ORIGINAL PAPER

Exploring the Cognitive Foundations of Managerial (Climate) Change Decisions

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Abstract

Climate change is a complex, multilevel challenge with implications of failure unimaginable for current and future generations. However, despite the Paris Agreement supporting the imperative for action in an atmosphere of scientific consensus, organisations are failing to take the decisive action required. We argue that this lack of organisational action needs to be addressed by examining the cognitive foundations of managerial decisions on climate change and sustainability. A systematic review of research on cognition, sensemaking and managerial interpretation where it is linked to climate change or sustainability is presented within this article. The results detail a multilevel analysis highlighting key themes and the core concepts from the literature including factors shaping the cognitive process, to elucidate reasons for inaction and potential for promoting change. Through this research, an integrated model is presented demonstrating the interaction of factors, cognitive processes and outcomes. Based on this analysis, potential reasons for inaction are proposed and countered by three potential solutions linked to leadership, social norms and structural reform.

Keywords Cognition · Sensemaking · Cognitive framing · Managerial interpretation · Climate change · Sustainability

Introduction

Concern is growing that as a civilisation we are exceeding the planetary boundaries that sustain life (Rockström et al., 2009). In December 2015, the 21st Conference of Parties (COP 21) delivered a global agreement for countries to reduce emissions to keep temperature increases below 2 $^{\circ}$C, with an aspirational target of 1.5 $^{\circ}$C (United Nations, 2015) with moral and legal cases raised to support this action. Despite this positive development in the movement against climate change there are no clearly developed paths for most countries to achieve the pledged reductions (United Nations, 2018). Further within countries where emission trading schemes are in place many organisations are yet to make the transformational changes required to decarbonise their operations (Laing et al., 2013; Okereke & Kung, 2013; Wade & Rekker, 2020). Wright and Nyberg (2015) have argued that organisations are actively locked into a process of creative self-destruction, exploiting the earth's resources at their own risk and the risk of civil societies; however, practical alternative solutions are not forthcoming. With close to unanimous scientific consensus on the anthropogenic nature of climate change (Cook et al., 2013, 2016) achieving change to halt the further degradation of the earth's atmosphere must be considered the salient wicked management challenge of the next decade. Given this overwhelming evidence on the need to act on climate change we ask why do decision makers remain complacent? Understanding the process of decision-making for or against action on climate change and sustainability is a vital step in overcoming long standing inertia in many organisations on the issue.

Management studies has evolved over the last 75 years to include cognitive perspectives in addition to the dominant economic view (Fassin et al., 2011). Increasingly management researchers are looking to the foundations of strategy which focus not on the actions and strategies themselves but on individuals and their interactions to comprehend the decision-making process (Felin et al., 2015; Gond & Moser, 2019; Gond et al., 2017; Groschl et al., 2019; Hahn

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et al., 2014). A branch of CSR research has recently emerged termed micro-CSR to capture research in these areas with streams identified as psychological or sociological (Gond & Moser, 2019). Reaching back for over three decades academics such as Weick (1988, 1993), Sharma (2000), and Kaplan (2008, 2011) have provided insight into the cognitive processes that occur when decisions are made in complex environments through research on cognition, sensemaking and managerial interpretation. Linked to Herbert Simon's (1957) concept of bounded rationality, research on cognitive processes acknowledge the difficulty in accounting for multiple factors from a diverse array of areas (Fassin et al., 2011) including, operational, financial, strategic and stakeholder factors when making a decision.

Despite the excellent body of research that has being amassed further work remains. Gond et. al. (2017) presented six research deficits through their insightful review of psychological microfoundations of corporate social responsibility. This article will seek to address two of these challenges relating to "mechanisms of reactions" and "new and more relevant individual differences that operate as drivers", while seeking to establish why managers remain complacent on the issue of climate change despite the clear imperative for action. Informed by the work of Gond et al. (2017), Gond and Moser (2019) and Groschl et al. (2019) our research, through a systematic review, will establish a clear understanding of the theoretical constructs of cognition, sensemaking and managerial interpretation, their relation to each other and to the issues of climate change, before examining the complexity of factors shaping these constructs. The scope of the research presented in our paper will be broadened beyond that of Gond et al. (2017) to consider both positive and negative influences that herein have been termed 'factors' rather than 'drivers'. A systematic review is appropriate to establish a synthesis of existing literature based on the rigourous assembly, analysis and interpretation (Rousseau et al., 2008) of the three foundational cognitive research areas to provide an understanding of the current state of research.

Through this research we will make three key contributions. Our first contribution will be to develop a systematic analysis of research on cognition, sensemaking and managerial interpretation linked contextually to sustainability and climate change with concept clarification as it relates to levels of analysis (the individual, organisation or general population). The second contribution is through the development of a construct specific, multilevel review of the factors which shape each of these cognitive foundational areas grouped into individual, organisational and societal levels. Our third contribution is a framework demonstrating the interplay between the cognitive perspectives, their construction and their relationship to outcomes (further cognitive change or behavioural action). Finally, a discussion based on this research presents three key issues leading to complacency and three paths to overcoming the inaction of decision makers on climate change.

The Systematic Review

The research problem addressed within this article has been examined through a systematic review of business and management literature. The method was chosen to provide rigour to the data gathering process ensuring that the data analysed came from high-quality, peer-reviewed prior research, that it was collected in an unbiased manner and analysed to interpret the state of research on foundations of managerial decisions (Rousseau et al., 2008; Tranfield et al., 2003; Williams et al., 2017). The methodology applied within the systematic review followed an established process based on the structure of past reviews by Williams et. al. (2017) combined with recommendations from Rousseau et. al. (2008) and Tranfield et. al. (2003) on the technical aspects to ensure rigour in the review process. The methodology has been broken into seven key steps under three broad categories (Tranfield et al., 2003; Williams et al., 2017):

1. Planning:

   a. evaluating the methodological appropriateness;
   b. developing the protocol including establishing boundaries (time period; journals including quality assurance); establishing search terms; determining search engine.

2. Executing the review:

   a. data extraction and assurance of suitability;
   b. collating database;

3. Analysis and reporting:

   a. conducting descriptive analysis
   b. conducting thematic analysis.
   c. reporting and recommendations

Planning the Systematic Review

A systematic review of literature relating to managerial cognitive processes applied when dealing with sustainability issues was required to address the lack of comprehensive academic frameworks through which to interpret decisions on sustainability and climate change. Searches of google scholar and Scopus revealed that no such review existed linking cognition or sensemaking with climate change or sustainability.

Examining the methodologies of past reviews of research conducted on sustainability topics a decision was made to

commence the review from 1990 and continue to the date the review was conducted in May 2020 (Williams et al., 2017). The 1990 date reflected a point of time subsequent to the UN Brundtland Report (1987), and prior to the commencement of other key events in global environmental management such as the Earth Summit (1992). It was also timed to reflect early progress within the academic community on the natural environment including the Talloires Declaration (1990), and the establishment of the Organisation and the Natural Environment Division at the Academy of Management (1990) (Williams et al., 2017).

Consistent with the necessity for literature included in the systematic review to be of the highest academic rigor a list of quality journals was completed. To identify appropriate journals initially a list of 49 potential journals was compiled based on past high quality reviews (Kaplan, 2011; Williams et al., 2017). This list was then compared to the Australian Business Dean's Council (ABDC) quality list. Where journals were ranked A or A* they were automatically included. Five journals received a lower rank on the ABDC list so their Scientific Journal Ranking (SJR) was examined. Where the SJR was over the level of one the journal was included; however, three of the five fell below this level and were excluded from the analysis. The final list is provided in Table 1 below.

The management database Scopus was selected as the search engine to be used to locate the appropriate articles based on its potential to include high ranking, peer-reviewed journals. Search terms were expanded beyond cognition to include sensemaking and managerial interpretation to capture core cognitive process literature in the review. The initial search included the terms cognit*; sensemak*; or manager* interpret* within the title, abstract and keywords and the results for these searches were then further filtered for terms of sustain*; natural environ*; or climate change within the article.

