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# Sustainable innovation journeys: exploring the dynamics of firm practices as part of transitions to more sustainable food and farming

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**Abstract**

Deep structural and sustained change is necessary to tackle contemporary environmental challenges.  How such change emerges and can be governed has been explored through the notion of sustainable innovation journeys.  To date research had conceptualised such journeys as transitions to more sustainable socio-technical systems, e.g. mobility, shelter, food and farming.  However, there is a paucity of how innovation proceeds in firms as part of sustainable innovation journeys.  This paper begins to address this gap in knowledge.  A longitudinal case study was completed of a medium sized food processing firm in the UK. Qualitative data were collected using ethnographic methods such as participant observation. Drawing on practice theory, a conceptual framework was developed which enabled us to explore and make sense of the Firm's sustainable innovation journey conceptualized as practices. Findings show that we can usefully treat a firm as a flow of practices that either resist or otherwise accommodate new practices deemed more sustainable.

**Key words: Sustainable Innovation Journeys; Practice Theory; Food and Farming**

# 1      Introduction

Deep structural change is required to address contemporary environmental challenges such as climate change and resource depletion (DECC 2009). How such change might be achieved is the subject of a growing body of research concerned with transitions to more sustainable, socio-technical systems that meet societal demand for functionalities such as mobility, shelter and food. Transitions research is concerned with the dynamics of socio-technical innovation. How such complex innovation processes unfold over time is of particular interest and has been studied by a number of authors under the heading sustainable innovation journeys.

Previous studies framed by the journey metaphor explored the dynamics of product innovation in discrete organisational entities (Van de Ven, *et al*., 1999). In contrast sustainable innovation journeys have been studied at various scales including societies, sectors and nations in order to identify policy lessons for management (Geels *et al*., 2008). Also in the context of structural change to resolve contemporary environmental challenges the term 'sustainable' has been used to recognise that in order to address contemporary environmental challenges, innovation needs to be *sustained* for long periods of time - decades rather than years *ibid*.

In terms of characteristics, research suggests that sustainable innovation journeys are likely to be open and uncertain, full of search and exploration processes, twists and turns to be explored and involve actors navigating, negotiating, and struggling their way forward and sometimes backward (Van de Ven *et al*., 1999; Geels *et al*., 2008). Also and importantly, actors involved in such journeys may not know the final

destination; there may be a general sense of direction but the precise journey changes as the traveller gains more knowledge and experience (Geels *et al.*, 2008).

With the notable exception of Lovell's work on discourse, politics and power in sustainable innovation journeys (Lovell, 2008) much of the research completed to date in this field has been informed by the conceptual apparatus of Transition Management (TM), e.g. the Multi Level Perspective (MLP). Seen in this way, research on sustainable innovation journeys reflect the dynamics and characteristics of the innovation process portrayed by TM concepts. However, research rooted in practice theory also provides insights on innovation and deep structural change in the context of sustainability.

Practice theory focuses on people and the multiple, mundane, routinized doings that constitute society. Practices are constituted by their distinct elements such as people, forms of knowledge, things (artefacts) and their use. While practice is conceptualised as what people do, this approach also shows that human action is contingent upon many elements beyond the individual. In other words, practices are more than what people do because forms of knowledge and technologies, which lie beyond individual actors, are also implicated. Theories of practice, therefore, suggest that changes in what people do cannot be reduced to individuals' attitudes, behaviour and choices (Shove, 2010). Analysis centres upon practises rather than individuals. Actor agency and change is subsumed within practices. While earlier research on practice theory tends to focus on the persistence of practices, more recent research highlights how practices develop, sustain and disappear. This process involves the establishment of

relationships between elements that constitute a practice: materials, competences, meanings.

Recent work has attempted to link practices and show how relationships are formed between them. For example, in the context of western mobility practices, Watson (2012) explores how the practices of cycling and driving co-evolve: a process which involves among other things the defection and enrolment of elements of practice such as human actors. A systems of practice perspective has also emerged (Watson, 2012). This suggests that when practices are performed, such as cycling or driving, these are linked to the dynamics of practices through *'attendant systems of velo and automobility such that the systems themselves are transformed.'* Seen in this way, as a practice such as cycling is propagated, the meanings and discourses around it would change too, as cycling becomes mundane and unremarkable. Norms and expectations gradually shift. If these work in concert as part of a pattern of increasing recruitment to cycling, then a transition to velomobility can start to build. Thus transitions gather momentum around relatively soft changes in cycling, which then could become sufficiently normal and legitimate as a mode of transport and shift the priorities of road design and even formal rules of the road. Discourses would be re-wrought and as the material requirements for transport shifted with changing patterns of travel practices, the fortunes of manufacturers and their supply chains would also.

Importantly, proponents claim that innovation processes conceptualised as systems of practices cannot be explained in terms of niche and regime dynamics which lie at the heart of TM conceptual apparatus, e.g. the MLP. Instead, such processes are primarily understood as the co-evolution of practices: practices of recruitment to

cycling and defection from driving.  However, it is also recognised that opportunities to change such practices are somewhat dependent upon changes to the practices which constitute associated systems.  In the case of mobility these might include practices of:

1) road building and maintenance;
2) legislation and governing;
3) manufacturing and retailing.

 Here authors draw attention to the need to understand how practices co-evolve across diverse locales comprising the different levels of the socio-technical system through which transition comes about.  While patterns of recruitment to different mobility practices are necessary to incremental processes of system transition, the implication of a 'system of practice' approach is that changes to the system can result from shifts in practice at any level.  For example, changes at the landscape level (of the MLP), such as peak oil can translate into recruitment to cycling practices.

The practice approach to studying innovation, and the systems of practice approach in particular, may therefore provide new insights on the dynamics (twist, turns and reversals) of sustainable innovation journeys.  The systems of practice approach highlights the need to understand how practices co-evolve across different locales.  However, while there is considerable body of knowledge on household practices and practices associated with certain activities such as mobility (cf. Higginson *et al*., 2013; Watson, 2012), little is known about the dynamics of practices in firms and how such practices in firm locales may form part of sustainable innovation journeys.

In this contribution, we therefore begin to address this concern. The power of the practice approach may partly lie in its ability to show that firm practices are not given or static. Research may reveal the contingency of firm practices and the opportunities for intervention may become more visible.

In this paper we therefore consider in the context of sustainable innovation journeys studied from a practice perspective

1) the dynamics of practices in firms;
2) how these might be conceptualised;
3) how the dynamics of firm practices reveal opportunities for action that shape sustainable innovation journeys.

