self-efficacy theory proposes that people with high self-efficacy (those who believe they can perform well), are more likely to embrace new behaviour. Self-efficacy refers to an individual's belief in their capacity to effectively perform and execute a behaviour (Bandura, 1977; Bandura, 1997), reflecting an individual's perception of their ability to succeed in a task. This indicates the importance of communicating that actions for interventions that foster sustainable behaviour are straightforward and achievable, and it highlights the importance of education and training in order to improve ability. Likewise, the importance of skill development in the process of behaviour change is highlighted by self-determination theory, which states that to achieve lasting change, skill development should be combined with intrinsic motivation (Ryan, & Deci, 2002). It also asserts that intrinsic motivation does not rely on external factors such as rewards or punishment, rather, it exists within the individual and is primarily stimulated by interest and enjoyment of the task itself (Ryan, Deci, 2002). Specifically, for environmental behaviour-change interventions, it indicates the importance of skill development and education concerning social and environmental responsibility.

Personal satisfaction is another intrinsic factor which encourages people to repeat a behaviour and is highlighted by operant conditioning theory (also called instrumental conditioning). This theory is based on the premise that if the

consequence of a behaviour is satisfying, it is more likely to be repeated than those that produce unpleasant consequences (Gardner, & Gardner, 1988). In other words, satisfying consequences strengthen behaviour. For behaviour-change interventions, operant conditioning implies providing positive and constructive feedback (after a new behaviour has been adopted), making outcomes observable and measurable, and highlighting the positive outcomes of a behaviour.

Festinger (1957) proposed another perspective on the way people make certain choices. In his cognitive dissonance theory, he points to the intention behind the adoption of certain behaviour. Cognitive dissonance refers to a situation involving conflicting attitudes, beliefs or behaviour and suggests that people adopt certain behaviours in order to free themselves from an uncomfortable state of dissonance caused by violation of their self-image (Festinger, 1957). In psychology, cognitive dissonance is the state in which an individual holds two or more contradictory beliefs or values. Therefore, although cognitive dissonance creates mental stress or discomfort, it leads to alteration in one of the attitudes, beliefs or behaviour thereby reducing the discomfort and restoring balance (Festinger, 1957).

Social marketing (McKenzie-Mohr, 2000) also focuses on internal factors that trigger altruistic (selfless) behaviour. Social marketing uses principles of marketing combined with behaviour change for the benefit of society. It focuses on promoting socially-valuable information and socially-accepted behaviour (McKenzie-Mohr, 2000) and is being applied in different ways to foster sustainable behaviour. The technique involves raising environmental awareness through education and use of ‘social proof’.

2.2.5 Importance of Social and Contextual Factors in Behaviour Change

In a broader sense, theories, models and approaches can be classified into two categories: 1) approaches that focus on behaviour change at individual level and 2) approaches that believe behaviour to be a consequence of societal norms and expectations. The theories and models discussed in the previous section highlighted the key motivators of behaviour change including information (format and content), communication, credibility of communication, attitude, intention and self-efficacy. These theoretical constructs focus more on personal factors and do not take social and contextual factors into account. They view behaviour as a personal and individualistic phenomenon, whereas, according to Gestalt and Eco-psychology, an appreciation of holism is important, understanding that nothing can be viewed as independent of the whole (Theodore, Mary, & Allen, 1995). From the perspective of environmental behaviour, it is important to consider the system in which the behaviour is created (Theodore et al., 1995). Human behaviour is socially grounded and deeply embedded in its social context, therefore surrounding influences including the social group play a critical role in influencing individual choices (Network for Business Sustainability, 2013; Koger, & Winter, 2011; Gardner, & Stern, 1996). Social factors, therefore, become important during the process of behaviour change because it is the social context in which behaviour evolves, nurtures, persists, changes or defects (Shove et al., 2008; Scott, Bakker, & Quist, 2012).

The influence of social context on individual behaviour cannot be neglected, which is why individualistic behaviour-based interventions such as the design-led behaviour change approaches have received critical responses (Shove et al., 2008; Almquist, & Lupton, 2010; Pettersen, & Boks, 2008; Verganti, 2013). Interventions that address only personal factors at an individual level, and ignore

social influences, are unlikely to work (COI, 2009), whilst interventions that act at personal and social levels are more likely to effect behaviour change (COI, 2009).

2.2.6 Theories Emphasizing Social and Contextual Factors

Emphasizing peer pressure and social norms

Theories that emphasize the influence of social and contextual factors on individual behaviour, consider behaviour to be a consequence of societal norms; expectations of the system in which the individual is living. For instance, the drive theory posits that the presence of an audience (social presence) has an impact on individual performance (Weiner, 1972); and, if the response is correct, social presence can enhance performance. For interventions, this means that the presence of an audience can be used to build peer pressure and to encourage performance. It is also proposed by the goal-setting theory, which asserts that if commitment to a goal is made in public or if the ambition is made visible to a public, it tends to spark social image concerns and social pressure, which can augment performance (Locke, & Latham, 2002). Social, or peer, pressure is a common social phenomenon, referring to the affective influence on an individual to change in response to feeling pressured by a peer group (Smith, & Flower, 1984), and is considered one of the predominant motivators of human behaviour.

Social pressure is also induced by social comparison. The social comparison theory emphasizes this by positing that individuals want to gain accurate self-evaluations by comparing themselves against each other. By comparing their performances, people gain information about themselves and make inferences that are relevant to their self-esteem (Festinger, 1954); therefore, comparison is a commonly used tool for self-enhancement. The behaviour of an individual is similarly influenced by prevailing social norms; the rules of the behaviour that

are considered culturally acceptable in a society (Jackson 1965; Lapinski, & Rimal, 2005). People in a group tend to comply with these social norms in order to avoid difficult consequences such as an adverse impact on their social image. For interventions targeting behaviour change of a group, social norms help in building up social pressure and are used to guide the behaviour. Social proof (also known as informational social influence) is another common strategy based on the observation that people tend to follow what others are doing around them, and is used for building social pressure around an individual and thereby influencing the choices they make. It is a psychological phenomenon where people prefer to simulate others' actions in an attempt to reflect correct behaviour (Aronson, Wilson, & Akert, 2005). For interventions targeting environmental behaviour change, this indicates the importance of communicating what others are doing and what actions others are taking to benefit the environment.

Emphasizing self-enhancement and social identity

Furthermore, the concept of self-verification plays an important role in social behaviour change. The self-verification theory posits that people want to be known and understood by others and that individuals prefer others to see them as they see themselves (Berlyne, 1971). Self-verification is linked with self-esteem and considered as motivation to maintain or to change one's behaviour; it, therefore, helps in escalating social interaction within a group (Berlyne, 1971). In support of this concept, the self-enhancement theory asserts that people learn about themselves through evaluations and feedback they receive from others (Sedikides, & Strube, 1995). Individuals aspire to receive positive feedback from others, which works as a motivation for them to improve (Sedikides, & Strube, 1995), thereby indicating the importance of social interaction and positive feedback in behaviour change interventions.

Likewise, groups to which people belong, are considered as important sources of pride and self-esteem (Tajfel, 1979). This is highlighted by the social identity theory, which asserts that social identity is a persons' sense of who they are, based on the group or the categories (e.g. social class, family or teams) they belong to. These categories or groups change the member's self-perception, attitudes and behaviour so, in order to enhance their self-image, people tend to work towards enhancing the image of the group (Tajfel, 1979).

Based on social learning

Social learning and observation play a key role in reinforcement of behaviour as people observe, learn, and replicate the positive behaviour of others around them. This importance of learning new behaviour from others is well-recognized and highlighted by various theories. For instance, the social cognitive theory holds that an individual's knowledge acquisition takes place through social interaction and by observing others (Bandura, 2002). The theory emphasizes the role of observation and social interaction and its impact on reinforcement of behaviour. Observers choose to replicate a certain behaviour depending upon whether they observe that people are rewarded or punished for behaving in that way (Bandura, 1989). The importance of social learning is also highlighted by social learning theory, which holds learning to be a cognitive process that takes place in a social context (Bandura, 1969). For interventions, it indicates the prominence of social context (including social interaction and observation) in acquiring new behaviour. Similarly, situated learning theory also places emphasis on the social context in which new behaviour is learned. It holds that learning is a function of activity, context, and culture in which it occurs (Hanks, Lave, & Wenger, 1991), thus proposing social interaction as a critical component of situated learning in encouraging the learner to adopt the new behaviour (Hanks et al., 1991).

2.3 GAMIFICATION

2.3.1 Play and Games

Clark (1987) defined game as *an activity among two or more independent decision-makers seeking to achieve their objectives in some limiting context*. The definition refers to game as a rule-based system, in which players try to achieve objectives. In his definition Clark (1987) emphasizes four key terms. 1) *Activity* (a process or event) 2) *Decision-makers* (players actively involved in the decision-making process) 3) *Objectives* (clearly defined goals and targets) 4) *Limiting Context* (the rules and structure of the game). Parlett (1990) on the other hand, defined games by categorizing them into two types, i.e. formal and informal games. "An informal game is merely undirected play, or playing around, as when children or puppies play at rough and tumble" (Parlett, 1990). Informal games can also be referred to as play, whereas, a formal game always has two components: 1) *Ends*: it has a definite goal or an endpoint 2) *Means*: it is based upon rules and materials by which a player wins the contest (Parlett, 1990).

Likewise, Salen and Zimmerman (2004) defined 'playing a game' as a process which involves making meaningful choices and taking actions. They further add to this by stating that every action of a player within a game results in the creation of new meaning within the system. For instance, when a chess piece is moved it establishes a new relationship, which gives rise to a new set of meanings – meanings created by the player's actions (Salen and Zimmerman, 2004). Salen and Zimmerman (2004) emphasise that the most essential components of a successful game are 'meaning' and 'play', and that these two are intimately related. They also suggest that in order to create a satisfying game experience for the players, designers should consider experiences that have meaning and are meaningful. The goal of successful game design should be the *creation of meaningful play, which emerges from the relationship between the player's action and system outcome* (Salen, & Zimmerman,

2004). This refers to the process by which a player takes action and the game system responds to that action.

2.3.2 Defining Gamification

Two definitions are commonly used to define gamification. These are: 1) *The application of game elements and game principles in non-game contexts* (Huotari and Hamari, 2012; Deterding et al., 2011), and *2) The use of game-thinking and game mechanics to engage users and solve problems (*Zichermann, & Cunningham, 2011). These definitions theorize that gamification requires the use of game mechanics and game elements alongside other non-game components to achieve goals beyond pure entertainment. Deterding et al., (2011) define gamification as the systems which use game elements for a purpose, rather than the development of a fully-fledged game. They further add to this by stating that a game can be differentiated from play because it is based on clearly defined rules, and guides the users to achieve discrete goals and outcomes. On the other hand, Werbach and Hunter (2012) compared gamification to reverse engineering by positing that gamification is about understanding what makes games fun and effective, and applying them to address real-world challenges.

Application and benefits

Gamification makes serious and monotonous tasks interesting and enjoyable (Gilbert, 2015). It has the potential to add fun and entertainment to structures which have become too rigid or formal. This offers ways to gain leverage on real-world problems. For the past two decades, individuals and organizations have been creating thoughtful games to address real-world problems (Werbach, & Hunter, 2012; Gilbert, 2015). *Gamification* is applied across diverse sectors such as business, education, entertainment, healthcare and sustainability. Gamification is frequently used as a tool by educators to teaching important and challenging concepts in the

classroom in a playful way. Game-based curriculums are becoming quite popular in teaching concepts of mathematics and physics.

Furthermore, the massive proliferation of database technology, mobile devices, and social networking platforms has added another dimension to the application of gamification. And now, in a world where the majority of the urban population has (easy) online access at all times, companies are adopting game as a strategy in order to leverage business objectives such as increasing profit gains and building markets. Organizations are designing various game-based systems, which leverage game-thinking to reach out and motivate consumers, explain difficult concepts, enhance relationships, and deepen commitments (Gilbert, 2015). Gamification is helping organizations to move away from extrinsic motivators such as monetary rewards, towards intrinsic motivators *(*Zichermann, & Cunningham, 2011). Businesses are utilizing gamification to drive engagement, interaction, collaboration, awareness and learning *(*Zichermann, & Cunningham, 2011). Sales and marketing departments within these organizations are constantly envisioning game-based frameworks through which corporate marketing can reach out to more and more consumers (Gilbert, 2015).

Categorization

Werbach and Hunter (2012) classified gamification into three categories based upon their purpose. These categories are as follows:

Internal Gamification: refers to the use of gamification to improve productivity within an organization. The objective here could be to foster innovation or enhance interaction and collaboration (Werbach, & Hunter, 2012).

External Gamification: refers to the use of gamification to increase engagement between businesses and customers, to build stronger loyalty and help business gain more profit (Werbach, & Hunter, 2012).

Behaviour-change gamification: refers to gamification targeting development of new habits among a population. These interventions focus on motivating people to adopt certain desired actions and behaviour such as adopting sustainable actions or making better health choices (Werbach and Hunter, 2012). Social games are used as a platform across behaviour-change interventions for applying the strategies derived from the theoretical constructs discussed in previous sections. These social game-based interventions (such as GBCPs) make use of game elements to engage and stimulate the players to adopt desired behaviour under the influence of a social setting. They use game mechanics to trigger various factors such as social pressure, social norms, social proof and social identity concerns to influence the behaviour of a particular social group. Such game-based interventions are applied across diverse sectors such as healthcare, education, entertainment, and sustainability.

2.3.3 Game Mechanics in Gamification

Although, gamified interventions may or may not always have a clear 'end or win' condition, they do have some common aspects integrated in their structure, which drive users to accomplish both short-term and long-term goals (Gilbert, 2015). According to Gilbert (2015) the structure of a gamified intervention consists of progress paths, interactions, data, feedback and goals (Figure 2.2). The progression path including elements such as levels, story arcs, obstacles, and badge collection define clear objectives, which in turn drive interactions. Interaction is supported by various factors such as direct feedback on actions, rewards, support from friends and community members, and tips provided at interface level. These interactions result in data generation, which can be utilized in variety of ways to meet target goals.

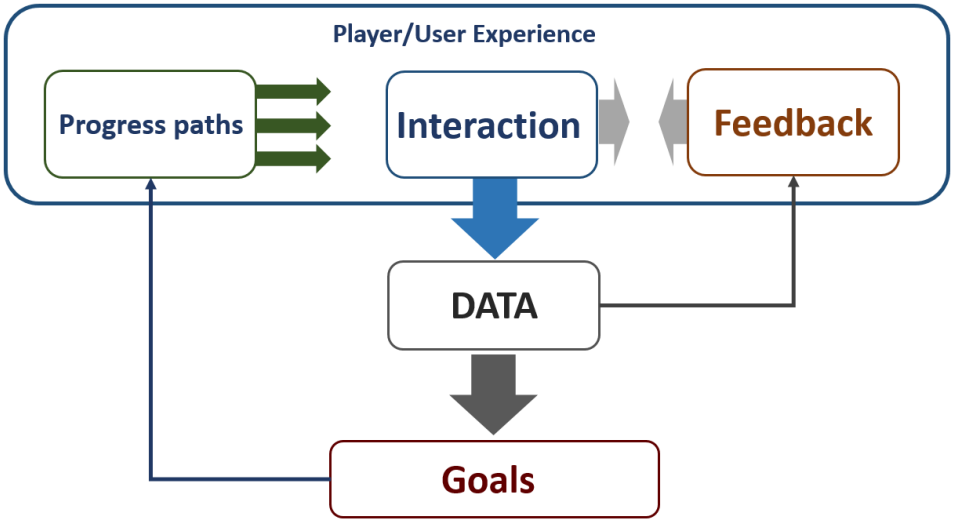

Figure 2. 2 Architecture of gamified systems. Source: Gilbert (2015).

According to Deterding et al., (2011), game elements consist of common characteristic elements that are found in most games. These may include elements such as progression path, levels, feedback systems, rewards, rules, avatars, goals, ranks, etc. Such elements play a significant role in game play (Deterding et al., 2011). Likewise, Werbach and Hunter (2012) describe game elements as building blocks that form the integrated experience of the game. Werbach and Hunter (2012) categorise game elements into three categories: 1) dynamics 2) mechanics and 3) components. Table 2.3 describes the breakdown of each of these categories. 'Dynamics' refers to the big picture aspects that have to be considered and managed but are never directly a part of the game whereas 'mechanics' refers to elements that constitute the basic processes driving the action forward and engaging the players. The 'components' category refers to specific components of 'mechanics' and 'dynamics' (Werbach, & Hunter, 2012).

Game Dynamics	Game Mechanics	Game Components
Constraints	Challenges	Achievements (defined objectives)
Emotions	Chance	Avatars (visual representations of player)
Narrative	Competition	Badges
Progression	Cooperation	Boss fights
Relationships	Feedback	Collections
	Resource acquisition	Combat
	Rewards	Content unlocking
	Transactions	Gifting
	Turns	Leaderboards
	Win states	Levels
		Points
		Quests
		Social graphs
		Teams
		Virtual goods

Table 2.3: Game dynamics, mechanics, and components. Source: Werbach and Hunter (2012).

Game elements play key roles as they add fun and excitement to the process by directing players to compete and perform the desired actions in a playful way (Hargreaves, Nye, & Burgess, 2008; Schoech et al., 2013; Frederiks et al., 2015). Zichermann and Cunningham (2011) mentioned that though there are plenty of game mechanics, not all are directly transferable to gamification. The following section briefly discusses some of the most common game mechanics that are used in gamification.

Progress path and levels

Progress path and levels are important components of a game. They are essential in order to pace the players through a journey on varying stages from initial steps to final goals. Levels indicate a user's progress within the game. They either indicate a user's status and mastery of a system or a user's position within a system

(Zichermann, & Cunningham, 2011; Werbach, & Hunter, 2012; El-Khuffash, 2012). The design of the progress path and levels are important to maintain the players' interest throughout the game and avoid defection (Gilbert, 2015; Schoech et al., 2013; Frederiks et al., 2015). For this reason, various challenges and difficult tasks are generally broken down into smaller achievable steps, making it easier for players to perform and keeping them motivated. This stepwise process makes the game suitable for all players including beginners and increasing difficulty levels are also important as they define a clear upward playing path (Zichermann, & Cunningham, 2011). Maintaining a moderate difficulty level is essential in any game or challenge to sustain the players' interest and, to this end, once players complete a task they are rewarded and encouraged to undertake another level of challenge (Schoech et al., 2013; Sharma, & Siu, 2017).

Engagement model: challenges, competition and collaboration

An engagement model is at the heart of any game, involving several activities such as setting up individual and team-level challenges, defining goals and targets, competitions, collaboration, monitoring, and interaction between the players. Engagement adds the fun and excitement that keeps players engaged throughout the process (Schoech et al., 2013; Sharma, & Siu, 2017). Challenges are one of the most essential components of the engagement process. Werbach and Hunter (2012) defines challenges as tasks that require some effort to solve. Challenges also direct players' actions within the gamified system (Zichermann, & Cunningham, 2011). Challenges are crafted into the gamified system with meticulous consideration, as they motivate players to accomplish certain tasks. Team-level challenges are considered important in gamified interventions as they motivate players to work together as a team to achieve set targets. They nurture a sense of belonging and commitment towards the team and inspire all team members to work as a cohesive unit towards a defined objective (Kultima et al., 2017). On the other hand, competition makes the players compete with one another, resulting in a clear winner and loser (El-Khuffash, 2012). Competition determines which player

or team can perform certain tasks better or quicker (Werbach, & Hunter, 2012). Competition is triggered by challenges and social comparison through leaderboards.

Triggers

Triggers work as calls to action in a game, and are incorporated in the form of timely reminders, which are used to provoke an immediate response (Fogg, 2009; Wu, 2011; Kaptein, 2011; Frederiks et al., 2015). Triggers are also designed to inform participants exactly what actions must be performed, and when (Fogg, 2009). Fogg (2009) states that triggers play a key role in the process of behaviour-change, as they tell the user to complete the action in a certain moment, also referred as a call to action. Triggers work as sparks that motivate the user and signals that function as a reminder (Fogg, 2009). Wu (2011) mentions that when a player is unaware of his ability, hesitant or distracted, a good trigger can motivate them to perform the desired behaviour. A trigger can take many forms, but its objective remains the same. It may be in the form of reminders from other participants or could be in props or personalized messages. In game-based behaviour-change interventions, triggers are used to encourage adoption of certain actions during the game.

Rewards and recognition

Rewards and recognitions are considered one of the key components of game mechanics because they work as motivators and feel-good factors for the players (Gilbert, 2015). Players are rewarded for learning and performing a particular action, and their efforts are recognized in public (Zichermann, & Cunningham, 2011; Schoech et al., 2013; Fredericks et al., 2015). While rewards are usually in the form of personal benefits, recognition is something that enhances both social- and self-image of the players. Players in social games are rewarded for promoting the game, for conceptualizing strategies, and for leading activities and events that benefit the game's success. Rewards can be of different types and levels. These can be symbolic (such as badges or points), or might be economic (*Werbach, & Hunter, 2012).* Since the reward mechanism is central to a game, it requires thoughtful

planning and execution. Werbach and Hunter (2012) mention that points are given when a player accomplishes something that the system anticipates. Gilbert (2015) highlights the importance of points by demonstrating how points provide immediate feedback, keep score, establish trust, provide a track of progression, and provide useful information to the developers and designers. Werbach and Hunter (2012) define badges as "chunkier version of points", also referred to as achievements. Zichermann and Cunningham (2011) describe badges as a "visual points system"; visual representation of a specific accomplishment. Some of the commonly used point systems in gamification are as follows:

Experience points: First introduced in the table-top dice game *Dungeons & Dragons*, experience points are used widely across many role-playing videogames (Gilbert, 2015). Experience points only indicate the performance or the rank of a player over time, and do not have any redeemable value (Zichermann, and Cunningham, 2011). These are rewarded when the player accomplishes the desired task or overcomes a challenge.

Redeemable points: These are exchangeable points which can be redeemed for rewards such as money, a gift hamper or other rewards within the gamified system (Zichermann, and Cunningham, 2011; Gilbert, 2015). Redeemable points work as a virtual economy that motivates participants to adopt and perform desired actions.

Skill points: Skill points relate to the development of a specific skill or task (Gilbert, 2015). They encourage a player's sense of mastery in specific skills. These points can be earned for specific actions, such as the quality of photographs (Zichermann, & Cunningham, 2011).

Reputation points: Reputation points indicate the trustworthiness or credibility of the player (Zichermann, & Cunningham, 2011). These points usually refer to votes or ratings that a player, member or an organization receives for their interaction

with other community members or participants (Gilbert, 2015). For instance, ebay's point system indicates the trustworthiness of a seller in terms of product quality and shipping details. Reputation points can be linked to various privileges and accesses (Gilbert, 2015).

Victory points: Victory points are the points that player receives after winning a game. In some cases players do not know about the victory points until the end of the game when they are counted up to determine a winner (Gilbert, 2015).

Feedback

Two types of feedback are commonly used in games. These are 1) data-based feedback and 2) post-performance feedback. Data-based feedback is real-time feedback that allows players to monitor their own, as well as other player's, performances (Fischer, 2008). Data-based feedback is essential in social games as it stimulates the competition motivating players to perform, whereas post-performance feedback is provided to a player after they have performed an action. Post-performance feedback is usually in the form of positive and constructive responses that encourage the player to repeat certain behaviour or improve their performance (Fischer, 2008; Xu, 2012; Froehlich, 2015). Since feedback has both informational and motivational properties, it enhances the process of engagement (goal-setting, competition, collaboration etc.) (Froehlich, 2015). It enables progress towards a goal by encouraging the participant to move from one step or level to another.

Social comparison (leaderboards)

Social comparison is another of the most essential components of social games. It refers to the comparison of performances between players, which brings fun and excitement into the process and boosts performance. Comparison leads to competition and encourages players out-perform the others. Comparison may be between individual players as well as between teams (Zichermann, & Cunningham,

2011; Schoech et al., 2013; Frederiks et al., 2015; Sharma, & Siu 2017). Social comparison techniques convey social norms and social proof triggering social pressure and social identity concerns, all of which influence behaviour (Sharma, & Siu 2017). Leaderboards are commonly used for comparison as they allow the players to see where they stand relative to each other. Werbach and Hunter (2012) suggest that while social comparison through leaderboards can be motivating, they can also be demotivating for players who have lagged behind from the top. It can lead to defection from the game.

2.4 SUMMARY

The chapter has reviewed various theories, models and approaches to behaviour change. These approaches have emerged from the fields of behavioural sciences and environmental and social psychology, and are widely applied across various sectors including sustainability. These theories and models provide understanding of the key determinants of behaviour with their associated cause and effect. They also provide a basis for predicting new behaviour patterns, reasons for adoption of new behaviour, and for understanding how habitual behaviour is replaced by conscious decisions.

The chapter also discussed the key motivators of behaviour change, behaviour change techniques, and design-led behaviour-based approaches. The design-led approaches to behaviour fall under the multidisciplinary fields of design research and practice, ‘design for behaviour change’ and ’design for sustainable behaviour’. These design-led behaviour-based approaches rely on the principles of cognitive psychology and behavioural science, and make strategic use of design to encourage efficient usage of products and resources by employing various behaviour change techniques discussed in Table 2.2. These behaviour change techniques are applied by industrial designers at the point-of-interaction

between the product and the user to influence a positive change in use behaviour.

The theories and models from behavioural science, cognitive and social psychology are widely applied across various sectors including health, education, entertainment and sustainability. In a broader sense, these theoretical constructs can be classified into two broad categories of 1) constructs that emphasize personal factors and benefits, considering behaviour change at an individual level, and 2) constructs based on the assumption that behaviour is a consequence of social influence, societal norms, expectations, and social learning).

Theoretical constructs from behavioural science and psychology consider various extrinsic factors such as personal benefits (money, time, and resources), aversion to loss, persuasive communication, influences on decision-making by controlling choices, setting goals and targets, together with intrinsic factors such as altruism and self-satisfaction. These theories and models indicate the importance of factors such as communication and its credibility, information, (format and style), attitude, personal benefits, and presentation of choices. However, little emphasis is placed on how social influence impacts on behaviour whereas, constructs from social psychology do emphasize the central importance of social context on individual behaviour; they highlight the centrality of social norms, social proof, social learning, self-verification, self-enhancement, social identity, social learning, social comparison, and peer pressure in the process of behaviour change. They also hold that the patterns of behaviour are socially and institutionally grounded.

2.5 RELEVANCE OF BEHAVIOUR CHANGE THEORIES AND MODELS IN THIS STUDY

The GBCPs studied are based on social games for the purpose of fostering sustainable behaviour. These programmes make use of a wide range of behaviour-change techniques and strategies, which are delivered over a long period of time to foster a culture of sustainability within the social group in question. For optimum effectiveness, these programmes try to address the factors influencing behaviour at different levels. GBCPs involve a complex web of both personal and social factors that guide people to adopt sustainable actions and behaviour. Personal factors include benefits and rewards, whereas social factors include social image concerns, social norms, and social comparison (to name a few). These motivational factors are interwoven through game mechanics, which provide a platform for engagement and for introducing these motivational factors.

Bearing this in mind, and in order to understand the mechanics of GBCPs, key elements involved in the process of change, and the behaviour change strategies and techniques used, it was essential to gain in-depth understanding of various theoretical constructs relevant to behaviour change alongside the principles of game mechanics. Behaviour-change theories and models provide a foundation for identifying a range of phenomena, events, concepts and strategies taking place across GBCPs. Theoretical constructs also help in identifying which underlying personal and social factors specifically motivate participants to adopt sustainable actions across the GBCPs. They also help in understanding how the combination of multiple factors in GBCPs produce a supportive context and an influential social environment which encourages participants to adopt sustainable behaviour. Theoretical constructs also help to identify how these arranged social network encourages participants to perform consistently, and

how interactions among social group members nudge participants into action. Overall, this theoretical understanding helps in breaking down the entire process into its individual components of activities, phenomena, processes, strategies and events, and helps in analysing the selected GBCPs from the perspective of behaviour change.

Chapter 3 Cases

Game-based behaviour change interventions are widely applied across sectors such as healthcare, entertainment, education and sustainability. In the context of sustainability, some of the GBCPs have been quite effective. These programmes have helped individuals, families, social groups, and organizations to make more informed sustainable choices, and have encouraged a wide range of sustainable actions, claiming to have established a culture of sustainability within social groups. This chapter briefly introduces some cases in which GBCPs have been effective in encouraging adoption of sustainable behaviour. It highlights how these programmes work and their resulting impact.

3.1 JOULEBUG

JouleBug is a free playful mobile app that encourages its players to share their sustainable actions within their online social networks. Its objective is to make sustainable living social, simple and actually fun. In its approach, it uses elements of mobile gaming, social media, and educational tools, and blends them into an engaging format (figure 3.1 – 3.4). Its game-based approach makes it easier for players to make everyday habits more sustainable at home, work and play (JouleBug, 2015; Typhina, 2015; Grossberg et al., 2015; Kisurina, 2017).

JouleBug encourages its players to take a wide range of sustainable actions as part of their daily routine, helping them reduce their energy bills and minimize resource consumption. It uses a game-based approach to engage and motivate players, which makes the process fun and exciting for them. JouleBug provides to its players a list of over four hundred sustainable actions pertaining, for example, to energy consumption, waste reduction, re-use of products (like water bottles), use of local merchandise, saving paper, and water consumption.

Through its game-based model, it encourages players to adopt these actions in their every-day lives in order to reduce their environmental footprint. JouleBug syncs up with their online utility account, extracts useful information, and processes it in a way that can help the players reduce their utility bills. It then presents the impact report to the users so that they can see how much money they have saved each month (JouleBug, 2015; Grossberg et al., 2015).

JouleBug inspires players to learn and adopt sustainability actions in playful and social ways. It engages its players in a challenge, wherein they can choose from a wide range of sustainable actions. Challenges induce competition among the players and encourage them to perform the desired behaviour in order to earn rewards and improve their scores. JouleBug calculates scores on the basis of pins and badges earned, which are based on actions taken by the individuals. Once the players perform an action, they can upload pictures and earn rewards in terms of pins, badges and points and having reached a milestone, they can 'buzz' them out to their online networks, also encouraging them to compete with their friends on Facebook and Twitter (JouleBug, 2015; Typhina, 2015; Grossberg et al., 2015; Kisurina, 2017).