Executing the Systematic Review

Conducting the initial review returned 724 articles within the Scopus database. Details of these articles (including title, abstract, author, journal, year of publication) were downloaded into an Excel file. This initial number of articles was examined for duplication of entries. There were multiple instances where articles contained references to both sustainability and one or both of the other search references. Once duplicates were removed 567 articles remained to be considered for analysis. All 567 articles were downloaded and reviewed to verify that they actually contained the search terms in the appropriate context. Articles were excluded from the data set for several reasons including not actually relating to sustainability (e.g. content about sustainable competitive advantage) or containing a general reference to cognitive/cognition without any depth (e.g. a mention of

Table 1 Journals included in the systematic review

Category	Journals
Management Journals	Academy of Management Annals, Academy of Management Journal, Academy of Management Perspectives, Academy of Management Review, Administrative Science Quarterly, Advances in Strategic Management (SRJ 1.3), British Journal of Management, Health Care Management Review, Industrial Marketing Management, International Organization (SRJ 7.36), Journal of Applied Psychology, Journal of Business Research, Journal of International Business Studies, Journal of Management, Journal of Management Inquiry, Journal of Management Studies, Journal of Organizational Behavior, Journal of Sport Management, Long Range Planning, Management and Organization Review, Management Learning, Management Science, Medical Care Research and Review (SRJ 1.6), MIS Quarterly, Organization Science, Organization Studies, Organizational Behavior and Human Decision Processes, Organizational Research Methods, Personnel Psychology, Research Policy, Strategic Management Journal, Strategic Organization
Specialty Journals	Accounting, Auditing and Accountability Journal, Accounting Organizations and Society, Business and Society, Business Ethics Quarterly, Business Strategy and the Environment (SRJ 2.17), Corporate Governance, Journal of Business Ethics, Journal of Cleaner Production (SRJ 1.62), Journal of Industrial Ecology (SRJ 1.49), Leadership Quarterly (SJR 3.19), Organization and Environment (2.61), California Management Review, Harvard Business Review, Sloan Management Review

cognitive bias) or where the concept was not a key aspect of the article.

Analysing and Reporting on the Results of the Review

After the initial review for relevance 219 articles were deemed appropriate out of the initial 567 articles located. The full text PDF of these 219 articles was loaded into an NVivo database. The articles were then thematically hand coded for the following key areas:

Key Coding Categories:

- Cognitive process focus*: Articles were coded depending on whether their content was mainly linked to cogni-

tion (or cognitive framing); sensemaking; or, managerial interpretation.

- Level of Research: Articles were coded by whether their content related to managerial populations (individual decision makers); general organisational research; or the general population (outside an organisation e.g. customers).
- Type of Research: Articles were coded by whether the research presented was theoretical or empirical in nature.
- Theme of Research: Each article was examined for its overarching theme of research.
- Core Concepts: Articles were examined for their core concepts for example how the cognitive process was structured, processed or mobilised.
- Factors: Where articles presented factors behind the cognitive process the factors were also coded and later thematically categorised by whether they related to the individual, the organisation or society.

Note: Articles were coded by whether cognition, sensemaking, or managerial interpretation was the central focus of the study. Where article content crossed between perspectives they were coded for their dominant focus.

Coding for Categories, Research Themes and Factors

Although all article included in the initial review contained some discussion of cognition, sensemaking or managerial interpretation in many these references were not consequential to the overall research. Articles were only categorised as cognition, sensemaking or managerial interpretation when the article contained a substantial section of content on the category and applied it theoretically to the research. Where cognition, sensemaking or managerial interpretation were identified as a central focus of the article under examination the theme for study was also recorded. As understanding the foundations was critical to answering the research question factors identified as impacting the individual's cognition, sensemaking or managerial interpretation were coded for all articles.

Description of the Systematic Review Articles

Within the 219 articles coded a trend in publishing was observed over the last decade with increasing numbers of articles either focussing on, or mentioning, cognition, sensemaking or managerial interpretation. During this ten year period article numbers have grown from around five articles per year to over forty such articles being published on the topics in 2019. Journal of Business Ethics; Journal of Cleaner Production; and, Business Strategy and the Environment have consistently been the main journals publishing on the topics over the period examined. Details of this analysis

are presented within Fig. 1 below. Further, the vast majority of the articles published have been empirical with only 18% theoretical in nature.

Of the 219 articles coded, 61 were found to contain either cognition, sensemaking or managerial interpretation as a key conceptual focus (34 cognition; 22 sensemaking; 5 managerial interpretation). Originally only two articles were located with a focus on managerial interpretation. Due to the low numbers of articles being returned a second separate review was completed examining the articles which referenced the original Sharma article from the year 2000. Of the 966 articles which cited Sharma (2000) in Scopus, 299 articles came from the journals considered in this review. The abstracts of each of these 299 articles were then reviewed to establish whether they were in fact about managerial interpretation or whether it was a minor citation within the text. Only two of the articles contained the complete term 'managerial interpretation' in their abstract, title or key words in addition to containing content on a sustainability-related topic; however, the simplified term 'interpret' identified 14 articles. The sustainability-related topic verification resulted in five remaining articles of which two were already contained in the data set. This process resulted in an additional three files which were included in the review.

These 61 articles have been the subject of further focussed analysis with details provided in Fig. 2 below. Examining the distribution of the 61 articles shows that the Journal of Business Ethics and the Journal of Cleaner Production have dominated the discussion in question consistently over the last decade. Consistent with the larger data set just 10 out of the 61 (16%) were theoretical in nature highlighting the need for further theoretical investigation to support this growing research focus.

Research Results

The results of the systematic analysis will be presented below.

Summary of Research Themes

Within the articles examined the majority considered cognition (either the topic in general or through the view of cognitive framing) with 36% examining sensemaking and 8% managerial interpretation. Articles in each of these cognitive process categories were examined for the level of research, type of research, key theme of their research, core concept and the factors that affected each category. Figure 3 highlights the relative numbers of articles coded to each category by level and type of research.

The detailed results of the review as they relate to each cognitive process (cognition, sensemaking and managerial interpretation) will now be presented in further detail. The
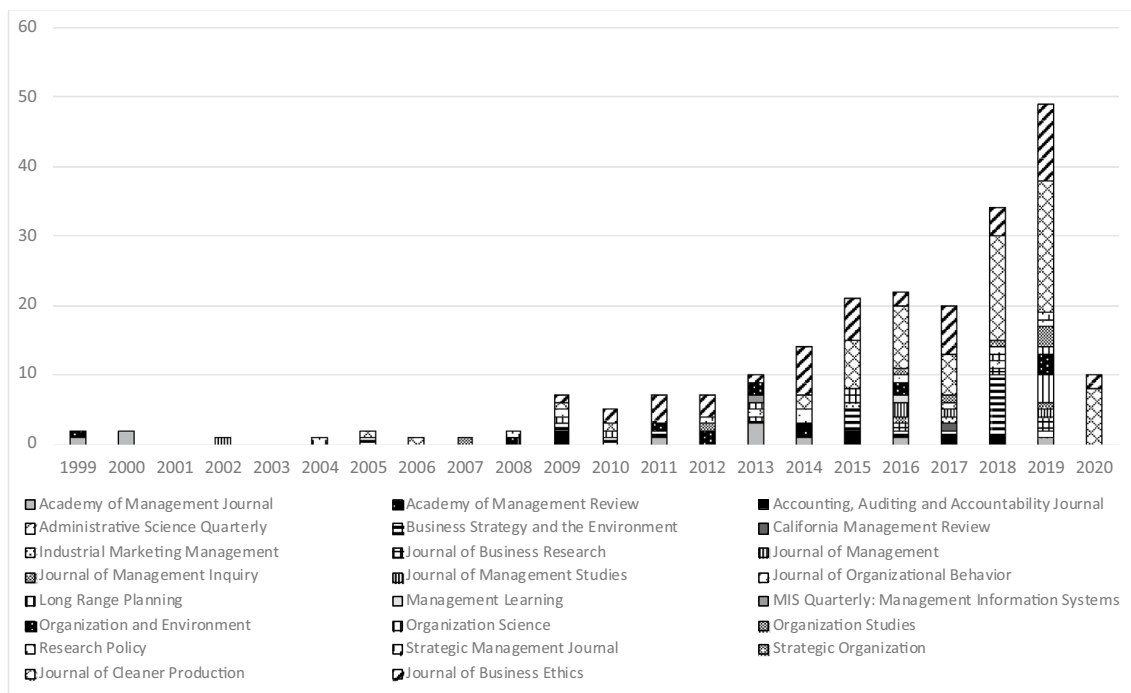
Fig. 1 Articles published linking to cognition, sensemaking or managerial interpretation; and climate change, sustainability or natural environment
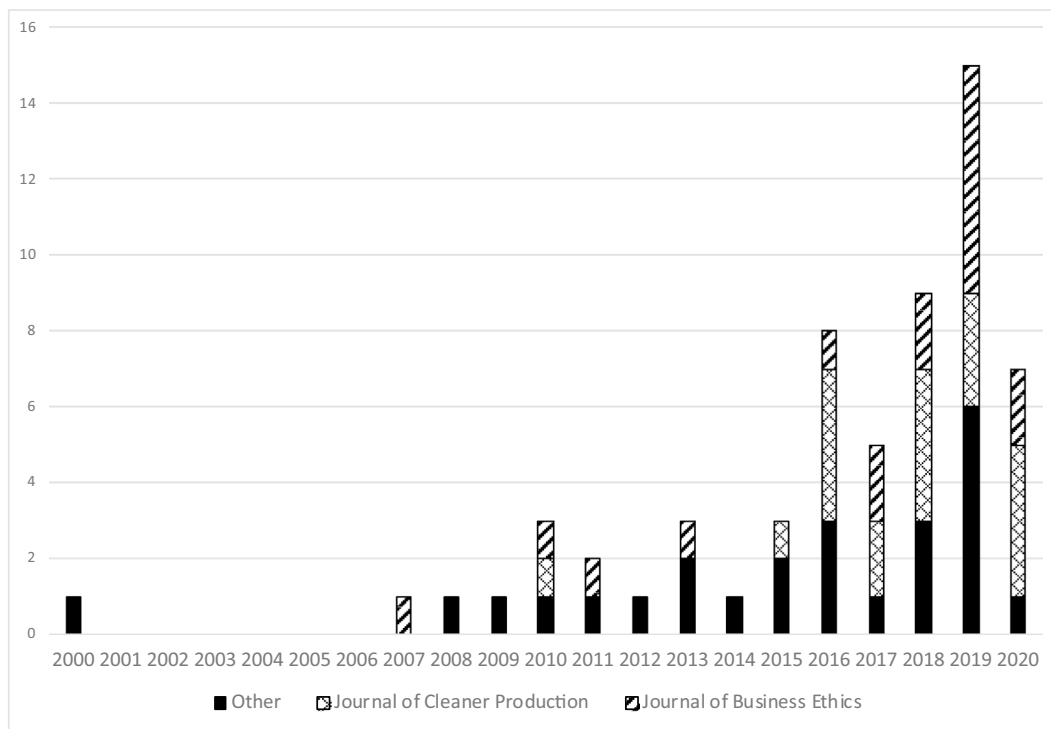