We explore the dynamics of practice in a medium sized food processing firm from the UK food and farming sector. Food and farming across the world including in the UK gives rise to significant environmental impacts, such as intensive land use, fresh water abstraction and energy consumption (IMechE, 2012) and innovation to address these are sought (Defra, 2006; Cabinet Office, 2008; GO-Science, 2010; Blay-Palmer *et al*., 2013). This firm therefore provided an interesting context in which to study how sustainable innovation journeys emerge in a firm situated in a sector with significant sustainability challenges.

The remainder of this paper is structured as follows. I the next section, details of the research method and the conceptual framework developed to explore the dynamics of practice are presented. A narrative of the innovation journey as it unfolded inside the

firm is presented in the next section:  the dynamics of practices observed using the
conceptual framework are explored and unpacked.  In the final section, insights on the
dynamics of practices and utility of the conceptual framework to explore these are
discussed, conclusions drawn and recommendations for further research made.

## 2      Method and conceptual framework

The firm processes a variety of vegetables which are distributed to UK food
manufacturers who typically use these to produce fresh ready meals.  This firm
formed the basis of a longitudinal case study. Qualitative data were collected during
the period 2008-2012, using ethnographic methods, including participant observation
and semi-structured interviews.  These ethnographic methods required the researcher
to engage with social settings in which phenomena can be explored (Hammersley and
Atkinson, 1995). The researcher was positioned inside the firm and participated in the
firm's sustainable innovation journey not as an employee but as an academic partner
collecting data while participating in firm activities. The firm comprises several
departments such as production, estate management and sales. The Researcher
engaged with practices associated with these departments over the course of the study.
This insider position provided the Researcher with an opportunity to observe and
reflect on practices and events in the firm.

Participation in the firm's daily activities enabled the researcher to observe practices
such as food processing and events such as environmental management meetings,
focus group meetings and workshops. Participation was determined by invitation from
key individuals such as the Managing Director. The researcher participated in several
environmental management meetings and followed up on how practices changes (or

not) in response to actions agreed in these meetings. For example, a number of focus groups were formed to develop and implement environmental management measures in the firm. These focus groups included key individuals from the firm (e.g. managers) and the researcher.

Data collected via participant observation were recorded in a reflective diary. Ethnographic methods typically require the researcher to participate in the social setting over an extended period of time.  While the period of this study encompassed four years, the frequency of visits to the firm changed over time. The Researcher visited the firm on average 3 days a week during years 1 and 2. Visits to the firm were reduced to once a month in years 3 and 4.

Semi structured interviews were also conducted with key informants in the firm to complement the researcher's observations. Key informants were identified on the basis of their role and understanding of the case study situation (e.g. senior managers and managers in the firm's departments). Interviewees were typically asked to describe their role in the firm; their views on environmental challenges facing the firm and its sector; how to address those challenges; including motivations to resolve environmental challenges. A total of 15 interviews were conducted. The interviews were recorded and transcribed.  The combination of interviews and participant observations enabled multiple perspectives on the firm's sustainable innovation journey to be gained.

A conceptual framework was developed using a funnel approach (Hammersley and Atkinson, 1995) to facilitate data analysis. While data were collected inside the firm,

literature (e.g. concerned with practice theory and innovation) was simultaneously reviewed to inform data analysis. This enabled a rich account of the sustainable innovation journey expressed in terms of the dynamics of practices to be developed. Thus the paper offers both insights on how sustainable innovation journeys unfold in firms, from a practice perspective, as well as details of an approach to studying such phenomena.

## 2.1    Conceptualising the dynamics of practice in a firm

Somewhat surprisingly, there is a paucity of research on how *sustainable* innovation proceeds in a firm. As noted earlier in this paper, research on innovation journeys has focused on product innovation in discrete organisational entities (Van der Ven *et al.*, 1999). This argues that within organisations innovation journeys involve new *ideas* which are developed and implemented to achieve desired *outcomes* by *people* who engage in *transactions* with others in changing institutional and organisational *contexts*. Other perspectives on innovation within organisational entities that tend to treat innovation processes as a series of processes from which particular outcomes arise. These emphasise a series of discrete stages which form model pathways from idea, to plan and implementation (*cf.* Arnold and Hockerts, 2011; Soril and Stokic, 2009). Similarly, the work of Van der Ven *et al.*, (1999) divides innovation into slices of time. Certain activities which should be undertaken at particular times to achieve successful innovation, are emphasised. Innovation is completed when outcomes are realised, ended and terminated, i.e. innovation is episodic.

In contrast, Beveridge and Guy (2005) argue that environmental innovation is a complex and messy process and that accounts which emphasise model pathways from plan to implementation are 'too clean' and do not adequately account for this process.

What may be going on between and beyond stages and the effects of context (e.g. spatial, institutional) in which environmental innovation unfolds is often overlooked *ibid.* Indeed, it is increasingly accepted that innovation does not emerge from a linear process, which proceeds from plan to implementation; Innovation is rather a complex process which is not determined by distinct factors involving the pursuit and avoidance of drivers and barriers.

With these thoughts in mind, let us return to practice theory to develop conceptual apparatus that may avoid these pitfalls and help make sense of how innovation proceeds in a firm. Reckwitz (2002) defines a practice as:

"*a routinized type of behaviour which consists of several elements, interconnected to one another: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge*" (Reckwitz, 2002:249).

Drawing on this definition as well as the work of Giddens (1984) and Warde, (2005), Shove and Pantzar (2005) have developed a framework to help make sense of practices. In this framework, practices are composed of three discrete and interlocking elements: materials, competence and meaning.

- Materials - objects, infrastructure, tools, hardware and the body itself

- Competences - forms of understandings and practical knowledge required to perform practices

- Meaning - an element that represents the social significance of practice and consist of the mental activities, emotion and motivational knowledge.

Practices exist when these elements are integrated and linked together. When elements are drawn together through successive moments a practice is performed. For example, when the practice of driving is performed the many interrelated physical elements (e.g. roads, petrol stations,) including the idea that driving provides a convenient means of transport are drawn together.