Figure 3. 1 JouleBug iPhone app. Source https://joulebug.com/

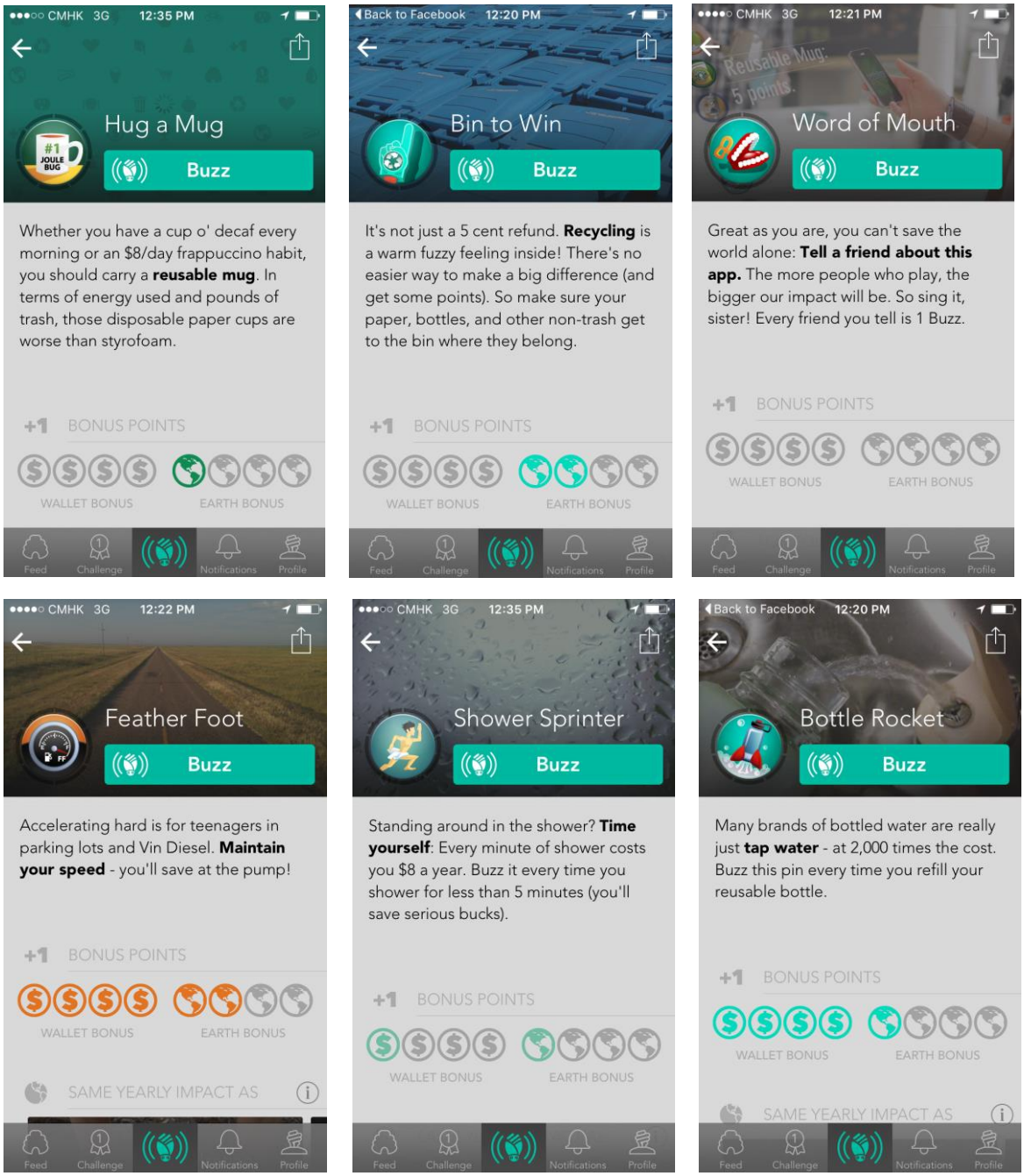

Figure 3.2 JouleBug app., communicating a wide range of sustainable actions to its users in a playful way. Source: JouleBug iPhone app

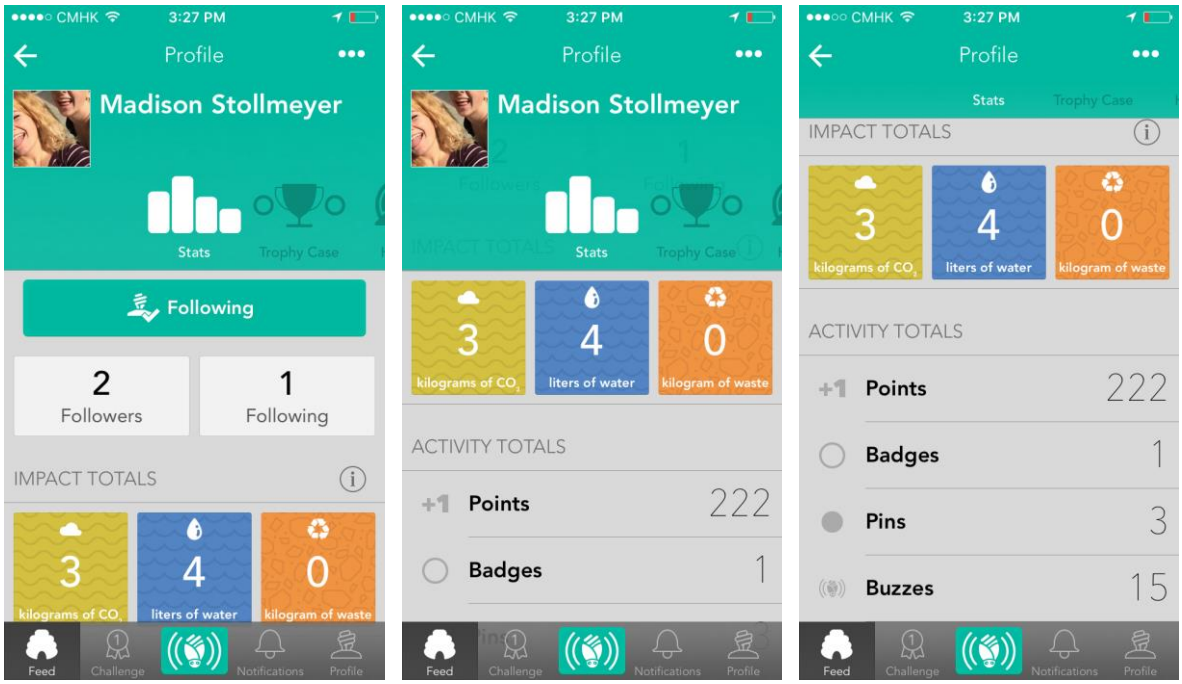

Figure 3.3 Profile page of JouleBug participants. Source: JouleBug iPhone app.

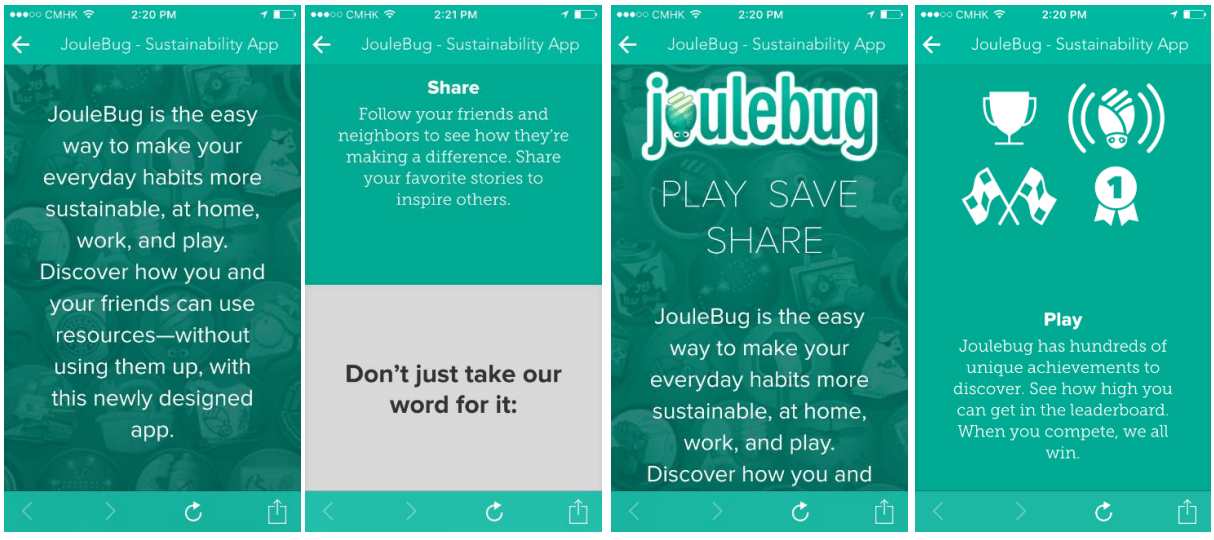

Figure 3.4 Introductory messages from JouleBug to its participants. Source: JouleBug iPhone app.

3.1.1 Impact

JouleBug claims that on an average its users save US $200 a year through all their sustainable actions (JouleBug, 2015). ICubed, a KPIT company that implemented the JouleBug challenge across its organization, found it very effective. JouleBug succeeded in building a culture within the organization that deeply embraced sustainability. The JouleBug challenge brought fun and excitement to the employees, and encouraged them to learn sustainable practices in a playful way Grossberg et al., 2015. It not only brought benefits in terms of improving sustainability habits in the work environment, but also improved engagement and interaction between different business areas. The challenge enabled interaction between areas that would not otherwise have interacted with each other (JouleBug, 2015; Grossberg et al., 2015; Kisurina, 2017).

JouleBug also collaborated with the Wesleyan University by introducing a challenge there. Associate Professor Mary Alice Haddad found the JouleBug challenge a positive experience and mentioned, in her feedback, that JouleBug was able to create a community challenge for the university, which focused on sustainable actions applicable to campus life. It created friendly competition, which encouraged the participants to adopt sustainable practices (JouleBug, 2015; Kisurina, 2017). With over eighty participants, including students, staff and faculty members, they completed two challenges in which more than fifteen individuals even reached national standing with a thousand points. The university found JouleBug to be an effective tool in their ongoing efforts to improve campus-wide sustainability (JouleBug, 2015; Grossberg et al., 2015).

3.2 SAINSBURY'S GREENEST GROCER CAMPAIGN

Sainsbury's is the second largest chain of supermarkets in the UK, where they launched the Greenest Grocer Campaign in October 2013. The objective of the

campaign was to raise awareness among the stores' employees and engage them in reducing energy consumption by 3%. Figure 3.5 shows Sainsbury's employee participating in Sainsbury's Greenest Grocer Campaign. With the help of Global Action Plan's team, the company developed an action-oriented campaign that focused on encouraging energy-saving actions among in-store staff members. Stores were engaged in a friendly energy-saving competition, and their comparative performances were communicated across the community on a weekly and monthly basis (Global Action Plan, 2013; Whetter, 2015).

Figure 3.5 Sainsbury's employee participating in Sainsbury's Greenest Grocer Campaign. Source: https://www.globalactionplan.org.uk

Staff members were first trained about specific actions they could take to reduce energy use, and also on the procedures, benefits, and rules of the challenge. During the challenge, the performances of different stores were compared using league tables, which created a friendly rivalry between stores who were competing against each other. During the challenge, monthly events were conducted to further help staff members with specific actions and a variety of prompts in the form of posters and other visual cues were used to help them troubleshoot common operating myths. The programme continuously quantified the impact of actions and communicated the results to the stores, not

only in terms of savings and energy reduction, but also in more understandable terms such as loaves that could be baked and cups of tea that could be prepared (Global Action Plan, 2013; Whetter, 2015).

3.2.1 Impact

The campaign reached all 1,200 stores and engaged over 2000 staff members in the challenge, during which time the programme saw a 3.2% reduction in energy consumption against a 3% target, which means twenty-two million kWh were saved, or almost 9,000 tonnes of CO_2.The programme resulted in savings of £2m. Programme managers reported that this campaign brought about positive change among its employees, and everyone was excited to make a positive environmental impact (Global Action Plan, 2013; Whetter, 2015).

3.3 BIG ENERGY RACE

In 2014, four of Britain's energy companies (British Gas, EDF Energy, Npower, and Green Energy) collaborated to initiate the Big Energy Race. The objective of the programme was to reduce the energy consumption of four thousand households by encouraging them to take simple energy-saving measures in their household routine. These included actions such as turning off the lights, and other appliances, when not in use. A team of community leaders was appointed to talk to the household members and explain the energy-saving actions and rules of the challenge, using their knowledge of the community to promote the programme. An online information hub was also set up for participants, which they could use as a support to find out how to make informed choices about the energy they consume (Global Action Plan, 2015).

This challenge initially encouraged the participants to perform small tasks such as turning off the TV and taking shorter showers. More difficult tasks were

broken down into small achievable steps so that the participants did not have to make major changes in their lifestyle. Teams and communities started working together to achieve the set goals and the game was shown to motivate the communities' teamwork towards common targets, even persuading those who would not otherwise have taken such actions, to join in (Figure 3.6 to 3.9). Based on their comparative performances, participants and teams were rewarded and incentivized in the form of points for every challenge they completed so that, overall, the game-based process made boring tasks such as turning the lights off a lot more fun. In addition to the incentives, a prize of £20k was announced for the winning team to invest in their community. The Big Energy Race triggered fierce competition among communities, with a Lancashire-based community eventually winning the prize (Global Action Plan, 2015).

3.3.1 Impact

On an average, the Big Energy Race saved participants up to £117 each on their energy bills. Overall, the programme saved 484,259 kilowatt hours (kWh) of energy or 239,349kg in CO_2 emissions. The majority of the participants committed themselves to continuing with their energy saving behaviour in future (Global Action Plan, 2015).

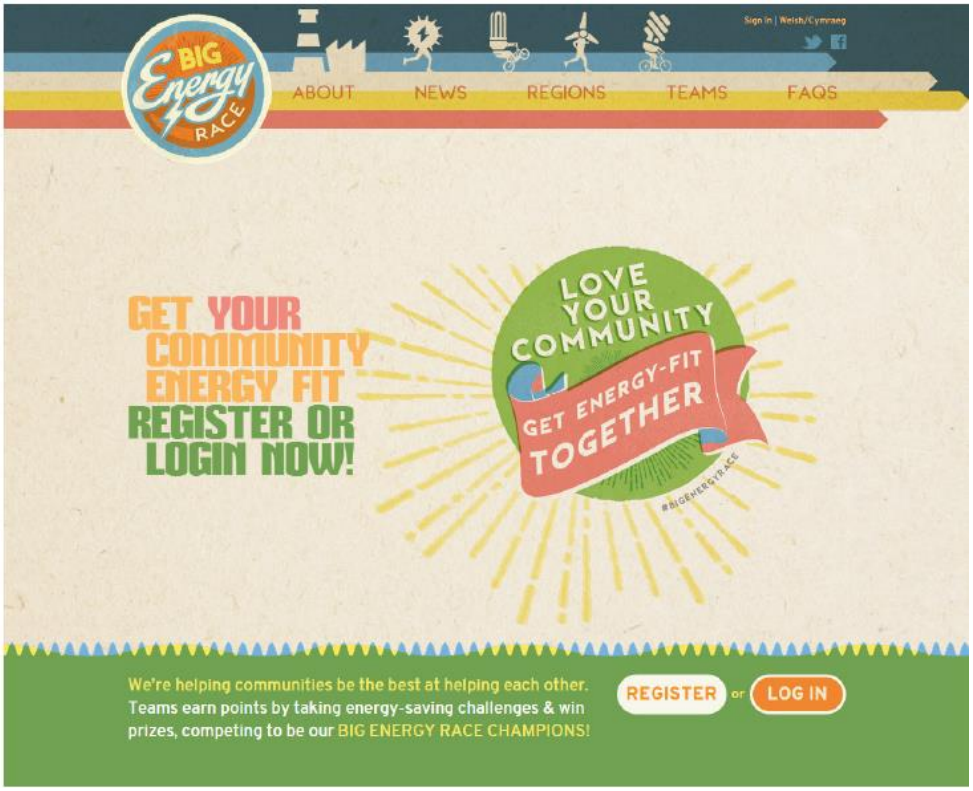

Figure 3. 6 Big Energy Race website screenshot. Source: http://www.bigenergyrace.org/

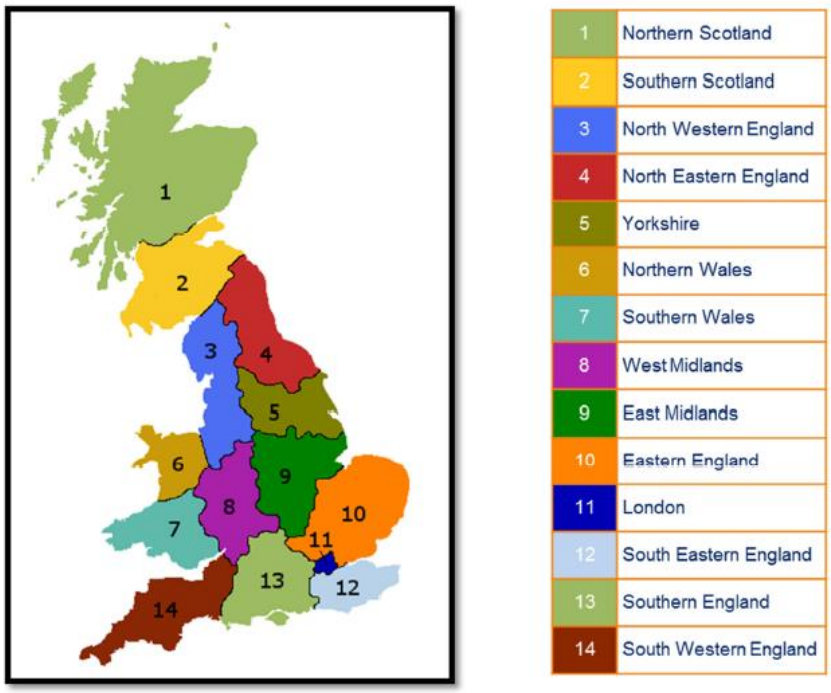

Figure 3.7 Big Energy Race regions across UK. Source: Global Action Plan (2015)

Region	Number of teams
Northern Scotland	4
Southern Scotland	2
North Western England	8
North Eastern England	0
Yorkshire	2
Northern Wales	0
Southern Wales	1
West Midlands	3
East Midlands	6
Eastern England	2
London	4
South Eastern England	2
Southern England	1
South Western England	4

Figure 3.8 Number of teams participating in Big Energy Race. Source: Global Action Plan (2015)

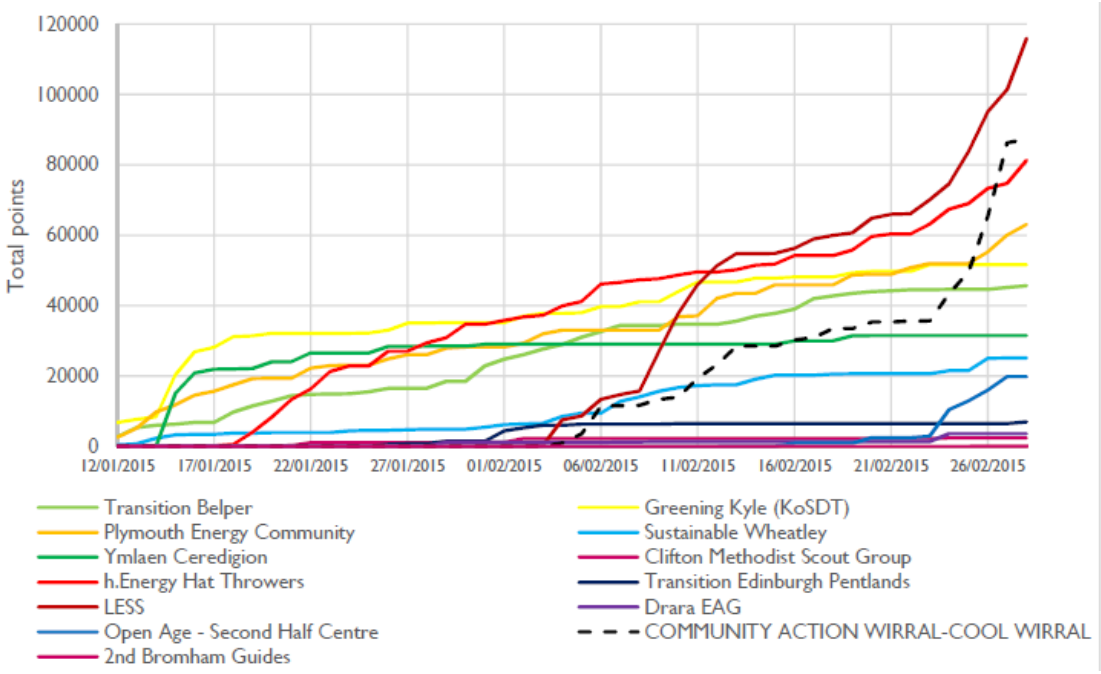

Figure 3.9 Accumulation of points by teams participating in Big Energy Race. Source: Global Action Plan (2015)

3.4 OPERATION TLC

TLC stands for mainly three actions: T-turn off equipment, L-lights out, and C-control temperatures. In 2012, the sustainability team at Barts Health NHS Trust realized that the energy consumption in their hospitals was increasing due to poor staff practices such as improper use of lights, machines and heating equipment. To address this concern, Operation TLC, an award-winning behaviour-change programme was developed by teams from Barts Health Trust and Global Action Plan. The success of the programme meant it was implemented (and still continues) in NHS trusts across the UK. The objective of Operation TLC was to improve staff and patient satisfaction by providing them a comfortable environment, whilst reducing energy consumption within the hospitals, by encouraging more efficient use of heating and lighting equipment. The programme first offered training and education to the staff members, which allowed them to adopt the best actions to reduce energy costs in in their respective areas (Barts Guidebook TLC, 2013; Operation TLC Research Summary, 2015; Ashden Case Study, 2016; Global Action Plan, 2013).

Hundreds of staff members from various departments and wards participated in the programme and were grouped ward-wise into teams, to select the most effectual actions they could practice on their wards. Trusted messengers and leaders such as directors and senior managers were recruited to promote the programme. These trusted messengers inspired their respective team members to adopt suitable energy saving actions on their wards. The senior members of staff also reinforced the programme by featuring in a short three minute film and, additionally, a sustainability team was formed, which conducted several rounds of the wards to encourage actions and troubleshoot problems. Several events and workshops were also conducted, and prompts in the form of posters and stickers were used to remind team-members of their actions (Barts Guidebook TLC, 2013;

Operation TLC Research Summary, 2015; Ashden Case Study, 2016; Global Action Plan, 2013).

Teams competed against each other over managing their wards efficiently and saving energy. Rewards were announced, in the form of 'team of the month' and luxury hampers given to the team members, to engage and motivate competition. Teams that made extra effort in reducing energy consumption were rewarded and team performance compared on a regular basis. Teams which performed well were asked to share their success stories and achievements with others (Barts Guidebook TLC, 2013; Operation TLC Research Summary, 2015; Global Action Plan, 2013).

3.4.1 Impact

The programme caused significant behaviour change in the hospital setting while also improving patients' experience. Operation TLC resulted in financial savings of £500,000 annually, which is approximately 3% reduction on energy bills at Barts Health. This is approximately equivalent to 2,200 tons of CO_2 each year, meaning that Operation TLC delivered long-term cost benefits to the organization (Barts Guidebook TLC, 2013; Operation TLC Research Summary, 2015; Ashden Case Study, 2016; Global Action Plan, 2013). Refer figure 3.10 - 3.11.

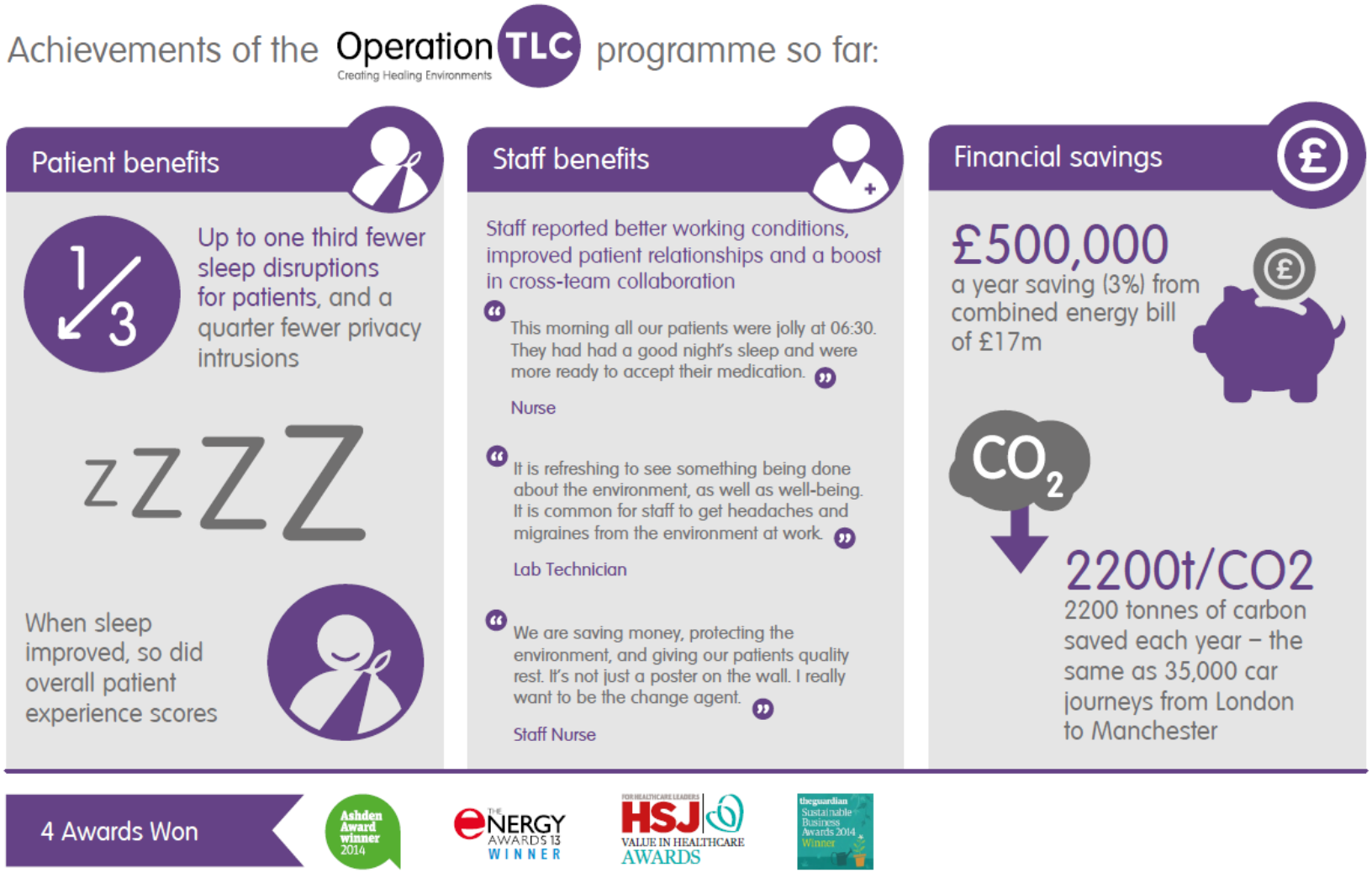

Figure 3.10 Achievements of Operation TLC programme. Source: Ashden Case Study (2016)

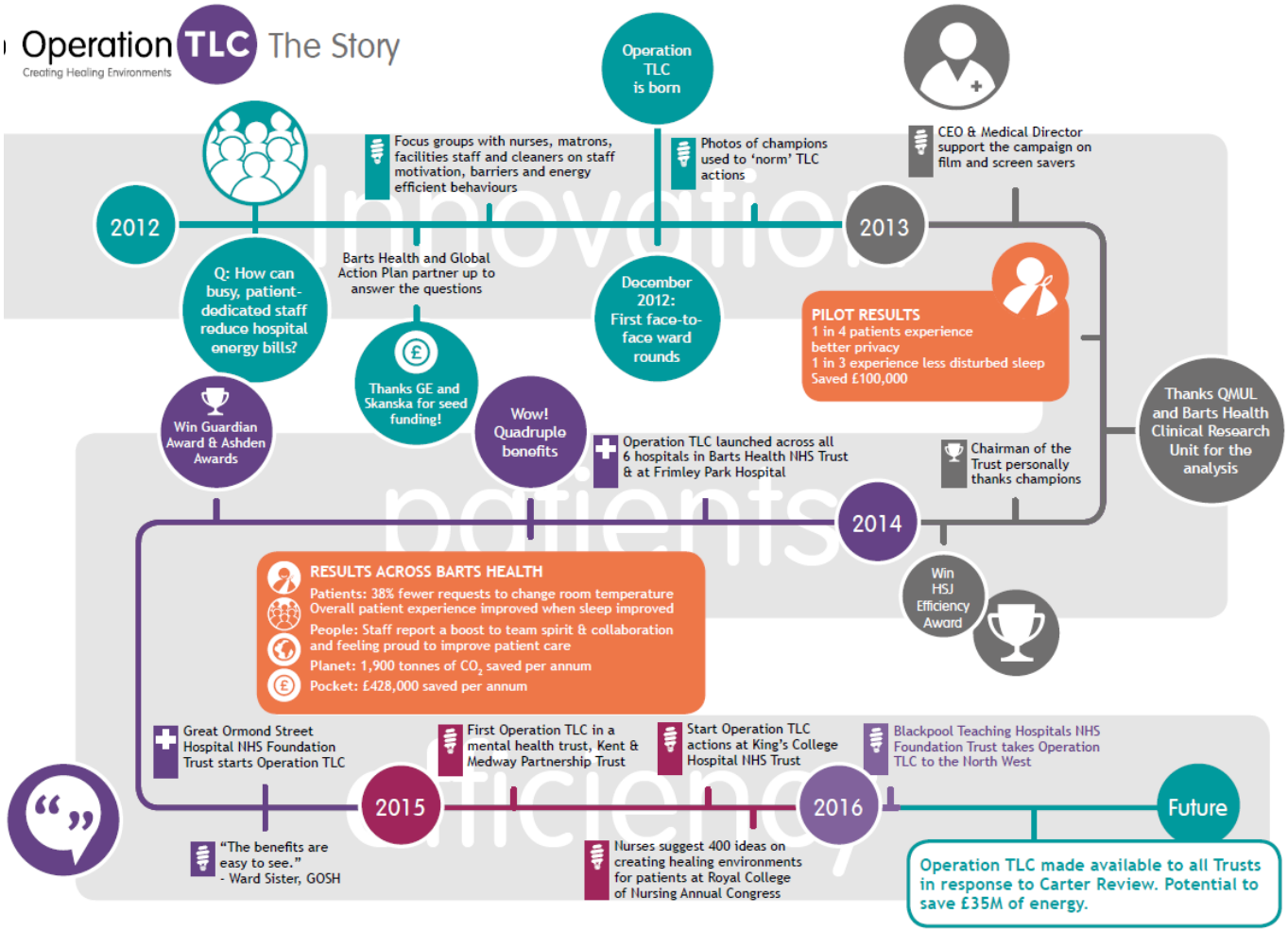

Figure 3.11 Story of Operation TLC programme. Source: Ashden Case

3.5 BIDGELY

Bidgely is an online platform that provides comparisons of a household's energy consumption with that of other homes in the neighbourhood (figure 3.12). It also provides a product-specific and usage-specific breakdown of the information and provides comparative data against the average consumption. This comparative information is communicated through easily understandable visuals in the form of charts and graphs, as well as via persuasive action-oriented messages, which encourage consumers to take immediate actions in order to reduce energy bills (Bidgely, 2015; Chakravarty & Gupta, 2013; Vapenik, Kovalcik, Fecilak, & Jakab, 2015).

Bidgely provides regular feedback that directs the consumers towards particular actions and the time at which these need to be conducted. It also allows consumers to monitor their consumption in real-time, and provides alerts and personalized context-based recommendations to improve performance. Bidgely uses appliance-specific breakdown, performance comparison, persuasive messages, feedback and timely reminders to motivate and engage the consumers. Bidgely claims that its users have seen average reduction of 6% in household energy consumption (Bidgely, 2015; Chakravarty & Gupta, 2013; Vapeník, Kovalcik, Fecilak, & Jakab, 2015).