Fig. 2 Publication of articles in key journals by year

factors shaping each process will also be outlined before the study results are integrated into a framework illustrating the cognitive processes of decision-making on climate change/sustainability. The role played by each cognitive process will be highlighted including their interactions and feedback mechanisms. Finally, a discussion on the potential reasons for inaction and avenues for future research will be presented.

Cognitive Foundations of Managerial Decision-Making

The three perspectives on cognitive processes: cognition, sensemaking and managerial interpretation will be discussed in detail within this section. Initially a general description of the concept will be provided, followed by a discussion of the themes and core concepts contained within the research.

Cognition Combined within this section two theoretical concepts will be presented, that of cognition and cognitive framing. The concept of managerial cognition has been defined in a variety of ways from the simplistic view of "how and what managers think about and understand various firm issues that require action" (p533) by Madhavaram et. al. (2011) to more complex discussions including the process of executive attention and interpretation by others such as Gavetti and Levinthal (2000) and Ocasio (2011). This prior research supports the assumption that managers

are limited by bounded rationality when making sense of complex, unpredictable environments and that managerial cognition is subjective to factors such as prior experience and individual characteristics which shape cognitive frames of reference (Lin & McDonough, 2014; Shang et al., 2010). Similarly managerial decision-making on climate change is defined by just such complexity and uncertainty.

Cognitive frames, shaped by managerial cognition, have been presented by academics as a concept to represent the generalised views used by managers to understand their environment (Barr et al., 1992; Goffman, 1974; Hahn et al., 2014; Kaplan, 2011; Walsh, 1995). Within research examining cognition of individual managers it can be viewed as a process combining subconscious and directed attention shaped by an array of elements from an individual's background and experience including factors within the organisation in which they work and the society in which they live. An individual's cognitive frame shapes their view of a given situation in terms of the way they look for and assimilate knowledge (Kaplan, 2008). A manager's frame dictates their ability to manage potentially conflicting management pressures or issues. Research has been conducted into the orientation of a manager's cognitive frame and its implications for strategic management styles such as the degree of ambidexterity (Hahn et al., 2014; Sharma & Jaiswal, 2018). The greater the experience of an individual in a given organisational environment, the greater the complexity of frame,
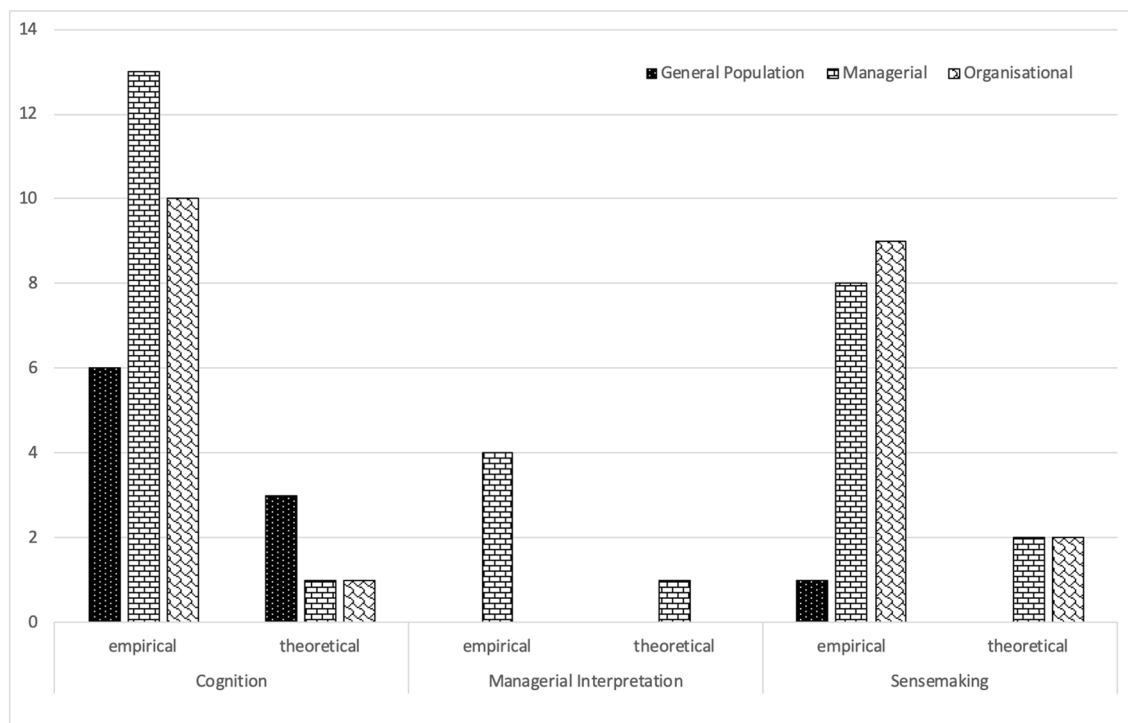

Fig. 3 High level overview of articles coded on cognition, sensemaking and managerial interpretation

directing their search for information under the scanning process of sensemaking (Hahn et al., 2014; Schaltenbrand et al., 2018). Further, recent studies have specifically considered the direction of an individual manager's cognitive frame for making sense of sustainability issues, consequences for action and the management of tensions in decision makers (Hahn et al., 2014; Sharma & Jaiswal, 2018). For a given change event a series of frames are possible dependent on factors such as an individual's knowledge, prior experience and alliances. These links between frame complexity and the path dependency of frame development have considerable implications for understanding managerial complacency on climate change issues. The question remains as to whether managers with little experience of the complex and transformational nature of changes arising through climate impacts and decarbonising reform have the complexity of frame to consider solutions to act.

Research Themes: Articles examined through the systematic review provide a comprehensive view of cognition through research conducted at the level of the individual, the organisation and within the general population, see Table 2 below. Although all results have been provided summarised within the table, only the themes relating to the individual level cognition will be discussed in depth below, in keeping with the research question to examine managerial decisions linked to climate change. Research themes identified in the articles were:

- Factors Shape Cognition
- Cognition Shapes Decisions/ Action
- Cognitive Factors Shape Action
- Cognition Shapes Frame
- Cognitive Framing Shapes Decisions
- Cognitive Frames Enable Sensemaking

These research themes will now be discussed, commencing with cognition, then cognitive framing, before the core concepts of the articles are presented.