Shove *et al.* (2012) and Watson (2012) suggest that innovation is integral to the performance of practices and involves the (re)configuration of constituting elements. Seen in this way, innovation encompasses changes (or not) in the elements of practice that constitute performances. Following this practice view of innovation, Shove *et al.* (2012) identifies four distinct processes:

1. a new practice can emerge in which elements are drawn together for the first time and create a new performance

2. practices persist through successive moments of performances

3. the links between the elements that sustains a practice can be broken and associated performances can therefore disappear

4. a change in one practice can influence other interrelated practices

To explore sustainable innovation journeys in a firm from a practice perspective, we focused on practices performed in the firm (e.g. production, sales) and developed a

framework to make sense of how these develop over time. We therefore occupy an epistemological position which treats the sustainable innovation journey in a firm as a bundle of practices that are developed and redeveloped over time. Seen in this way, making sense of sustainable innovation journeys conceptualised as practices does not involve identifying distinct environmental practices. In contrast, when practices are performed in a firm, resources such as water and energy are implicated and residuals to air and other bodies arise. Thus sustainable innovation journeys involve developing new practices, redeveloping existing ones and importantly, discarding potentially problematic ones. A framework, depicted in Figure 1, was developed to explore sustainable innovation journeys in a firm conceptualized from this perspective. This framework suggests that practices can be explored by focusing on three interlocking elements; these are people, visions and artefacts.
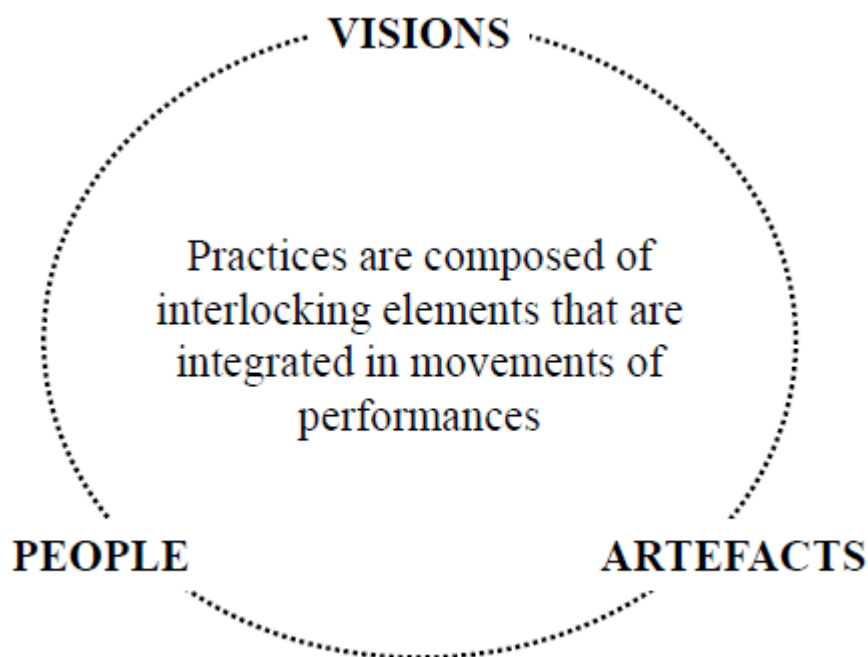


**Figure 1: Conceptual framework**

**People** are viewed as the carriers of practices (Shove *et al*., 2012). For example, production and sales are performances that are carried out by people embedded in the firm. While Shove *et al.* (2012) see people as implicit in practice, we argue here that people form a dynamic element of practices in their own right. This is because people in a firm have different roles, they move between and beyond firm practices, new people are appointed while others leave the firm. In other words, people in a firm's practices engage and disengage over time. People include any individual that is actively involved in the firm's practices at certain times, and are not just staff (managers and employees) but also consultants, customers, suppliers and regulators.

**Visions** form the second element of the conceptual framework. In aggregate, this element comprises the knowledge and meaning required of practices. For example, a common vision of good environmental business in many firms is 'making more products while using fewer natural resources'. In accounting for visions, this element enables us to explore how participants make sense of existing as well as future practices. And this matters, since visions shape the development of practices, i.e. innovation. Hence, vision is not an attribute in the minds of individual participants, but rather a discrete element of practice in which people participate. Visions found in a firm cut across many practices and cannot be easily bound to individual practices in a firm.

**Artefacts** are the third element of this framework. In aggregate, this includes technologies and other material stuff such as infrastructure, (e.g. buildings), devices (e.g. tools and machines) and literatures, (e.g. management frameworks, standard operations procedures, legislations) that are enrolled in the firm's practices. Here we

draw on Pinch and Bijker (1984) and argue that artefacts are socially constructed because they are both made and used by people. For example, a strategic document in a firm is an artefact developed by people. We can treat such artefacts as an outcome of strategy making practices. However, a strategic document only exists through the active and successive integration of this artefact in other firm practices (e.g. production). Similar to people and vision, this element may therefore be implicated in many practices at the same time.  For example, a strategic document in a firm may influence how sales and production is performed.

In summary, the conceptual framework presented above enables practices to be explored.  It emphasises the idea that when practices are performed many interlocking elements, including people, visions and artefacts are implicated.  Importantly, a practice cannot be reduced to any of these individual elements.  Elements of the firm's practices are not fixed but rather fluid. The dynamics of sustainable innovation journeys, conceptualised as practices, are shaped by the (re)configuration of elements involved and how these change over time. In other words, people change as new colleagues engage while others may disengage from the firm's practices.  Visions of requirements cut across many practices, and while new visions can emerge, those that are no longer required disappear. Artefacts in firm practices may change as new ones are enrolled and those that are no longer needed are discarded. In this way, we can account for what goes on inside a firm as a bundle of practices comprising interlocking elements, which exist through successive moments of performances expressed in terms of what people do. With this description in mind we can now show

how we used the dynamic model of practices to understand a sustainable innovation

journey in the case study Firm[1].


### 3       The dynamics of practice in the Firm

In this section we use the conceptual framework to explore a sustainable innovation

journey.  We focus on practices in a firm but recognise that these are founded on

elements which may not fall neatly within the firm's boundary.  Initial findings

showed that the case study Firm was deemed by participants to consist of two sets of

practices: 1) commercial practices and 2) operational practices as shown in Figure 2.


Commercial practices involve maintaining access to raw materials and ready-meal

markets and included specific practices that are performed such as procurement and

sales. Operational practices involve maintaining production of processed vegetables

such as peeling, dicing and packaging. It also includes transport to deliver products to

customers. Additionally, it involves those practices associated with estate

management such as maintenance of food processing equipment, energy and water

supply infrastructure and waste management.