Figure 3.12 Bidgely mobile app showing energy usage details. Source: Green Button Ontario

3.6 KUKUI CUP

The Kukui Cup was a challenge designed to foster energy conservation and to increase energy literacy (Johnson, 2010; Brewer, 2011; Brewer et al., 2011). The challenge combined a number of elements into an overall game experience. Software was designed to provide an online platform for the Kukui Cup Challenge, containing a list of actions that participants could take in order to reduce energy consumption. The challenge was first introduced in the residence halls of the University of Hawaii, at Manoa campus, in October 2011. Over a thousand residents, grouped into teams, participated in the challenge, and the energy consumption of the teams was monitored using smart meters installed on each floor of the hall of residence. The challenge used elements such as real-time energy feedback, goal-setting and commitments, challenges, competitions and rewards to engage and motivate the participants. It was observed that the best team reduced its energy usage during the challenge by 16% and that the participants' knowledge around the topic of energy consumption increased significantly compared to the non-challenge participants (Johnson, 2010; Brewer, 2011; Brewer et al., 2011; Brewer, Lee, & Johnson, 2011; Johnson et al., 2012; Brewer et al., 2013).

Chapter 4 Research Methodology

This chapter outlines the research strategy, framework, and the methodology adopted in this study. Since this research was qualitative and explorative in nature, it adopted qualitative methods for investigating the questions posed in Chapter 1. This chapter first outlines the structure and framework of the research, which includes the phases and steps involved, overall methodology and methods, as well as how the different phases complemented each other in different ways. It also highlights the epistemological stance and theoretical perspectives adopted in this research, and discusses the reasons behind selecting specific methods for data collection, interpretation and analysis. The chapter goes on to explain how acquiring data from different sources helped in triangulating and validating the findings, which improved the validity and reliability of the research.

4.1 RESEARCH STRUCTURE AND FRAMEWORK

The activities in this research were divided into five stages: 1) background review of behaviour-change approaches for sustainability, 2) research design, 3) literature review, 4) exploration of a wide range of implemented cases of GBCPs, and 5) investigation and analysis of cases. These stages were closely associated with each other as activities performed and data collected at each stage provided useful insights for the next. Although the activities performed at each stage were different, collectively, they all contributed to the research and helped reveal answers to the research questions. Figure 4.1 depicts the research framework.

Research Framework

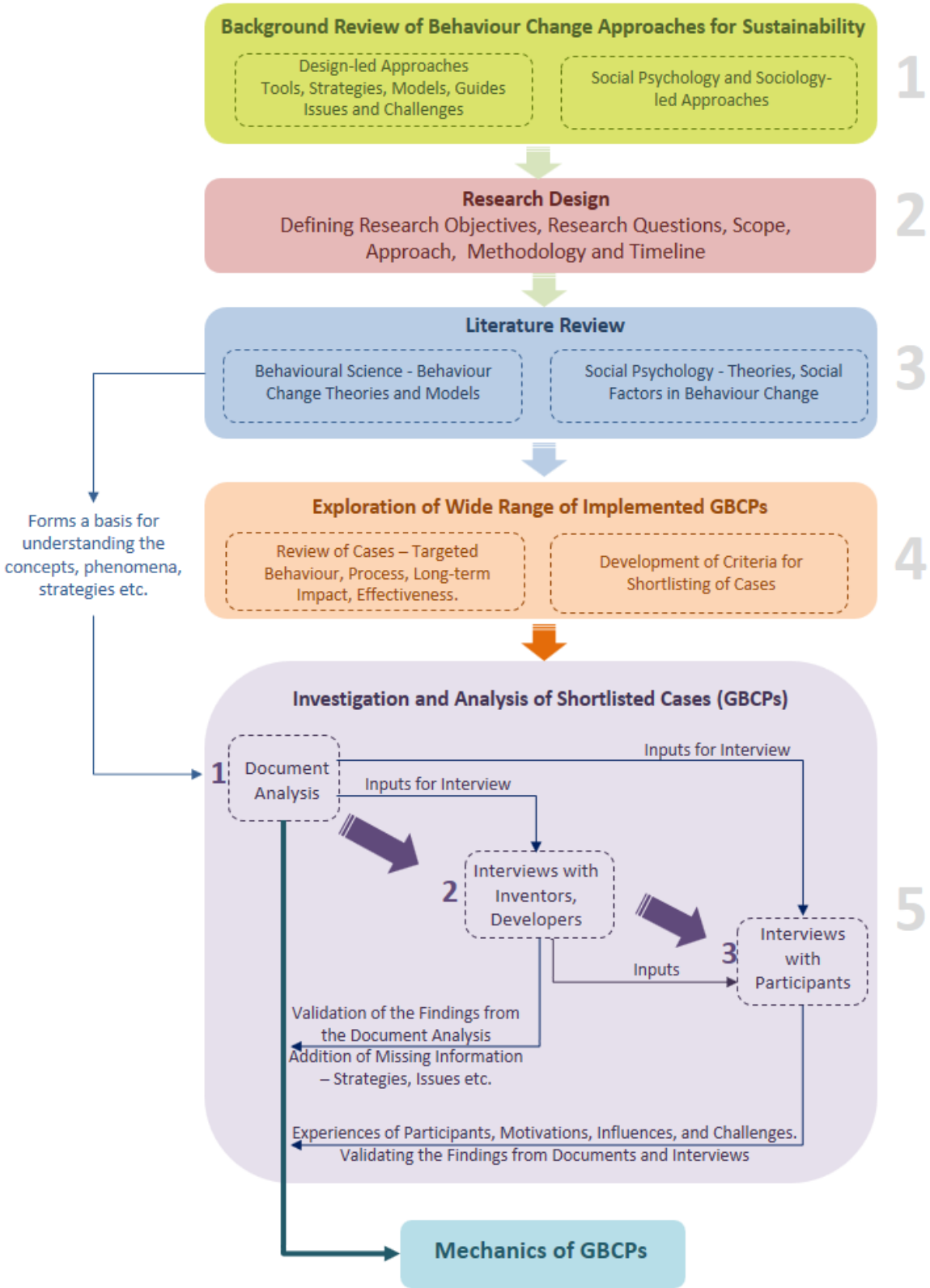

Figure 4. 1 Research framework

The project started with a background review of various behaviour change approaches used for fostering sustainable behaviour. The objective of the background review was to develop an overall understanding of the field in terms of past research, existing approaches, techniques, and their impact on behaviour. The study also focused on understanding the design-led approaches, tools, strategies, and models used by designers to influence behaviour. These design-led approaches and techniques mostly focus on the design of products and their interactions that influence the use behaviour. In addition, several emerging social psychology and sociology-led approaches to behaviour change were reviewed during this phase. These approaches focus more on the social dimension of behaviour change, particularly those that involve the use of social influence. This background review of behaviour-change approaches informed the later stages of the study.

The understanding developed in stage one of the background review helped to clearly define objectives of the research, and provided useful inputs for stage two, which focused on planning research activities, defining clear objectives, questions, and scope for research. The research questions helped in defining the methodology, and steps and methods involved in the research. A detailed plan and timeline of the research was also prepared during this stage.

After defining the clear objectives, questions, and methodology, stage three focused on conducting a study of various behaviour-change theories and models from the fields of behavioural science and social psychology. The objective was to develop an understanding of the theoretical constructs, approaches, motivators, and the role of social factors in behaviour change. This understanding built a foundation for analysing the cases of GBCPs.

Thereafter, in stage four, a wide range of implemented GBCP cases were collected from diverse sectors and reviewed before deciding upon the criteria for shortlisting cases for further investigation. Stage five focused on investigating the four selected cases through three different channels. The study adhered to grounded theory protocols pertaining to data collection and analysis. The methods used for data collection were 1) document analysis, 2) interviews with the founders and 3) interviews with the participants. Over fifty published documents pertaining to these were collected for analysis, including case studies, journal articles, magazines and newspaper articles, resource libraries, training material, business reports, marketing and promotional material, manuals, customer feedback reports, website content, mobile application content, official blogs, policy manuals, strategic plans and structure, posters, brochures, and flyers, and communication between the programmes and participants. To gain insight into the cases, a thorough examination of these documents was conducted using the open and axial coding procedure (Straus & Corbin, 1998).

Document analysis was an explorative phase of the study, which focused on identifying elements concerning phenomena, events, processes and activities that contributed to the process of behaviour change across the observed cases. Findings from the document analysis provided useful inputs for the second line of enquiry, the interviews. Interviews with the founders helped validate findings collected from the documents, and in collecting additional information that had not previously been captured through documents. Interviews provided useful inputs from the perspective of inventors, about issues such as strategies and techniques that did or did not work. Interviews with the participants were equally useful in validating findings from previous sources and capturing the participants' perspective, acquiring information such as their motivation for change, influences, and issues or challenges when using the programme. Overall, different stages in

the research interacted and complemented each other in distinctive ways, so that collecting data from three different sources improved the validity of the study.

4.2 EPISTEMOLOGICAL STANCE AND THEORETICAL PERSPECTIVE

Gray (2013) suggests that the choice of methods should depend upon the research methodology chosen, and the choice of methodology should, in turn, depend upon the theoretical perspective and epistemological stance adopted by the researcher. Crotty (1998) also proposes that there are inter-relationships between the theoretical stance adopted in the research, the methodology, methods, and the epistemology.

This research is inductive in nature. Dewey (1933) defined a general paradigm of enquiry for scientific studies as 1) inductive and 2) deductive. While the deductive approach moves towards hypothesis testing for confirming or refuting a principle, the inductive approach relies upon data collection and analysis to observe emerging patterns for suggesting relationships between variables. The observations can be used for constructing generalizations, and even theories (Gray, 2013). Being inductive, this research adopted the methodology and methods to support this explorative approach.

Besides being inductive, this research is explorative, interpretive and qualitative in nature. The theoretical perspective adopted in this research is interpretivism, which is closely linked to constructivism. Constructivism posits that "*knowledge (truth and meaning) does not exist in some external world, but is created by the subject's interaction with the world*" (Chia, 2002). It holds that subjects can construct their own meaning of a phenomenon in different ways as per their personal interpretation of the phenomenon. Therefore, since the knowledge is based on an individual's interpretation, it can be multiple and contradictory but still valid (Gray, 2013). It also assumes that the researcher cannot separate

himself from what he knows due to the fact that reality cannot be separated from our knowledge; both lie in the same world (Creswell, 2013). Being qualitative in nature, the research is based on this assumption that knowledge is subjective, multiple and constructed by the individual involved in the research situation (Creswell, 2013). Therefore, researcher's clues are inherent in all phases of the research process and cannot be separated, as both lie in the same world.

The epistemology of a study is primarily concerned with the nature and scope of the knowledge, being concerned with its origin and means of acquisition (Zalta, 2003). The knowledge developed in this study takes the form of the mechanics of GBCPs, consisting of key elements (events, activities, strategies, phenomena and processes) of GBCPs. The understanding was derived through systematic and logical interpretations of implemented cases through three different lines of enquiry.

4.3 METHODOLOGY – GROUNDED THEORY

The study was explorative in nature as it intended to identify all incidences, phenomena, activities and events that directly or indirectly influenced the behaviour of the participants across the observed cases of GBCPs. While some of these concepts were quite noticeable, others were less visible and required careful review of each situation and setting, whilst maintaining an open mind. Therefore, the study required an explorative yet methodical way of analysing the implemented cases.

Grounded theory was adopted as the main methodology as well as strategic method in this project to study and analyse the implemented cases. It was used as an overarching methodology to study data from each case study. Grounded

theory is an inductive research approach, which emphasizes the emergence of theory from the "*ground of direct, empirical experience*" (Friedman, 2008). It is commonly used in research to derive common themes from the data. The methodology was originally developed by Glaser and Strauss (1971) and Corbin and Strauss (1990) and involves multiple coding and recoding of data in order to identify common patterns and derive general theory. Grounded theory is a general method of analysis that accepts qualitative, quantitative and hybrid data collected from surveys, interviews and cases (Glaser, 1978). Researchers look for patterns from the data, collected through interviews, documents and observations (Denef, Opperman, & Keyson, 2011).

The research adhered to grounded theory protocols regarding methods for data collection and analysis. However, being interpretive and qualitative in nature, the research relied more on naturalistic methods (Figure 4.2), with the methods used for data collection being as follows:

1. Document analysis
2. Interviews with the founders and inventors
3. Interviews with the participants

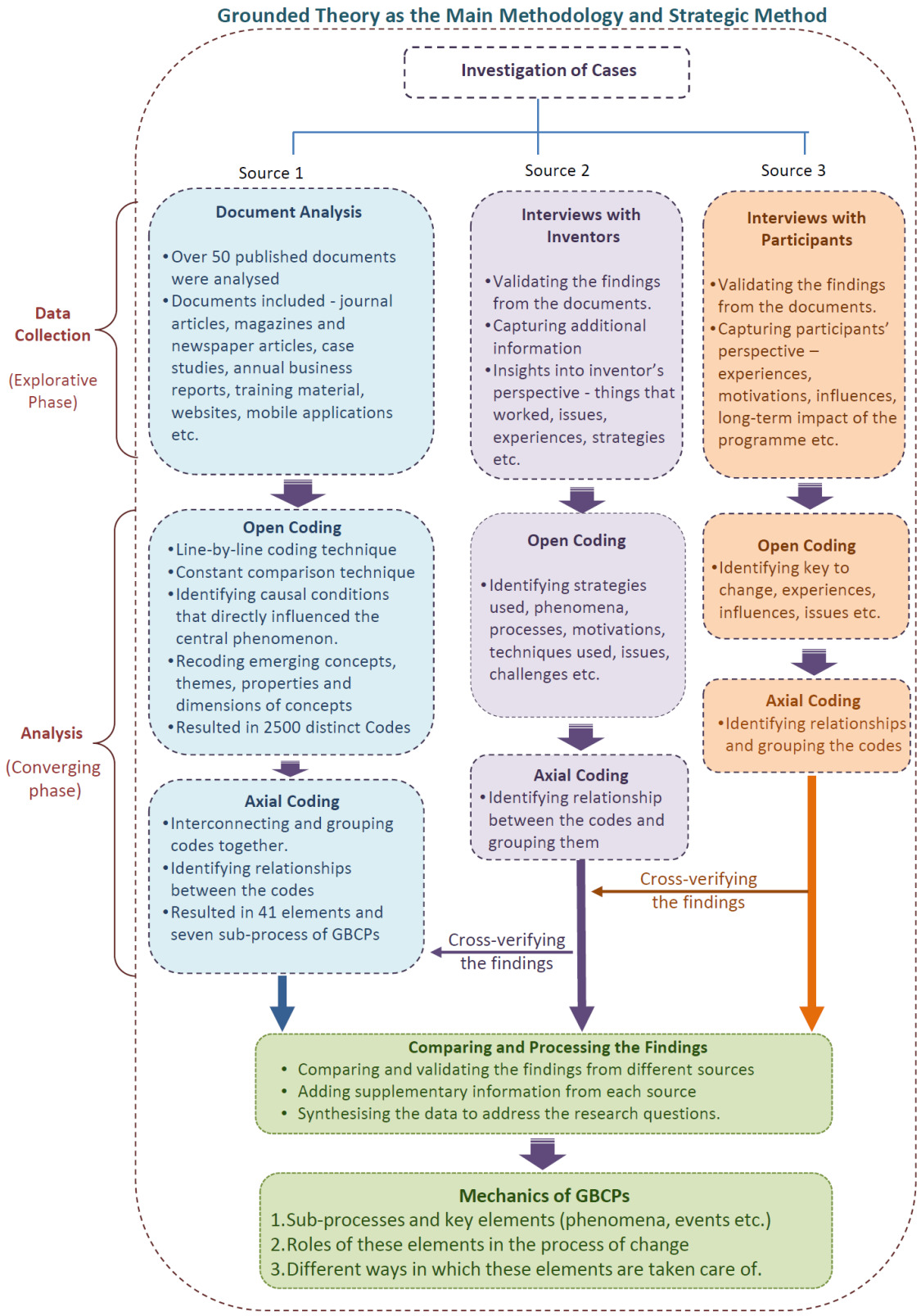

Figure 4.2 Research methodology

4.4 REASONS FOR EMPLOYING GROUNDED THEORY METHODOLOGY

There are several reasons why grounded theory was considered an appropriate approach for this study. Firstly, it provides a technique for controlling biases in the study, a control achieved by using the constant comparison technique (Straus & Corbin, 1998), which requires the researcher to note his assumptions, acknowledge them as data in the form of memos, and compare this with the data captured in the study. The technique also attempts to saturate findings by constantly comparing each emerging concept and code with previous instances, a process of comparing with what has occurred previously and how different that presentation was from this instance. The process requires reviewing, questioning and comparing each code several times, but ensures a reduction of bias-induced distortions in the study.

Grounded theory is commonly used in design research because it is an explorative and flexible approach that allows continuous reframing and re-orientation of research questions and methods as the research progresses. It allows the researcher to align goals and direction as the study evolves and as fresh concepts and themes emerge, which is why it supports studies that require an explorative approach. Lilley (2007) and Tang (2010), who used grounded theory methodology in their research, stated that it provides flexibility for the researcher and enables details to evolve and unfold as the work progresses. This explorative and adaptive nature of grounded theory made it suitable for this project which has required an explorative and open-minded approach to identify the causal factors influencing participant behaviour in different ways. As the research evolved and patterns began to emerge from the analysis, various elements, processes and their roles became clear.

In addition, Grounded theory is particularly considered to be an appropriate strategy when seeking to generate theory grounded in case study data (Orlikowski, 1993; Maznevski, & Chudoba, 2000; Urquhart, 2001; Fernandez, 2004). According to Eisenhardt (1989), generating grounded theory from case study data has three major strengths:

1) Theory building from case studies using a constant comparative method is likely to result in a novel theory. Constant comparative method encourages creative thinking and an open-minded approach, which produces theory with fewer researcher biases.
2) The emergent theory will have a close connection with the case study data, therefore, the theory can be further tested and expanded in subsequent studies.
3) Research validity is relatively high because of the level of validation performed by constant comparison and questioning of data.

The objective of this research was not to produce a single theory, rather to identify causal or contributing factors, such as activities, events, phenomena, processes and motivations, together with their roles. Applying grounded theory to cases study was valuable, as it produced rich and creative data and yielded richness of information. It was an explorative, detailed, and extremely methodical approach, which helped in controlling biases, and was therefore appropriate for identifying patterns from this accumulated data, which demanded an explorative yet methodical approach.

4.5 CRITERIA FOR SELECTION OF CASES

GBCPs are implemented across diverse sectors including entertainment, healthcare, business and sustainability. Based on the scope and objectives of the

study, criteria were defined for shortlisting cases for further investigation. These criteria ensured that the cases being selected would fall within the pre-defined scope of the study, in order to properly answer the research questions. The following criteria were used for selecting cases:

- Since social game-based interventions are applied across diverse sectors, the main objective of the selected programme should be to foster sustainable behaviour and actions. It should target a range of sustainable actions rather than just one. These actions could pertain to waste reduction or minimizing energy, water and fuel consumption.
- Programmes should use elements of game mechanics in the process of behaviour change.
- Since the study focuses on social game-based interventions for behaviour change, selected programmes should target behaviour change within a social group (as opposed to individuals).
- The programme should be action-oriented, which means that it should encourage participants to perform the actions in the real world.
- The programme should be implemented for at least two months, and be effective in encouraging sustainable actions. It should have resulted in savings of at least 2% on utility bills, or claimed (through published reports) to have established a sustainability culture within the social groups concerned.

Based on these criteria, eight cases were shortlisted. But, since the study reached saturation level (following the grounded theory protocols), only four cases were analysed.

4.6 DOCUMENT ANALYSIS

4.6.1 Document Analysis as a Research Method

"*Document analysis is a systematic procedure for reviewing and evaluating documents*" (Bowen, 2009). Document analysis was chosen as the first method of investigation, as documents typically provide unbiased and neutral information about a case (Bowen, 2009). Document analysis requires that the data should be meticulously reviewed and analysed to gain understanding of the concepts involved, extract empirical data and derive meaning (Straus & Corbin, 1998). Document analysis involves evaluation of published documents in printed as well as electronic form and may consist of text or images that have been published without a researcher's intervention. They could also take the form of diaries, journals, event schedule, letters, newspapers, books or brochures. Coffey and Atkinson (1996) suggested that for document analysis, the documents must be published and be 'social facts', meaning that they are shared socially.

Denzien (1970) recommended that a document analysis should be used in combination with other qualitative data collection method, for triangulation, and so, two different sources of evidence and methods contributing to the same study would verify the findings in qualitative research and seek convergence and validation (Denzien, 1970). These supplementary methods may include interviews and observations Yin (1994). Triangulation through a supportive method, along with document analysis, provides a convergence of evidence that supplies greater credibility to the research; by comparing data collected through multiple methods, the biases that exist in a single study are reduced (Eisner, 1997).

4.6.2 Procedure

The objective behind conducting document analysis was to identify multiple causal conditions such as phenomena, incidences, events, processes and activities that contributed to the process of behaviour change across observed cases. Besides this, it aimed to identify the role of these elements and different ways in which they were taken care of across the cases of GBCPs. To study these elements, over fifty published documents pertaining to the cases were identified for analysis, including case studies, journal articles, magazine and newspaper articles, items from resource libraries, training material, business reports, marketing and promotional material, manuals, customer feedback reports, website content, mobile application content, official blogs, policy manuals, strategic plans and structures, posters, brochures, flyers and communications between the programmes and its participants. To gain clear insight into the cases, a thorough examination of these documents was conducted using open and axial coding procedures (Straus & Corbin, 1998).

Document analysis focused on identifying causal conditions that directly persuaded the central phenomenon of behaviour change, or indirectly contributed to the process by enabling an influential social environment, or by assisting with effective functioning and implementation of the programmes. It sought to identify all the elements, identify their types, sub-categories, properties, roles, and the way these elements (causal factors) were taken care of in the process. This process included studying intervening conditions such as prerequisites, steps, situations and application procedure of these causal factors.

4.6.3 Open Coding

In the first phase of analysis, an open coding (Straus & Corbin, 1998) procedure was followed to identify salient categories from the text. It was an explorative

phase in which the procedure was conducted with an open mind to identify categories of information in the documents. A line-by-line coding technique (Straus & Corbin, 1998) was used to identify and apply codes to each line and phenomenon, the idea of this process being to identify and label the specific phenomenon taking place. The process helped identify what was going on in terms of processes, activities, events, incidences, motivations, intentions, even the smallest activity that contributed to the central phenomenon.

A constant comparative approach (Straus & Corbin, 1998) was followed consistently throughout the process of open coding. The objective of using this approach was to attempt to saturate findings by comparing each label with previous instances. During this procedure, the similarities, variations and differences between each emerging concept were carefully observed and compared with previous instances across all cases with consideration and awareness of what had occurred previously and how different it was from this present instance. Each time a new concept emerged, it was compared back against similar codes that had occurred on previous occasions or in other cases, and the process was repeated several times for thoroughness and accuracy. The process was exhaustive and helped ensure consistency in applying codes and reflection on variations and differences between them. During this labelling, comparison and analysis of the text, some questions asked were: who is doing this; when are they doing it; where are they doing it;, what are they doing; how are they doing it; what are they trying to achieve; in what ways is it different from previous instances; how are people responding differently; what happens to beginners, as well as experts, and how do they respond to the programme; how are contextual differences addressed, and how is the system taking care of the diverse participants? Some common themes and categories that started emerging during this stage of research were recorded separately.

After analysing the documents of the first case, the same process was repeated with the second. While analysing the text of the second case, some new information emerged, for example, in the form of incidences, roles and events. With this new information, it was essential to return to the first case and identify if similar incidences had also occurred there, and how they specifically differed from the second. This process of cross-comparison between cases had to be repeated several times to glean maximum information.

The process reached theoretical saturation (Straus & Corbin, 1998) when all variations of concepts had been identified and no new relevant data could be observed. Saturation level was reached during analysis of the third case, which was the stage when the entire data set had been compared, coded and all kinds of concepts and phenomena recorded with no new illumination emerging across the cases, so that all varieties of concept and possibility was exhausted. By this stage, all the elements with their dimensions and properties were well-established and validated. To fully ensure theoretical saturation, documents from the fourth case were also analysed, to observe meticulously if any new insights would emerge.

The process resulted in over one thousand five hundred distinct codes consisting of all causal conditions such as incidences, events, activities, settings, phenomena, processes, strategies and motivations that contributed to the process of behaviour change. The codes also consisted of ways in which these elements were addressed or delivered across the cases, their properties and dimensions, and their corresponding situations, settings, prerequisites and methods of application.

4.6.4 Axial Coding

Once the complete set of codes was received, an axial coding (Strauss & Corbin, 1998) procedure was followed to explore relationships between the codes and to make connections between them. The objective was to see how these codes were related to one another, and how they could be classified and grouped on the basis of underlying phenomena. The complete set of codes was reviewed several times and their relationships, commonalities and themes were identified. Questions asked during this stage were: are similar phenomena occurring in other places or across other cases; how is one phenomenon related to another; does it co-exist in another situation; does it signify a property or dimension of certain key phenomena? Codes were grouped into categories based on the underlying phenomena, themes and similarities. The process produced forty-one categories, referred to as 'elements' that contributed to the process of behaviour change across the studied cases of GBCPs.

The codes under each of these forty-one categories were again grouped into two sets to answer the research questions. These groups were 1) the role that the element plays in behaviour change, and 2) different ways in which the element is being taken care of across the cases. The data was further rearticulated into a more simplified and understandable format in terms of tables and maps (see chapter 5). The entire process was carried out manually and it took almost nine months as the data was immense. The forty-one categories (elements) are as follows:

1. Developing Self-efficacy
2. Developing Empathy towards the Environment
3. Developing a Sense of Commitment to a Programme
4. Removing Barriers

5. Training and Education
6. Benefits (Personal, Social and Environmental)
7. Rewards and Recognition
8. Social Image Concerns
9. Social Pressure
10. Self-identity Concern
11. Compliance with Social Norms
12. Image of a Programme
13. Promotional Activities
14. Formal Association
15. Fun and Excitement
16. Benchmarking
17. Pledge (Commitment in Public)
18. Goals and Targets
19. Engagement (Challenges, Competition and Collaboration)
20. Infrastructure and Resources
21. Persuasive Communication
22. Use of Influential Leaders and Trusted Messengers
23. Framing of Information
24. Quantifying and Smart Processing
25. Flexible and Adaptable Approach
26. Social Proof (Informational Social Influence)
27. Sharing Achievements
28. Events and Meetings
29. Social Interaction
30. Monitoring and Cross-referencing
31. Social Comparison
32. Averting Defection and Handling Discouragement

33. Incubation of Behaviour
34. Positive Feedback
35. Progression Track
36. Prompts, Reminders and Tips
37. Retaining the Programme to Embed the Culture
38. Attention to Inclusiveness
39. Attention to Context
40. Selection and Performability of Desired Behaviour
41. Assessment and Evaluation

4.6.5 Pilot Study

The first document of the first case that was analysed through an open coding procedure was considered to be a pilot study. After generating the codes, the data was reviewed to observe for consistency in the coding process and similarities among the codes. It took some time for the investigator to get used to the constant comparison technique process of constant questioning and line-by-line coding. The codes generated from the first document were categorised using an axial coding procedure. Once the method became stabilized and the researcher was used to the process, the procedure was repeated with other documents. Following a complete analysis procedure on one document during the pilot study, helped correct any processing errors at an early stage.

4.6.6 Theoretical Sampling

Theoretical sampling refers to the process of data collection for generating theory, whereby the researcher collects and analyses the data and then decides what data to collect next in order to develop the theory as it emerges (Glaser & Strauss, 1971). One of the basic questions in the design of case study research is whether it studies a single or multiple cases, so researchers need to determine,

before the start of the study and depending upon the nature of the enquiry, whether it is going to be based on single or multiple cases (Yin, 1994). However, when using a grounded theory approach, this decision cannot be taken at an early stage because it remains unknown, at this point, if the case will result in pattern detection and saturation. Glaser and Strauss (1967) suggested that, in grounded theory, sampling depends upon the emergence of the concept and theoretical saturation, not by design.

This project was intended to identify causal conditions in terms of phenomena, incidences, processes, activities and events across the GBCPs, therefore requiring the investigation of multiple cases to explore these concepts and emerging patterns and meaning that the selection of cases was not a prior determination. Over eight cases of GBCPs were shortlisted for the study, but four cases were analysed one by one. Most elements were identified during investigation of the first case. During the second case study, only a few new concepts emerged. During study of the third and the fourth cases, no new concepts emerged. It was during the study of the third case that the study reached theoretical saturation. This was the time when all the concepts and phenomena had been identified and nothing new was visible. Although the fourth case was from a different context, the causal factors and phenomena throughout were similar to previous cases and no new concept was visible. Although a number of cases were shortlisted on the basis of the established criteria, decisions regarding selection of cases for study were governed by grounded theory protocols. The four cases studied were: 1) JouleBug 2) Big Energy Race 3) Operation TLC Programme, and 4) Sainsbury's UK's Greenest Grocer. Although the objectives of these programmes (cases) were the same, the context of application significantly differed one from another.

4.6.7 Advantages and Limitations of Document Analysis Method

When compared with other qualitative research methods, document analysis has both advantages and limitations (Bowen, 2009). Some of the advantages are as follows:

- Documents are 'unobtrusive' and 'non-reactive' sources, which are unaffected by the research process or by the presence of the researcher (Bowen, 2009). Therefore, document analysis is able to address the problems related to reflexivity, which is commonly observed across other qualitative research methods. Reflexivity refers to the awareness of an investigator's personal biases which tend to influence the study.
- Being non-reactive, makes documents a stable source of information. The researcher's presence does not change the data being analysed and the researcher can always refer them back for review (Merriam, 1998).
- Documents typically provide unbiased and neutral information about a case (Bowen, 2009). Besides this, documents are considered to be precise in explaining a case. Particularly, published documents with inclusion of exact names, references, and details of events make them a useful source through which to analyse a case (Yin, 1994).
- Document analysis is cost-effective and efficient compared to other qualitative methods. The data has already been gathered and it is just a matter of judiciously selecting and analysing the documents (Bowen, 2009). It is also considered an efficient method because it requires data selection, instead of data collection (Bowen, 2009).
- Majority of the documents are easily accessible to public, especially since the arrival of internet, and most are obtainable without the permission of the author or organization. These records also include reports on public events and activities, which may otherwise be difficult to access.

For these reasons, the easy accessibility of data makes document analysis an attractive option among qualitative researchers (Merriam, 1998; Bowen, 2009).

- Documents cover a wide range of information such as activities and events over a long span of time and in many settings (Yin, 1994).

However, document analysis is not always advantageous, as it can have limitations. These are:

- Documents are often prepared for specific purposes rather than research and, as a result, they may not provide sufficient details to answer a research question directly. Therefore, it is recommended that document analysis should be used in combination with another qualitative data collection method for triangulation (Denzien, 1970).
- Since document analysis requires that the data should be meticulously reviewed using questioning and constant comparison techniques, it makes the process time consuming, by requiring the data to be reviewed several times (Strauss & Corbin, 2008).
- Sometimes irretrievability of documents can be a concern as the authors or organizations may decide, deliberately, to block access (Yin, 1994).
- Yin (1994) mentioned that an incomplete selection of documents would suggest 'biased selectivity'. At times, the documents (particularly in the context of organisations or institutes) are likely to be aligned with the policies, brand image and marketing agenda, considerations which tend to make documents biased.

4.7 IN-DEPTH INTERVIEWING

4.7.1 In-depth Interviewing as a Research Method

Qualitative in-depth interview is an approach for collecting information via the sequence of narratives through which people describe their world (Silverman, 2005; Marshall & Rossman, 2014; Hesse-Biber, Nagy, & Leavy, 2010; Taylor, Steven, Bogdan, & DeVault, 2015). In-depth interviewing, also known as unstructured interviewing or qualitative interviewing, is one of the most commonly used methods of qualitative research, in which the researcher asks open-ended questions and records the respondent's answers (Berry, 1999). The method is particularly useful for collecting information pertaining to a respondent's experiences, opinions, values, and views of the subject under study (Crossman, 2013; Aroni & Hays, 2008; Rubin & Rubin, 2011; Darlington & Scott, 2003). It helps the researcher gain a holistic understanding of the respondent's point of view of the situation (Berry, 1999).