Articles describing cognition at a managerial level focus on the role of cognition in shaping the decision-making process and outcomes, and factors shaping cognition itself. The existence of tensions and trade-offs in the management of sustainability issues has been well established (Hahn et al., 2014; Pinkse & Kolk 2010). Cognition has been presented in the articles reviewed as shaping the way individuals deal with tensions. Examples can be identified in the development of a corporate climate change strategy where a multistage process was adopted balancing local knowledge and capabilities in a multinational organisation (Lei et al., 2017), or, where managerial cognition on environmental factors was balanced with external resource acquisitions in the development of eco-innovation activities within a company (Peng &

Liu, 2016). These two examples demonstrate the complexity of factors challenging corporate action on climate change, including variations in knowledge, culture and resources, as well as the temporality of progress on sustainability.

Further tightening the lens on processes forming cognition on sustainability/climate change several articles discussed the dual process shaping an individual's cognition. Researchers Eberhardt-Toth and Wasieleski (2013) and Zollo (2021) highlighted the two aspects of cognition in the explicit (conscious and effortful) and the implicit (effortless automatic) aspects that combine to shape an individual's cognition. The implicit aspect is actioned automatically to evaluate a problem with the explicit aspect able to override the automatic reaction through effortful thought and problem solving (Eberhardt-Toth & Wasieleski, 2013). Both studies link decisions to moral development with Zollo (2021) presenting the role of moral intuition and intuitive moral judgement (affect laden intuition), including emotion processing, underlying ethical decisions. Although factors (individual, organisational and societal) shaping cognition are often considered in academic literature the intuitive process including emotions is only occasionally included presenting an avenue for future research in progressing decision-making on sustainability and climate change. Gond et. al. (2017), also identified the knowledge deficit relating to the role of affective processes and emotions in engagement with CSR, further supporting continued research in this area.

Many articles have specifically examined cognition through the lens of framing. Research has defined frames as cognitive ''knowledge structure that directs and guides information processing'' (Cornelissen & Werner, 2014, p. 184; Haney, 2017). Formed by and informing the process of cognition and sensemaking, cognitive frames are an integral part of the interpretations and overall decision-making process relating to sustainability and climate change. Frames play a central role in directing strategic decisions within organisations (Kaplan, 2008). Hahn et. al. (2014) found, when regarding sustainability issues, managers may take either a business or a paradoxical frame. They further proposed that these frames shape decision-making in terms of its scope, level of innovation, speed and risk intensity. Under cognitive framing theory once managers have interpreted a situation based on their individual frame, they will adopt a certain decision with regards to an issue. A manager's frame may alter over time due to the influence of experience (Bergman et al., 2019; Grewatsch & Kleindienst, 2018; Liao, 2016; Zuzul, 2019) on the complex combinations of factors which form cognition. Research suggests that managerial responses to given situations highlight how the frames used and the decisions made by management are highly dependent on previous experience (Hahn et al., 2014). Again, raising the role of experience, this time with reference to frame formation, strongly supports the connection between

Table 2 Research themes and core concepts identified within key research focussing on 'Cognition' presented for each focus level (whether the articles examined the managerial, organisational or general societal populations)

Focus Level	Research Theme	Core Concepts	References
Managerial	*Factors Shaping Cognition* Various factors shape managerial cognition (individual; organisational; societal). E.g. Individual ability variables and motivation variables; Individual moral maturity and perceived moral intensity of sustainability issue; temporality; mindfulness training on cognitive abilities; Association between individual ethics, honesty and moral development; decision-making horizon influence on sustainability frame	*Determining*- Factors determine cognition towards sustainability *Dual process*- Implicit and explicit; Effortful (conscious thought) and effortless (automatic processing) aspects *Evolving*- Evolution of cognition over time *Co-evolution*- Increased complexity of knowledge (non-financial) increases proactive sustainability initiatives *Malleable*- Cognition can be actively shaped e.g. through mindfulness training	Eberhardt-Toth & Wasieleski (2013) Gröschl et al. (2019) Siqueira & Pitassi (2016) Chung & Hsu (2017) Sharma & Jaiswal (2018)
	Cognition Shapes Decisions/Action Balance between individual cognitions and external factors. E.g. between individual cognitions and external resource support (eco-innovation); balance between individual cognition on climate change (local and global) and local capabilities; response to stakeholder pressure	*Thresholds to action*- Support factors internal and external to organisation *Tensions*- Competing knowledge and views in creating a climate change strategy *Shaping*- Response shaped by cognition e.g. Stakeholder pressure	Peng & Liu (2016) Lei et al. (2017) Schaltenbrand et al. (2018)
	Cognitive Factors Shape Action Factors associated with cognition shape action. E.g. managerial moral reflectiveness shapes ethical leadership actions; Increased cognitive complexity shapes sustainability decisions; culture effects agency; knowledge of environmental strategy	*Complexity*- Increased cognitive complexity measured by lens differentiation (number of cognitive lenses used) and lens integration (connections between lenses) influencing sustainability decisions *Reflectivity*- Managers considering morality in their experiences shape actions *Autonomy*- Moderating factor between moral reflectiveness and ethical leadership *Determining*- Effect of culture on moral agency	Gröschl et al. (2019) Babalola et al. (2019) Hiekkataipale & Lamsa (2019) Yang et al. (2019)
	Cognition Shapes Frame An individual's cognition shapes the frame they take in managing tensions. Both cognitions and frames are dynamic	*Tensions*- Understanding tensions by managers determines frame *Evolving*- Frames evolve and change over time influencing and being influenced by the frames of others (Dynamic) *Shaping*- Cognition shapes frame	Sharma & Jaiswal (2018)
	Cognitive Framing Shapes Decisions Cognitive frames shape decisions made within companies by managers. Role of framing in managing tensions i.e. business case vs paradoxical frame	*Tensions*- Managing tensions between sustainability drivers *Influencing*- Frames influence sensemaking *Determining*- Frames determine decisions *Paradoxical*- Including detailed search, multiple factors with a range of rationales in decision-making; Acceptance of tensions *Interacting*- Frames interact within an organisation	Hahn et al. (2014) Sharma & Jaiswal (2018)
	Cognitive Frames Enable Sensemaking Frames enable interpretation shaping action towards sustainability	*Enabling*- Frames enable sensemaking/interpretation	Sharma & Jaiswal (2018)

Table 2 (continued)

Focus Level	Research Theme	Core Concepts	References
Organisational	*Framing Shapes Action* General framing within an organisation shapes action. E.g. on future oriented behaviour; temporality impact of frame on environmental product/process innovation	*Facilitator-* Framing through language shapes action *Director-* Temporality of frame impacts investment. E.g. framing over long term leads to innovation investment	Liang et al. (2019) Liao (2016)
	Competing/Divergent Cognition Inhibiting Action Issues arising from contrasting frames preventing action (in contrast to aligned frames). Contrasting frames may inhibit action around organisational goals requiring decoupling process. E.g. business and NGO collaboration. A common shared vision is necessary	*Competing frames-* Inhibiting action from competing frames within a diverse group. Shared cognition/Divergent cognitive representations *Collective framing-* Process by which individual managerial frames come to be adopted across organisation *Frame decoupling-* Decoupling of a frame is required before an alternative is adopted. Process involves separating each component and associated issue. Once decoupled components can be altered and combined to distinct organisational frames aligned with organisational goals *Engaging Paradox-* Managing competing frames is necessary when two companies with different goals join e.g. business and NGO	Zuzul (2019) Meyer et al. (2016) Sharma & Bansal 2017 Olazabal & Pascua (2015)
	Framing Shapes Capabilities Focus of firm level frame shapes capabilities. E.g. capabilities in stakeholder integration, market sensing, and learning	*Director-* Frame orientation directs capability development	Grewatsch & Kleindienst (2018)
	Collective Frame Shapes Industry Development The dominant frame in industry on developments e.g. renewable energy, technology deployment etc. progresses over the industry development	*Shared beliefs –* Industry level shared beliefs shape managerial cognition	Bergman, et al. (2019)
	Cognitive Factors Shape Learning Cognition shapes perception and ability to learn from events. Learning from rare events is challenging but can be promoted. Learning in organisations usually occurs through systemization and programming. Adaptive capacity implications	*Impediments-* Uniqueness can impede leaning *Interconnected processes-* Behavioural and cognitive learning simultaneously *Adaptive capacity-* ability to learn from extreme events to promote resilience	Starbuck (2009)
	Framing Shapes Cognition Linguistic framing of firm documents can shape cognition of stakeholders in a misleading fashion. Legitimising through words and images	*Shaping-* Framing to through language can deceive not directly but through linguistic constructions. Framing through image word combinations to elicit emotions and attention	Crilly et al. (2016) Lefsrud et al., (2019)