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[1] From this point onwards the case study firm will be termed the 'Firm' and a firm in general
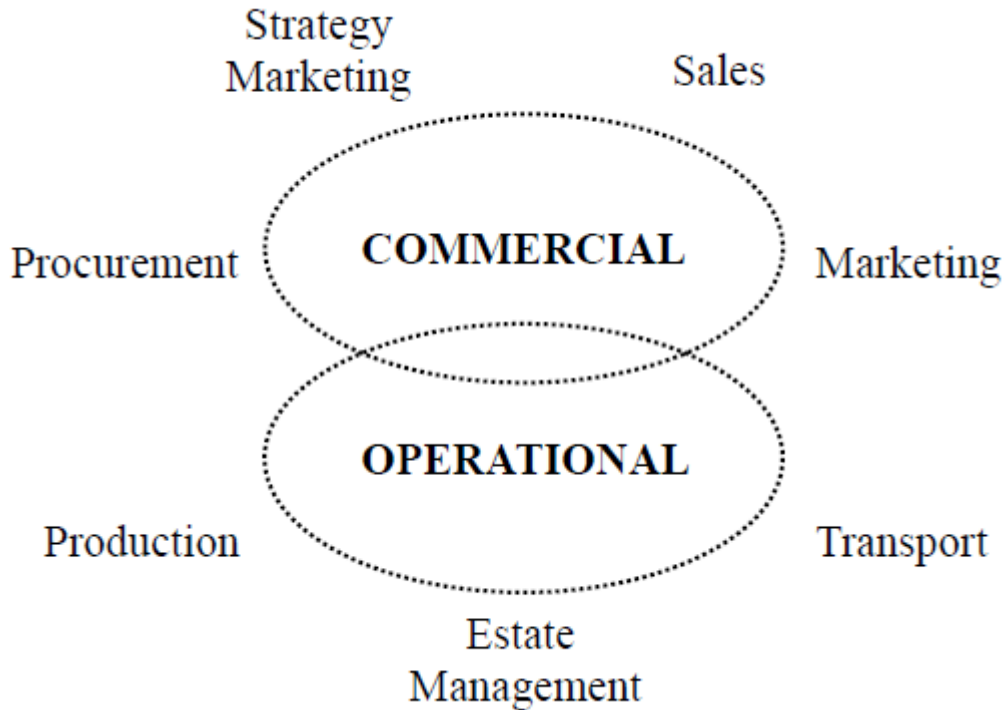as 'firm'.

**Figure 2: Practices in the Firm**

Drawing on our conceptual framework, we understand these bundles of practices to be based on many interlocking elements, which include people visions and artefacts. Commercial and operational practices were performed in the Firm and observable. The journey began with development of an environmental strategy for the Firm. This strategy drew on a vision for the Firm's development pursued by the Managing Director in collaboration with other participants, e.g. the Sales Manager. At this time, the Firm was looking to expand and address resource use, e.g. energy and water use. However, before we proceed, we have to recognize that strategies are not found outside practices rather they made through them and influence other practices.

The Firm's Managing Director (MD) led development of a corporate environmental strategy. This strategy aimed to improve resource productivity and achieve

competitive advantage. It was identified by the MD that this could be achieved by producing more products while using fewer resources.  The environmental strategy focused on the development of innovations to reduce resource inputs necessary for production. Resources included raw materials (e.g. vegetables) and how for example round shaped potatoes that are easy to peel might be sourced.  A focus on energy also emerged and various energy generation technologies (e.g. photovoltaics, wind turbines) and energy efficiency measures were considered.

In addition to raw materials and energy, water resource management is a key issue in the UK food and farming sector and was identified by participants as a key challenge to the Firm.  Water is abstracted from the Firm's own borehole.  It is subsequently used in production, to keep vegetables and equipment clean.  After the water has been used for these purposes it is then treated in an onsite water treatment plant.  The Firm sought to develop innovations associated with various aspects of water use. New practices were sought that increased production but used fewer resources such as water. The environmental strategy emerged in the Firm's strategic management practice and impacted both commercial and operational practices.  A focus on developing practices that specifically reduced water use in the firm emerged from this strategy. Below we draw on the conceptual framework to explore the multiplicity of interlinked practices associated with water use in the Firm and the associated sustainable innovation journey.

### 3.1    *Environmental strategy making practices*

The sustainable innovation journey associated with water use in the Firm in particular, begun with a focus on environmental strategy.  This strategy was made in practices

which were observed in bi-monthly meetings held in the Firm during the period between 2008 and 2010. These strategy making practices were orchestrated by the new Managing Director (MD) who invited people, including the Researcher, Operational Adviser, Factory Manager and Commercial Director to participate in these. Within these practices an emphasis on commercial viability was observed. For example, this involved thinking about the commercial value of various environmental innovations proposed to reduce water use in operational practices.

Using the conceptual framework we can trace the interlocking elements of this practice. People in these meetings were the Managing Director, Operational Adviser, Factory Manager, Commercial Director and the Researchers. Additional participants were a Marketing Consultant enrolled by the MD to assist in the development of this strategy. The vision underpinning this strategy making practice emphasised resource management. It was believed that better resource management could help resolve environmental issues and generate commercial value. Salient artefacts observed in this practice included the strategic framework, which was produced in strategy making practices (e.g. bi-monthly meetings). This framework comprises storylines that linked the Firm's practices to resource management issues that could help realise commercial value. For example, a key story line captured in this strategic framework was 'greener and leaner'. This refers to the idea that raw material inputs (such as potatoes) as well as other inputs such as water and energy can be managed to add commercial value to the Firm's outputs, e.g. ready meal products. This focus on resource productivity is consistent with the Firm's commitment to the voluntary agreement established by the UK Food and Drink Federation (FDF). This voluntary agreement is treated as an artefact in this strategy making practice. Participants made

use of this voluntary agreement to help make sense of environmental issues (e.g. water use, energy consumption and solid waste streams) and recognise the value of addressing these issues for commercial reasons. The elements of these environmental strategy making practices are detailed in Table 1.

**Table 1: Elements of environmental strategy making practices**

| People | Visions | Artefact |
|---|---|---|
| Managing Director, Operational Advisor; Factory Manager; Commercial Director; Marketing Consultant; Researchers | Better resource management helps resolve environmental issues and has commercial value. | Environmental Strategy; Voluntary Agreement |

This environmental strategy emerged and persisted for some time. However, it did not develop in isolation. Rather, practices of environmental strategy making were affected by other practices in the Firm (e.g. production and estate management) and also influenced the development of these Firm practices. In other words, the environmental strategy were co-constructed and not purely driven by the MD. Here, we do not deny that the relationship between this particular practice observed and others in the Firm is complex. We cannot express this relationship using terms such as cause and effect. In contrast, we can say something about how interventions to improve environmental performances and gain competitive advantage emerged in practices of environmental strategy making (e.g. bi-monthly meetings). People, such as the MD and Factory Manager involved in environmental strategy making agreed

on actions to develop new practices (e.g. marketing of environmental credentials) and to change existing Firm practices (e.g. production).  Below we unpack these pathways.