In-depth interviews are more like a conversation rather than being based on a predefined set of questions (Marshall & Rossman, 2014). The researcher introduces a few general topics, to help uncover the respondent's views, but the idea is to let the participant's viewpoint on the topic unfold as the participant not the researcher, views it (Marshall & Rossman, 2014; Hesse-Biber et al., 2010; Taylor et al., 2015). Although the research aims to allow a participant to uncover their experiences, a certain degree of systemization and structure may still be required in the questions (Boyce & Neale, 2006). It is recommended that in-depth interviews should be supported by a secondary data collection method for triangulation (Marshall & Rossman, 2014).

The most important aspect of in-depth interview approach is to facilitate it by conveying the attitude that the respondent's experiences and viewpoints are

significantly useful and valuable. Besides this, it is considered essential that the researcher uses appropriate questioning techniques, asking clear, single and open-ended questions; asking about experience and behaviour before requesting opinion; questioning in an appropriate sequence; probing with follow-up questions wherever required, and avoiding sensitive questions (Berry, 1999; Hesse-Biber et al., 2010; Taylor et al., 2015; Minichiello, Aroni, & Hays, 2008; Rubin & Rubin, 2011; Darlington & Scott, 2003; Fielding, 2003). It is also important to establish an easy rapport during the conversation and to make the respondent feel comfortable.

An interviewer is expected to be skilful at personal interaction and possess good listening skills, question-framing skills, as well as an ability to gently probe for elaboration (Marshall & Rossman, 2014). They should be able to uncover the participant's experiences and viewpoints on the events. The key steps involved in conducting an in-depth interviewing are planning the interviews (respondents needed, information required, and background such as ethical standards), developing instruments such as an interview protocol and interview guide; conducting interviews and recording data, analysing data by transcribing it and identifying themes and patterns, and disseminating the findings (Boyce & Neale, 2006).

4.7.2 Procedure

In-depth interview was used as a source of secondary data collection in the project. In-depth interviews were used because they are considered one of the most effective methods of capturing experiences (Fontana & Frey, 1994; Flick, 2009). All interviews were semi-structured, and allowed the interviewees to express their opinion openly. The interviews were conducted with 1) the founders, organizers or managers of the programmes (cases), and 2) the people

who participated in these programmes. The objectives of conducting in-depth interviews were 1) to gain insights on the missing elements, which could not be captured through documents, 2) to cross-verify data collected through documents, and triangulation of data through another source of evidence, and 3) to gain insights into the experiences of the founders and developers of the programmes as well as the participants.

Instruments such as an interview protocol, interview guide, and recording devices were used in the process. The interview guide consisted of a list of questions with starting and ending notes. However, depending upon the flow of the conversation and the answers received, the sequence of the questions was not followed exactly and some questions were skipped. Depending upon the answers given, several follow-up questions were also asked in order to probe into the details. Open-ended and clear questions were asked during the interview and it was kept informal, conversational and flexible, allowing the interviewees to express themselves freely. The duration of the interviews were 40-50 minutes, and the conversations were voice-recorded with prior consent of the interviewees.

4.7.3 Interviews with the Developers

Objective

In-depth interviews were conducted with the developers, founders and organizers of the GBCPs. The objective was to understand various aspects of the programmes that could not be captured through documents. For instance, the impact of the programme in the long run, the nature of feedback from participants, strategies that did or did not work, alterations that organizers had to make in the programme, and the challenges faced by the programme organizers in reaching out and convincing participants. Besides this, the objective

of conducting interviews with the developers was to verify findings from the documents, which included the key elements (processes, activities, phenomena, motivations and events) that played a role in the process of change, and different ways in which these elements were taken care of.

Interview guide and questions

A preliminary draft of the interview guide was prepared, which consisted of questions related to specific GBCPs (cases). The questions covered all relevant aspects of the case, keeping in mind the overall objectives and line of enquiry. The first section of the guide consisted of questions such as what kind of activities and events were initiated by the programme to raise sustainability awareness; what motivated the participants to adopt sustainable actions; how the programme reached out, convinced, engaged and motivated participants; what strategies worked or did not work; what motivated participants to perform sustainable actions consistently over a longer period of time; what were the challenges faced by the programme and how did they overcome those challenges; what kind of feedback was received from participants, and what was the long term impact of the programme? These were open-ended and general questions. It was expected that, while answering, the interviewees would indicate all elements that played the role in the process of behaviour change. It was also expected that, based on the answers received, several follow-up questions would be required to probe into details.

Although it was expected that the answers to the questions would provide adequate details about all the key elements of the process and their role, a second section of the interview guide was also prepared. This section was more flexible, with the questions depending upon answers received from the first section. The questions in the second section enquired specifically about

elements which were captured through documents but not mentioned by the interviewee in their answers. For instance, they covered the role of elements such as social comparison, prompts and reminders in the process, and how these elements were taken care of. It was anticipated that these specific questions would only be asked if the interviewee did not mention an element that had been captured through document analysis. As a precautionary measure, the questions in the interview guide were discussed with fellow researchers to help spot any ambiguity in interpretation.

Sampling

Four developers (one from each programme) were invited to participate in the interview. These were the founders or organizers who had comprehensive knowledge of these cases, so it was anticipated that they would be able to provide in-depth information about various aspects of these cases. It was also anticipated that one interview session would be sufficient, however, if required, a follow-up interview would be scheduled to probe more deeply into certain details.

Pilot study

A pilot interview was conducted with one developer of a programme, using the initial draft of the interview guide. The purpose of this interview was to spot issues with the procedure or questions that could be misunderstood. During the interview, in order to probe into details on some aspects, it was felt necessary to ask the interviewee to state some examples, in particular, examples of how they overcame challenges of keeping participants engaged for a longer period of time. Based on the pilot study, the interview guide was modified and this question was added. No other issues were observed with the questions, which indicated that more pilot interviews would probably not contribute further to

precision of the interview guide, and hence one pilot interview was considered sufficient. However, other minor case-specific alterations in the interview guide were made in subsequent interviews.

4.7.4 Interviews with the Participants

Objective

In-depth interviews were also conducted with the people who participated in the GBCPs, with the objective of understanding aspects of the programmes from the perspective of participants, for instance, motivations, influences, challenges, impact of the programme on their long-term behaviour, and their subjective experiences. The objective was also to understand aspects of the programme which could not be captured through document analysis and to verify findings from the documents.

Interview guide and questions

The preliminary draft of the interview guide consisted of questions such as: what motivated the participant to associate with the programme; what motivated them to adopt and perform sustainable actions; in what ways did they contribute to promoting the programme; what challenges did they face in adopting sustainable actions in their daily routine; which activities, processes, and events kept them engaged throughout the process; what difficulties and challenges did they face in the overall process; what strategies did they use to overcome these challenges; how was their overall experience, and what was the long term impact of the programme on their behaviour? It was expected that while answering these questions the interviewees would indicate all the elements that played a role in the process of behaviour change. However, a second section of the interview guide was also prepared to specifically probe into elements that might have been captured through the documents but not mentioned by the

interviewees. This section of the interview guide was more flexible and the questions depended upon answers received in the first section.

Sampling

The sampling process adhered to grounded theory protocols which insist that the sampling should depend upon the emergence of the concept and theoretical saturation, not upon design (Glaser & Strauss, 1967). Therefore, initially two participants from each case were invited for interview and it was anticipated that sample size may have to be increased if these interviews resulted in new information beyond what had been captured through documents. Convenience sampling (Saunders, Lewis, & Thornhill, 2012) was used, and interviewees were selected on the basis of their convenient accessibility. It was also anticipated that one interview session would be sufficient, however, if required, a follow-up interview would be scheduled to probe into certain details.

Pilot Study

A pilot interview was conducted with one of the participants of GBCPs to spot issues with the procedure and with questions formulated in the interview guide. It was noticed during interview that, some questions had to be skipped whereas, other additional questions were necessary in order to probe specific areas. It was realized that no changes were required in the interview guide which mainly covered a set of general questions, so the same interview guide was used while conducting the other seven interviews.

4.7.5 Analysis of Interview Data

Interview data was collected in the form of voice recordings and then transcribed for analysis. An open and axial coding (Strauss & Corbin, 1998) procedure (explained in section 4.6.3) was followed to analyse this data. The process used

a line-by-line and constant comparison technique (Strauss & Corbin, 1998) during the open coding procedure. While the open coding procedure helped in coding data and identifying various incidences, phenomena, events, processes and activities that contributed to the process of behaviour change, the axial coding procedure helped establish relationships between these codes and developing categories. Analysis of the four interviews with developers and eight interviews with participants revealed useful insights into the cases. The developers and founders of the GBCPs shared their experiences, examples, strategies, elements and, moreover, they provided information some of which was not captured through documents. Chapter 5 provides details of the findings, although it was not possible to generalise from these in-depth interviews because the sample size chosen was small and random sampling was not used. However, interviews provided deeper insights into the cases and supplemented the data collected through other channels.

4.7.6 Advantages and Limitations of In-depth Interview Method

In-depth interviewing method has both advantages and limitations. Some of the advantages of this method are as follows:

- The main advantage is that it provides considerably more detailed information than can be extracted through other data collection methods. It allows the investigator to gather detailed information about a person's preferences, thoughts and behaviour, which are otherwise difficult to capture. The method also has the flexibility to probe more details following a particular insight (Silverman, 2005).
- For respondents, it provides a conversational and relaxed atmosphere in which they feel more able to express thoughts and feelings about their subject, as opposed to filling out a survey (Boyce & Neale, 2006).

- In-depth interviewing is considered a cost-effective method as the interviews can be conducted via telephone or video-calls, using internet.

However, in-depth interviewing method is not always advantageous. There are a few limitations of this method. Some of these are:

- Interviews are based on the assumptions that the respondents' claims are potentially depicting a true picture (Silverman, 2005). Hence, interviews are prone to biases because respondents might want to prove that the programme or the organization is working well due to their stake in the programme or for other reasons (Boyce & Neale, 2006). Interviews can result in biased responses influenced by interviewees providing answers that they think the interviewer wants to hear (Lee, 2000; Boyce, 2006).
- In-depth interview is a time-intensive process, because it requires a substantial investment of time to conduct the interviews, transcribe the data, and analyse the results (Silverman, 2005).
- The process requires interviewer to be trained in certain interviewing skills and techniques, for instance, planning the interviews, making participants' comfortable, listening carefully, asking open-ended questions, framing questions appropriately and probing for elaboration (Lee, 2000).
- Interviews can result in an incomplete collection of data if not captured properly (Lee, 2000; Boyce, 2006). To avoid this, interviews should preferably be audio-recorded. Although the process of transcribing from audio is time-consuming, it ensures complete collection of data (Silverman, 2005).

4.8 COMPARISON OF FINDINGS

When findings from the document analysis and the interviews were compared, it was found that most of the information collected through interview had

already been captured from the analysis of documents. The categories developed from the analysis of documents had already captured the majority of the causal factors (incidences, phenomena, events, activities, motivations and processes) that contribute to the process of behaviour change across the cases of GBCPs. However, the interviews did reveal some new information, which was not captured through documents. This additional information was not in terms of new categories (elements) or concepts but concerned different ways in which these elements were taken care of across the GBCPs. Chapter 5 provides details of different ways in which the elements were taken care of across the cases.

4.9 USE OF EMERGENT TECHNOLOGIES IN RESEARCH

4.9.1 Emergent Technologies

Big Data

Immense data sets of various types and from different sources are increasingly available to the marketers. Such data is increasingly available because more interactions with customers are taking place across various mediums such as mobile devices and online social media, where all interactions and activities can be easily recorded. By spending time online, consumers have become data generators, who are constantly creating content or at least leaving traces (McAfee et al., 2012). Big data generated by consumers can be grouped into two types: 1) *Structured or transactional data* and 2) *Unstructured or behavioural data* (Erevelles, Fukawa, & Swayne, 2016). Businesses utilize both types of data in order to meet their business objectives. There are several defining characteristics of Big Data, such as: 1) it is gigantic – the digital processes make Big Data even bigger; 2) it exists in variety of formats and types, including words, images, video or other non-numeric consumer output; 3) it is unlikely to be in one place; 4) it is not managed through traditional database tools (Paharia, 2013; Hofacker, Malthouse, & Sultan, 2016).

Big data allows businesses to learn about their customers, their behaviour, choices, and expectations. This data has vast applications such as in deciding merchandise layout, promotional strategies and targeted advertisements etc. It also has applications in other functions of the business such as in manufacturing, R&D and Supply Chain Management (Hofacker, Malthouse, & Sultan, 2016). Businesses use Big Data for customer engagement as well as employee engagement. They use it to retain customers, sustain partners and to enhance customer engagement by utilizing different forms of data collection and analysis techniques. They use techniques such as crowd sourcing, sentiment analysis, outlier detection, cohort analysis, cluster analysis, predictive modelling, split testing, and stream processing (Hofacker, Malthouse, & Sultan, 2016). Big Data generated directly from consumer behaviour, particularly through their interaction with the social world, is becoming one of the main influencers of marketing decisions and in the execution of marketing campaigns. By influencing various marketing initiatives, Big Data has transformed the way marketing is conducted today (Erevelles, Fukawa, & Swayne, 2016).

Data Analytics

Data Analytics (also referred as Data Analysis) consists of various qualitative and quantitative techniques, used to analyze behavioural data and patterns when enhancing productivity and business gains (National Research Council, 2012). Data Analytics uses specialized systems and software to examine data sets in order to draw conclusions from the information. Businesses use a variety of Data Analytics techniques and technologies to make more informed corporate decisions, whereas researchers use them to test theories and hypotheses. Various specific applications, such as Business Intelligence (BI), reporting and Online Analytical Processing (OLAP), Advanced Analytics, and Business Analytics fall under the umbrella of Data Analytics. Business Analytics is oriented towards

business uses, whereas Data Analytics has a broader focus (National Research Council, 2012).

4.9.2 Use of Emergent Technologies in GBCPs

With the use of advanced technologies, GBCPs usually have access to large volumetric data generated by the participants. This data includes information shared by participants on social media and the interactions that take place between participants through websites and apps. GBCPs collect both historical data and current data, which is constantly generated during participation in the challenges conducted by the programmes. GBCPs also acquire data pertaining to participants' consumption behaviour from their energy meters, utility bills, and also directly from utility companies. GBCPs additionally collect information about a participant's behaviour and performance from their profile page, recording points and badges earned, challenges undertaken, actions performed, and achievements shared on social media.

Big Data gathered from different sources is subsequently analyzed to generate useful information that benefits the programme. Various Data Analytics tools are used in this process of scrutinizing the data from different perspectives and generating meaningful action-oriented insights. This data is evaluated to assess the programme's impact and determine the most appropriate processes, strategies and activities that can assist its effective functioning and implementation. Such activities will include, promotional campaigns and events, motivational strategies, sustainable actions that can be adopted, strategies for effective participant engagement, processes for amplifying social learning and comparison, and strategies to avoid defection from the programme. Although technologies do not play a direct role in the process of behaviour change across

GBCPs, they do play a significant role in enabling various processes and actions that drive behaviour change.

GBCPs also collect and examine historical data to generate useful information in the form of a progression track. This progression track is made available to the participants in visually comprehensible formats such as graphs, charts, and points. A progression track indicates the participant's development within the programme, depicting how far they have advanced, and how well they have performed in past sustainability challenges. This information is very motivational for both individual participants and teams, as it encourages them to undertake new and more difficult challenges. Big Data and Data Analytics play a key role in acquiring and analyzing information that generates a progression track. They not only help improve the operational efficiency of GBCPs, but also optimize promotional campaigns, extending the programmes' outreach and making them more appropriate to a particular context.

When participants adopt and perform sustainable actions, they earn rewards in the form of points and badges that reflect on their profile page and are also shared on social media. Programmes draw this data from apps and social media websites, and use it in many ways. For instance, GBCPs use Data Analytics tools to determine which sustainable actions are most popular and can easily be adopted by the participants, and which actions are comparatively difficult to perform. This analysis helps the organizers in deciding the actions, simplifying complex actions into smaller steps, and deciding which communication strategies will best help adoption of certain sustainable actions. This analysis also directs GBCPs towards appropriate training programmes for participants. Overall, Data Analytics aids continuous evaluation of actions (desired sustainable actions), and development of actions and challenges suitable to both

context and the participants' abilities. This improves the impact and effectiveness of the programme.

GBCPs further use technologies such as Big Data and Data Analytics to extend the outreach of the programme. For instance, they collect and analyze Big Data pertaining to enrolment rate depending on location, defection rate, and reasons for defection from the programme. Programmes determine their area-specific promotional and communication strategies as well as techniques for minimizing defection rate, all based on this data analysis, which also helps identify the areas with low enrolment rate, so providing useful insights for promotional campaign strategies. If the analysis indicates a lower enrollment rate in a specific region, organizers often recruit local leaders and trusted messengers to promote the programme in that region.

Processes and activities such as social interaction between participants, social comparison and cross- referencing of behaviour play an important role in the process of behaviour change across GBCPs. These activities amplify social learning, trigger competition and communicate social norms (expected behaviour within the group), all of which motivate participants to adopt sustainable actions. GBCPs use Big Data and Data Analytics to analyze how well these activities are functioning and how can they be improved. The programmes continuously collect and analyze Big Data, using it to make ongoing changes that amplify social interaction and learning. For instance, based on analysis, new team engagement strategies, rewards for encouraging social interaction or team meetings and events may be determined. Additionally, the programmes make changes to their engagement models based on such analysis, changing strategies, rules of the challenges, and even defining new engagement

techniques. All these decisions pertaining to ongoing changes rely on the Big Data and Data Analytics.

GBCPs similarly analyze Big Data when evaluating the overall programme effectiveness in terms of its ability to reach out to participants and effectively engage them over a longer period of time, foster a long-term change and make a significant real-world impact. Data Analytics quantify aspects such as the programme's effect on individual behaviours, savings on utility bills and the number of sustainable actions performed. This assessment plays an important role in extending the programme's outreach, particularly when the achievements and real-world impact are communicated to outsiders. To analyze the programme's effectiveness, GBCPs collect Big Data by tracking energy meters, utility bills, rewards earned, and participant performances in sustainability challenges. Thereafter, Data Analytics contributes to decisions about steps to improve, identify and address issues to keep the programme active and engaging, whilst simplifying the process for participants, designing future challenges and addressing matters of usability, technology, interaction, and communication. Besides these functions, continuous collection of context-specific Big Data, and analysis thereof, makes the system intuitive, context-aware and more accurate. It contributes to the programme's contextual appropriateness and suggests tailor-made context-specific actions to the participants dependent on location, climate conditions and usage pattern. It helps in identifying precisely how many resources participants can save based on their observed actions in specific contexts.

4.9.3 Use of Big Data and Data Analytics in this Research

To study the implemented cases of GBCPs, this research collected data from three different sources. These were: published documents pertaining to the

cases; interviews with the organizers; interviews with the participants. This research accessed Big Data, and the results of its analysis appertaining to various aspects of the programmes, through published documents studied through document analysis. These documents included business reports, annual reports, case study reports, websites, apps, journals, magazines, marketing and promotional materials. Big Data, accessed through published documents, included information such as the number of participants associated with the programme, regions to which the participants and teams belonged, types of sustainable actions being performed by participants, rewards and badges earned, achievements shared on social media, total points earned by the teams and cumulatively by all participants, savings on utility bills, energy savings in terms of CO2/ KWH, and the programme's yearly impact.

Big Data provided useful insights pertaining to the cases studied here and on their impact in terms of behaviour change. It helped identify various elements that contributed to the process of behaviour change, the role of these elements in the process of change, and ways in which these elements were applied. For instance, Big Data helped shed light on what actions were more popular and easily adoptable, which marketing and promotional activities were impactful, which type of rewards were more motivating, how social comparisons nudged the participants, and what forms of persuasive communication were more effective. Furthermore, Big Data and Data Analytics aided identification of the level and type of engagement, real-world impact of actions, response to textual and visual persuasive messages, results of the challenges, team-wise performances, progression track of both the participants and the programme itself, as well as the defection rate.

4.10 VALIDITY AND RELIABILITY

Triangulation in collection of data enhanced the validity of the research. Data collected from three different sources helped in justifying both the outcome and the rationale behind the outcome. Internal and external validity was enhanced when the findings collected from different sources were analysed and compared. Besides this, the constant comparison technique used in the analysis process further contributed to validity of the research.

Reliability in this project is primarily concerned with the replicability of the procedure in order to consistently derive the same outcomes. In order to achieve reliability, each step in the study and analysis was broken into explicit components, so that they could be referred back and audited to repeat the same results. These evidences, with logical step-by-step explanations of each event, make the study more reliable. An additional check was that the majority of the data pertaining to cases was collected through documents that could be referred back to and audited with the same results. Moreover, the data collected from the interviews and the entire chain-of-evidences were documented and linked from initial questions to findings.

4.11 STRENGTHS AND LIMITATIONS

The study had both strengths and limitations. The limitations are mainly posed by the methods, procedures and sample size chosen in this study. The first method used for investigating the cases was document analysis, which holds the possibility that the published documents had been produced for specific purposes and with certain intent. For instance, information in the documents could be aligned to a marketing agenda or public image of the programme. Similarly, the interview method used in the study could be considered prone to

bias because respondents tend to speak in favour of programmes they are associated with.

The study was explorative in nature and adopted an exhaustive approach to identify various causal factors and conditions that contribute to the central phenomenon of behaviour change. However, it is possible that some factors or intervening conditions have been overlooked, or have remain unnoticed and could not be captured during analysis. An additional consideration is that since the sample size was small, it is not possible to draw generalizations from the findings. Furthermore, the study examined only specific type of cases of GBCPs, which limits the applicability of the findings as they may not be widely applicable to other contexts or game-based interventions, nor to interventions that focus on encouraging other types of behaviour. The findings from this study are relevant only to social game-based interventions focused on encouraging sustainable actions.

The study also has strengths due to the rigorous approach and the methods adopted. The study analysed published documents when investigating the cases, and these are considered as 'unobtrusive' and 'non-reactive' sources, which are unaffected by the presence of the researcher (Bowen, 2009). Since the data pertaining to the cases was collected through documents, it adds to the reliability and replicability of the research because these published documents can be referred back to and audited with the same results.

In addition, the methods chosen for data collection and analysis provided meaningful and adequate data for answering the research questions effectively. The data was collected from three different lines of enquiry and the findings were compared. The findings from the document analysis were compared with

those from the interviews, which helped validate the findings and add missing information. Triangulation in collection of data enhanced the validity of the research.

4.12 CONCLUDING REMARKS

The chapter has provided a comprehensive description of how the research was conducted including the theoretical stance, methodology adopted, methods and techniques used and strengths and limitations of the methods. It described the overall structure of the study, the strategy adopted, and how various stages of the research complemented each other in the process. The chapter also focused on how the data from three different sources was gathered and analysed, and how the findings from these sources supplemented each other. It highlights the factors that contribute to enhancing the validity and reliability of this research.

Chapter 5 Mechanics of Gamified Behaviour Change Programmes

The chapter is based on analysis of the data captured from four diverse cases of GBCPs. The data was captured through three different sources: 1) documents, 2) interviews with the founders and organizers, and 3) interviews with the participants. This data was analysed to extract answers to the research questions posed in chapter 1, and was further synthesized in a more comprehensible form of tables and figures. The chapter elucidates the results of the study in the form of the mechanics of GBCPs, and explains the causal factors and conditions that contribute to the process of behaviour change across the observed cases. This includes the key elements (incidences, activities, phenomena, processes, events, strategies and motivations) that contributed to the process of behaviour change across the studied cases. The chapter also specifies the role that each of these elements plays in the process of encouraging adoption of sustainable behaviour, and different ways in which each of these elements was taken care of across the studied cases.

5.1 ELEMENTS OF GBCPs

The term 'elements' refers to the causal conditions and factors that contribute to the central phenomenon of behaviour change across the observed cases. The elements include various constituents of GBCPs, such as incidences, phenomena, activities, events, strategies, motivations and processes that play a role in the process of behaviour change, or in effective functioning and implementation of the cases of GBCPs. These elements directly or indirectly contribute to the process of encouraging a positive change in environmental behaviour among the participants.

The analysis of four studied cases of GBCPs produced forty-one categories (Table 5.1), referred to as 'elements'. These elements were an integral part of the process and played multiple roles in the process of behaviour change across the cases. While some of these elements played a more direct role in the process, others played an indirect role by supporting other functions and processes. For instance, 'social interaction' helped in the process of preparing, social learning, motivating, and in communicating social norms to the participants. It also encouraged goal setting and benchmarking amongst participants.

These forty-one elements do not represent sequential steps or procedures of GBCPs, rather, these are incidences, activities, motivations and phenomena that take place simultaneously and their roles overlap. Some events, activities and phenomena take place at specific times (e.g. participants were rewarded after their performances), while others take place constantly throughout the process. Additionally, there are different ways in which these elements are taken care of or addressed across the cases.

Although these elements break the entire process of GBCPs into its individual elements, the overall process remains a complex phenomenon because of the multiple and overlapping roles of the elements and their coinciding occurrences. These elements, their properties and dimensions, overlapping roles, and coinciding occurrences make the mechanics of GBCPs far more than straightforward. Table 5.2 describes each of these elements and their roles in the process of behaviour change across GBCPs.

Table 5.1: Elements of the GBCPs (Sharma & Siu, 2017).

5.2 ROLE OF INDIVIDUAL ELEMENTS IN GBCPs

Table 5.2 provides a comprehensive list of roles that each individual element plays at different stages of the programme. It was observed that each element played multiple roles which coincided with that of other elements. For instance, 'persuasive communication' helps in extending the outreach of the programme, motivating the participants to adopt sustainable actions and in building a

positive image of the programme. It was observed that some elements directly contribute in motivating participants to adopt sustainable actions, whereas, others indirectly contribute to effective functioning and implementation of the programme, or help in creating an influential social environment for behaviour change.

Roles of Individual Elements in the GBCPs

Persuasive Communication

Persuasive communication refers to evidenced-based, logical and convincing communication, which includes – the benefits of associating with the programme, the image of the programme (credible, responsible, well-researched actions), environmental consequences of actions (educational) and benefits of adopting the new behaviour. It also includes communication useful for developing empathy towards the environment, and stimulating action (action-oriented messages, behaviour-based tips, recommendations).

- Essential for extending the outreach of the programmes by motivating outsiders to associate with them
- Contributes to the process of image building in many ways. A positive image reinforces credibility and commitment to a programme.
- Helps to rearrange current beliefs and affirmations
- Helps to stimulate participants to adopt new behaviour and improve performance.
- Call to action (provokes immediate response).
- Essential for retaining longer engagement and averting defection.
- Helps to increase awareness and willingness to contribute to the environment
- Contributes to building up tolerance and empathy for the environment.
- Involved in conveying the image of a programme to participants and outsiders
- Communications such as behaviour-based tips and recommendations help participants to incorporate actions into their daily routines.
- *Keeps participants updated with new research, programme effects, results, etc.*
- *Example: Big Energy Race used persuasive communication as a technique throughout the process. It helped in many ways, such as in extending the outreach of the programme, building a positive image, stimulating*

participants to adopt sustainable actions, and in encouraging the participants to perform consistently.

Events and Meetings

- Promotional events play a role in extending the outreach of a programme.
- Provide a social interaction platform for participants to learn and monitor each other's progress and set new benchmarks.
- Participants learn new strategies to incorporate actions into their routines and earn more rewards.
- Help to communicate and establish social norms (expected behaviour in the group), which builds up social pressure.
- Meetings help to define roles and responsibilities for participant / team members.
- Provide a platform for educating participants and outsiders on sustainable actions and raising awareness.
- Reinforce social integrity among community members as they form similar opinions and views through social interaction and sharing.
- Trigger competition and social comparison, thereby motivating participants to perform better.
- Events for celebrating success and rewarding participants make the process lively and interesting.
- Events/activities such as the 'action of the week' encourage participants to focus more on a particular action.
- Motivate participants to set new benchmarks.
- Avert defection by re-engaging participants if they become inactive.
- Top performers are recognized and rewarded in public events, enhancing their social image and inspiring others to perform.
- *Example - JouleBug encouraged its participants to organize various group activities and events such as - weekend cycling, food and drink etc. These events improved social interaction among the participants and made the process more lively and exciting.*

Social Interaction

- Helps to communicate and establish social norms (expected behaviour in the group).
- Social media posts spread sustainability awareness and motivate learning and adoption of new behaviour.
- Triggers competition and social comparison, thereby motivating participants to perform better than others.

- Helps to build up social pressure.
- Participants learn from each other regarding the actions they can take.
- Reminds participants of the best actions to take at an appropriate time.
- Reinforces social integrity among community members, who form similar opinions and views when they socially interact and share.
- Motivates participants to set new benchmarks.
- *Example: Big Energy Race organized various events and meetings in which the participants interacted with each other. Participants shared their strategies, learnt from best practices, formed positive opinions and views about the programme, and benchmarked performances. Social interaction also helped in communicating the expected behaviour (social norms) and in encouraging the participants to perform well for the team.*

Sharing Achievements

- Intensifies the spread of the network when achievements are shared with outsiders. Encourages outsiders to associate with a programme.
- Sharing achievements with outsiders helps to build the image of the brand.
- Sharing achievements with a social group enhances the social image of the participants, one of the key motivations to perform.
- Sharing actions and achievements on social media raises awareness of sustainable actions and their environmental impact.
- *Example: JouleBug rewarded its participants for sharing their achievements (environmental impact), photo-in-action, and comments on social media. When participants shared their achievements, it inspired others to join the programme.*

Developing Self-efficacy

- Reinforces self-confidence among participants in terms of their ability to perform desired actions efficiently.
- Rearranges current beliefs in terms of ability to complete tasks and reach goals.
- Encourages participants to undertake more difficult challenges.
- Retains longer engagement and averts defection.
- Encourages participants to become leaders and ambassadors of a programme.
- *Example: To reinforce self-confidence among the participants, Sainsbury's communicated to its participants that - actions are easy to perform, difficult actions can be performed by breaking them down into smaller steps, and even small actions can make a big difference to the energy bills. Once participants gained self-confidence in terms of their*

ability to perform the desired actions efficiently, their performance improved significantly.

Developing Empathy for the Environment

- Makes participants more conscious of the environmental impact of their routine actions.
- Stimulates learning and adoption of sustainable actions.
- Triggers commitment to a programme.
- Encourages participants to spread sustainability culture by extending the outreach of a programme.
- Retains longer engagement and averts defection.
- Increases willingness to contribute to the environment.
- *Example: Operation TLC Programme educated its participants on consequences of day-to-day actions on environment. It developed empathy for the environment, made the participants conscious of their actions, and increased willingness to contribute to the environment.*

Developing a Sense of Commitment to a Programme

- Stimulates active participation and adoption of desired behaviour**.**
- Encourages participants to extend the outreach of a programme.
- Brings a sense of ownership of and responsibility to the team.
- Retains longer engagement and averts defection.
- Encourages participants to become leaders and ambassadors of a programme.
- Committed participants perform consistently, which adds to the image and credibility of a programme.
- Committed participants set new performance benchmarks that inspire others.
- Participants actively spread the positive image of a programme on social media.
- *Example: Big Energy Race, through various strategies, tried to develop a sense of commitment to the program. Committed participants performed consistently, which added to the image and credibility of the programme. Committed participants became leaders and ambassadors and helped in extending the outreach of the programme*

Infrastructure and Resources

- Participants are given necessary infrastructure to perform the desired behaviour.
- Facilitate a communication platform between a programme and participants.