Table 2 (continued)

Focus Level	Research Theme	Core Concepts	References
General Population	*Shaping Cognition* Various factors shape an individual's cognition. Cognitive bias. Cognition is also shaped by perceived social value	*Interactions-* Moral emotions interact with persuasion social influence; *Dual process-* Implicit and explicit; Effortful (conscious thought) and effortless (automatic processing) aspects. Conscious (cognitive) can shape unconscious(affective) response; *Enhancing-* Emotion and intuition; *Causal relationship-* Beliefs tied through integrated system; *Shaping-* Factors shape cognition include personal, outcome perception and social judgement	Zollo (2021) Henry & Dietz (2012) López-Navarro et al. (2016) Zhou et al. (2018a, 2018b) Lin & Hsu (2013) Wang et al. (2019)
	Cognition on behaviour The effect of cognition to behaviour e.g. publicity on environmental citizenship linked to pro-environment behaviour	*Direction-* Knowledge linked to behaviour	Wang et al. (2020)

complacency and inexperience of climate change/sustainability action.

Reflecting the dynamism of the frame creation process within their study into cognitive frames Sharma and Jaiswal (2018) found that environmental events were triggers for frame changes. Their longitudinal study of a global Indian pharmaceutical company showed that unexpected events acted to change the temporal decision horizon altering the managerial cognitive frame applied to a given project. Temporal elements shaping frames were identified within several articles highlighting the evolutionary nature if progress on climate change (Gröschl et al., 2019; Sharma & Jaiswal, 2018).

In summary, experiential and evolutionary processes alter cognition and an individual's frame with implications for the way they approach an issue, manage tensions and potential bias. Applying these principles to a corporate example a manager who has been involved in an unsuccessful investment attempt in an emerging renewable technology may adopt a business focussed, risk averse frame when faced by a similar investment opportunity. The reverse may be true where a successful attempt was made.

Core Concepts: The research relating to managerial level cognition and cognitive framing was analysed for the core concepts of how they were structured, acquired or mobilised. These core concepts, presented in Table 2, have been summarised below, grouped under shared concept areas with repartition removed.

Reductionist:

o Dual process – *Effortful (conscious thought) and effortless (automatic processing) aspects.*
o Tensions – *Managing competing knowledge and views determines individual's frame.*
o Thresholds to action – *Support factors internal and external to organisation.*
o Paradoxical – *Including multiple factors, with a range of rationales identified through a detailed search in decision-making. Acceptance of tensions.*

Dynamic:

o Evolving – *Evolution of cognition and cognitive frames over time.*
o Co-evolution – *Increased complexity of knowledge increases proactive initiatives.*
o Malleable – *Cognition can be actively shaped e.g. through mindfulness training.*
o Interacting – *Frames interact within an organisation.*

o   Altered – *Factors determine cognition towards sustainability, e.g. culture, cognitive complexity, morality*.

Shaping

o   Determining – *Frames determine decisions*.
o   Shaping – *Cognition shapes frames. Outcomes shaped by cognition/ cognitive frame*.
o   Influencing – *Frames influence sensemaking/interpretation process and outcomes*.
o   Enabling – *Frames enable sensemaking*.

Examining the core concepts defining the process of developing and applying cognition and cognitive framing three key descriptive areas emerged from the analysis. An individual's cognition and cognitive frame is dynamic. They continue to be modified in line with new experience, interactions and information, evolving over time. Cognition and cognitive frames are directive, with cognition developed through experience altering frames (Bergman et al., 2019) and shaping sensemaking, interpretation and ultimately decisions. Finally, cognition and cognitive frames are complex and reductionist. To this end they are shaped by factors at an individual level, through the organisation in which the individual works and the society in which they live, they also act to reduce complexity managing tensions and paradox. Understanding the core concepts of cognition and cognitive framing provides insight into potential reasons for complacency while also providing direction on intervention points to drive progress.

Sensemaking The concept of sensemaking was first proposed then popularised by Weick (1988, 1993 and Weick et al., 2005) to describe the process by which individuals develop cognitive structures around the complex and unknown so that it can be acted upon (Ancona, 2011). The theory has become highly influential to researchers within the field of organisational studies (van der Heijden & Cramer, 2017). Managing to promote sustainability meeting the challenges of a climate change transition is defined by complexity and trade-offs. Events may occur contrary to an individual's existing formation of meaning (Bien & Sassen, 2020). Sensemaking is a process of interpretation where organisational actors attach meaning to events to mediate uncertainty (Fontana, 2019; Tisch & Galbreath, 2018; Weick, 1993) forming a foundation frame for individuals to use as an established point of reference (van der Heijden et al., 2010). Three key sequential processes are reported to occur through sensemaking, specifically scanning, interpreting and responding (Hahn et al., 2014). When faced with a new situation to which they have no prior frame individuals cannot develop an interpretation without first understanding its content (van Der Heijden et al., 2010), in turn determining the adequacy of the response. The greater the level of sensemaking the higher the chance that the individuals involved will be able to successfully manage effects that arise, the reverse is also true that poor sensemaking may equate to suboptimal management (Tisch & Galbreath, 2018).

Often studied in the context of managers, sensemaking is regularly followed by a process of sensegiving, thereby enacting the realisation of the frame constructed through the sensemaking process (Fontana, 2019). Sensegiving occurs when an individual seeks to convey their sensemaking to relevant others (Tisch & Galbreath, 2018), a social interaction creating a shared meaning. Managers play a significant role in the change process as sensemakers and sensegivers as they are both in the position to promote their sensemaking to achieve a dominant frame but also more likely to have access to the slack resources required to invest in change (Schaltenbrand et al., 2018). Hahn et. al. (2014) highlight the connection between sensemaking and cognitive framing where an individual's frame influences their scanning and in turn their interpretation of a given situation.

Research Themes: Articles examined through the systematic review provide an overview of research conducted at the level of the individual, the organisation and within the general population, see Table 3 below. Although all results have been provided in Table 3, only the themes relating to individual level sensemaking will be discussed in depth below, in keeping with the research question to examine managerial decisions linked to climate change. Research themes identified in the articles are:

- Making Sense
- Giving Meaning
- Factors Influencing Sensemaking
- Sensemaking in Investment
- Patterns of Sensemaking
- Sensemaking Leader

These research themes will now be discussed below, before the core concepts of articles are presented.

In line with the overarching description of sensemaking, research concentrated on the making of sense, the giving of sense and factors associated with sensemaking. Research suggests that it is not just in new complex situations of external origin that sensemaking has benefits, sensemaking in the strategy formation and implementation process has been found to impact corporate reputation and performance (Khan, 2018). Sensemaking in a sustainability transition within the higher education sector was examined by Bien and Sassen (2020) identifying discourse strategies, triggers of resistance and determinants in the process of developing sense and giving meaning in conceptualising a sustainable future.

Table 3 Research themes and core concepts identified within key research focussing on 'Sensemaking' presented for each focus level (whether the articles examined the managerial, organisational or general societal populations)