### 3.2 Marketing practises

The stated aim of the Firm's environmental strategy was to gain competitive advantage by improving resource productivity. The MD recognised a need to redevelop the Firm's brand to reflect this new business approach. New practices of marketing emerged in the Firm. The MD enrolled a marketing consultancy to assist in the marketing of environmental credentials. Among other things, a new company website was developed in which the environmental strategy was disclosed.  Key elements of this new marketing practice are depicted in Table 2.

**Table 2: Elements of new marketing practices**

| People | Visions | Artefact |
|---|---|---|
| Managing director; Marketing Consultant; Researchers | Marketing environmental credentials is important to gain competitive advantage | Environmental Strategy; Company Website |

This new marketing practice developed for some time in year 1. However, at the beginning of year 2 this new practice struggled to persist.  The implications of this are considered in section 3.3 below. The environmental strategy making practice also emphasised the need to address resource productivity issues in the Firm's operations and led to the development of new practices in these.  A key challenge identified by participants involved in the Firm's operations was water use. People engaged in estate

management practices recognised that the Firm was at the upper limit of its water abstraction licence quota. Also, the Firm's water treatment plant was working at the upper limit of its capacity. This was viewed as a problem because both limits to abstraction and the water treatment plant's capacity could constrain production growth and prevent the Firm from expanding. Thus, new practices were sought in the Firm to address issues of water use. New practices focused on (1) water treatment and abstraction (2) reducing water use in production.

### 3.3    Estate management practices: water abstraction and treatment

Estate management practices involved water abstraction and treatment. Water is abstracted from a borehole and supplied via water pipes to the factory floor. Appropriate water qualities for food production are achieved via water cleaning methods such as filtration. Water is used in production in which it becomes contaminated and needs treatment. Water treatment ensures that the quality of water discharged from the Firm to the local stream is commensurate with the requirements of UK regulations.

Water management practices are composed of many inter locking elements. The first element is people, in this case, water engineers who have specific engineering and technical expertise in water abstraction and treatment. They are responsible for maintenance and repair of equipment; making recommendations on how equipment may be developed; and compliance with all relevant regulations. The second element is vision. The vision underpinning this practice was that water abstraction and treatment is an appropriate and legitimate way to manage water in the Firm. This vision exists not only in the minds of the water engineers. It is also captured in

literature such as manuals associated with operational procedures, e.g. management

protocols. Here we observed a strong focus on water abstraction and treatment as the

main approach to water management: 'this is the way we tackle water related issues

around here'. The final elements of this practice are artefacts such as the borehole,

the water treatment plant and other infrastructure. These elements are extensive and

require significant financial resources to develop and maintain. Thus, artefacts play a

key role in shaping and maintaining this practice – the water treatment plant is the

way to clean effluent water. The interlocking elements of water management (e.g.

abstraction and treatment) are detailed below in Table 3.


**Table 3: Elements of water management practices**

| People | Visions | Artefact |
|---|---|---|
| Water treatment Engineers | Water abstraction and treatment is an appropriate and legitimate way to manage water in the Firm. | Borehole; Water treatment plant; the water infrastructure in the Firm (e.g. water pipes and water pumps); water quality standards and associated regulations; management protocols |


New water treatment practice was sought to overcome limits to the water treatment

plant's capacity. The Firm's Managing Director appointed an Operational Advisor to

search for a solution to this problem who engaged a water treatment consultant to

assist in this project. It is noteworthy here that at this stage, the challenges of water

use in the Firm were framed within and by water treatment. A new water treatment

practice was sought. A combination of anaerobic digestion technologies and

membrane reactors, both requiring significant investment but offering the possibility of water recycling, was considered. These artefacts would underpin a new practice that would resolve both limits to water abstraction and water treatment capacity. However, this new practice was not developed as high investment costs were seen as prohibitive. The payback period for this investment was too long. Thus rather than develop a new water treatment practice, existing water treatment practices were developed. This involved expansion of water treatment capacity largely through the acquisition of additional water holding tanks. The water holding tank and associated infrastructure expanded capacity and enabled the existing water treatment practice to develop and persist. The reconstituted elements which support this redeveloped water treatment practice are detailed in Table 4.

**Table 4: New elements of water management practices**

| People | Visions | Artefact |
|---|---|---|
| Operational Advisor; Water Treatment Consultant | Water abstraction and treatment is an appropriate and legitimate way to manage water in the Firm; issues of water treatment can be resolved by increasing its capacity | New water holding tank and associated infrastructures, e.g. water pipes and water pumps |

The financial and economic context of the Firm changed during the development and implementation of this environmental strategy. An emphasis on cost cutting and the redevelopment of existing practices emerged, while investment in large capital

projects (e.g. membrane reactors) to support development of new practices was discarded. At the same time the new practices founded on the Firm's commercial practices such as the marketing of environmental credentials were struggling to persist. The marketing of environmental credentials was seen to perhaps compromise other commercial values. This practice was therefore no longer pursued in the Firm. Environmental strategy making focused increasingly on cost reductions that could be attained through better resource management in operational practices. Thus a focus on the development of production practices emerged, with environmental strategy no longer based on commercial practices but on operation practices, i.e. it moved within the Firm.

### *3.4    Production practices: food processing*

Significant quantities of water are used in food processing, e.g. in peeling, washing equipment. Here, people in production use water in conjunction with technologies (e.g. water-pipes and food processing machines). Water was seen as a necessary resource to maintain a clean and hygienic production process. This vision was not only in the minds of people, including production staff, production managers, but also it was captured in management protocols and legislation (e.g. for food safety). The interlocking elements of food processing are detailed below in Table 5.

**Table 5: Elements of food processing practices**

| People | Visions | Artefact |
|---|---|---|
| Production staff; Production managers | Water is necessary to maintain clean and hygienic production process | Water infrastructure (e.g. water hose pipes); food processing machinery (e.g. dicers, peelers, conveyors); management protocols and legislation |

As noted above, water management was largely framed in the Firm in terms of water abstraction and treatment. Water management in production was viewed as an essential utility necessary to maintain a clean and hygienic production process. However, participants in the environmental strategy making practice (e.g. the MD and Factory Manager) wanted to change production in order to reduce water use in these and thereby ease pressure on water treatment and avoid the need for further capital investment in these. Development of new production practices were thus inspired by strategy making, and were sought simultaneously with development of the water treatment practice (e.g. inclusion of larger holding tanks) described above.