- Facilitate a social environment for influencing and incubating behaviour.
- Facilitate a close-knit network where diversely located participants can socially interact.
- Facilitate various processes and activities such as preparation, education, communication, monitoring, engagement, competition, social comparison, evaluation, quantification and evaluation.
- Facilitate collection and processing of information such as effects, social comparisons and progression tracks. Translate data into an understandable format.
- Play a key role in promotion of a programme, particularly through participants sharing their performance on social media.
- Useful in reminding participants of desired behaviour through notifications, messages, reminders, prompts, etc.
- *Example: In Greenest Grocer Campaign, Sainsbury's provided all necessary infrastructure and resources to the participants. This included a list of sustainable actions, information brochure, prompts, reminders, tips, rewards, and comparative scores through leaderboards. This made it easier for the participants to adopt and perform the new behaviour.*

Assessment and Evaluation

- Regular assessment helps to evaluate the effectiveness of a programme and decide on steps to improve it.
- Evaluation helps to identify and address issues to keep a programme active and engaging.
- Constant evaluation and improvement in a programme also help to simplify the process for participants.
- Assessment of the results of challenges provides useful insights for designing future challenges.
- Help to identify what is/is not working in a programme and issues that require immediate attention.
- Help to identify and address issues related to system usability, technology, competitions and challenges, engagement, motivation, social interaction, information communication, preparation and performance of actions.
- Success of a programme in fostering a positive change in environmental behaviour can be evaluated along with its influence in the long run.
- Provide insights for designing new events and activities to improve social interaction and expand the social aspect of the game.
- *Example: JouleBug conducts quarterly and yearly assessment to evaluate the overall impact of the programme. Based on the results of assessment, it makes several changes in the programme to make it more effective.*

Quantifying and Smart Processing

- Continuous collection and processing of contextual information makes the system intuitive, context-aware (smart) and more accurate, which adds to its credibility.
- Provide context-specific actions and recommendations to the participants (considering location, weather, usage, utility rates, habits, etc.).
- Suggest to participants how much they can actually save based on their context.
- Make effect calculations more accurate.
- Reporting the real-world effects of actions in terms of savings (by directly syncing to utility bills) makes participants believe in their actions and motivates them to perform certain actions again.
- Help to improve a programme by delivering insights into the most preferred and effective actions.
- Quantify the performance of individual participants and a programme.
- Help in tracking the progression of a programme.
- Quantify the effect of each action and help to communicate the anticipated effect to new participants, encouraging them to adopt those actions.
- Knowing that the system quantifies and processes actions, effects and rewards accurately makes it more credible, which encourages people to associate with it.
- Analysis helps to understand the effects of actions.
- Help in acute analysis of comparative performance and rewards, the key motivators in the process.
- Measure and analyse user engagement and commitment through social interactions, comments, sharing of photographs, etc. This helps to improve engagement activities, which play a key role in the process.
- *Example: JouleBug collects, quantifies, and processes information related to context (usage, utility rates, location, weather etc.), impact of actions, savings, and performance. This helps in improving the programme by delivering insights into the most preferred and effective actions.*

Use of Influential Leaders and Trusted Messengers

- Trusted messengers, influencers or leaders are the carriers of the brand. They play a key role in extending the outreach of a programme. They inspire people to associate with a programme.
- Plays a role in educating participants and teams.
- Leaders are effective and encourage participants to perform desired behaviour. Leaders also organize events and meetings to ensure the performance of participants and teams.

- Encourages participants to perform well so that they can be leaders and carriers of a programme.
- Leaders/trusted messengers help to build and spread the credible image of a programme.
- Participants choose to become carriers of a programme to enhance their social image.
- *Example: In Big Energy Race, leaders and trusted messengers played a key role. They helped in recruiting the participants, organizing events to promote the programme, organizing regular team meetings that kept the participants engaged and motivated throughout the programme.*

Flexible and Adaptable Approach

- Altering a programme and strategies according to situation, capacity and context makes the programme more effective.
- Customizing and syncing with a particular context (work, home, university, etc.) make a programme implementable and the desired behaviour achievable.
- Adaptability and customizability make a programme fit into a current context without demanding a major change.
- Constantly learning and adapting to a context gradually improves a programme.
- When a programme adapts itself to a current context such that it does not require too much of a deviation in routine, it is easier for participants to perform the actions.
- An adaptable approach prepares a programme to accommodate diverse users (e.g., late joiners, individuals, groups, experts, beginners) and make adjustments according to the context.
- Participants can be re-energized through intermediate rewards and activities if they become less active.
- *Example: Big Energy Race made several changes in its challenges and strategies according to the context, situation, and the ability of the participants. This made it easier for the participants to perform the actions, and the programme was able to accommodate diverse users. This gradually improved the programme.*

Removing Barriers

- Improves the ability of participants to adopt and perform sustainable actions.
- Helps ensure longer and active engagement throughout the process.
- By removing barriers, a programme brings all participants to one level, where they can actively compete and perform.

- Providing required infrastructure, tools and technology platforms improves the efficiency with which desired behaviour is performed.
- *Example: Operation TLC Programme conducted initial study to identify barriers that can hinder performance. It then provided required infrastructure, tools and information, which engaged the participants effectively and improved the efficiency with which desired behaviour could be performed.*

Attention to Inclusiveness

- Helps to include and effectively engage all participants irrespective of diversities.
- Helps to provide a platform where diverse (geographically, culturally) participants can interact, compete and be influenced.
- Helps to conceptualize competitions and challenges that are suitable for all (including beginners and experts).
- Helps to decide on actions that are suitable for all participants across different levels of expertise.
- Helps to establish a platform for communication and interaction between participants who are located far apart.
- Helps to make the process suitable for all so that participants remain associated and perform desired behaviour for a longer period.
- *Example: To include and effectively engage all participants irrespective of diversities and different levels of expertise, Big Energy Race designed variety of challenges (with varying difficulty level). They designed local community level challenges for beginners whereas national level challenges for experts.*

Attention to Context

- Improves the effectiveness of a programme by taking contextual factors into consideration. Shapes a programme to suit a context.
- Helps to conceptualize appropriate competitions and challenges that are most suitable for a particular context.
- Helps to decide appropriate actions that can easily be performed in a particular context, considering the current routine, structure and availability of tools and technology.
- Helps to decide on the key motivations and rewards that can encourage users to perform.
- Helps to make a task easy and achievable for participants without demanding a major change in their current routines.
- Helps to implement a programme effectively without demanding a major change in the current system.
- Helps to effectively use the current system's structure and hierarchy and embed a programme in the system.

- Helps to accurately quantify efforts and their effect while considering the contextual factors (work, home, square footage, weather conditions, etc.)
- Helps to provide accurate context-specific recommendations and feedback to participants.
- Programmes taking contextual factors into account are able to embed new culture in current systems without a major investment.
- *Example: Sainsbury's identified a list of sustainable actions and challenges considering the limitations of their stores and availability of tools and technology. This shaped their programme to suit the context.*

Prompts, Reminders and Tips

- Calls to action (provoke immediate response).
- Constantly remind participants of specific actions they must take.
- Timely reminders/alerts inform participants of exactly when actions must be performed to ensure their behaviour is performed repeatedly and their performance improves.
- Personalized tips (based on past behaviour and context) escalate performance and help participants incorporate actions into their daily routines.
- Help participants to gain trust in a programme and feel as though their actions are valuable and they are being observed. Participants act more responsibly as a result.
- Along with notifications, ensure that desired behaviour is repeated consistently.
- Notifications, reminders and messages sent by fellow participants intensify social interaction.
- *Example: Operation TLC Programme used wall posters consisting of specific actions the participants can take in their wards. These posters worked as prompts and constantly reminded participants of specific actions they must take.*

Averting Defection and Handling Discouragement

- Keep participants active throughout the process.
- Avert disengagement/defection with a programme.
- Longer and active engagement ensures the likelihood of continued behaviour in the future.
- Deal with discouragement, failure and setbacks to make participants active in a programme.
- *Example: To re-energise the participants and to keep them actively involved in the process, Big Energy Race organized various activities, events, meetings and even introduced surprize rewards in the process.*

Retaining a Programme to Embed a Culture

- Retaining a programme helps to embed a culture within a social group/organization over the long term.
- Actions performed consistently over a long period replace old habitual (unsustainable) behaviour.
- Once a culture is embedded within a social group/organization, it is sustained over a longer period, as new participants also tend to comply with it. It becomes easier to convince new participants to do so.
- Positive change inspires others to adopt similar cultures within their social groups/organizations.
- Once a culture is created in a social group/organization, it becomes easier to sustain.
- *Example: Sainsbury's shared the success stories of the programme with its participants. This earned trust, encouraged the participants to perform consistently, and therefore helped in retaining the programme. Actions performed consistently over the long term replaced old habitual (unsustainable) behaviour and embedded a culture of sustainability within the stores.*

Incubation of Behaviour

- Transforms a beginner into an expert at performing the desired behaviour.
- Escalates performance by emphasizing the adoption of more difficult actions and challenges.
- Sustainable behaviour gradually becomes a part of one's routine.
- Prepares participants to perform more complex sustainable actions and address more complex challenges.
- Retains engagement and motivates participants to perform consistently.
- Actions performed consistently over a long period replace old habitual (unsustainable) behaviour.
- Nurtures a culture (sustainability) within a social group/organization.
- *Example: JouleBug's challenges and reward systems are designed in a way such that they encourage the participants to perform actions consistently (repeatedly) for a certain duration. This transforms a beginner into an expert at performing the desired behaviour, and sustainable behaviour gradually becomes a part of one's routine.*

Image of Programme

Type of image brands try to project: credible, playful, entertaining, forward thinking, youthful/young (youngsters participating in and liking the programme), smart and updated, technologically advanced,

friendly, environmentally aware and conscious, valuing each participant and in line with the new catching-up trend, i.e., sustainability.

- A positive image helps a programme to extend its outreach. Participants are motivated to associate with a programme that has an image of being 'playful', 'credible', 'environmentally concerned' and 'forward thinking'.
- A positive image helps a programme to bring a sense of pride and self-esteem to participants.
- A credible image strengthens faith and confidence in and commitment to a programme.
- A positive image helps a programme to inspire participants to become leaders, trusted messengers and promoters of the brand.
- *Example: JouleBug regularly conducts research to assess the overall impact of the programme on environment and also on participants' behaviour. It highlights these results in its communications to build a positive image of the programme. This helps in extending the outreach of the programme.*

Social Image Concerns

Type of associated social image: responsible, environmentally aware, environmentally concerned consumer, best performer, inspiring figure, sustainability ambassador, smart in saving money, updated on latest trends (as sustainability is the new trend), forward thinking and technologically smart and updated.

- Social image concerns are among the key motivators for adopting desired behaviour.
- Serve as mechanisms to leverage performance.
- A participant's enhanced social image inspires others to follow the same path.
- Anticipated social image and recognition are among the key motivators for association and help to extend the outreach of a programme.
- Make participants learn desired actions proactively.
- Motivate participants to perform better to surpass their own previous performance. Participants take actions to retain a certain status, such as that of 'top performer'.
- Nudge non-performers (participants who would not perform otherwise) to adopt certain basic actions at least.
- Encourage participants to share achievements with outsiders.
- Build social pressure, which nudges participants to adopt desired behaviour.
- Intensify social interaction between participants (to learn new behaviour and share achievements).
- Motivate participants to perform consistently to retain a certain image and status.

- Positive results of an enhanced social image strengthen commitment to a programme.
- Encourage participants to promote a programme proactively, so that they can be seen as sustainability ambassadors, initiators and inspirers in their social groups.
- Participants associate with a programme and perform (to enhance their social image) so that they can be inspiring figures/sustainability ambassadors in their social groups.
- *Example: Participants of Big Energy Race shared their rewards and achievements on social media with their social group and friends. This enhanced their social image as best performer, inspiring figure and sustainability ambassador. It motivated the participants to perform better to surpass their own previous performance.*

Fun and Excitement

- Make the entire process fun and entertaining.
- Retain longer engagement by keeping participants actively involved throughout the process.
- Playful image of a programme encourages outsiders to associate with it.
- Make the process of learning and performing new behaviour fun.
- *Example: JouleBug announces surprize rewards in the middle of the challenge to make the process exciting and to reenergize the participants.*

Monitoring and Cross-referencing

- Monitoring sparks competition and comparison, which stimulate learning and adoption of new behaviour.
- Allow participants to cross-reference and reflect on their own actions.
- Help in setting new benchmarks and performance targets.
- Retain longer engagement. The visible performance of others motivates participants to perform consistently.
- Help in implicitly communicating and establishing social norms (expected behaviour in a group).
- Build up social pressure.
- *Example: Sainsbury's Greenest Grocer Campaign teams compared and cross-referenced their performances with other teams through comparative charts and leaderboards. This sparked competition and comparison, which stimulated learning and adoption of new behaviour.*

Selection and Performability of Desired Behaviour

- Make actions easy to perform and adoptable in daily routines.
- Make the process hassle-free, such that it requires fewer prerequisites, investments and resources.
- Make the desired behaviour fun and entertaining.
- Make a performance quantifiable, result-oriented and effective.
- Make actions suitable for all participants with different contextual constraints, expertise and capacities to perform.
- Make actions suitable for individuals and groups.
- Improve performability of actions using different technologies, products and models (Windows, Mac, Android, etc.).
- *Example: Organizers of Operation TLC Programme selected (sustainable) actions which can easily be performed by the participants (hospital employees) with available resources and technology. Actions were also simplified and broken down into small steps. All this made the actions easy to perform and adoptable in daily routines.*

Framing of Information

- Strategically framed information is more understandable and motivational.
- Information framed in a motivational way encourages association and helps to spread the outreach of a programme.
- Stimulates adoption of new behaviour.
- Rearranges current beliefs and affirmations related to the importance of actions.
- Provokes immediate response.
- Highlights the importance of small actions by making them look more meaningful and worthy of attention.
- Builds up tolerance and empathy for the environment.
- Helps in building an effective and credible image of the brand (the way results and effects are framed).
- Encourages participants to perform consistently and remain associated.
- *Example: JouleBug showed the (anticipated) cumulative impact of participants' yearly (not monthly or weekly) performance to communicate the importance of small actions. Results strategically framed by JouleBug in yearly terms (big numbers) looked more significant, meaningful, and worthy of attention. It built a positive image and helped in extending the outreach of the programme.*

Social Comparison

- Induces social pressure, which influences participants to learn and adopt new behaviour.

- Performance comparison leads to social image concerns, which nudges participants to perform.
- Intensifies competition, which drives performance.
- Encourages participants to perform desired behaviour consistently.
- Implicitly communicates social norms.
- Intensifies competition, which adds fun to the process.
- Keeps participants engaged throughout the process.
- Performance comparison, scoring and ranking make the process interesting, thereby motivating participants to associate with a programme.
- *Example: Sainsbury's compared the performances and shared comparative data and leaderboards with teams regularly. This social comparison sparked competition and social image concerns, which nudged the participants to perform better.*

Social Pressure

- Nudges participants to change their attitudes, values and behaviour to conform to the behaviour of the group.
- Influences decisions and choices.
- Stimulates learning and adoption of new behaviour to conform to peer pressure.
- Influences participants to perform desired behaviour consistently.
- Motivates participants to engage in team-building and promotional activities.
- Encourages participants to share achievements on social media.
- An increased amount of people conforming to the behaviour of the group helps to strengthen social norms.
- *Example: When JouleBug compared the performances of participants, it indirectly communicated the social norms (expected behaviour within the social group). It stimulated learning and adoption of new behaviour to conform to peer pressure.*

Self-identity Concerns

Type of social identity: belonging to the winning team or being a member of a winning team, a member of a credible programme contributing significantly to the environment, etc.

- Stimulate efforts in favour of a programme. Participants take actions that strengthen and enhance the image of the programme with which they are associated. To improve their self-image, participants enhance the status of the groups to which they belong.
- Key motivators for adopting desired behaviour. Stimulate performance in favour of the teams/groups to which members belong.

- Promote teamwork. Encourage participants to collaborate and work for the benefit of the team, as they feel a sense of pride in belonging to a winning team.
- Help to extend the outreach of a programme and build its image (when participants spread positive word about the programmes with which they are associated).
- Serve as mechanisms to leverage performance.
- Participants make an effort to increase their strength by associating with more people.
- Good performance as a result of self-identity concerns boosts the image of a programme.
- Enhanced self-identity of a participant inspires others to follow the same path.
- Nudge non-performers to adopt certain behaviour in favour of the team/group to which they belong.
- Encourages participants to share achievements with outsiders to communicate their identity.
- Intensify social interaction between participants to help them learn desired actions and behaviour.
- Motivate consistent performance to retain the image/status of a team/programme.
- Improved self-identity strengthens commitment to a programme.
- Reinforce a sense of commitment and belongingness to the programme/team/challenges with which participants are associated.
- *Example: JouleBug created profile page of each participant, which included details such as name, photograph, group/team to which the participant is associated and performance scores. Public profile gave an identity to the participants and sparked a sense of commitment towards the team they were associated with. This stimulated efforts in favour of the programme. To improve their self-image, participants took actions that strengthened and enhanced the image of the programme with which they were associated.*

Compliance with Social Norms
• Indicates socially acceptable behaviour to participants (what to do and what not to do). • Guides and directs behaviour. • Creates social pressure that influences participants to learn about and perform socially acceptable behaviour. • Influences participants to repeat behaviour and perform consistently. • Influences participants to share their achievements on social media and spread the outreach of a programme. • Makes people perform who would not perform otherwise. • Stimulates people to associate with the network.

- *Example: When Big Energy Race compared the performances during various meetings and events, it indirectly communicated the social norms (socially acceptable behaviour) to participants. It created social pressure that influenced participants to learn about and perform socially acceptable behaviour.*

Social Proof

- Positive social proof helps to spread the network and encourages association.
- Reinforces credibility and strengthens faith, confidence and commitment to a programme.
- Enhances the image of a programme.
- Stimulates learning and adoption of new behaviour.
- Amplifies competition.
- Retains engagement throughout the process.
- *Example: Big Energy Race communicated the increased strength (number of engaged participants) of the programme with outsiders. It helped in building a positive image and encouraged outsiders to join the programme.*

Benchmarking

- Amplifies performance and inspires participants to learn about and adopt new behaviour to achieve the level of top performers/set benchmarks.
- Setting new benchmarks one after the other keeps participants engaged.
- Adds fun and excitement to the process.
- Challenges participants to achieve a new (higher) level that they would not try to achieve otherwise.
- Instigates a challenge that inspires participants to make significant changes in their routines to adopt desired behaviour and improve performance.
- Achieving the level of set benchmarks brings a sense of pride and confidence, and enhances participants' social image when their achievements are shared.
- Participants try to perform like leading performers (whom they have benchmarked) so that a programme can also advertise their profile. They can also become inspiring figures, thereby enhancing their social image.
- Allows participants to cross-reference and reflect on their own actions.
- *Example: JouleBug regularly shared the profiles and scores of the top performers, and participants were encouraged to benchmark these performers. Benchmarking amplified performance and inspired*

participants to learn about and adopt new behaviour to achieve the level of top performers/set benchmarks.

Pledge (Commitment in Public)

- Inspires participants to achieve what they have publicly committed to achieve to be consistent with their social image.
- Encourages participants to undertake even more difficult tasks and actions that they would not undertake otherwise.
- Enhances participants' social image, which encourages their further performance and inspires others.
- *Example: JouleBug made pledge, commitments and goals visible to public through the profile page, which also showed the progress. This inspired participants to achieve what they had publicly committed to achieve to be consistent with their social image.*

Goals and Targets

- Goals delineate clear objectives of challenges (e.g., achieving a 3% reduction), thereby guiding the roadmap for action.
- Goals add fun and excitement to the process, which keeps participants engaged and motivated.
- Setting new goals one after the other keeps participants engaged and improves performance.
- Goals provide a clear target, encouraging participants to make additional efforts to achieve them. Goals help participants take their performance to a much higher level that they would not try to achieve otherwise.
- Achieving a goal brings a sense of pride and encourages participants to share their achievements, which in turn promotes their programmes.
- Accomplishing a set goal boosts participants' confidence and inspires them to take on another challenge.
- *Example: Sainsbury's defined clear goals for its teams i.e. 3% reduction in energy consumption. Goals delineated clear objectives of challenges, thereby guided the roadmap for action. Goals also added fun and excitement to the process, which kept participants engaged and motivated.*

Engagement (Challenges, Competition and Collaboration)

- Adds fun and excitement to the overall process and makes the process interesting.
- Challenges and healthy competition motivate outsiders to associate with a programme, thereby helping to scale up and spread the network.
- Motivates participants to learn, adopt and perform desired behaviour to compete with others or win a challenge.

- Levels of challenge and competition keep participants engaged and motivated throughout the process.
- Collaboration escalates the process of interaction between team members.
- Competition escalates the process of monitoring and learning from others.
- Being part of a team or a group encourages participants to perform well for the teams to which they belong.
- Collaboration and teamwork help to establish social norms within a group.
- Active engagement ensures the likelihood of continuation of behaviour in the future.
- *Example: JouleBug's process consist of a series (different levels) of challenges such that there is always another bigger challenge awaiting after the participants had achieved one. This keeps the participants engaged throughout the process and maintains fun and excitement in the process.*

Progression Track

- Its visibility reinforces confidence in one's self and in the system.
- Encourages participants to set new targets and undertake new (more difficult) challenges.
- A positive progress track motivates participants to remain engaged with the solution.
- Positive progress of the brand makes participants feel that their efforts are contributing to the bigger effect and that they are an important part of a big system.
- *Example: Operation TLC Programme regularly communicates the progress of teams and overall results of the programme to its participants. Visibility of progression track reinforces confidence, and makes participants feel that their efforts are contributing to the bigger effect and that they are an important part of a big system.*

Benefits (Personal, Social and Environmental)

- Positive effects of actions intensify the spread of the network.
- Anticipated benefits (personal, social, environmental) motivate participants to associate with a programme and adopt desired behaviour.
- Positive effects add to the image of the brand (credibility). In particular, cumulative yearly results are very effective.
- Effects of actions (savings of money, kWh, CO2, etc.) are useful in tracking one's performance.
- Useful in setting benchmarks and goals.

- Positive effects boost participants' performance, stimulate them to perform again and retain their engagement.
- Results provide a basis for comparing performance and building social pressure.
- Enhance participants' social image when they share positive results on social media.
- Positive environmental impact of actions lends participants a feeling of positive responsible contribution and encourages further performance.
- *Example: Big Energy Race promoted the programme by communicating the anticipated benefits (personal, social, environmental) and rewards. Anticipated benefits motivated the participants to associate with the programme and adopt desired behaviour.*

Rewards and Recognition

- When announced publicly or shared on social media, rewards enhance participants' social image. They are one of the key motivations to learn about and adopt new behaviour and improve performance.
- Participants' social image is enhanced when they are recognized in public, which inspires others to associate with a programme.
- Anticipated rewards help to extend the outreach of a programme.
- Keep participants engaged in the process.
- Rewards add fun and excitement to the process.
- Rewards (points, badges, etc.) form a basis for comparing performance in competition and are useful in tracking performance.
- Useful in setting benchmarks and goals.
- Rewards are a form of positive feedback and appreciation of a performance. They encourage participants to repeat behaviour.
- Rewards and achievements shared on social media motivate others to associate with a programme.
- *Example: Big Energy Race rewarded the participants for learning and performing sustainable actions. When announced publicly or shared on social media, rewards enhanced participants' social image. Rewards and recognition were one of the key motivations to learn about and adopt new behaviour and improve performance.*

Positive Feedback

- Informs how well an action was conducted and the scope for further improvement.
- Motivates participants to perform certain actions again.
- Stimulates participants to perform better than they performed previously and better than others.
- Specific recommendations help participants to scale up their performance.

- Makes participants feel that the system is responsible, watchful and concerned about each individual's performance.
- *Example: JouleBug communicated the immediate positive impact (personal, social and environmental) of actions to its participants. This motivated the participants to perform certain actions again.*

Training and Education

- Stimulate participants to learn to make informed choices.
- Raise awareness of the environmental consequences of daily action.
- Help to actively engage participants throughout the process (information about the system, objectives, process, available actions and the rules of the game).
- Stimulate participants to perform.
- Spark tolerance and empathy for the environment.
- Logical reasoning and evidence strengthen participants' belief in their new behaviour.
- Enable participants by providing knowledge, technology, platforms, etc.
- *Example: Sainsbury's Greenest Grocer Campaign educated new participants on the environmental impact of actions. It also communicated information regarding the system, objectives, process, available actions, and the rules of the game. This sparked tolerance and empathy for the environment and helped in effectively engaging the participants in the process.*

Formal Association

- Sparks a sense of belongingness.
- Adds to social identity, pride and self-esteem.
- Stimulates performance to improve the image of the brand with which they are associated.
- Boosts promotion. Participants become promoters of the brand with which they are associated.
- Increased association enhances the image of the brand and its output.
- *Example: JouleBug encourages its participants to join formally by filling an online profile. The profile consists of information such as name, photograph, challenges, points earned, badges earned etc. This sparks a sense of belongingness, which stimulates performance to improve the image of the programme with which they are associated.*

Promotional Activities

- Increased strength of participants improves the overall effect of a programme.
- Promotion increases the popularity of the brand.
- Add to social proof, making it easy to convince others.

- Motivate and lend a sense of pride to participants.
- *Example: Big Energy Race organized various activities, campaigns and events to promote the programme. Some promotional activities were also carried out by trusted messengers, leaders, influencers and key believers. Promotional activities increased strength and popularity of the programme. Increased strength helped in building a positive image of the programme. It encouraged more people to associate with the programme.*

Table 5.2: Roles of Individual Elements in the GBCPs

5.3 DIFFERENT WAYS IN WHICH THE ELEMENTS ARE ADDRESSED

The second part of the research questions posed in Chapter 1 is related to how these elements are taken care of. In order to understand the mechanics of GBCPs, and how these programmes foster sustainable behaviour, it is also important to understand how these elements are addressed or taken care of. It becomes necessary to understand how these causal conditions and factors are applied, in what situations they are applied, what are their prerequisites, and what are the important considerations while applying them. The objective is to understand how these elements are integrated in GBCPs, what are the important considerations, techniques, strategies, and approaches used to integrate them, and what issues are paid attention to while applying them. One such example is asking how the element 'persuasive communication' might be used in GBCPs, what is the content of the communication, and when was it used? Table 5.3 provides an answer to the second research question. It provides a complete list of all forty-one elements and mentions different ways in which each element is taken care of across the studied cases of GBCPs.

Different ways in which the elements are addressed or delivered

Persuasive Communication
• Persuasive communication is used throughout the process. Convincing logical reasons behind the rightness of actions and choices are repeatedly conveyed to participants. • Communication containing 'anticipated benefits' and 'rewards' is used throughout the process to motivate outsiders to associate with the programme. • Communication containing evidences, past results, success stories and participant experiences is used to convey (credible) images of the brand. • Communication containing strength (number of registered participants) of the programme, yearly savings, actions taken and their environmental impact is used to convey social proof. • Various types of communication are used to appeal to moral, social and environmental responsibility, and to stimulate tolerance and empathy towards the environment. These communications include, for example, evidences and environmental consequences of actions.

- Communication regarding easiness, playfulness and effectiveness of the process are used to promote the programme.
- Communication comprising action-oriented messages, practical measures, behaviour-based tips, timely reminders and recommendations are used to help the participants accommodate actions into daily routine.
- Transparency regarding the objectives of the brand, process and model is maintained in communications.
- A personalized, friendly, creative, playful, memorable and clearly understandable communication style is used throughout. This reflects in text, graphics, colours, design of website, applications etc.
- Various forms of communication are used throughout the process to motivate the participants. They target both extrinsic factors (benefits and rewards) as well as intrinsic values (moral and environmental responsibility). A balance between extrinsic and intrinsic factors is maintained.
- Regular updates are provided to the participants. These communications include new research, new actions, and achievements of the programme Results of challenges are used to update the participants regularly.
- Communication consisting of results, impact of actions and progression track is used to nurture confidence and to nudge the participants.
- Information within all communication is framed in such a way as to be impactful.
- Different types of communication are used throughout the process to keep participants engaged with the programme.
- Channels used for communication are accessible to most participants including websites, mobile applications and face-to-face communication.

Events and Meetings
• Mainly, two types of event are conducted, one with outsiders to promote and extend the outreach of the programme, and the other with the participants. • Events and meetings involve discussion of results and performances, thus providing a social interaction platform for participants to learn and monitor each other's progress and set new benchmarks. They also help communicate social norms and expected behaviour, which builds social pressure. • Events and meetings involve learning new strategies for incorporating new actions into routines and earning more rewards. • Roles and responsibilities for participants or team members are defined in the meetings. • They provide a platform for educating participants and outsiders about sustainable actions, and for raising awareness.

- Events and meetings focus on social interaction and sharing, so reinforcing social integrity among community members and forming similar opinions and views within the group.
- Comparative results are discussed, which triggers competition and social comparison, thereby motivating participants to perform better.
- Events for celebrating success and rewarding participants make the process lively and interesting.
- Events also encourage participants to focus on certain actions. For example, 'action of the week' encourage participants to concentrate on a particular action.
- Meetings also focus on averting defection by re-engaging participants if they become inactive.
- Top performers are recognized and rewarded in public events, which enhances their social image and inspires others.

Social Interaction

- Activities such as peer endorsement, push notifications, comments on actions and performances, events, meetings, and sharing profiles to a public domain are used to escalate social interaction amongst participants.
- Participants are encouraged to interact. They can follow others, comment on their performances and even remind them when actions need to be performed.
- The process of social interaction between participants is simplified.
- Promotional events, weekly and monthly meetings, help escalate social interaction among team members.
- While interacting, participants share new learning, strategies to adopt actions into their daily routine, and strategies to earn more rewards.
- Participants share their performance scores and progression track, which encourages others to set new benchmarks.
- Actions are automatically visible to others, so encouraging them to view, comment and follow.

Sharing Achievements

- By informing about the benefits of sharing, participants are encouraged to share achievements with outsiders.
- Sharing capitalises on a natural sharing instinct and people's obsession with sharing on social media.
- Participants are rewarded for sharing their achievements, writing reports, sharing photographs etc.
- The process of sharing is facilitated by linking websites and apps with social networking platforms.

- Participants share new learning, strategies to adopt actions into their daily routine, and ways to earn more rewards.
- Participants share photographs, comments, feedback and messages on social media to enhance their web presence and social image.
- Milestones and performances are kept private until the participant feels like sharing, so respecting privacy and freedom while sharing on social media.

Developing Self-efficacy

- Communicating to the participants that the challenges are easy and can be completed easily.
- Progression track shows how far participants have come, and the next level of challenges they can undertake.
- Reminding the participants that complex tasks can be broken down into small steps.
- Providing necessary tips and tricks to perform efficiently.
- Conveying that the programme will offer guidance and friendly assistance whenever required.
- Recognizing small efforts to make participants feel the importance of small actions.
- Making the participants reflect on their ability to perform complex challenges.
- Practical measures help participants to accommodate actions into their routine.

Developing Empathy for the Environment

- Persuasive communication is used to develop empathy for the environment, using convincing evidenced-based reasoning behind the rightness of actions or choices and explaining their environmental impact.
- The anticipated annual environmental impact of desired actions is communicated in understandable formats.
- The adverse impact of unsustainable routine actions is communicated in a simple, impactful way, by using analogies such as the number of trees that could be saved or number of houses lit.
- Impact of actions is sometimes communicated using analogy.
- A sense of social (moral) and environmental responsibility is encouraged, to stimulate tolerance and empathy towards the environment.
- The importance of small actions and their impact on the environment is accentuated by showing a region’s collective yearly impact.