Focus Level	Research Theme	Core Concepts	References
Managerial	*Making Sense* Individuals social process of making sense (or sensemaking) of new issues or information that are complex, surprising or confusing. Process is evolving and shifts over time with the introduction of new information. E.g. market information for developing strategy; technological information;	*Ongoing*- Ongoing process, dynamic and evolving *Construction*- Sense constructed over time. Meaning of sustainability needs to be constructed and shared in a setting *Communicating*- Language constructs reality. Common vocabulary enhances understanding e.g. along supply chain. Role of discourses *Categorising*- Fitting new information in structures or new categories for decision-making *Shaped*- Sensemaking process is shaped by others e.g. managers shape the sensemaking process of others when they make sense and set goals or strategies. Shaped by individual's knowledge structure *Trade-offs*- All issues cannot be prioritised at once. Paradox need to be understood before being managed *Interpretation*- The process of translation of new information into knowledge	van der Heijden & Crammer (2017) Khan (2018) Fontana (2019) Bien & Sassen (2020) Child (2019)
	Giving Meaning Sense giving refers to the process of disseminating new views and shaping meaning. E.g strategy implementation	*Sharing*- Sense is shared through communication and action to give meaning and create a shared understanding *Communicating*- Language communicates reality. Common vocabulary enhances understanding. New meme's or narratives *Acting*- Action translates meaning and develops shared understanding *Change Agents*- Role of change agents in shifting action over time. A change agent is a sensemaker who's actions and sensemaking process shape a shared view *Cyclic*- Process of gradual cyclic change *Transfer*- Sense transferred between actors *Influencing*- An active, conscious process. Executives can influence from top down	van der Heijden & Crammer (2017) Khan (2018) Waddock (2019)
	Factors Influencing Sensemaking Sensemaking influenced by practical and social factors. Degree of influence may depend on individuals position in the company. E.g. of Influences: Individual influences or collective influences; negative influence of perceived hypocrisy; social circles; emotions and desire for social status; decision makers maybe more likely influenced by financial factors while also shaped by cultural social conventions. shaped by past sector issues e.g. Rana Plaza incident. Individuals connected with the environment e.g. farmers may derive meaning from it. Factors may be individual; organisational or from outside the organisation	*Shaping*- Factors continuously shaping sensemaking process. Individuals knowledge structure shapes the sensemaking process *Trade-offs*- Actors may be aware of the negative financial payback but still proceed based on perceived elevation of their social status derived from the investment. Business expectations and moral purpose *Creative*- Constructing a new meaning requires active imagination	Fontana (2019) Waddock (2019) Fassin et al. (2011) Babua et al. (2020) Tisch & Galbreath (2018) Aguinis & Glavas (2019)
	Sensemaking in Investment Managers must make sense of new innovations before they are willing to invest. E.g. Leadership in Energy and Environmental Design (LEED)	*Change Agents*- Executives as change agents	Fontana (2019)

Table 3 (continued)

Focus Level	Research Theme	Core Concepts	References
	Patterns of Sensemaking Patterns of sensemaking found to exist linked to individuals influences. e.g. opportunistic sensemaking; win–win sensemaking; hygienic sensemaking; philanthropic sensemaking	*Categorised*- Patterns of sensemaking observed after decision makers have reviewed information and balanced trade-offs	Fontana (2019)
	Sensemaking Leader "The leader as shaman has three central roles: healer, connector, and sensemaker in the service of a better world" Waddock, 2019 Leaders towards action on climate change need to recognise the need to shift, conceptualise the change and actively cultivate a new way	*Redefining*- Leaders can shift the discussion and culture towards sustainability and responsibility (from growth and profit). Changing values, business strategy and culture. Shaping the shift to values other than profit may be easier in SME *Leading*- Leading the change through capability development, investment and sensegiving	Waddock (2019) Fassin et al. (2011)
Organisational	*Frames on Sensemaking* Organisational sensemaking shaped by mental models thereby operating in a perceived environment	*Influenced*- Shaped by frames	Basu & Palazzo (2008)
	Organisational Sensemaking Basu and Palazzo (2008) proposed organisational sensemaking involves three processes: (1) Cognitive (firms relationship with stakeholders and views about the external environment); (2) linguistic (explaining reasons for decisions or actions with others); and (3) conative (adopted behaviour)	*Determining*- Sensemaking process determines a company's character *Communicating*- Sensemaking can be demonstrated by a company's use of language	Basu & Palazzo (2008) Green & Peloza (2015)
	Process of Organisational Sensemaking—Making Collective Sense Although sensemaking is completed at an individual level social relationships may lead to community level sense. Organisational sensemaking occurs through a process involving change agents, communication and action. A shared meaning is constructed through social interaction – colleagues come to see their environment in a common way	*Enactment*- Perception and action. Approaches for operationalizing sense giving–pragmatic strategy (within goals) or systemic strategy (within systems and policy) (van Der Heijden et al., 2010) *Change agents*- Mediators in translating company sense *Communicating*- Social interactions and communications share sense. Sense can also be shared across platforms based on issues *Sharing*- A shared meaning is constructed through social interaction. Collective sense shared through community *Action*- Action driven sensemaking. Shared view created through action. Beliefs shape actions and actions shape beliefs	Tisch & Galbreath (2018) van Der Heijden et al. (2010) Štumberger & Golob (2016) Benn et al. (2013) Selsky & Parker (2011) Dwyer & Hardy (2016)
General Population	*Influences in Sensemaking* Sensemaking influenced by practical and social factors including experience	*Shaping*- Factors shaping the sensemaking process dependent on ecological embeddedness and degree of experience in similar situation	Whiteman & Cooper (2011)
	Patterns of Sensemaking Patterns of sensemaking found to exist linked to individuals influences	*Categorised*- Patterns of sensemaking observed	Whiteman & Cooper (2011)

Organisational cognitive and linguistic processes are central to sensemaking and the construction of reality leading to certain actions (Basu & Palazzo, 2008; van der Heijden & Cramer, 2017). Industries can establish communal vocabularies, building connections and understandings (van der Heijden & Cramer, 2017) strengthening the role of the in situ change agent. Change agents are an important part of the sensemaking process within an organisation and feature in many of the articles reviewed highlighting another perspective through which to consider inaction and opportunities for intervention (van der Heijden & Crammer, 2017; Waddock, 2019).

The social context plus the leader's self-identity shape the selection of sensemaking cues (Bien & Sassen, 2020). Once an executive manager has constructed meaning, potentially framing a new vision for the company, a process of sensegiving may follow through which the individual seeks bring the vision to reality through communication (Bien & Sassen, 2020; Fontana, 2019). Fontana (2019) in their research on diffusing environmental innovations in Bangladesh apparel companies provided an interesting analysis linking "patterns" of sensemaking, which we consider could be interpreted as frames, contextually shaped by past individual, environmental and social factors to investment decisions. While the situation was shaped by contextual events such as the Rana Plaza collapse disaster the study linked investment to the executive's emotions and social status desires. Critically the results of the article found that although 90% of the 30 executives did not associate investment in environmental innovation to positive financial performance, or the expectation of any direct financial benefit, 70%, however, did associate the investment with higher social recognition (Fontana, 2019). Understanding this perceived lack of association between action on sustainability issues and financial benefit may elucidate part of the reason for managerial complacency particularly when considered through the traditional business lens of profit maximisation.

The unifying role of sensemaking is consistent with the work of Aguinis and Glavas (2019) where sensemaking, through a CSR perspective, is presented as a mechanism through which individuals can find meaning within their work. Connecting meaning, rather than, or in addition to, traditional economistic value was also raised within the article "Shaping the Shift: Shamanic Leadership, Memes, and Transformation" by Waddock (2019). Waddock's article examined the role of the leader in redefining the organisation towards achieving a resolution of major problems, such as climate change, revisiting the position of shaman in traditional cultures. As sensemaker and sensegiver, an organisational leader has the potential to shift the conceptualisation of business and leadership, conveying a new vision through their communications, shaping strategy, values and systems of belief (Waddock, 2019).

Core Concepts: The research relating to managerial level sensemaking was analysed for the core concepts of how it was structured, acquired or mobilised. These core concepts, presented in Table 3, have been summarised below, grouped under shared concept areas with repartition removed.

Creating

o   Construction – *Sense constructed and shared in a setting.*
o   Ongoing – *Ongoing process, dynamic and evolving, gradual cyclic change.*
o   Creative – *Constructing a new meaning requires active imagination.*

Interpreting

o   Categorising – *Fitting new information in new structures or categories for decision-making.*
o   Shaped – *Factors continuously shape the sensemaking process including by an individual's knowledge structure and others.*
o   Trade-offs – *All issues cannot be prioritised at once.*
o   Interpretation – *The process of translation of new information into knowledge.*

Leading

o   Sharing – *Sense is shared through communication and action to give meaning and create a shared understanding.*
o   Communicating – *Language constructs and communicates reality. Common vocabulary enhances understanding e.g. along supply chain.*
o   Acting – *Action translates meaning and develops shared understanding.*
o   Change Agents – *Change agents shift action over time. A change agent is a sensemaker who's actions and sensemaking process shape a shared view.*
o   Transfer – *Sense transferred between actors.*
o   Influencing – *An active, conscious process e.g. Executives influence from top down.*
o   Redefining – *Leaders can shift the discussion and culture towards sustainability and responsibility (from growth and profit), changing values, business strategy and culture.*
o   Leading – *Leading the change through capability development, investment and sensegiving.*

In summary, core concepts identified within the literature on sensemaking relate to the construction of sense by seeking certain information linked to the individual's cognition or cognitive frame, interpreting this complex information,