The Firm's water engineers were tasked with identifying ways to reduce water use in production. Changes in production were observed. These were initiated by the water engineers, who noted that people in production used open water hose pipes to clean food processing machinery. While this was seen by the Firms' engineers as a wasteful way to use water in production, this issue was now also recognised by production managers. Among other things, water guns were identified as an appropriate artefact

to address this problem. A small number of water guns were initially installed by engineers in certain locations in the food processing factory. The intention here was to eventually put water guns on all open hose pipes. However, during these initial trials people working in production found that these water guns (new artefacts) hampered other food processing practices such as cutting, slicing and packaging vegetables. Water guns were heavy to use and it took longer to operate water guns compared to open hose pipes. The water guns installed in the factory were removed and this change in production practices did not persist. However, this does not mean that enrolment of new artefacts (e.g. water guns) was the only intervention pursued in the Firm to resolve issues associated with water in the firm. Other interventions were also explored. For example, production managers asked people involved in production practices to reduce water use where possible. The interlocking elements observed in the development of new production practices are depicted in Table 6.

**Table 6: New elements of production practices**

| People | Visions | Artefact |
|--------|---------|----------|
| Managing Director; Factory Manager; Water Treatment Engineer; Researchers | Resource Management: reduce cost of factor input in relation to production throughput; avoid costly upgrade of end-of-pipe technology by easing pressure on water treatment plant | The Firm's Environmental Strategy; Factory Management Framework; water guns |

Development of production practices formed a part of the sustainable innovation journey in the Firm. However, while these formed the focus at a particular time in

this journey, they did not replace water treatment. Rather water treatment is a practice that persisted in the Firm, even though new production practices emerged. Water treatment remained a legitimate means to address water use, while production practices were developed to reduce water use in food processing. Hence this point in the innovation journey highlights both the persistence of performances and changes in these.

As noted above in section 3.2, a focus on reducing costs emerged in the Firm. The Firm's environmental strategy was not viewed as a priority. The environmental strategy making practice struggled to persist and disappeared. More specifically, key elements that sustained strategy making in the Firm were removed or left the Firm. For example, the MD, who initiated this strategy making practice, left the firm. Moreover, the strategic framework was discarded and the vision that improving resource productivity was important to attain competitive advantage was no longer deemed legitimate. The elements discarded from food processing practices are depicted in Table 7. This demonstrates that while new practices were performed and observed, such developments are reversible. Indeed, the broader notion of reducing water use was no longer viewed as a priority in the Firm at this time.

**Table 7: Elements discarded from Firm practices**

| People | Visions | Artefact |
|--------|---------|----------|
| Managing Director | Superior resource productivity provide a mean to gain competitive advantage in this sector | Environmental Strategy |

Subsequent to the disappearance of environmental strategy making practice rooted in commercial practices, the sustainable innovation journey continued in operational practices. Developing and maintaining operational practices was at this time a key priority in the Firm.  An interim Managing Director was appointed by the Parent Group[2]. Prior to this appointment, he worked as operational director in another division of the Group and was partly selected for this reason. This MD enrolled a new Factory Manager with a particular remit to develop production further. For example, new practices were developed to monitor and report what was going on in food processing. While such production management practices existed in the past, they were further developed. For example, an operational management framework was introduced by the Factory Manager and became visualized in the production meeting room.  This framework became a monitoring device and provided people managing production an overview of food processing practices (e.g. peeling). This focus on operational practices recognized an opportunity to develop new environmental management practices such as monitoring and reporting water use and energy consumption. The Factory Manager appointed the water engineer as Environmental Officer and enrolled him in this new environmental management practice. An environmental management framework was developed in operational and estate

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[2] The Firm form part of a group of food processing firms owned by a Parent Group

management practices and merged with the overall operational management framework. In other words, this environmental management framework developed within and through Firm practices. The Environmental Officer played a key role in the practices of environmental management. He collected information about water use, energy consumption and waste streams and reported this information to the production meeting. This information was found to be useful in the firm to identify and prioritise interventions to improve resource productivity and reduce cost. The interlocking elements of this new environmental management practice are provided in Table 8.

**Table 8: New elements of environmental management practice**

| People | Visions | Artefact |
|---|---|---|
| New Managing Director; new Factory Manager; Water engineer/ Environmental Officer | Resource management and cost of these provided the focus of attention | Operational Management Framework; Environmental Management Framework |

This new environmental management practice emerged in operational practices and persisted. Issues of resource management were recognised in this environmental management practice and influenced other Firm practices such as production. For example, a water recycling device was added to one of the peeling machines used in food processing. This new artefact contributed to significant savings to water use in production, without compromising other interrelated practices and outcomes such as peeling.

### 3.5    *Sustainability strategy making practice*

The next stage in the Firm's sustainable innovation journey involved a sustainability strategy making practice.  This practice was initiated and owned by the Parent Group. It was developed as a response to a major customer's sustainability strategy and the Food and Drink Federation's revised sustainability framework and associated voluntary agreement.  The Parent Group appointed a Sustainability Director. The vision underpinning this new sustainability strategy practice was that sustainability provided a legitimate frame for business continuity in the UK food and farming sector. In the Parent Group, business continuity refers to access to, and availability of, raw materials and utilities (e.g. water, energy). It was noted that price fluctuations, natural resource scarcity in the world may in future effect food processing.

The Sustainability Director engaged participants from the Firm in this strategy making practice.  For example, the new factory manager and a water treatment engineer, who was appointed Environmental Officer in the Firm. This sustainability strategy making practice was observed in monthly meetings.  The interlocking elements observed that constitute this practice are detailed below in Table 9:

**Table 9: Elements of sustainability strategy making practice**

| People | Visions | Artefact |
|---|---|---|
| Sustainability Director; Environmental Officer; Factory Manager; the Researcher | Sustainability provide a legitimate frame for business continuity in terms of access to and availability of natural resources that are essential to complete food processing | Sustainability framework developed by a customer; Sustainability framework developed by the Food and Drink Federation; Sustainability Strategy Framework developed internally |

Thus, inspired by established ideas of sustainability and associated frameworks found in the food and farming sector, the Sustainability Director in collaboration with participants in the Firm and other divisions of the Parent Group developed a Sustainability Strategy. This Sustainability Framework was based on four key themes:

(1) social responsibility;

(2) natural resource use;

(3) transport, and

(4) waste removal and disposal.

Subsequently, this strategy-making practice and the resultant sustainability strategy framework influenced the maintenance and development of certain practices in the Firm. For example, issues associated with the future availability of natural resources such as raw materials, water use and energy consumption was identified. In

commercial practices, new practices were sought for procurement of raw materials. The Sustainability Director noted that a number of the firm's raw material suppliers (e.g. tomato growers in southern Europe) are located in areas that may face significant water shortages in the future. This was not only seen as a problem for suppliers but also a potential problem for the Firm: if the supply of raw materials is hindered, then the Firm's activity may be impaired. In response, the participants in the Firm including the Firm's Commercial Manager recognised a need to develop a new procurement strategy. However, development and implementation of this procurement strategy could not be observed within the duration of the study.