Developing a Sense of Commitment to a Programme
• Communicating the big picture and objectives of the overall programme, as in: "We are Sainsbury's and we want to be the UK's greenest grocer". • Educating participants on the importance of small actions and their environmental impact. Also expressing the importance of each individual participant in the programme and the difference that individuals can make collectively. • Conveying a positive (credible) image of the programme by showing its past results, success stories, associated partners, dedicated research team, quantifying mechanism and by communicating the programme's objectives. • Assigning responsibilities to the participants to bring a sense of belonging, commitment and ownership towards the team and the programme. • Encouraging the participants to take ownership, and become leaders and ambassadors of the programme. • Credible evidence showing the overall yearly savings and environmental contribution of the programme. • Transparency is maintained in communication about such objectives as the programme's process and working model. • Using persuasive communication (convincing logical reasoning) to develop a sense of commitment towards the programme. • Communicating the anticipated annual benefits and rewards (personal, social and environmental). • Using social proof by showing the number of participants engaged, their yearly savings, actions taken, and the environmental contribution. • Appeal to moral, social and environmental responsibility to promote tolerance and empathy towards the environment. • Positive communication regarding the overall process, transition and actions helps develop a sense of commitment to the programme. • Communicating the anticipated benefits and rewards, involving fun, entertainment and competition in the process. • Real-world impact of the actions is visible to the participants. • Regular updates are provided on new research, new actions and achievements. • Progression track shows how far the participants have come • Rewarding the participants for their performance, sustainable actions and efforts in promoting the programme.

Infrastructure and Resources

- Necessary infrastructure, such as technology, tools, software, apps, is provided to the participants free of charge.
- During the initial phase, participants are trained in the use of these tools, technology and resources, which includes monitoring the actions, using resources library, viewing others' profile, understanding comparative scores, evaluating impact of actions, interpreting performances and the way the system processes the impact.
- All supporting infrastructure and resources are provided free. They are easy to use and fit into the participant's individual context. Use of these tools and technology is simplified and made hassle-free so that participants can learn easily.
- Most of the tools and technology used, such as mobile phone and internet, are commonly accessible to everyone so that participants do not have to make purchases.

Assessment and Evaluation

- Analysis is conducted at the end of every challenge to evaluate its effectiveness and potential areas of improvement. Factors analysed include results, impact, actions, savings and issues about performing the actions.
- Effectiveness of the programme is evaluated in terms of its ability to reach out to participants, effectively engage them over longer periods, encourage them with the programme and foster a long-term change.
- Surveys and feedback are used to evaluate the impact and effectiveness of the programme in inducing positive change in behaviour and attitude.
- Methods used for evaluating the effectiveness of the programme include: value survey, opening attitude survey, behaviour survey, self-reported impact, narrative evidence, follow-up survey and interviews, as well as feedback from participants and team leaders.
- Before-and-after surveys are conducted to track changes in behaviour and attitude. These help identify what is or is not working and any issues that need to be addressed.
- Evaluations are also carried out regularly during the course of the process.
- Monthly or quarterly evaluation reports reveal the actions that are most and least preferred. They also help identify the challenges faced by participants in adopting desired actions.
- Factors such as numbers of buzzes, amount of sharing on social media, social interaction and actions performed are also taken into consideration while evaluating the programme.

- On the basis of this assessment, changes are made in the programme, for instance, ways of boosting interaction and sharing amongst participants.

Quantifying and Smart Processing
• Programmes gather and process data collected from the user's context on a regular basis. Information collected includes location, utility rates, weather, and usage behaviour (habits). • Contextual factors are taken into account for calculating the anticipated impact. • The immediate and accurate impact of actions is quantified. • Analyses a behaviour pattern and its contextual information, and accordingly recommends appropriate actions for improvement. Some of these are tailor-made (participant-specific) recommendations and not a common formula for everyone. • Reports the real-world impact of actions (in terms of consumption) by directly syncing with utility bills. • Collects and analyses information about communities, teams, participants, buzzes, actions, rewards, badges, usage and social interaction between participants. Insights from the analysis help improve the programme. • Analyses the impact of actions to identify which activities are most effective and generating good savings, and which are the most preferred actions. • Quantifies the impact of individual actions as well as the overall impact of the programme. • In-depth analysis helps communicate the anticipated impact of each action to new users. • Quantifies the actions to determine comparative performances and rewards. • Personalized messages and notifications are sent to participants on the basis of evaluation of the performance. The evaluation process also takes contextual factors into account. • Monthly or quarterly reports are prepared showing a participant's activities. These are useful in assessing the impact of the community and the overall programme, and highlights actions that need more attention. • Impact is shown in understandable form such as graphs, statistics and comparisons. • Measures performances regularly and makes the progression track visible to participants.

Use of Influential Leaders and Trusted Messengers

- Key influential persons such as the dean, senior managers and directors were chosen to introduce programmes to the organization. They promoted the programmes and motivated participants to adopt desired actions**,** becoming the face of the programme in a particular area**.**
- Top performers were recruited as leaders and promoters.
- Programmes consist of a mechanism for identifying the top performers and key believers as potential leaders and promoters of the programme.
- Participants are encouraged to become leaders and carriers of the brand, through messages such as "*Become a leader and lead sustainable actions in your community*".
- Benefits of taking a leading role are communicated to participants by, for instance, associating leadership role with enhanced social image. These benefits encourage participants to become carriers of the programme.
- Leaders have different roles such as, forming the community, organizing events, leading teams, designing challenges, preparing and educating participants and promoting the programme.
- Leaders or influencers are usually the people whom participants trust and listen to. Usually a local person is chosen for this role because they are familiar with the community.
- Leaders can see the overall results, performances and the overall impact of challenges. Accordingly, they can make changes in the challenges and events.
- Leaders design challenges and engage the communities.
- Leaders also address queries and concerns of the participants.
- When a participant performs well, takes ownership of the team or starts playing an active role that is considered a sign of a potential leader.
- Maintaining a credible and trustworthy image of the programme inspires participants to become programme carriers.
- Active participants who promote the programme are also chosen to be future leaders.

Flexible and Adaptable Approach

- Programmes study the context of application and make necessary changes to make the programme suit the context. They also ensure that the programme does not make too many changes in the existing procedures of the context. For example, in a hospital setting, participants and institute should not need to make significant changes in their routine, procedures or system.

- Programmes are constantly evaluated and assessed, with strategies and challenges restructured accordingly to improve their effectiveness.
- Challenges and actions are structured to be performed easily in a particular context.
- A flexible and adaptable approach is followed throughout.
- Accommodating all types of participants, including allowing late-joiners to participate and compete in challenges.
- Allowing some customization in the apps and websites so that teams can add their own logo and local photographs to give personal identity.
- Introducing unplanned events and surprise rewards to add excitement to the process, which re-energizes participants who may have become less active during the long process.
- Constantly updating actions, features and introducing new ways of expanding the social aspect of the game. Also improving its usability, communication and resource libraries.

Removing Barriers
• Initial study (observations and interviews) were conducted to understand which barriers hinder performance. Study identified contextual barriers such as social norms, structure, routine, rules of the system and limitations of the context. • Study also helps identify levels of awareness, motivations, and accessible technologies and channels of communication. • Participants are provided with appropriate support in terms of tools and technology, which enables them to effectively engage in the programme and adopt desired actions. These technologies and tools help with processes and activities such as preparation, social interaction, communication and competition. • Participants are trained in the use of these tools and technology. • To remove barriers related to lack of knowledge, participants are educated about the actions and their environmental impact. • Identifying and removing barriers is a continuous process. Participants and their performances are constantly observed to identify any barriers and hindrances. • To address potential negative social influences from their surroundings, an entire social group or organization is engaged in the programme. • Adjusting the programme to suit the context (existing routine, system and hierarchy) makes it easier for participants to conduct actions.

Attention to Inclusiveness

- A variety of challenges, of varying difficulty, were designed to suit different levels of expertise. For example, local community level challenges are suitable for beginners whereas national level challenges for experts.
- A wide range of actions is available to choose from, differing in terms of tools, technology, and the level of expertise required in performing them.
- Series of rewards for all levels of performers, for example, simple rewards for beginners.
- Attention is paid to all types and levels of performers. Sufficient time is provided for learning so that participants can build expertise in performing the new behaviour, and participants are not pushed too hard initially.
- Letting beginners develop competence. Encouraging them to move step-wise and undertake easy challenges first.
- Facilitating close interaction between geographically distributed participants.
- Using simple and understandable communications formats, employing images, simple text and graphs, and avoiding complex figures.
- Appreciating and rewarding the initial efforts of beginners or entry-level participants.
- Training beginners so as to improve their performance.
- Educating participants or groups so that they all hold similar understanding and opinions.

Attention to Context

- Deciding actions dependent on the limitations of a particular context and the availability of tools and technology.
- Taking into account the variety of products and models (Mac, Windows, Android etc.) available to participants, and providing product-specific information as required.
- Motivation varies from context to context, so motivations and rewards are selected to interest participants from a targeted group.
- Using most accessible and available tools and technology.
- Acquiring context specific details such as the location, area per square metre, equipment being used and the participant's age.
- Conducting an initial study, through interviews and observation, to identify key motivations to change, culture, barriers and limitations in performing the behaviour. For example, instead of website or mobile app, information may be in a printed version for school children.
- Talking to people to understand what motivates them to make changes in their work place and daily routine. Motivation could include

saving money, improving patient-care or contributing to the environment.

- Studying the participant's context, daily routine and activities helps to decide a baseline against which their performance can be measured.
- Constant monitoring and analysis of a participant's behaviour pattern with respect to their context (location, weather, etc.). Accordingly, recommending personalized tips, taking into account their behaviour and contextual limitations.
- Studying the context's existing structure and hierarchy, and using this pre-existing system to benefit the programme.
- Altering the programme to suit the context, without requiring major changes to the existing system, but integrating the programme, wherever possible, into the pre-existing system.
- Considering contextual factors such as area, weather conditions, environment, location (work or office), to accurately quantify the impact of the actions.
- Identifying local leaders and influencers from the context.

Prompts, Reminders and Tips

- Timely reminders are sent to participants prompting precisely when actions need to be performed. For example, “Today is an alert day – take action now”.
- Besides notifications sent by the programme, participants are also encouraged to send reminders or push notifications to team members.
- Participants are constantly reminded about the anticipated impact and benefits of actions.
- Action-orientated, personalized tips are provided for highest impact. These tips are based on the analysis of participant's behaviour and context.
- Prompts, such as post-it notes on monitors and switches, texts on white boards, posters and stickers, are used to grab attention.
- Push notifications are sent, by the programme and fellow participants, to inform about new sustainable actions.

Averting Defection and Handling Discouragement

- Fun and excitement plays a key role in the process. Without fun and excitement participants tend to become inactive. To keep participants actively involved and to bring excitement, challenges, competitions, creative interactions, activities, events, meetings, and rewards are introduced.
- Besides fixed rewards, short term (daily or weekly) and several surprise rewards are introduced in between challenges.

- Positive and upbeat communication is used to handle discouragement, for example, “Don’t worry, you will pick it up, the actions are easy.”
- Rather than difficult actions, small, easily adoptable actions are encouraged, that take less time and fit into the daily routine.
- Building trust through communication. If participants trust the programme they are less likely to disengage.
- Earning trust by showing improvement or results, such as savings or bills.
- Handling discouragement by recognizing and rewarding even minor efforts. Participants or teams can be discouraged after losing a challenge, which may affect future performance.
- Handling discouragement by encouraging participants to perform better in the next challenge.
- Averting early defection by rewarding small efforts initially.
- Showing a progress path, including improvements from their initial performance.
- Constantly communicating the positive output of the programme makes participants feel they are a part of a successful programme in which their small actions are crucial.
- Removing contextual barriers throughout the process to avert defection.
- Not highlighting any deviance. Not showing how many people are not following, disengaging or not adhering to the social norms and expectations.
- Providing positive feedback so that participants repeat the behaviour (*operant conditioning*).
- Not pushing participants too hard initially, as it may cause defection (as experienced by JouleBug) – allowing gradual progress.
- Showing immediate results. A visible, positive personal, social or environmental impact of an action boosts performance and retains engagement.
- Constantly motivating participants to perform by showing the progress that others are making.
- Communicating how small actions are valuable and make a significant contribution to the environment.

Retaining the Programme to Embed the Culture

- Showing a strong business case, positive results and success of the programme. Positive results earn trust and encourage participants to perform consistently.
- Nurturing the network through champions and leaders. Encouraging champions and leaders to increase the strength of the programme and spread its outreach.

- Embedding the programme in the existing environment. Using the existing system's routine, infrastructure and hierarchy rather than altering the system.
- Communicating results on a regular basis. Positive results encourage participants to repeat the behaviour and share their actions and achievements. Results shared on social media encourage outsiders to associate with the program.
- Removing contextual barriers throughout the process to avert defection.
- Handling discouragement and setbacks to avert defection.
- Trying to keep the process lively, exciting, engaging and simple. Organizing various events and activities and celebrating success.
- Respecting the learning curve and not pushing participants too hard, whilst setting a good learning pace for them. Since behaviour is learned over time, ensuring that actions are performed consistently over a pre-determined period, so encouraging step-by-step learning.
- Positive feedback shows progress path and improvements since the initial performance.
- Positive, understandable, non-intensive, playful and motivational communication is used throughout the process. Reasons are given not to pull back, so that participants perform regularly and a culture is developed within the social group.
- Recognizing and rewarding efforts on regular basis.

Incubation of Behaviour

- Since behaviour is learned over time, it is ensured that the actions are performed consistently and repeatedly for a certain duration.
- Challenges and reward systems are designed in a way such that they encourage participants to perform actions consistently and repeatedly, not just once.
- A good learning pace is set for participants to encourage step-by-step learning.
- Constantly showing the others' progress and making social comparisons to keep participants motivated.
- Participants are encouraged to undertake more difficult challenges gradually. Messages such as, "*Okay, okay not that tough, you can do it!*" are used.
- The impacts (personal, social and environmental) of actions are communicated constantly throughout the process to keep participants motivated.
- Participants are repeatedly reminded that they can save more and win more rewards.
- Personalized action-orientated tips are provided to help escalate the performance.

- Participants are encouraged to self-monitor their actions and make an effort to improve their relative performance, including checking their consumption and taking necessary steps to improve.

Image of the Programme

- A 'playful' and 'entertaining' image reflects in the communication style, graphics, games and websites. It is also communicated through the pictures and promotional videos, which show that participants are having fun.
- Depicting in advertisements that youngsters, fashionable and well-to-do participants associate with the programme, and that sustainability is catching up as a new trend among young people. This also reflects in the text style and graphics.
- Technologically advanced, smart, and updated images are portrayed by communicating that the programme has a dedicated research team, uses advanced technology and infrastructure in the process, and how the system is regularly updated.
- Communicating that the programme is concerned about the environment and that its objective is to contribute to the environment. Highlighting the impact that the programme has made over time (in terms of resource savings).
- Communicating throughout that the programme is like a friend, who will assist in changing behaviour and habits. Also informing that the process is easy; the system will understand the participant's behaviour and guide with personalized tips and actions.
- Communicating that all the actions are impactful and well-researched because a dedicated research team accurately quantifies the impact of those actions.
- Showing past results, performance data, success stories, and annual results in measurable terms of impact on the environment (savings in terms of CO_2, kWh, etc.).
- Communicating that the programme is associated or supported by other well-known, credible partners such as government organizations.
- Showing the number of participants associated with the programme in different regions, along with their savings (social proof).
- Communicating a positive image of the programme is reflected in promotional campaigns such as, "Try it out yourself – don't just take our word for it".
- Communicating that the programme is already used by well-known governmental organizations and universities.
- Different media channels are used to communicate and build the programme's image.

- A credible and trustable image is built by maintaining transparency, through clear communication of how the programme works and its key objectives.

Social Image Concerns

- Participants share and publicize their rewards and achievements on social media to enhance their social image.
- Performances such as those of top performers, winners, awardees are also publicized by the programme.
- Top performers are rewarded and recognized in public, sometimes also at events.
- Profiles, containing the top performers' scores, are made visible to all. A publicized social profile helps enhance social image. Profiles show trophies, points, savings, buzz history, performance graphs and more.
- Constant communication about how association with the programme can enhance social image such as, "Become an inspiring figure in your community."
- Participants are encouraged and rewarded for sharing their performances on social media.
- Communicating the social and symbolic meaning (related to social image) attached to good performance, for example, participants will be considered as inspiring figures or sustainability ambassadors in their social groups.
- Communicating the social and symbolic meaning attached to the programme: that sustainability is trending as a new culture, so participants will be considered as modern, trendy, and forward-thinking within their social group if they perform and associate with the programme. This social and symbolic meaning is also communicated indirectly through the advertisements, which depict youngsters participating in the programme.

Fun and Excitement

- Introducing a number of activities and events into the process.
- Interesting challenges and competitions that are creative, entertaining and non-repetitive.
- Fun and entertaining promotional events and educational activities.
- Participants are encouraged to share their creativity during the process in different ways.
- Creative and playful communications are characterized by humour. Playfulness reflects in the text, colour and graphic styles of websites and apps.
- Interesting rewards.
- Events for celebrating success.

- Social comparison also adds excitement to the process.
- Adding excitement to the process through encouraging communication, such as “Hey you have done this very well. Now let’s try another challenge? You can do it, it is not that difficult”.
- Rewards in between processes also add excitement and re-energize the participants. Otherwise the lengthy process may be boring.
- Public rewards and publicizing the awardees on social networking and programme websites.

Monitoring and Cross-referencing

- Participants can monitor their actions through websites, apps, weekly updates, scoreboards, points-tables, and also monitor others’ performances during social events and meetings.
- Updates on performances are provided throughout the process.
- Participants are encouraged to follow and benchmark the top performers.
- Participants are encouraged to see how their competitors, neighbours and team members are performing.
- Leading performances are constantly shared so that others can cross-reference and set new benchmarks.

Selection and Performability of Desired Behaviour

- The process is simplified by breaking complex actions down into small achievable steps.
- Making actions more fun and playful by associating them with competitions and rewards.
- Making the process easy and hassle-free. Simplifying the process, minimizing prerequisites, easy sharing, less investment and shortening the procedures, for example, by linking the programme directly with utility bills.
- Having well-researched result-oriented actions. Using a research team to quantify the real-world impact of the actions.
- Making the actions quantifiable so that performances can be evaluated and compared.
- Encouraging participants to move step-by-step: take small actions in the beginning followed by complex later challenges.
- A mechanism for regularly quantifying the impact of actions.
- Using easily accessible infrastructure, tools and technology.
- Actions designed in such a way that they can be performed in different contextual settings.
- Actions designed to accommodate diverse participants, from beginners to experts, so having a range of actions to choose from.

- Product-specific details of actions are communicated to users so that they can perform the actions using available technology, products and models.
- Strategies which help adopt the actions into daily routine are communicated to participants.
- Emphasis is on the importance of small steps and actions that may otherwise be ignored.
- Selecting actions that are quantifiable and have an immediate impact, visible to participants.
- List of actions includes those that most participants already perform, thus allowing them to self-identify as someone who is already saving energy.
- Participants are encouraged and rewarded for sharing new sustainable actions, ideas and strategies.

Framing of Information

- Anticipated environmental impact of actions are framed to look more meaningful, notable and worthy of attention.
- Associating a symbolic meaning with actions in order to encourage the participants, implying “You look smart and grown up if you do certain things”.
- Showing the (anticipated) cumulative impact of a participant's yearly performance in order to express the importance of small actions. Impact in annual terms, using big numbers, looks more significant.
- Impact framed in a more practical and understandable format using analogies, such as the number of trees saved, number of fish tanks that can be filled or number of houses lit.
- Showing yearly loss that can be averted, yearly savings and benefits. Also, rather than savings, informing participants of the cost of not performing the actions.
- Progression track, improvements, results and savings are communicated in an understandable format, using graphs and figures.
- Comparative information is framed in a motivational format so that participants know where they stand against others and can set relative benchmarks. Using graphs, rankings or points table to communicate performance and convey what and how much they should do to reach a certain level.
- All communications between the programme and its participants are framed to encourage in one way or another. Either they induce social pressure, or make the impact/results look more meaningful.
- Results of the programme are made to look more impactful by showing the cumulative impact (accumulated years and participants) of the programme. This includes total savings on utility bills and resources.

- Mentioning the annual country-wide impact of an action, using understandable analogies to make them worthier of attention, for example by stating that in 2009, America recycled 82 million tons of material, the equivalent of 33 million cars off the road.
- Communications are strategically framed so there is a balance between intrinsic (environmental) and extrinsic factors (personal benefits, competition).

Social Comparison

- Performance data is constantly collected from the participant's end.
- A quantifying mechanism that measures and quantifies the efforts in terms of common parameters like financial savings, environmental contribution (in terms of CO_2, kWh, litres of water, kgs of waste).
- Acts as a mechanism for analysing comparative performances.
- Comparative data is translated into meaningful and understandable formats such as graphs, scoreboards, points table, ranking or leader-boards.
- Impact of action and comparative results are communicated instantly.
- Progress of others and comparison to them is always visible.
- Regularly communicating that others are taking these actions.

Social Pressure

This includes factors contributing to building of social pressure – compliance with social norms, compliance with tasks assigned to team members, performance linked with the progress of the team, compliance with commitments made in public, social image concerns, perceived impact of actions on social image, social proof, and implicit comparisons.

- Social proof is used as one of the tools to communicate norms and induce social pressure. Participants are shown that others are performing the desired behaviour, which indirectly communicates the expected behaviour.
- Constantly communicating what others are doing, and showing their performances throughout the process, in terms such as “others around you are taking actions, it’s time for you to act”.
- Social events such as training sessions and meetings are useful in building social pressure through implicit comparison, as participants share their roles and performances.
- Challenges, competitions and social comparisons, such as ranking or scorecards, play a key role in inducing peer pressure. Participants are concerned about their image, which is related to their performance.

- Social interactions between participants also induces social pressure as performances and actions are implicitly compared and expected behaviour is communicated.
- Increased group size has proved more influential in inducing social pressure.

Self-identity Concerns
• Participants share their team's performance on social media to enhance their self-identity. • Top performers and teams are publicized by the programme on social media or in events, which enhances their self-identity. • Profile page includes name of the participant, photograph, the group or team to which they belong and performance scores. The profile provides a participant with added identity, increasing a sense of commitment towards the challenge and their team. • Participants are encouraged to share performances on social media and rewarded for doing so. • Participants are grouped into teams, which encourages them to perform better for the benefit of that team or group.

Social Norms
• Normative appeals, using descriptive norms. Depicting what commonly happens in the group, for instance, that people compete, adopt new behaviour, consistently perform, achieve, share or inspire others. • Use of injunctive norms during the preparation phase to formally describe the rules of the game. Some rules are communicated during the process as well. • Constant updates of actions, scores etc., show how others are behaving, in order to indirectly communicate the expected behaviour within the group. • Indicating how others are acting in a given situation and, therefore, what is expected. • Normative messages directly communicate an expected behaviour using persuasive communication, personalized feedback and tips, such as “Others around you are taking actions”. • Messages clearly communicate the type and quantity of behaviour expected. • Social comparisons indirectly clarify the expected behaviour and build social pressure. • Both verbal and non-verbal communication are used to communicate expected behaviour. • Social norms are shared and acquired through social interaction.

- Prompts, reminders, posters and personalized messages communicate the expected behaviour.
- Groups and teams define the norms by formally outlining the behavioural expectations and roles in team meetings and events.
- Communicating that adoption of sustainable behaviour (desired behaviour) is an increasing phenomenon in the social group and society.
- Communicating social and symbolic meanings associated with this acceptable behaviour in the community or social group directs people towards socially acceptable decisions.
- Achievements and rewards shared with other participants indirectly communicates the expected behaviour in the group.
- Rewarding initiators, early joiners and first adopters. This helps establish norms for those who are not engaged in sustainable actions.
- Indicating that sharing actions and achievements on social media is an expected behaviour, by showing how others are doing and by placing the 'share' button near achievements.
- Teamwork and collaboration help in sharing culture within the group.

Social Proof (Informational Social Influence)

- Communicating the increasing strength (number of engaged participants) of the programme encourages outsiders to join.
- Communicating that all the participants are satisfied with the benefits and rewards.
- Showing that everyone is having fun in the process.
- Communicating that all participants and groups easily adopt sustainable actions.
- Showing real-time actions being performed by participants, alongside their results.
- Showing how participants enhance their social image by performing and sharing achievements, and how lead performers have become inspiring community leaders.
- Showing that the large groups are making significant contributions to the environment.
- Communicating that people have successfully adopted new behaviour and are continuously saving energy and money.
- Participants finding the process easy and fun.
- Participating in the programme and adopting sustainable actions is becoming a trend.

Benchmarking

- By regularly sharing profiles and scores of the top performers, participants are encouraged to benchmark these performers.

- The process of benchmarking top performers is made easier by allowing participants to use the 'follow' option provided on profiles.
- Once participants follow a leading performer, they get regular updates from that benchmarked performer.
- Scores and profiles of the leading performers are advertised and visible throughout.
- Benchmarks are usually set by participants or by the teams themselves, with the programme lending support by encouraging the process of benchmarking.
- Participants are encouraged and invited to compete with the leading performers.
- Participants can monitor the progress of top performers through websites, apps, weekly updates, scoreboards, points-table and also directly during social events and meetings.

Pledge (Commitment in Public)

- Participants are encouraged to commit publicly or sign a pledge.
- Pledge, commitments and goals are publicly visible on the profile page, which also shows progress.
- Participants are constantly reminded of their commitments.
- Participants are informed about the positive consequences of accomplishing a pledge or commitment, particularly how it will enhance their social image.
- Participants are encouraged to share their achievements once they have accomplished their pledge.

Goals and Targets

- Goals are set by the programme, teams, and by the participants themselves.
- The profile page shows set goals, challenges and progress. It makes the goals of teams and participants visible to the public.
- Goals, particularly when publicly visible, encourage participants to achieve in order to live up to their social image.
- After completing one goal, participants are encouraged to set another.
- Realistic and achievable goals are set taking contextual limitations into account.
- Setting up step-by-step targets, starting with simpler ones.
- Bringing a sense of commitment to the set goals through encouraging communication, for example “We are Sainsbury’s and we are the UK’s greenest store”.

Engagement (Challenges, Competition and Collaboration)
• The process of engagement involves competition, collaboration or both. Competition occurs between individuals and teams, whereas collaboration is between members working together for team success. • A wide range of challenges (with varying levels of difficulty) is designed to suit diverse participants, such as in the 'state' and 'national' level challenges. • After completing one, participants are encouraged to undertake a more difficult challenge. • Interesting, non-repeating and creative challenges or competitions are introduced every time. • Each challenge is well-defined, having a name, clearly-defined objectives and actions, and a scoring mechanism. • Social comparison (comparison of performance across teams or individuals) is phenomenon common across all the challenges. Leader-boards, scoreboards and rankings are used for comparison purposes. • Participants are invited to compete with good performers. • Some challenges are suitable for the groups, while others are suitable for individuals. • Challenges are time specific and run for specified period. • Participants are encouraged to undertake easy challenges in the beginning, followed by more difficult ones. • Challenges encourage easy actions in the beginning and proceed step-by-step. • Some challenges also encourage promotional efforts, recruitment of new team members and social interaction.

Progression Track
• The progression track is visible throughout the process, and also communicated to participants at specific times. • Both an individual's progress track, and that of the brand, is communicated. • Progression tracking consists of historical data related to points, rewards, environmental contribution, number of challenges, bills, savings, and more, which are communicated by graphs. It clearly shows improvement from previous performances. • Exceptional progress is highlighted in events. • Feedback and personalized messages are usually communicated via the progression track, informing how far participants have come and encouraging them to undertake new challenges.

Benefits (Personal, Social and Environmental)
• Anticipated benefits, when communicated to outsiders, encourage them to associate with the programme. • Both extrinsic (personal benefits) and intrinsic (contribution to the environment) motivational factors are communicated to encourage association. • Benefits and impact are framed in a practical and understandable format. This could be in the form of analogy, or real-time savings on energy bills. • Immediate impact of actions is visible to participants. • Participants are encouraged to share their achievements on social media. • A mechanism constantly quantifies the real-world impact of actions. • Participants are assured that the process of achieving desired benefits or results is very easy. • Comparative results show a comparison of achievements between individuals, teams and groups. • The big picture, the cumulative impact of both team and programme, is constantly accessed and communicated to participants and outsiders. • Results shared on social media enhance the social image and social presence of participants. • Results help in setting new benchmarks and goals. • Anticipated benefits are visible to the participants throughout the process. • Results and scores are calculated on the basis of actions performed in the real world.

Rewards and Recognition
• Participants are rewarded for learning and performing sustainable actions. • Rewards are communicated immediately after each performance. • Anticipated rewards are always visible to the participants throughout the process. • Communication is proffered that winning rewards is easy. • Extra rewards for sharing on social media or for other promotional efforts. • Rewards are given for proposing new ideas, events or actions, such as the campaign ‘Ignite your Ideas’. • Rewarding early adopters and initiators in the programme. • Rewarding even small efforts of beginners. • Difficult tasks lead to more rewards. • Different levels of rewards match with different levels of expertise.

- A series of rewards (from low to high) are available to the participants in succession so that a higher level of reward is always in sight.
- Rewarding the participants for engaging with promotional activities, which include sharing achievements and success stories on social networks, or writing articles and blogs.
- Rewards for enrolling more participants and community groups with the programme.
- Rewards are calculated on the basis of actions performed in the real world.
- Rewards for team-building and team engagement activities, like organizing meetings and events.
- The process includes both long-term rewards and short-term prizes.
- A mechanism that quantifies the impact of actions in terms of game-based rewards, such as points, badges, comparative scores or ranking.
- Rewards are publicized because it enhances the social image of the receiver and encourages others to associate and perform.
- Use of symbolic points or badges is preferred, rather than giving economic rewards. Any economic reward, such as £20,000 in the case of the Big Energy Race, is for community development, not for personal use.

Positive Feedback

- Communicating the immediate impact of actions.
- Positive and constructive feedback stimulates players to perform even better.
- Constructive and encouraging feedback is provided to beginners and recognized slow performers, encouraging even smaller steps.
- Feedback often includes the participant's progression track.
- Personalized and context-specific feedback suggests participant-specific tips for improvement because participants feel more connected to personalized feedback.
- Comparative feedback communicates the social impact of actions.
- Data-based feedback includes progress track and improvements, and communicates performance-based actions to participants.

Training and Education

- Educating new participants on the environmental consequences of their daily actions.
- Informing about the objectives, process, actions, instructions, rules of the game, available actions and reward system, in a playful way.
- Communicating the personal, social and environmental benefits of a new behaviour.

- Communicating scientific and logical rationales behind the actions as well as their environmental consequences.
- Educational information features success stories of the programme.
- Practical measures and tips help participants incorporate their actions into daily routine.
- The system assists participants as a friend, accentuating that the process is simple and actions are easy to adopt.
- Conveying that the process is playful and fun.
- Providing accessible channels, resources, technology, software and training.
- Access to well-organized educational resources throughout, including a list of actions along with their impact, tips and strategies.
- Providing continuous update on new actions and tips throughout the process.
- Free access to technology, software and resources.
- Guidance on how to self-monitor and improve the actions.
- Constant updates on challenges and competitions through team news and leader-boards.

Formal Association
Key motivations for association: personal, social and environmental benefits.