Table 4 Research themes and core concepts identified within key research focussing on 'Managerial Interpretation'

Focus Level	Research Theme	Core Concepts	References
Managerial	*Frame Shape Interpretation* An individual's frames on a situation determines what they pay attention to and in turn their interpretation. E.g. new technology as a threat or opportunity determines their opinion on risk and subsequent search	*Shaped-* Frame shapes interpretation *Advancing or constraining-* Frames determine subsequent search *Categorization-* Frame determines categorisation. Categorisation reduces ambiguity	Sharma (2000)
	Interpretation Impacts Decision Managerial interpretations determined choice and degree of sustainability action. Mediating factors may include "responsibility to society and moral legitimacy" (Haney, 2017, p.261)	*Determining-* interpretation shapes subsequent action	Sharma (2000) Haney (2017) Zhou et al. (2020)
	Factors Influencing Interpretation Factors from the environmental and organisation as well as the individual shape interpretation	*Shaped-* Interpretations shaped by factors at the individual, organisational and wider environmental level	Sharma (2000) Haney (2017) Bowen (2007) Zhou et al. (2018a, 2018b)

making sense through a series of trade-offs. This sense is then communicated to others, sharing a vision or view through which the individual can act as a change making leader, redefining an aspect of the organisation.

Managerial Interpretation Managerial interpretation in the context of environmental strategy is linked back to Sanjay Sharma's (2000) article *Managerial interpretations and organisational context as predictors of corporate choice of environmental strategy*. Within the article Sharma outlines a model where managerial interpretation is linked to *issue legitimation, discretionary slack,* and *employee performance evaluation* with feedback loops between *environmental strategy* and *issue legitimation* and *managerial interpretation*. Based on data from firms within the Canadian oil and gas industry, the overall findings of the article proposed an association between the way managers interpreted an issue as a threat or opportunity and the strategies taken by the firm. Examining interpretation in greater detail literature proposes that managers apply frames, or categories to uncertain events or issues, shaping the ongoing process (Haney, 2017).

Since Sharma published the foundational article in 2000, it has been highly cited; however, few articles have a central focus on managerial interpretation in the context of sustainability, climate change or the natural environment. Further, many citations do not reflect an overall article focus on interpretation.

Research Themes: Articles examined through the systematic review provide an overview of research conducted on managerial interpretation relating to a sustainability context, see Table 4 below. All themes relate to individual level interpretation, providing a direct link with the research question examining managerial decisions linked to climate change.

Research themes identified in the articles are:

- Frames Shape Interpretation
- Interpretation Impacts Decision
- Factors Influencing Interpretation

These research themes will now be discussed below, before the core concepts of articles are presented.

The research reviewed on managerial interpretation illustrate the shaping of interpretation by factors in an individual's background and environment as well as the influence of their cognitive framing of an issue, demonstrating a link between the managerial interpretation and cognition literature. As mentioned earlier Sharma (2000) tied a firm's awareness of environmental issues to positive environmental activities (Zhou et al., 2020). Examining this link, Zhou et. al. (2020) examined whether low-carbon awareness promoted hard and soft environmental behaviours. The study, conducted within Chinese firms, found the latter association held with the effect stronger in companies that were not state owned (Zhou et al., 2020).

Exploring past this simple association between interpretation and action, two of the articles consider the interpretation in connection to dynamic capabilities. Zhou et al., (2018a, 2018b) find that dynamic capabilities support the managerial interpretation process. Haney (2017) examined the proposed link between threat perception and innovation in relation to climate change, with interpretation associated with the microfoundations of dynamic capability development. The article finds that two mechanisms positively impact the association between these factors, responsibility to society and moral legitimacy (Haney, 2017).

Core Concepts: The research relating to managerial interpretation was analysed for the core concepts of how it was structured, acquired or mobilised. These core concepts, presented in Table 4, have been summarised below collected under core concept areas.

Dependent:

- o Shaped – *Interpretations shaped by factors at the individual, organisational and wider environmental level including framing.*

Directing:

- o Advancing or constraining – *Frames determine subsequent search parameters.*
- o Determining – *Interpretation shapes subsequent action.*

Conceptually managerial interpretation is a process shaped by factors in an individual's background (personal, organisational or societal), and an individual's cognitive frame which then directs the choice and degree of managerial action on sustainability issues.

Understanding Factors Shaping the Cognitive Process To understand the reasons for managerial inaction, despite the individual's knowledge of climate change, necessitates an examination of the factors that underpin the cognitive process. To gain this understanding the articles that related to the managerial level cognitive processes were examined further for any mention of factors that shaped the process. Table 5 below is constructed grouping the factors by their source, specifically whether they relate to the individual, the organisation or society.

The cognition literature relating to the managerial cognitive processes revealed significantly more factors shaping the cognitive process than the sensemaking or managerial interpretation literature. The factors within cognition literature were also comparatively broad taking into account both background factors, including motivational and attitudinal, and factors relating to an individual's experience.

Individual factors are characteristics predominantly shaped by a decision makers life experience to date from inherent abilities and motivations, to their upbringing. Key factors were found to include ethics (Eberhardt-Toth & Wasieleski, 2013), culture (Aguinis & Glavas, 2019; Liang et al., 2019), morality (Aguinis & Glavas, 2019; Eberhardt-Toth & Wasieleski, 2013), language (Liang et al., 2019), environmental awareness (Peng & Liu, 2016), emotion (Eberhardt-Toth & Wasieleski, 2013), and many others. Morality and values featured within the many factors shaping sensemaking, as did those relating to social interactions. Emotional factors were only raised twice within the data set supporting past findings by Gond et al., 2017 that affective processes have been under researched in terms of how they shape evaluations.

Organisations themselves were also found to shape managerial decisions. A manager's experience guides their perception of a given situation, their ability to accommodate new knowledge and their likelihood of action. The organisation shapes action through its systems, culture and availability of slack resources, a factor often dependent on financial performance. The managers ability to scan the environment is proposed to increase in complexity the longer the individual is employed in a single industry (Schaltenbrand et al., 2018). Scholars have suggested that experienced individuals, with more advanced cognitive structures, approach a problem in a different way to their less experienced counterparts (Schaltenbrand et al., 2018). Factors including the company's financial situation (Peng & Liu, 2016; Schaltenbrand et al., 2018), CSR policies (Aguinis & Glavas, 2019), and an individual's work orientation (Eberhardt-Toth & Wasieleski, 2013) contribute to cognition, sensemaking and cognitive framing. Research has suggested that managers within different positions within a company differ in their cognitive development (Eberhardt-Toth & Wasieleski, 2013; Hahn et al., 2014). Eberhardt-Toth and Wasieleski (2013) were surprised to find that contrary to their expectations, the financial managers scored higher in their cognitive moral development than their non-financial counterparts. Other researchers have proposed that when a manager's functional background in internally focussed areas such as engineering or accounting they may be more interested in internal factors, whereas managers from externally focussed areas such as marketing are more likely to look to stakeholder demands (Hahn et al., 2014). Considering the high cognitive moral development in financial managers Eberhardt-Toth and Wasieleski (2013) identified that they may have underestimated the boundary spanning activities of the individuals.

The society an individual inhabits also plays an important role in shaping that individual's cognitive processes. Research suggests that elements including community values (Lopez-Navarro et al., 2016), legal/regulatory environment, physical environment (Sharma, 2000), environmental values (Peng & Liu, 2016), national culture (Liang et al., 2019), the political environment (Starbuck, 2009) and stakeholders all contribute to shaping a manager's cognitive processes.

Gaining an awareness of the factors that contribute to the way an individual understands and acts in decisions linked to climate change and sustainability issues is important if we are to promote accelerated action. Commonality can be seen within literature on cognition, sensemaking and managerial interpretation. This cross-over will be discussed further in the next section as the integrated model if presented.