## 4       Summary and Conclusions

This paper considers how innovation journeys emerge and proceed in a firm as part of efforts to attain more sustainable food and farming. Drawing on practice theory, preceding sections show how innovation journey's involve (at the same time) the development, persistence and deletion of practices. Such processes were open and uncertain, full of search and exploration processes, involving actors navigating, negotiating and struggling their way forward and sometimes backwards.

New environmental strategy making practices were developed in the Firm, which persisted for some time. While these led to the development of new marketing practices, these struggled to persist when environmental strategy making practices disappeared in the end of year 2, and environmental strategy making practices disappeared. However, this did not mean that activities in the Firm to resolve environmental challenges ceased. The nature and direction of the sustainable innovation journey rather moved to another area within the Firm. We observed that

the vision underpinning development of new practices changed from a focus on commercial values to the importance of cost cutting associated with natural resource use (e.g. energy and water). This insight shows that certain visions such as resolving environmental challenges to gain commercial value struggled to embody other Firm practices such as marketing and sales. In contrast, resolving environmental challenges as a means to cut cost associated with production were seen more credible. This vision embodied operational practices such as production. For example, water management practices in the Firm expanded from (re)development of abstraction and treatment to the development of new production practices to reduce water use.

From a practice perspective, notions of sustainability are constructed in practices, vary from context to context (e.g. sectors, locales) and shift over time (Guy and Moore, 2005). The findings of the paper are consistent with this view. We observed how the notion of sustainability in the Firm was made in environmental strategy making practices in years 1 and 2. The stated aim of this environmental strategy was to enhance the Firm's competitive advantage by improving resource productivity, reducing energy consumption and water use. However, at the end of year 2, the environmental strategy making practices struggled and this pathway did not proceed. We noted how subsequently the notion of sustainability shifted in the Firm. In years 2 and 3 the notion of sustainability was made in operational practices. For example, (re)development of food processing practices attracted the attention of senior managers (e.g. the Interim Managing Director and Factory Manager). They identified resource management as a means to reduce cost of production. During this time interventions were sought to reduce cost of raw materials and other inputs in production such as water. This pathway developed and proceeded in operational

practices. In years 3 and 4, a sustainability strategy emerged in the Parent Group as well as in the Firm. People in the Parent Group (e.g. Sustainability Director) and in the Firm (Factory Manager) recognised that resource input (e.g. raw materials, water and energy) are essential for business continuity. In this way, notion of sustainability was made in the firm's operational (e.g. production) and commercial (e.g. procurement) practices.

Insights from this longitudinal case study highlight additional salient characteristics of sustainable innovation journeys. The sustainable innovation journey in the Firm was found to be an ongoing and fluid process. Drawing on practice theory and the conceptual framework developed in this paper, we view the Firm as an ongoing flow of commercial and operational practices. These Firm practices are ongoing because they were made, remade and persisted or otherwise disappeared. Moreover we observed that participants tried to develop new practices and change existing ones. Development of new and existing practices influenced (or not) the configuration of other Firm practices. In other words, the flow of practices is not static but rather fluid. The fluid nature of the Firm's sustainable innovation journey refers to change in the configuration of elements (i.e. people, visions and artefacts) that constitute Firm practices. New elements emerge as new practices are formed involving new people that are appointed, artefacts that are enrolled and visions that take hold and embody Firm practices. However, new practices must be made and remade in order to persist.

These ongoing and fluid characteristics question established ideas of how sustainable innovation journeys proceed, in firms in particular. Perspectives on sustainable innovation tend to suggest that such journeys have discrete beginnings and ends (see

for example Van de Ven *et al.*, 1999). However, we found that such accounts of innovation were incongruent with observations in the Firm as among other things, beginnings and ends of innovation were difficult to delineate. For example, we observed that different pathways were pursued as part of the Firm's sustainable innovation journey. Some pathways were discarded (e.g. environmental strategy making), while others proceeded (e.g. sustainability strategy making) and continued to develop beyond the duration of this study. In other words, sustainable innovation journeys are ongoing. Insights presented in this paper also challenge the idea of agency in sustainable innovation journeys: the ability and capacity of key individuals to shape innovation in desirable directions. We found that participants in the Firm can act and intervene in practices but cannot control them. As an example of this we return to observations in the case study Firm to further unpack its dynamics.

As noted above and in section 3.4 environmental strategy making practices in the Firm struggled to survive and eventually disappeared. We also found that the sustainability strategy making practice that emerged at a later time was made, remade and persisted. And importantly, this new practice influenced other Firm practices such as procurement (see section 3.5). Unpacking the dynamics of these two events provides key insights. The former involved the development of new practices that were resisted by the existing flow of practices in the Firm. The latter involved the development of new practices which was accommodated by the flow of practices in the Firm. Thus, in accounting for innovation conceptualized as practices in a firm we observed that the existing flow of practices in the Firm resisted or accommodated new practices. In other words, the existing flow of practices *is* the Firm's journey, to which participants can engage with through action and intervention, i.e. developing new

practices. Participants pursued a particular 'solution' (new practice emerged) that was

convincing and worth doing. Thus, a general sense of direction, i.e. a pathway, of the

Firms sustainable innovation journey was created at certain times.

We therefore suggest that people have agency to intervene in sustainable innovation

journeys, however, not to control its pathways. The question then is: how might

participants of a sustainable innovation journey, such as people in a firm, intervene?

Drawing on practice theory and insights from this longitudinal case study we argue

here that opportunities for action to shape journeys may be achieved from knowing

the flow of existing practices. Knowing the flow of practices in which participants

wish to engage is a form of reflexivity. Here, visions put forward by participants to

develop (or not) new practices play a key role. In broad terms, visions that accord

with core business proposition may be accommodated and shape new firm practices,

and visions that are not seen credible as basis for action may be discarded. Moreover,

while the established flow of practices in the Firm can be thought of as the Firm's

journey that either resisted or otherwise accommodated new practices, the

development of new practices was not found to be limited to traditional firm

boundaries.  In contrast, firm practices co-evolve with other flows of practices

established across diverse locales (or institutional spaces) such as farming, food

policy, food retail and consumption. This insight accords with latest development of

practice theory in which links between practices and systems are emphasized

(Watson, 2012). We observed that Firm practices are embedded within a broader food

and farming system.  For example, environmental strategy developed in the Firm's

practices drew on ideas from the wider food and farming system. However, links

between firm practices and wider systems are complex and unclear, and could be the

subject of further research. A system perspective of practices can provide novel and useful insight to those who wish to act and intervene with sustainable innovation journeys in food and farming sectors.