- Personal benefits, especially savings, rewards and fun.
- Social benefits, especially enhanced social image. Participants fed back that they liked the potential of becoming an inspiring figure in their social group.
- Positive environmental impact of actions and responsibility towards the environment.
- The programme's image is a key motivation for association. The type of image associated with the programme is playful, credible, friendly, involves young and educated participants, is smart, updated and responsible towards the environment.
- A credible image is communicated through past results, achievements and associated partners.
- Social proof is another key motivation for association. Strength in the number of participants, their achievements, savings, rewards and contribution to the environment is communicated to outsiders.
- Sustainable actions are considered to be a new trend and culture, enthusing people to associate with the program.
- Challenges, competitions, fun and excitement are involved in the process, which makes it interesting and attractive to participants.
- Process is easy, cost-free and hassle-free.

- Process is impactful, action-oriented and result-oriented.
- The programme enhances the image of associated organizations and social groups.
- The programme serves as a tool for proactive employee engagement.
- There is wide range of simply performed actions, which fit easily into a personal routine.
- Use of accessible tools and technology.
- Results, benefits and rewards are instantly made visible to the participants.

Promotional Activities
• Activities, campaigns and events are used to promote the programme. • Promotional activities are carried out by trusted messengers, leaders, influencers and key believers. • Participants engage in promotional activities in order to become leaders and inspiring figures, which enhances their social image. • Participants are rewarded when they invite others to associate. • Achievements shared by participants on social media encourages outsiders to associate with the programme. • Programme also spreads through word of mouth. • Participants are encouraged to write online articles and blogs about their experiences. • Teams are awarded points for recruiting community groups and for inviting family members and friends. • Friends and family members help spread the programme's outreach. • Self-identity concerns motivate the participants to engage in promotional activities. Participants promote it in order to benefit the programme or the team they are associated with. • Intention to support the initiative is an additional reason to associate with the programme. • Some challenges focus on increasing the team's strength. • Personal, social and environmental benefits are communicated to outsiders. • Social proof is used in the promotional campaign, communicating the number of participants associated, annual savings and environmental contribution.

Table 5.3: Different ways in which the elements are addressed or delivered

5.4 SUB-PROCESSES OF GBCPs

Although each element was an integral part and played multiple roles in this multifaceted process, they were broadly classified into certain groups based on the phenomenon they contributed to. The elements were grouped into seven categories, which represent seven sub-processes of GBCPs. Figure 5.1 depicts a comprehensive view of the mechanics of GBCPs and seven sub-processes, which are seven divisions of the entire process of GBCPs, common to all the cases studied. Although these sub-processes were common across all the cases, they were carried out and executed in different ways. The section describes each of these sub-processes of GBCPs and their contributing factors (elements).

Mechanics and sub-processes of GBCPs

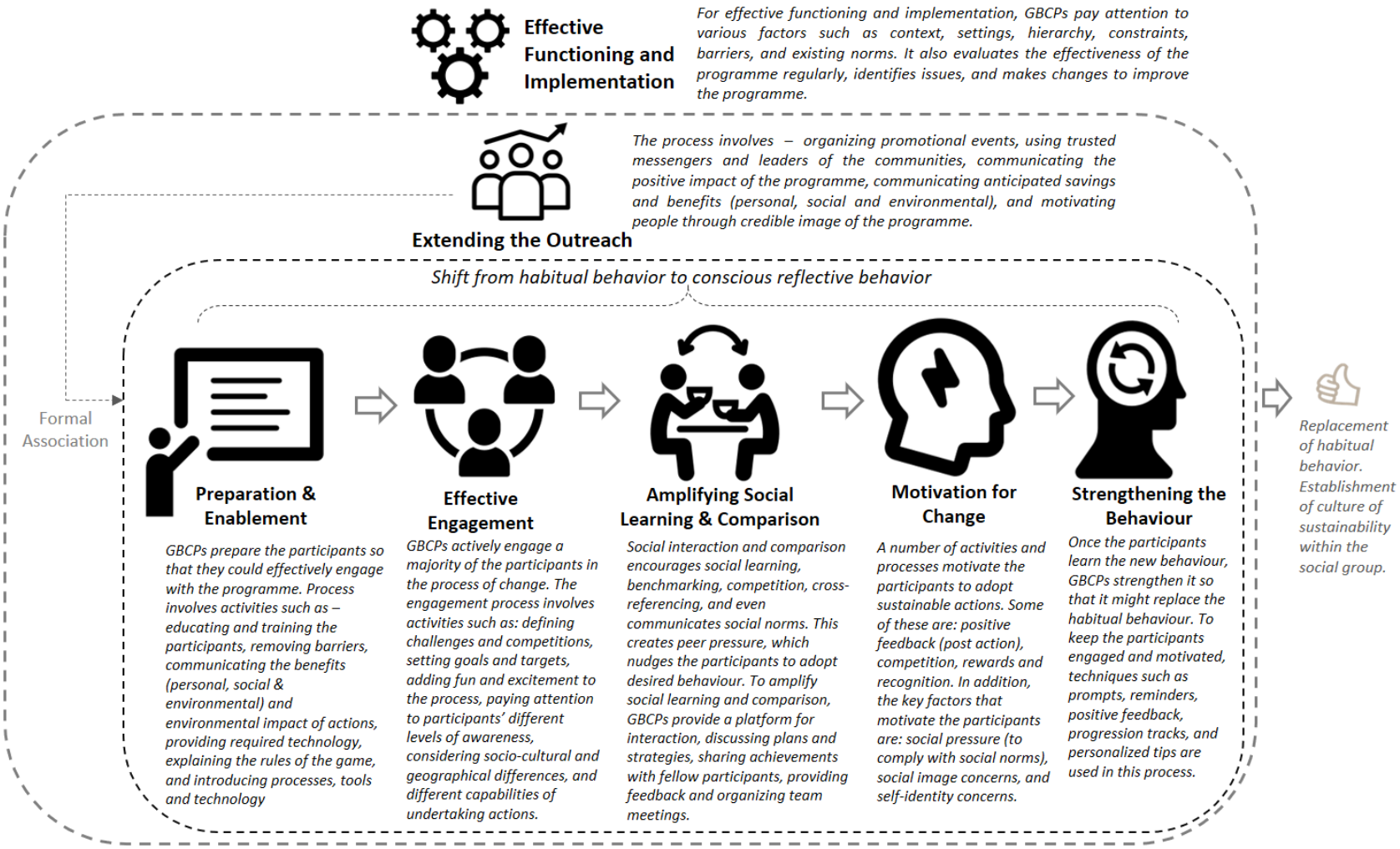

Figure 5. 1 Sub-processes of GBCPs

5.4.1 Preparation and Enablement

It was observed across the cases that GBCPs took a number of steps to train participants so that they could effectively engage with the programme and efficiently perform the desired actions. All such activities contributing to this process of preparation were grouped under the 'preparation and enablement' process. The process of preparation involves activities such as training, explaining the rules of the game, educating the participants on environmental impact of their actions, introduction to the process, tools, and technology. Besides developing an understanding of the programme, preparation and enablement also helps in developing empathy towards the environment, which makes the participants sincerely commit to the programme. During this process, GBCPs also attempt to address contextual barriers that could hinder the performance of the participants or could possibly demotivate them from adopting sustainable actions. They also attempt to develop self-efficacy (self-confidence) (Bandura, 1978) among the participants by communicating the simplicity of the process and actions, and by conveying the anticipated benefits and impact of individuals' actions on the environment. Figure 5.2 depicts various elements that support the process of preparation and enablement, and different ways in which they contribute to this process.

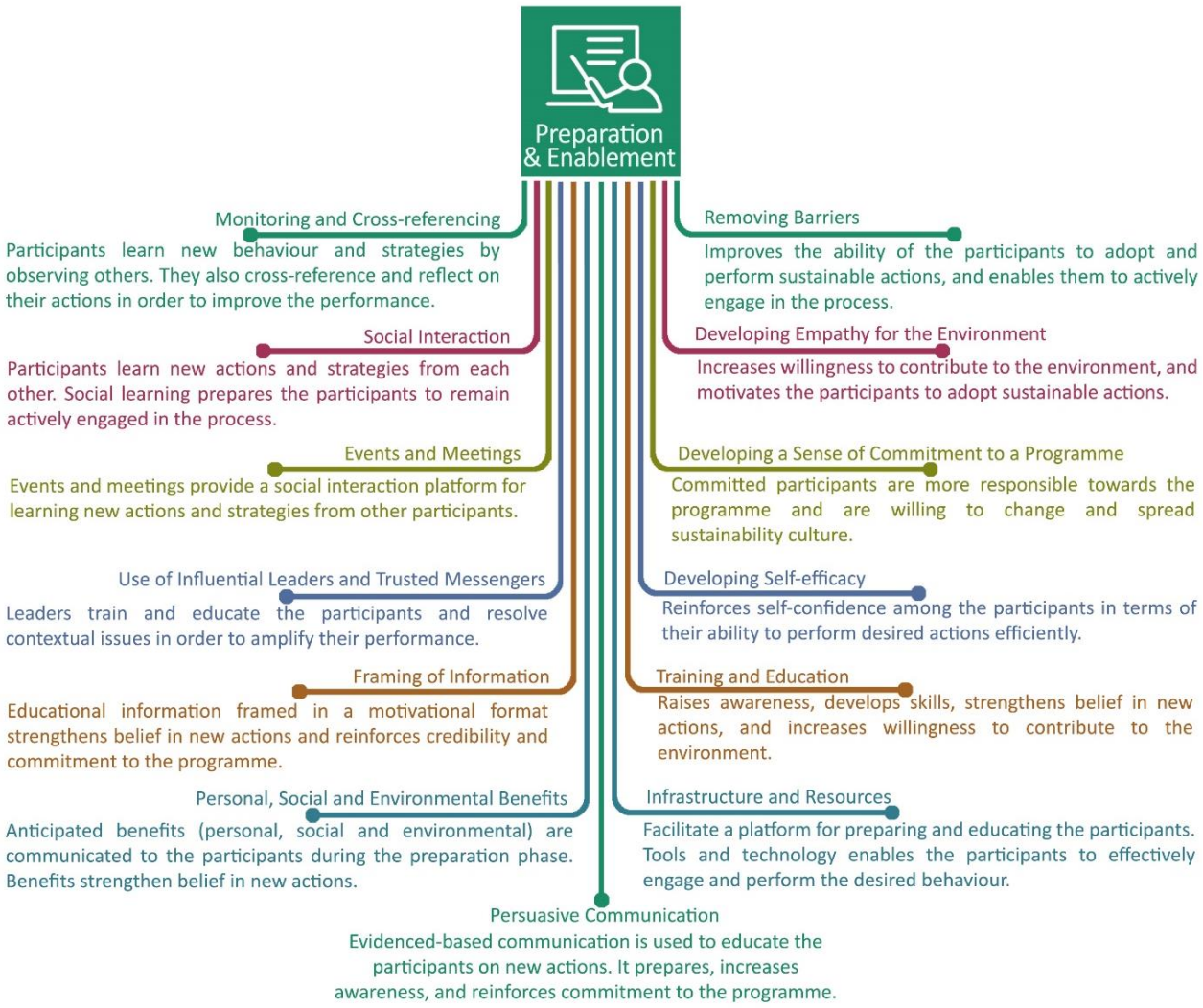

Figure 5. 2 Role of individual elements in 'Preparation and Enablement' (Sharma & Siu, 2017)

5.4.2 Amplifying Social Learning and Comparison

It was observed across the cases that GBCPs rely heavily on social influence for behaviour change and, therefore, social interaction becomes a key component of the entire process. Various activities, events and processes which focus on amplifying the process of social interaction, social learning, and social comparison have been grouped under the process of 'amplifying social learning and comparison'. It was observed across the cases that social interaction plays a key role in the process of behaviour change, as it socially influences the participants to adopt sustainable actions. It encourages social learning and comparison, benchmarking, competition, cross-referencing, and even indirectly communicates social norms (socially acceptable behaviour) within the social group. It also helps in creating peer pressure, which nudges the participants to perform desired behaviour.

For intensifying social learning and comparison, GBCPs encourage social interaction between the participants. They provide a platform for interaction, discussing plans and strategies, sharing achievements with fellow participants, and providing feedback. To amplify this process of social interaction, GBCPs also monitor the level of interaction taking place and reward the participants who escalate interaction or share their achievements with fellow participants and outsiders. In addition, the team leaders and trusted messengers are also encouraged to organize various team meetings and events within their groups to amplify social interaction. Figure 5.3 depicts elements that support social learning and comparison, and ways in which they contribute to this process.

Figure 5.3 Role of individual elements in 'Amplifying Social Learning and Comparison' (Sharma & Siu, 2017).

5.4.3 Effective Engagement

To effectively engage the participants and groups, it was observed across the cases that GBCPs pay attention to participants' different levels of awareness, socio-cultural and geographical differences, different levels of motivations, and even different capabilities of undertaking actions. To actively engage a majority of the participants and groups, GBCPs address these needs of diverse participants by carefully planning competitions, challenges, actions, rewards, and recognition processes. Challenges are designed to accommodate participants' different levels of expertise and capabilities. They are designed with varying difficulty levels, which make the process easy and stepwise. The process also pays attention to the learning curve, by providing sufficient time for participants to learn new behaviour. GBCPs also pay attention to accessibility of various tools and technology and possible barriers that could obstruct performances. All these factors make the process engaging for the participants. Figure 5.4 depicts various elements that support effective engagement and ways in which they contribute to this process.

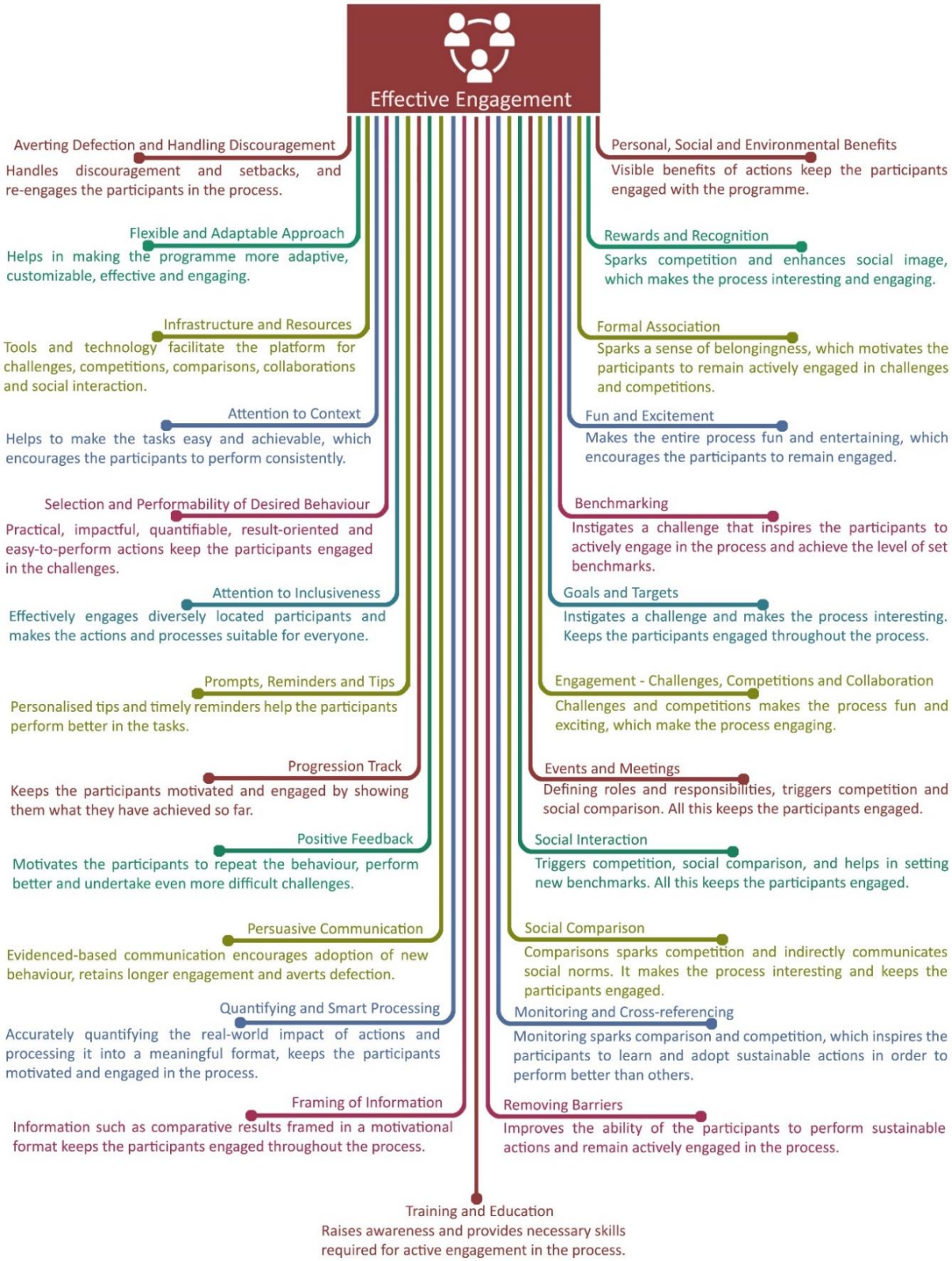

Figure 5.4 Role of individual elements in 'Effective Engagement' (Sharma & Siu, 2017).

5.4.4 Motivation for Change

Although a number of events, processes, and activities motivate the participants to adopt sustainable actions, it was learned from studying the cases that the key driving factors in the process are social pressure (to comply with social norms), social image concerns, and self-identity concerns. These driving factors, which are the subset of social influence, play a key role in encouraging the participants to learn and adopt sustainable actions. These driving factors motivate the participants to perform newly adopted actions consistently, and encourage them to share their achievements on social media with their friends and families. These factors are triggered by various elements in the process such as, social games and challenges, social interaction, social comparison, monitoring and cross-referencing. These elements create an influential social environment and circumstances which nudge the participants to adopt sustainable actions. Participants are nudged to meet the expectations of the social group, comply with social norms, match their performances with that of their competitors, perform to earn rewards, and contribute to the team's performance. Figure 5.5 depicts various elements that support motivation for change and ways in which they contribute to this process.

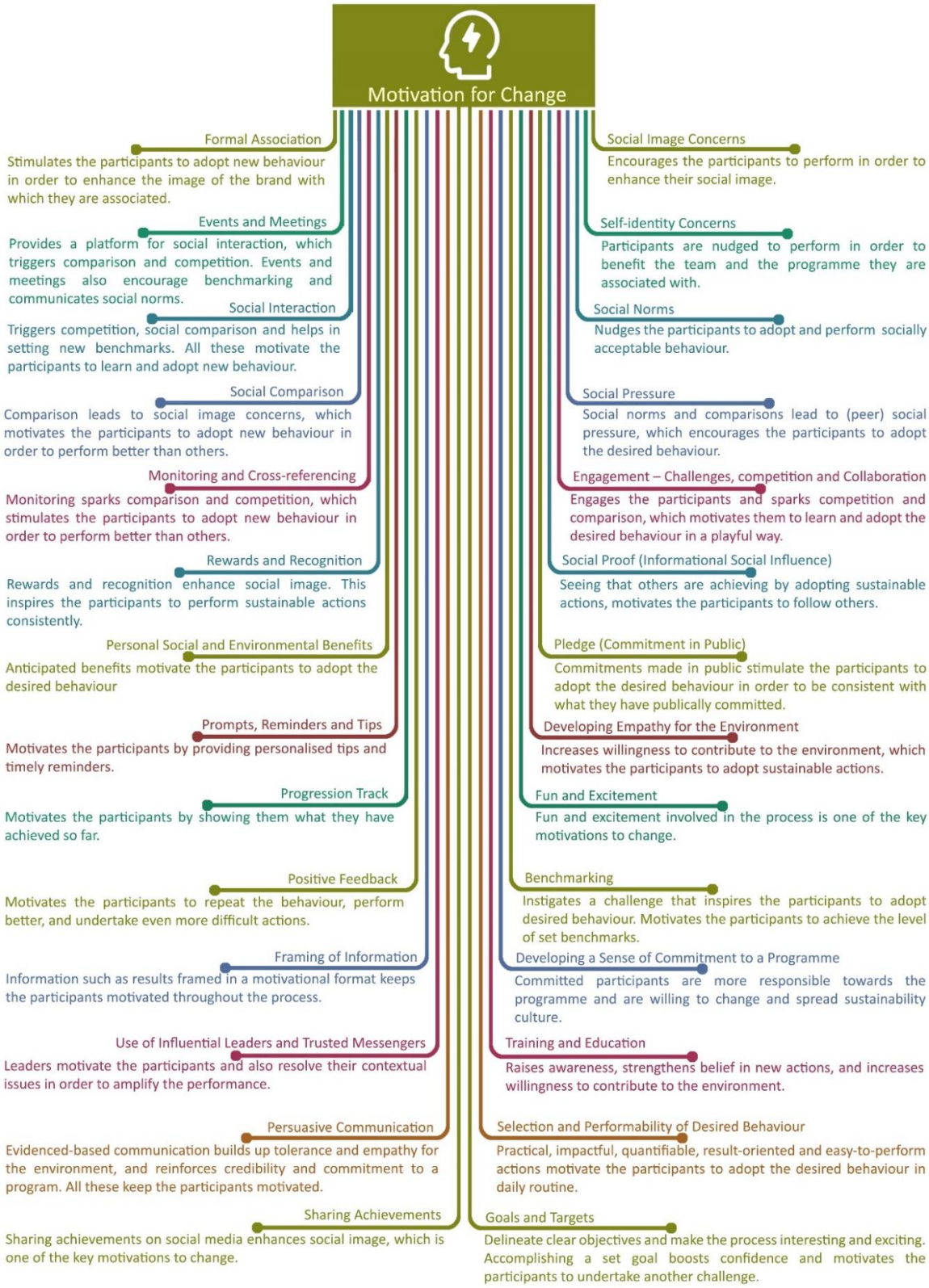

Figure 5.5 Role of individual elements in 'Motivation for Change' (Sharma & Siu, 2017).

5.4.5 Strengthening the Behaviour

It was observed across the cases that once the participants learn the new behaviour, GBCPs try to strengthen it so that it might replace the habitual behaviour. For this, they keep the participants engaged in the process, motivate them, and remind them to consistently practice the new behaviour. They make the participants practice the new behaviour for longer period, so that it becomes a part of daily routine. Techniques such as prompts, reminders, positive feedback, progression tracks, and personalized tips are used in this process. During this process of strengthening the behaviour, participants who become inactive are also re-energized and motivated to actively involve them in the programme. GBCPs encourage consistent performance so that new actions become habits and a sustainability culture can be established within the social group. Figure 5.6 depicts various elements that support the process of 'strengthening the behaviour' and ways in which they contribute to it.

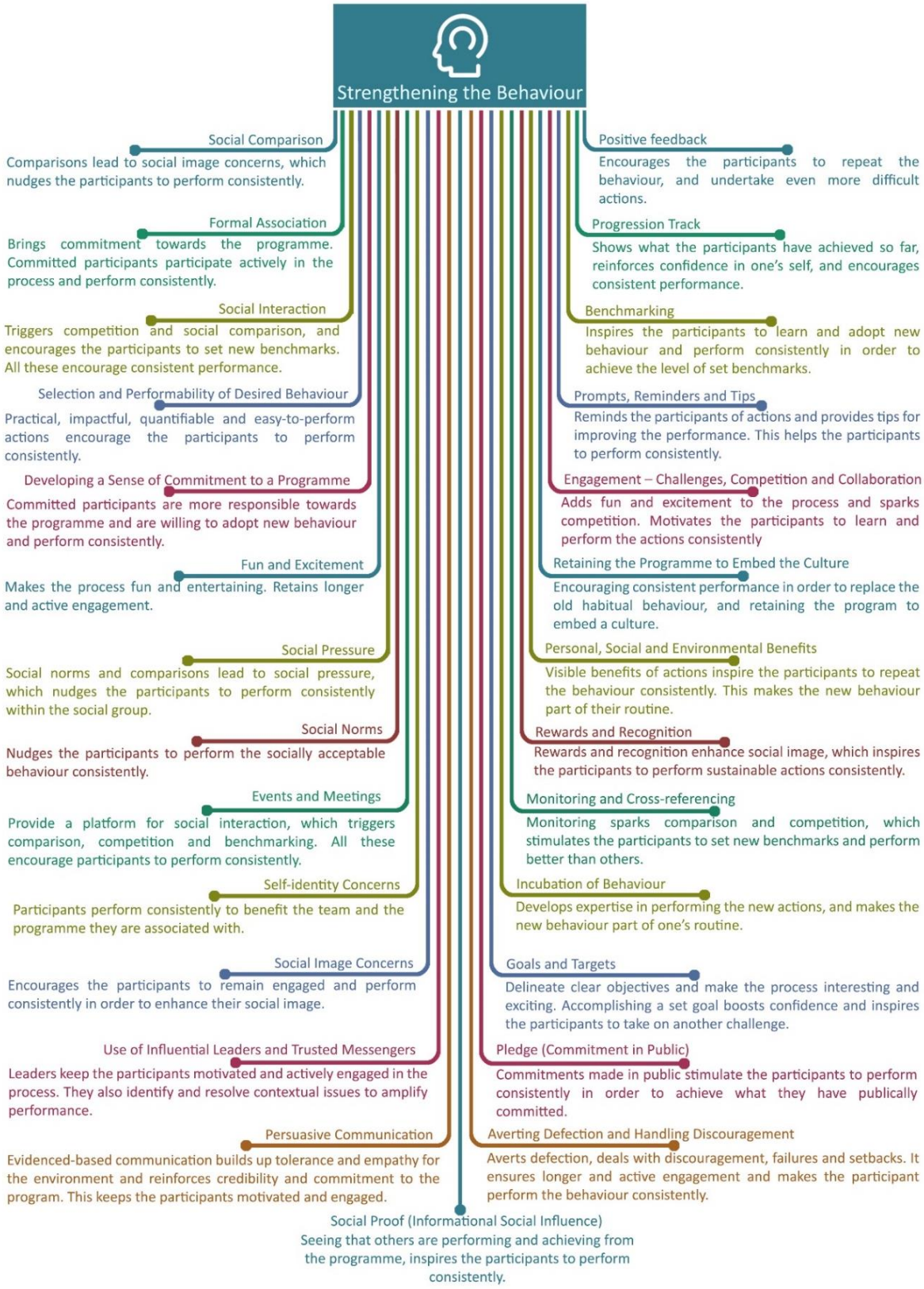

Figure 5. 6 Role of individual elements in 'Strengthening the Behaviour' (Sharma & Siu, 2017).

5.4.6 Extending the Outreach

It was revealed across the cases that GBCPs constantly encourage people (outsiders) to associate with the programme. They conduct a number of promotional activities and events, use social proof as a strategy, and make use of trusted messengers and leaders of the communities to extend the outreach of the programme. In addition, to promote the programme, GBCPs make use of persuasive communication to communicate the environmental impact of the programme together with its anticipated savings and benefits. Through different ways, they try to communicate the advantages (such as enhanced social image) of associating with the programme. They also motivate people through the positive and credible image of the programme. To extend the outreach, GBCPs communicate that the process involves competition, team-level challenges, rewards, fun and entertainment. In addition, the achievements and rewards shared by participants on social media also help in extending the outreach of the programme. Figure 5.7 depicts various elements that support 'extending the outreach' and ways in which they contribute to this process.

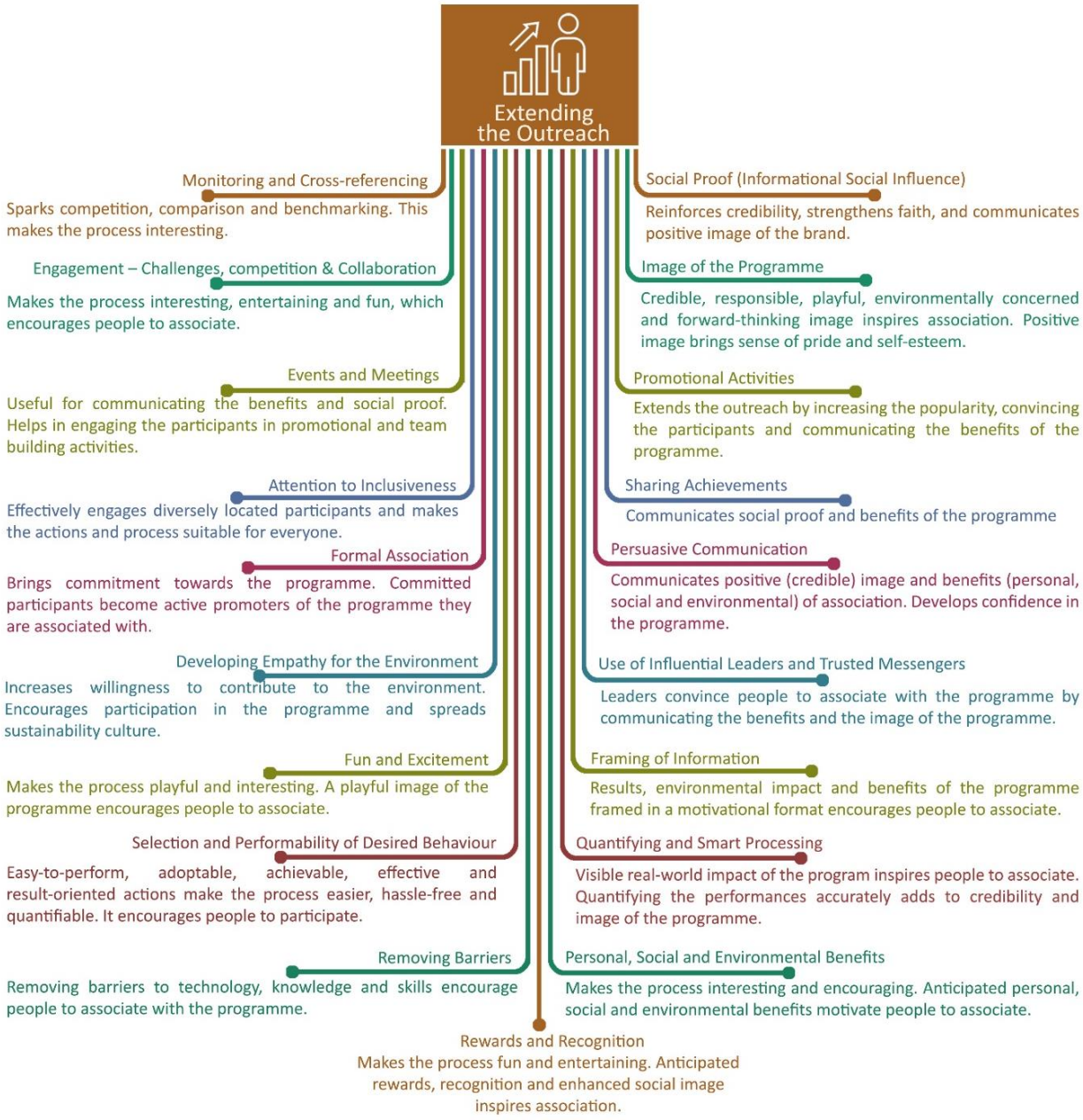

Figure 5.7 Role of individual elements in 'Extending the Outreach' (Sharma & Siu, 2017).

5.4.7 Effective Functioning and Implementation

In order to effectively implement and execute the programme, GBCPs pay persistent attention to contextual factors and inclusiveness, and adopt a flexible and context-oriented approach in their implementation. They study the context in which the programme is to be implemented, its system, settings, hierarchy, constraints, barriers, norms, and alter their course accordingly, to suit the context. When implementing the programme, their approach is to utilize the current system and its settings rather than making a major change. By taking these contextual factors into account, the GBCPs ensure that new behaviour can easily be adopted by the participants (within the limitations of the context) with minimal investment.