So in conclusion, this paper offers rich in depth insights on how sustainable innovation journeys emerge in firms from a practice perspective. It departs from earlier accounts of innovation journeys in which emphasize 1) model pathways from plan to implementation (c.f. Arnold and Hockerts, 2011; Soril and Stokic, 2009); and 2) episodes of innovation (cf. Van de Ven *et al*., 1999; Geels *et al*., 2008). Instead, our account is consistent with Beveridge and Guy's (2005) in that it highlights the importance of contexts (e.g. spatial, institutional) in which sustainable innovation unfolds. Indeed, by conceptualizing innovation journeys as practices we showed how existing practices in a firm resisted and/ or accommodated new ones sought as part of innovation journeys.

Importantly, our work emphasizes the dynamic nature of innovation journeys. As the term implies, we show that journeys are far from static. Our practice perspective does not prescribe how sustainable innovation journeys can unfold in firms by delineating pathways (*cf.* Geels, 2008; van der Ven, 1999). Rather, our research shows how directions are set in such journeys but not how destinations may be reached; how changes in practices can struggle to persist over the medium and long term and are therefore often only provisional achievements. In other words, our contribution highlights and provides a way of studying the *fluidity* of sustainable innovation journeys and emphasizes the difficulties of accounting for these using pre-existing frameworks that emphasize model pathways.

Firm practices are ongoing flows that are made, remade and persist or otherwise disappear. Practices are fluid because the elements (e.g. people, visions and artefacts) that constitute these change and in turn often affect the configuration of firm practices more generally. Seen in this way, participants may not be able to control flows of practices but they can observe and intervene, with varying degrees of success, in such flows.

However, our practice based approach is not without limitations. The effects of context in which sustainable innovation unfolds is not restricted to a firm's traditional boundaries. In contrast, firm practices may co-evolve with other flow of practices established across diverse locales. Hence, further research to develop a system perspective on sustainable innovation journeys could enable such dynamics to be explored. Furthermore, while our practice-based approach recognized three interlinked elements (people, visions and artefacts) we found that underpinning visions play a key role in development of new practices. However, while we are not suggesting that visions are a superior element to other elements (people, artefacts) of practices, we found that further unpacking of visions is needed. Drawing on the work of Lovell (2008) we can think of visions as story-lines that are materialized in practices. Story-lines can be defined as discursive cement that glues diverse actors together to perform action (Hajer, 1995). Tracing these story-lines and identifying how these are constructed may therefore be an important area for further research. Here, we suggest discourse analysis to unpack story-lines that may be found in the flow of practices that constitute food and farming.

# References

Arnold, M. G. and Hockerts, K., 2011. The greening Dutchman: Philips' process of green flagging to drive sustainable innovations. *Business Strategy and the Environment*, 20 (6), 394-407.

Beveridge, R., and Guy S., 2005. The Rise of the eco-preneur and the messy world of environmental innovation. *Local Environment*, 10 (6), 665-676.

Blay-Palmer, A., Landman, K., Kezevic, I. and Hayhurst, R., 2013. Constructing resilient, transformative communities through sustainable "food hubs". *Local Environment: The international Journal of Justice and Sustainability*, 18(5), 521-528.

Cabinet Office, 2008. Food *matters: towards a strategy for the 21st century*. London: Report published by the Strategy Unit, July 2008.

Department for Energy and Climate Change (DECC), 2009. *The UK low carbon transition plan: a national strategy for climate and energy.* London: DECC.

Department of Environment, Food and Rural Affairs (DEFRA). 2006. *Food industry sustainability strategy*. London: DEFRA.

Geels, F. W., Hekkert, M. P. and Jacobsson, S., 2008. The dynamics of sustainable innovation journeys. *Technology Analysis & Strategic Management,* 20(5), 521-536.

Giddens, A., 1984. *The constitution of society*. Cambridge, UK: Policy Press.

Government Office for Science (GO-Science), 2010. *UK cross-government food research and innovation strategy*. Government Office for Science. (Online). Available from http://www.bis.gov.uk/assets/goscience/docs/c/cross-government-food-research-strategy (Accessed 7 August 2013)

Guy, S. and Moore, S. A., eds., 2005. *Sustainable architecture: critical explorations of green building practice in Europe and North America*. New York: Spoon Press.

Hajer, M. A., 1995. *The politics of environmental discourse: ecological modernization and the policy process*. Oxford: Oxford University Press.

Hammersley, M. and Atkinson, P., 1995. *Ethnography: principles in practice*. 2nd ed. London: Routledge.

Higginson, S., Thomson, M. and Bhamra, T., 2013. "For the times they are a-changin": the impact of shifting energy-use practices in time and space. *Local Environment: The International Journal of Justice and Sustainability,* 10(5), 520-538.

Institute of Mechanical Engineering (IMECHE), 2013. *Global food: waste not, want not* (Online), Available from:

http://www.imeche.org/knowledge/themes/environment/global-food (Accessed 7 August 2013).

Lovell, H., 2008. Discourse and innovation journeys: the case of low energy housing in the UK. *Technology Analysis & Strategic Management*, 20(5), 613-632.

Pinch, T. J. and Bijker, W. E., 1984. The social construction of facts and artefacts: or how the sociology of science and the sociology of technology might benefit each other. *Social Studies of Science*, 14(3), 399-441.

Reckwitz, A., 2002. Towards a theory of social practices: a development in culturalist theorizing. *European Journal of Social Theory*, 5(2), 243-263.

Shove, E., 2010. Beyond the ABC: climate change policy and theories of social change. *Environment and Planning A*, 42(6),1273–1285.

Shove, E. and Pantzar, M., 2005. Consumers, producers and practices: understanding the invention and reinvention of Nordic Walking. *Journal of Consumer Culture*, 5(1), 43-64.

Shove, E., Pantzar, M. and Watson, M., 2012. *The dynamics of social practice: everyday life and how it changes*. London: Sage.

Sorli, M. and Stokic, D., 2009. *Innovating in product/process development. gaining pace in new product development*. Guilford, Surry: Springer.

Van de Ven, A. H., Polley, D. E., Garud, R. and Venkataraman, S., 1999. *The Innovation Journey*. Oxford: Oxford University Press.

Warde, A., 2005.  Consumption and theories of practice. *Journal of Consumer Culture*, 5(2), 131–153.

Watson, M., 2012. How theories of practice can inform transition to a decarbonised transport system. *Journal of Transport Geography*, 24, 488-496