GBCPs also take contextual factors into account while deciding the sustainable actions, challenges, and also when quantifying the impact of the actions. They provide context-specific feedback to participants to boost their performance. The programmes also consider different levels of awareness among the participants, their different capabilities, motivations, and social-cultural differences while designing challenges and the engagement model. Overall, they pay attention to multiple factors in order to effectively implement the programme. Figure 5.8 depicts various elements that support 'effective functioning and implementation' and ways in which they contribute to this process.

Figure 5.8 Role of individual elements in 'Effective Functioning and Implementation' (Sharma & Siu, 2017).

5.5 ROLE OF GAME ELEMENTS IN GBCPs

Although the roles of all individual elements have been described in Table 5.2, this section particularly emphasizes the role of game elements during behaviour change as observed across the cases of GBCPs. It was observed across the cases that gaming plays a vital role in the process as it adds fun and excitement, making the players compete and collaborate, and stimulating them to learn and adopt sustainable actions in a playful way. Elements of 'fame mechanics' such as the engagement model, rewards, triggers, social comparison and progress path and levels make the process highly immersive and compelling for participants. These elements create an influential social environment, which makes the participant adopt sustainable actions under the influence of the social game, and encourages them to perform the actions consistently. Figure 5.9 depicts the game elements involved in GBCPs and the factors that drive behaviour change.

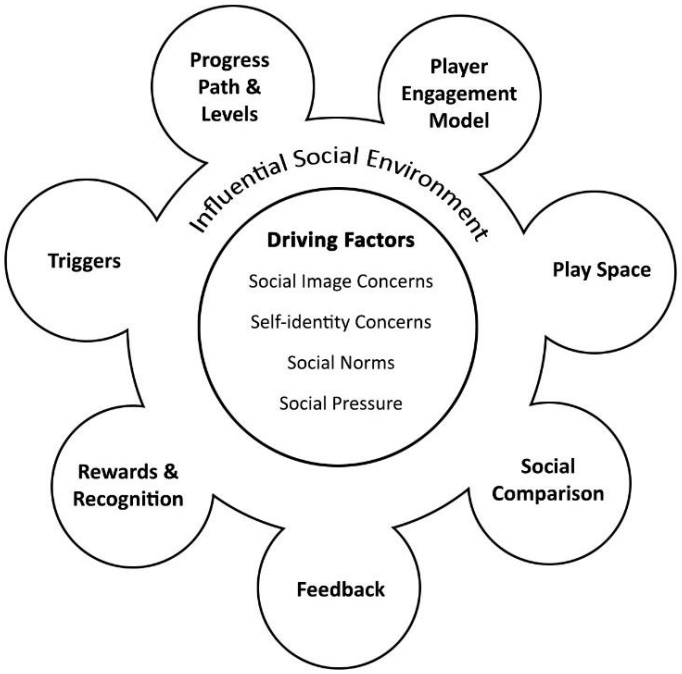

Figure 5.9 Game elements in GBCPs and the resultant factors that drive behaviour change (Sharma & Siu, 2017)

GBCPs encourage participants (players) to perform sustainable actions in the real world. Unlike video games, which take place solely in the virtual world, the play space for the studied cases was largely the real world. Although GBCPs make use of a virtual platform for educating, training, engaging and motivating the participants, the play space remains the real world, as the game requires participants to perform actions that have a real impact on the environment. It was also observed that, although participants were engaged through a virtual platform, the transition from virtual to real world was so smooth that the participants felt as if they were playing in the virtual world.

Gaming also helps in retaining the interest of participants throughout the process and takes them on a journey through various phases. The progress path and levels are designed for a 'moderate' difficulty level to retain the interest of the participants, but are not so difficult that they lead to frustration or defection from the programme. The challenges, progress path and levels are easy and stepwise, and they encourage the participants to undertake simple actions in the beginning and progress from one step to another. Positive feedback is provided as soon as the participants perform the actions.

Rewards and recognition play a central role in the process of GBCPs. Participants are rewarded for every action they perform and are encouraged to augment their performance from one level to next. Through rewards, participants are encouraged to undertake even more difficult challenges at the next levels. Rewards in the form of points and badges inform participants about their progress, and also help them compare their performances with that of other people. Recognition in public was observed as one of the motivating factors across the cases. When the performance of participants was recognized in public, it enhanced their social image.

The engagement model is at the heart of GBCPs. It involves a number of activities such as defining challenges, goals and targets, player interaction, rules of the game, competition, monitoring and cross-referencing, team work and so on. The engagement model adds fun and excitement to the process and makes the adoption of sustainable actions part of the game. It helps keep participants actively engaged for a longer period, and encourages them to adopt desired behaviour under the influence of the game. The observed cases of GBCPs involved both competitive and collaborative dimensions of engagement. The engagement model involves challenges and comparison of performances, which tends to spark competition and friendly rivalry between the participants. It also creates a suitable social environment, which constantly nudges the participants to learn and perform socially acceptable behaviour, and match their performance with that of their fellow participants. The pressure of not being seen as an under-performer and related social image concerns, nudges the participants to improve their performance consistently. Triggers in the form of prompts and reminders are used throughout the process to remind participants of their expected actions.

5.6 SUMMARY

The chapter presented the results of the study in the form of mechanics of GBCPs, and explains the causal factors and conditions that contribute to the process of behaviour change across the observed cases. These findings include 1) the key elements (incidences, activities, processes, phenomenon, events and motivations) that directly or indirectly contribute to the process of behaviour change across the observed cases, 2) roles that each individual element plays in the process of change, 3) different ways in which these elements are addressed or applied across the cases, and 4) sub-processes of GBCPs. These findings help

rationalise the key constituents of GBCPs, how they collectively create an influential social environment for behaviour change, and how they are able to establish a culture of sustainability within the targeted social group. The findings also highlight that, although various factors motivate the participants in one way or another, the key driving factors in the process were social pressure (to comply with social norms), social image concerns, and self-identity concerns. These driving factors played a key role in encouraging participants to learn and adopt sustainable actions. These findings also help in understanding how GBCPs - encourage participants to associate with the program, keep them actively engaged and motivated throughout the process, and encourage them to perform the sustainable actions consistently so that they become a part of daily routine. Overall, the elements (causal conditions and factors) and sub-processes collectively provide an understanding of the mechanics of GBCPs, which would be useful in conceptualizing such social game-based programmes aimed at fostering sustainable behaviour.

Chapter 6 Conclusions

Previous chapters of this thesis discussed the literature pertaining to behaviour change theories and models, implemented cases of GBCPs, methodology and approach adopted in this study, and the results of the study in the form of the mechanics of GBCPs. This chapter concludes the study. It summarizes the answers to the research questions formulated in chapter 1 and discusses how this research contributes to the knowledge of design. It also discusses how the findings from this research address the gap between design and social approaches to behaviour change, when meeting sustainability objectives. It also discusses how this research provides useful insights for designers and social entrepreneurs on the mechanics of GBCPs. Finally, the chapter discusses the limitations of this study and future research directions.

6.1 ANSWERS TO THE RESEARCH QUESTIONS

The study focused on understanding the mechanics of GBCPs, particularly, the causal factors and conditions that contribute to the central phenomenon of behaviour change across the observed cases. It studied four cases of GBCPs and dissected their entire process into individual components, identifying the key elements and their role in the process of change. It also grouped the elements into seven sub-processes on the basis of their roles. The study answered the two research questions formulated in chapter 1.

6.1.1 Q1. Key Elements of GBCPs

In the first phase of the study, the theories and models from behavioural science and environmental and social psychology helped in understanding various motivators of behaviour, and factors that contribute to behaviour change. The review of the literature also provided an understanding of behaviour change

approaches, and how different behaviour change strategies and techniques are applied across interventions. They also highlighted the influence of social and contextual factors on behaviour and how social influence can encourage the adoption of new behaviour. This understanding from the literature was useful in identifying various elements (causal factors and conditions – incidences, phenomenon, strategies, events, activities and motivations) that contributed to the process of behaviour change across the studied cases of GBCPs.

The study adopted grounded theory methodology for studying four cases of GBCPs. The cases were investigated through three different channels, which were document analysis, interviews with the founders and organizers of the programmes, and interviews with the participants. The analysis of the data produced over one thousand five hundred distinct codes, which were grouped into forty-one categories (referred to as elements) on the basis of the phenomena they contributed to. Table 5.1 provides a complete list of all the elements. The study dissected the entire process of GBCPs down into its individual elements (causal factors and conditions) and identified the role that each of these elements plays in the behaviour change.

These forty-one elements represent various causal factors and conditions that influence the central phenomenon of behaviour change (Tables 5.1 and 5.2). These elements are a mix of various incidences, phenomena, processes, activities, events, motivations and strategies that either directly contribute to the process of behaviour change, or indirectly contribute by creating a suitable environment for behaviour change, or contribute to effective functioning and implementation of these programmes. For instance, elements such as ‘formal association’, ‘training and education’ and ‘removing barriers’ represent some of the processes and activities which prepare participants for active engagement

with the programme. ‘Formal association’ and ‘training and education’ are essential in communicating the social norms, teaching the rules of the game and new strategies to participants. They also stimulate active participation and spark a sense of commitment to a programme, whereas a process such as ‘removing barriers’ improves the ability of participants to adopt and perform sustainable actions, and improves the efficiency with which the desired behaviour can be performed.

Elements such as ‘developing empathy for the environment’, ‘developing a sense of commitment to a programme’ and ‘framing of information’ represent some of the significant processes, which either directly motivate participants, or indirectly contribute to facilitating a suitable environment for change. They make the participants more conscious of the environmental impact of their routine actions, stimulate learning and adoption of sustainable actions, trigger commitment to the programme, encourage participants to spread a culture of sustainability, and increase willingness to contribute to the environment.

On the other hand, elements such as ‘goals and targets’, ‘persuasive communication’, ‘benchmarking’, ‘positive feedback’, ‘prompts, reminders and tips’, ‘rewards and recognition’, ‘progression track’ and ‘social comparison’ represent some of the behaviour change strategies and techniques. These techniques are essential component of game mechanics. They play a significant role in GBCPs as they make the process interesting and add fun and excitement to the process. They keep the participants actively engaged and motivated to perform the desired behaviour consistently. They also help in extending the outreach of programmes by motivating outsiders to associate with them.

Some of the activities and processes such as ‘persuasive communication’, ‘image of the programme’, ‘promotional activities’ and ‘framing of information’ are useful in building a positive image of the programme, and in reinforcing credibility and commitment to a programme. They help in increasing awareness and willingness to contribute to the environment, and are essential in retaining longer engagement and averting defection, whereas elements such as ‘attention to inclusiveness’, ‘attention to context’, ‘selection and performability of desired behaviour’ represent some of the important considerations in effective functioning and implementation of the GBCPs.

Although all the above-mentioned elements (processes, activities, events and strategies) individually stimulate participants to adopt sustainable actions in one way or another, collectively they trigger various social phenomena referred to as driving factors. These social driving factors are ‘social image concerns’, ‘social pressure’, ‘self-identity concerns’ and ‘social norms’, which nudge participants to adopt sustainable actions and perform these actions consistently.

These forty-one elements do not represent a stepwise process because they do not occur sequentially in GBCPs. Rather, these activities, phenomenon, events and processes take place simultaneously and their roles overlap each other. While some activities and events take place at specific times, others take place constantly throughout the process. For instance, the element of ‘feedback’ comes into play once the participant has performed an action, whereas an element such as ‘social comparison’ has taken place throughout the process. Although it was observed that these elements were common across all cases, they varied in terms of their properties, dimensions, and particularly the way they were carried out or applied.

Despite these coinciding occurrences and overlapping roles between elements making the process of GBCPs a complex phenomenon, an understanding of these elements provides useful insights into the mechanics of GBCPs. The answer to this first research question in the study provides an understanding of various phenomena, concepts, strategies, processes, activities and motivations involved in the process of GBCPs from the perspective of behaviour change. It also helps understand causal factors and conditions in GBCPs, which collectively constitute an influential social environment that nudges participants to adopt sustainable actions in a playful way.

6.1.2 Q2. Role and Application of Elements

Besides identifying the elements of GBCPs, the study also focused on identifying the roles that each of these elements plays in the process, and ways in which these elements were taken care of or addressed across the cases. The analysis of the data from four cases produced over one thousand five hundred distinct codes, which were categorized into forty-one categories (referred to as elements). While breaking down the process of GBCPs into its individual elements, attention was also paid to the properties and dimension of these elements, and how these elements are applied in GBCPs. The codes under each of these 41 categories were again grouped into two sub-categories to answer the second research question. These two sub-categories were 1) the codes explicating the role that the element is playing in the process, and 2) the codes explicating the properties and dimensions of the element, and the ways in which the element is taken care of. Table 5.2 provides a comprehensive list of the roles that each individual element plays at different stages of the programmes. In addition, Table 5.3 provides details of how each of these elements are addressed and applied.

Role of Elements

Each element plays multiple roles in this multifaceted process, and each one contributes to the process of behaviour change in many ways. It was also observed that the roles of these elements coincide and overlap with each other. For instance, the activity 'sharing achievements' in the GBCPs 1) enhances the social image of the participants, which encourages them to adopt and perform sustainable actions consistently, 2) helps in extending the outreach of the programme as it encourages people to associate with the programmes, and 3) helps in building a positive image of the programme. Similarly, other activities like 'promotion', 'use of influential leaders and trusted messengers', and 'events and meetings' also contribute to the process of extending the outreach of the programme. Trusted messengers and influential leaders are the carriers of the brand, who organise events and meetings, educate people in their social group, inspire people to associate with the programme, and spread the programme's credible image. Promotional activities and events increase the popularity of the brand, add to social proof, and convince people to associate with the programme.

To effectively engage the participants and take them smoothly through the process of change, GBCPs first prepare and enable them. Processes such as 'training and education', 'removing barriers', and 'infrastructure and resources' play an important role in facilitating the delivery of necessary infrastructure, resources and training to participants so that they can perform the desired behaviour. The role of the element 'infrastructure and resources' is to facilitate 1) a communication platform between the programme and diversely located participants, 2) a platform for social interaction, performance comparison, monitoring and cross-referencing of actions, and 3) collection, quantification and processing of information. Similarly, the process of 'training and education' is important in GBCPs as it stimulate participants to learn and make informed

choices as well as raising awareness of the environmental consequences of daily actions, and training participants about the rules of the game for active engagement. Taking a different role, 'removing barriers' improves the ability of the participants to adopt sustainable actions and to ensure longer and active engagement. By removing barriers, GBCPs bring all participants to one level, where then can actively compete and perform the desired behaviour.

Game elements such as 'goals and targets', 'engagement (challenges, competitions and collaboration)', 'rewards and recognition', 'positive feedback', 'prompts, reminders and tips', 'progression track' and 'fun and excitement' also play a significant role in the process of engagement. They keep the participants actively engaged throughout the process, delineate clear objectives, add fun to the process, encourage participants to adopt sustainable actions in a playful way, and stimulate them to improve their performance consistently. Prompts, reminders and tips work as 'call to action' and provoke immediate response. They remind the participants, in a timely way, of exactly when certain actions need to be performed and provide personalised tips (based on past behaviour and context) which help participants incorporate actions into their daily routine. The process of engagement involves challenges, competitions and collaboration, which make the overall process interesting. They stimulate participants to learn and adopt sustainable actions in order to compete with others or to win a challenge. Different levels of challenges and competitions in GBCPs keep the participants engaged and motivated throughout the process, and this active engagement ensures the likelihood of continuation of the learned behaviour in the future. Table 5.2 provides a comprehensive list of the roles that each individual element plays at different stages of the programmes.

Similarly, other game elements such as rewards, recognition, positive feedback, and progression track also contribute to the process of engagement. Rewards are a form of positive feedback and appreciation of a performance. When announced publically, rewards enhance the social image of the participants, which stimulate them to repeat the new behaviour. Feedback also motivates participants to perform certain actions again, and stimulates them to perform both better than previously and better than others. Likewise, visibility of their progression track makes the participant feel that their efforts are contributing to the bigger effect and that they are an important part of the big system. This visibility of progression track 1) reinforces confidence in one's self and in the system, 2) encourages the participants to set new targets and undertake new (more difficult) challenges, and 3) motivates them to remain engaged with the programme and perform consistently. Figure 5.9 depicts the game elements involved in the process, and section 5.5 describes the roles of each of these game elements.

Some of the processes and activities in GBCPs such as 'social comparison', 'social interaction', 'sharing achievements', 'benchmarking', and 'monitoring and cross-referencing' play a significant role in the process of engagement. They communicate and establish social norms (expected behaviour in the group), spread sustainability awareness, and trigger competition. When the performance of participants is socially compared it triggers healthy competition, indirectly communicates social norms, builds up social pressure within the group, and motivates the participants to set new benchmarks. 'Social interaction', 'sharing achievements', and 'monitoring and cross-referencing' also help in 1) cross-referencing and reflecting on one's own actions, 2) comparing performances and setting new benchmarks, 3) sparking competition between participants, 4) learning new sustainable actions from others, 5) learning new

strategies for adopting the actions into the daily routine, 6) establishing social norms, and building social pressure. All these motivate the participants to perform sustainable actions repeatedly which leads to them becoming integrated into their daily routine. Although each element (processes, activities, phenomenon) has its own specific role in the process of behaviour change, they collectively constitute an influential, healthy, and competitive social environment for behaviour change. This social setting results in multiple social phenomena such as 'social image concerns', 'self-identity concerns' leading to 'social pressure', and 'compliance with social norms', which nudges the participants to adopt and practice sustainable behaviour.

It was observed across the cases that besides external factors such as rewards, recognition, personal benefits, and enhanced social image, GBCPs also target intrinsic factors such as self-efficacy, altruism and selfless behaviour, to influence choices made by a participant and thereby target a positive change in behaviour. Various activities and processes of GBCPs such as 'developing self-efficacy', 'training and education', 'developing empathy for the environment' and 'developing a sense of commitment to a programme' are used to target these intrinsic factors. For instance, the process of 'developing empathy for the environment' makes the participant more conscious of the environmental impact of their routine actions. It also helps to stimulate learning and adoption of new sustainable actions, and encourages participants to spread a culture of sustainability by extending the outreach of the programme. Similarly, 'training and education' about the environmental impact of actions and their consequences also helps increase willingness to contribute to environmental welfare; and the process of 'developing self-efficacy' (Bandura, 1977; Bandura, 1997) refers to reinforcing self-confidence among the participants in terms of their ability to perform desired actions efficiently. GBCPs use a number of

strategies and techniques to make participants believe that sustainable actions are easy to adopt and perform. This encourages the participants to adopt new behaviour.

It was observed across the cases that once the participants adopt the desired behaviour, GBCPs encourage them to practice the new behaviour repeatedly so that it becomes a part of their daily routine and replaces the, unsustainable, habitual behaviour. In this process of gestation, elements (processes) such as 'incubation of behaviour', 'averting defection and handling discouragement', and 'retaining a programme to embed a culture' play a key role in GBCPs. The incubation process transforms a beginner into an expert at performing the desired behaviour and prepares the participants to perform more complex sustainable actions. The process 'averting defection and handling discouragement' deals with discouragement, failure and setbacks, and helps in averting disengagement with a programme by keeping the participant active throughout the process. Longer and active engagement ensures a higher likelihood of continuing the learned behaviour into the future.

Some of the elements (considerations, strategies, and processes) such as 'attention to inclusiveness', 'attention to context', 'quantifying and smart processing', and 'assessment and evaluation' are important in effective functioning and implementation of the programme. For instance, regular assessment helps to evaluate the effectiveness of the programme and decide on steps to improve it. It helps to identify and address issues to keep a programme active and engaging. Assessment of the results of challenges provide useful insights for designing future challenges, events and activities. Similarly, the process 'quantifying and smart processing' is a continuous one, which involves collection and processing of contextual information to make the system intuitive,

context-aware, and more accurate. It helps in reporting the real-world impact of sustainable actions and quantifying the performance of both individual participants and the programme. Similarly, 'attention to context' and 'attention to inclusiveness' are essential components of GBCPs as they help to effectively engage all participants irrespective of geographical and cultural diversity, and ability. These considerations help to make a programme suitable for all so that participants remain associated and perform the desired behaviour for a longer period. Table 5.2 provides a comprehensive list of the roles that each individual element plays in GBCPs.

Sub-processes

On the basis of the roles that each element plays in the process, they were broadly categorized into seven groups. These represent seven sub-processes of GBCPs that were common across the cases. These sub-processes are, 1) preparation and enablement, 2) amplifying social learning and comparison, 3) extending the outreach, 4) motivation for change, 5) strengthening the behaviour, 6) effective engagement and 7) effective functioning and implementation. Figure 5.1 depicts these seven sub-processes and section 5.4 explains each process in detail. Figures 5.2–5.8 depict the elements that contribute to each of these sub-processes, and also explain the roles that each element plays in the sub-processes. This break-down of the entire process of GBCPs into seven sub-processes provides useful insights into the functioning of these programmes.

Application

To gain in-depth understanding of the mechanics of GBCPs, in addition to the role of the elements, it is also important to understand how each element is addressed or delivered in the process. This includes understanding what

considerations are kept in mind while applying the elements, their dimensions, properties, the prerequisites for these elements and the context in which they are applied. Table 5.3 provides a list of ways in which each of these elements is addressed or delivered.

It was observed across the cases that, though the elements were common across all cases, the ways in which they were addressed or applied differed from case to case. For instance, the element of 'social comparison' is common across all the cases, but the way it is applied differs. Some programmes compare performances at particular intervals, such as weekly or monthly, whereas others make comparative results available at all times throughout the process. Similarly, 'social interaction', which was an important component of the GBCPs was carried out and achieved in different ways. Some programmes encourage interaction (feedback, suggestions and comments) between the participants using a digital online platform, whereas others encourage face-to-face interaction through meetings. Similarly, the element 'goals and targets' is used across all the cases, but the ways in which it is used differs from case to case. Table 5.3 provides a list of ways in which each element is applied.

It was observed that some cases used emergent technologies such as Big Data and Data Analytics in their process. These technologies played an important role as they assisted in the process of behaviour change by improving operational efficiency, optimizing promotional campaigns, and in understanding ongoing changes in behavioural patterns and actions across GBCPs. They also helped the organizers understand how small efforts and actions contribute to the programme's overall objectives, and what needs to be changed during the course of the programme; how to design challenges, and how to easily implement the programme in a particular context. Use of technology in GBCPs is

particularly useful for researchers, not only to promote understanding of various aspects of the programmes but also for comparing several programmes against each other in terms of their effectiveness in fostering sustainable behaviour. For designers and social entrepreneurs engaged in the design of game-based programmes that foster sustainable behaviour, these emergent technologies would be useful in effectively managing and implementing those programmes.

The answer to the second research question provides an understanding of the roles of the elements and different ways in which these elements are applied in GBCPs, highlighting the various factors considered while applying these elements in terms of the prerequisites, context of application, and strategies used. The answer to the second research question also provides useful insights into the sub processes of GBCPs by shedding light on how individual elements collectively contribute to the sub-processes, and how the sub-processes collectively contribute to the overall objective of the programme. Overall, these findings help reveal how the constituents (elements and sub-processes) of GBCPs collectively constitute an engaging and influential social environment, that encourages participants to adopt sustainable behaviour in a playful way.

6.2 CONTRIBUTION TO THE KNOWLEDGE OF DESIGN

The research highlights how GBCPs help participants (individuals, families, and organizations) to take more control over their everyday actions and make informed choices under the influence of social games. It indicates the potential of GBCPs and how they foster sustainable behaviour through social games. Through its constituting elements, their respective roles, and the sub-processes involved, the findings from the research provide useful insights into the mechanics of GBCPs. These findings provide a break-down of the entire process of GBCPs, and help to understand the importance of each constituent element

in the process of change, and the way it is addressed. Moreover, it provides an understanding of how the elements (phenomena, incidences, activities, processes, events, and motivations) of GBCPs collectively constitute an influential social environment for behaviour change that has the potential to foster a culture of sustainability within the targeted social group. The study draws attention towards the importance of such social game-based solutions in achieving a positive change in environmental behaviour.

The field of 'design' is evolving as design professionals are addressing an increasing range of social and environmental challenges. As a result, new approaches, strategies, languages, tools and methodologies are emerging, and the ideas about 'what design is' are thus changing (Chick, 2012). The design community is becoming increasingly conscious of its responsibility to meet sustainability objectives, and is progressively adapting to participate in sustainable development arenas. It has been acknowledged that design has the potential to address the sustainability agenda because it touches on various economic, environmental, social and cultural dimensions (Chick, 2012). It has started thinking beyond the eco-design principles, products, materials and processes, and is now considering the sociological and psychological aspects of consumption of products and resources (Chick, 2012; Sharma & Siu, 2016). The focus of design is shifting from consumer culture and economic markets to socially innovative design (design for social innovation) to address social and environmental challenges (Niedderer, 2013). This research contributes to this growing interest in the social dimension of design. It highlights the potential of a social game-based approach in addressing environmental challenges by achieving a positive change in consumption attitudes and behaviour.

Researchers have emphasised that in order to achieve the vision of a sustainable society, positive change is required in consumption behaviour, both at individual and collective level (Ehrenfield, 2008; Clune, 2010; Jakson, 2005; Belz, 2009). Moreover, since surrounding influences such as the social group or the community play an important role in influencing the choices made by an individual, behaviour change interventions should take social influence into account, and should socially influence groups in order to target societal change and to establish a long-term sustainability culture. With its creative interdisciplinary approach, ability to understand the context and produce co-creative and prototype solutions, design is best positioned to lead this collective social transformation (Chick, 2012). It has the potential to drive a positive change in consumption behaviour and establish a culture of sustainability. This research enables design to make strategic use of social influence as a tool to achieving a positive social change.

The research also addresses the concern expressed by some scholars on the gap between design-led and social approaches to behaviour change. In particular, Sharma and Siu (2016), Shove et al. (2008), and Scott, Bakker & Quist (2012) suggest that though design-led approaches have been quite effective in inducing a positive change in environmental behaviour, they are mostly product and action-specific, and seldom consider the social context in which behaviour evolves, nurtures, persists, changes and defects. As a result, these design-led behaviour change approaches to sustainability have received critical responses. Similarly, Clune (2010), Chick (2012) and Niedderer (2013) suggest that though the significance of the social dimension to behaviour change is well recognized, the domain has largely remained ignored and under-researched. And, despite significant contribution made by research in the field of ‘design for behaviour change’ and ‘design for sustainable behaviour’, there is a substantial gap

between design-led approaches and consideration of social and contextual factors that influence behaviour. There are no strategic frameworks available to facilitate designer's engagement with social behaviour changes that are directed towards meeting sustainability objectives.

Similarly, research also addresses the concern expressed by some scholars regarding the mechanics of (social) game-based interventions for behaviour change. In particular, Sharma and Siu (2017) suggest that though the importance of social and contextual factors on individual's behaviour is well recognized and even explicated by various theories and models in behavioural and social sciences, its application through (social) game-based solutions, for fostering sustainable behaviour, is relatively new. There is less research available on the overall mechanics of GBCPs, the factors that contribute to the process of behaviour change, and how these game-based social interventions can foster sustainable behaviour. For designers and social entrepreneurs engaged in behaviour change for sustainability, there are no guidelines and frameworks available that can help them when conceptualizing such game-based interventions for achieving sustainability objectives (Sharma & Siu, 2017; Niedderer, 2013)**.**

To some extent, this research addresses these gaps. It facilitates design's engagement in social behaviour change by targeting collective social transformation through game-based social interventions. It facilitates designers' ambitions to think beyond individualistic and product-specific approaches, and engage in the social dimension of behaviour change for environmental benefits. Through the mechanics of GBCPs, the findings of this research provide useful insights for conceptualizing such social game-based interventions for fostering sustainable behaviour.

For designers, creative idealists and social entrepreneurs engaged in behaviour change for sustainability, this research provides some essential touchpoints to consider while conceptualizing such social game-based interventions targeting behaviour change for environmental benefit. Although the research does not provide a complete procedure, nor steps or guidelines for conceptualising such programmes, however, the findings do help to elucidate the causal factors and conditions that contribute to behaviour change in GBCPs. These causal factors or elements (phenomena, incidences, events, activities, processes, and motivations) indicate some of the points to consider when conceptualizing GBCPs for fostering sustainable behaviour. The findings also offer different ways in which these elements (causal factors and conditions) can be applied in GBCPs. The study would encourage designers to consider social game-based solutions as one of the possible ways to address sustainability issues. Moreover, the research adds another dimension to how design can further contribute towards building a sustainable society.

6.3 LIMITATIONS OF THE STUDY

The study answers the research questions and provides an understanding of the mechanics of GBCPs through its constituting elements and processes. However, since the sample size of the studied cases was small, it is not possible to generalize the findings. The study was explorative in nature, and followed a rigorous process to identify various causal factors and conditions (elements and processes) that contributed to the central phenomenon of behaviour change. However, it is possible that some of the phenomena and concepts have remained unnoticed during the process and were not captured through the study.

Besides, as mentioned in section 4.5, the study focused on particular type of GBCP case. Therefore, the findings of the study have restricted applicability and may not be widely applicable to other contexts, other similar types of game-based interventions, or interventions focusing on encouraging other types of behaviour. The findings from the study are relevant only to social game-based interventions focusing on fostering sustainable behaviour.

In addition, there are some limitations of the study pertaining to the methods adopted in this research. Some of these limitations were discussed in section 4.10. The first method used for investigating the cases was document analysis. Although documents are considered as 'unobtrusive' and 'non-reactive' source, which are unaffected by the presence of the researcher (Bowen, 2009), there is a possibility that the case documents were prepared for other specific purposes rather than research. There is, therefore, a possibility that documents provided information aligned with the policies, image of the brand or marketing agenda, thereby introducing bias. Similarly, the interview method used in the study could also be prone to bias because respondents tend to speak in favour of the programmes they are associated with. Considering these limitations, the findings of the study cannot be considered universal. Nevertheless, the study does provide useful insights into the mechanics of GBCPs.

6.4 FUTURE RESEARCH

This study serves as groundwork for further research in this direction. It provides a foundation for investigating more structured tools, procedures, methods and guidelines for designers and social entrepreneurs, which could help them devise and effectively implement GBCPs for fostering sustainable behaviour. Future research in this direction should investigate well-thought-out, evidenced-based, tested procedures and techniques for conceptualizing GBCPs. Such research

could take a practice-based approach, involving design and implementation of such programmes in different contexts for a longer period, and extract insights for more structured tools and steps. These studies should also evaluate the impact and effectiveness of such programmes over a longer period.

Although this research provides an overall understanding of the mechanics of GBCPs, investigation of additional such diversely implemented cases could further enrich this understanding and bring new insights into sub-processes of GBCPs, properties and dimensions of the contributing elements, and ways in which these could be applied. Study of successfully implemented cases of GBCPs from diverse sectors such as healthcare, entertainment, and education may add new insights in terms of strategies, techniques and approaches which could be applied to the context of sustainability. Future studies should also focus on GBCPs that have not been effective or have failed to foster sustainable behaviour within a social group. Such studies should identify the factors that contributed to the failure and the elements that were missed out or were not addressed appropriately.

Considering that the significance of social influence on behaviour is now well recognized, continued studies on how design can contribute to this field are particularly necessary. Since design has the potential to lead positive social change (Muratovski, 2016), it becomes especially important for the discipline to engage in social approaches towards encouraging positive change in environmental behaviour. Besides game-based interventions, future research should also investigate other types of social interventions and approaches to behaviour change, and facilitate design's engagement in a collective social transformation. It should take an evidenced-based approach and investigate ways in which social influence can be harnessed to establish a culture of

sustainability within a targeted social group. This would another dimension to how design can contribute more effectively towards building a sustainable society.

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