An Integrated Perspective to Understand Climate Inaction

Although a theoretical link between knowledge, engagement and the commitment of managers on climate change with action, has been made by prior research (Furrer et al., 2012; León & Arana, 2015; Linnenluecke et al., 2015; Okereke et al., 2012) a thorough examination of the state of research

Table 5 Key 'Factors' identified within articles divided by cognitive themes and their origination

	Individual-Related Factors	Organisation-Related Factors	Society-Related Factors
Cognition Extensive coverage of factors. Focus includes individual attributes (personal, moral and practice related), business operational factors (including financial, system and capability based) and implications of pressures from society	Ability variables Motivation variables Attitudes e.g. to pollution reduction Beliefs Values Awareness of stakeholders Perceived stakeholder importance Cognitive moral development Moral reasoning or sustainable orientation Past experience of success/Failure. Success may lead to over prioritisation of primary stakeholders e.g. customers and under prioritisation of secondary stakeholders Emotions Environmental awareness (risk and cost–benefit) Environmental risk awareness Environmental cost/benefit awareness Perceived moral intensity of environmental problem Perceived importance of the ethical issue and context Ethics Ethical leader with authority to act Behavioural control Level of past corporate experience. Experience changes approach to a problem. Expert and novice differ in cognitive structure and way gather information and evaluate Job tenure Mindfulness Job function (neither were found supported) Personality traits e.g. need for closure tolerance for ambiguity Political ideologies Post-conventional reasoners Reflective leader	Training Connection to action and brand image and legitimacy Consumer pressure Corporate environmental commitment Common ethical principles Institutional logics (existing) Company culture guiding employee conduct and attitudes including values, principles, believes, enviro economic, participation level Creativity Business processes allow individuals to create meaning Motivation and resource bundles Leadership values Environmental managers attitude to stakeholder groups; Environmental strategy Ethics embedded in governance strategies and "concerned with authenticity and change, power and authority, leadership, imagination and the creation of sustainable value" Innovation capability Industrial characteristics Institutional information availability motivation and resource bundles Organisational structure; Organisational characteristics Organisational capabilities Perceived stakeholder importance Market performance Financial performance Government actions Social pressures Type of work (role) Industry membership	Business pressure from e.g. customers, community; suppliers; competitors, and financial institutions Stakeholder pressure from e.g. NGOs. media, governments, public organisations and local agencies. Environment-related information Formal stakeholder pressure e.g. law, regulation and policy and informal pressure e.g. institutions and social networks Stakeholder attitudes Laws, Regulations and rules; Scientific information availability Government intervention Time horizon on sustainability issue Technology Economic discontinuities Social norms Social pressure. High social pressure can lead to expensive fines, clean-up costs etc

Table 5 (continued)

|	Individual-Related Factors	Organisation-Related Factors	Society-Related Factors
Sensemaking Focus on morality and social connection. Language and influence of others important	Family Moral identity Environmental values Attitudes Moral purpose Value set (shaped by disciplinary socialisation) Taken for granted knowledge Recurrent practices Language "Imagined expectations of others" Environmental/ecological values	Profitability Language Institutional routines Leadership Work orientation Business expectations	Social status Stakeholders National culture Social circle
Managerial Interpretation Operationally focussed while including concept of responsibility to society	Ability to identify challenges Ability to interpret challenges Emotional associations Sense of control Long term thinking Perception and attention Social position	Discretionary slack Employee performance evaluation Environmental strategy Scope of operation Operational size Concept of responsibility to society Environmental issue legitimation as part of corporate identity Financial performance Connotation as "environmental leader" creates positive environmental associations Moral legitimacy Perceived role in society and approach to climate change through concept of responsibility	Issue legitimation Stakeholder pressure
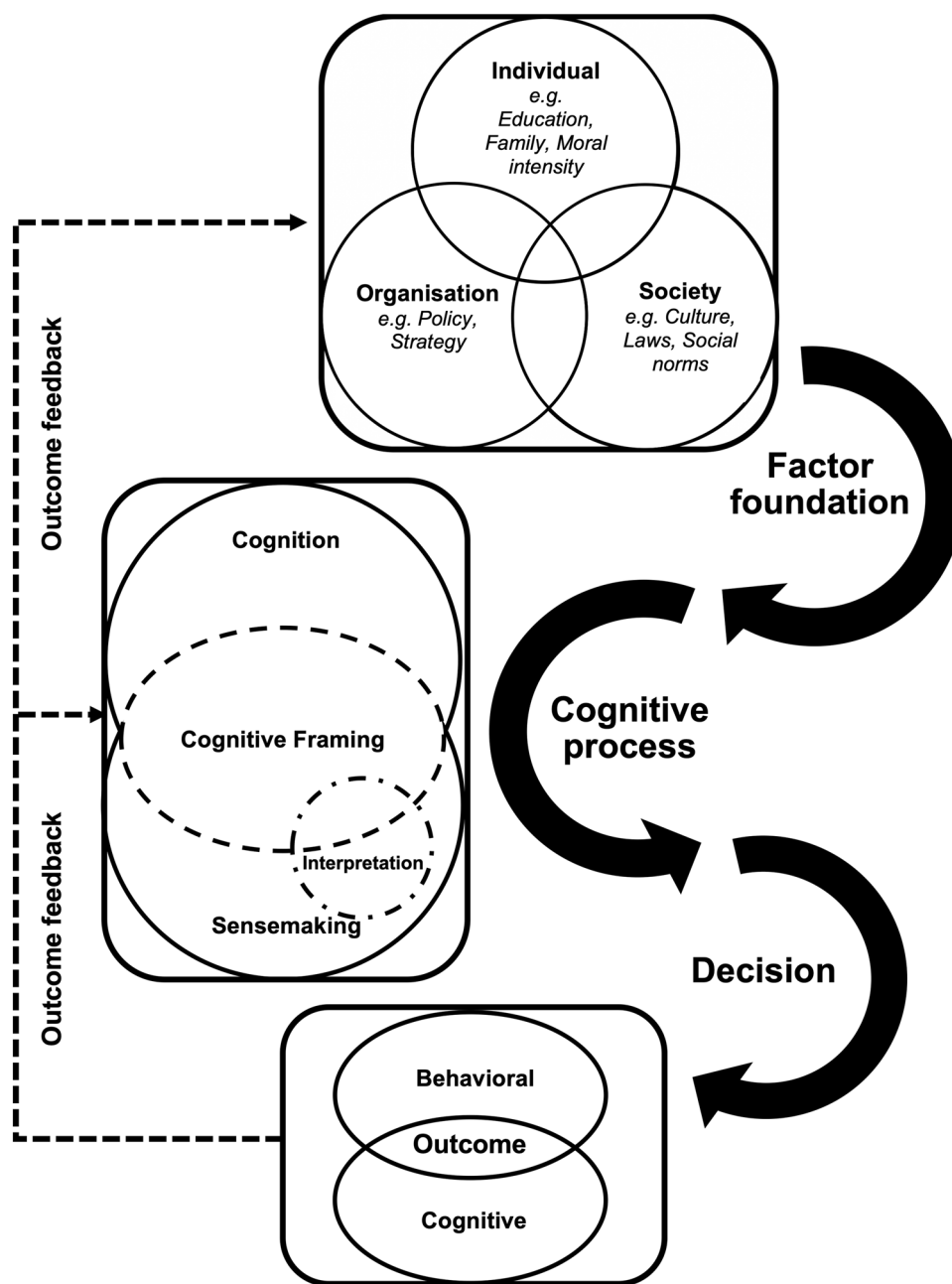
Fig. 4 An integrated model of decision-making on climate change and sustainability issues

on the topic has been lacking to date. This article has set out to establish underlying reasons for managerial inaction on climate change despite a recognition of the seriousness of the issue and the imperative for action. An integrated, dynamic, multi-conceptual model will now be presented (Fig. 4 below) synthesising the review results (summarised in Table 6 below) to identify interactions and potential intervention points. The concept of sensitive intervention points and tipping points has become recognised in natural and socioeconomic systems linked to climate change (Farmer

et al., 2019; Lenton et al., 2019) and provides a lens through which to interpret our review results.

Integrated Model

Decisions made by managers on issues and investments linked to climate change have been broken down into foundational factors and cognitive processes within this review, with components linked through a dynamic and interactive process. Commencing with foundational factors, individual, organisational
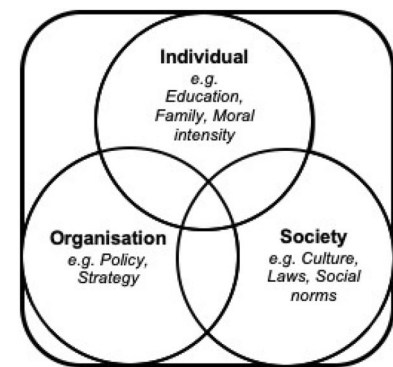
Table 6 Summarising the themes and core concepts of the processes of cognition, sensemaking and managerial interpretation

Research Themes

Cognition	Sensemaking	Managerial Interpretation
Foundation	*Foundation*	*Foundation*
Factors Shaping Cognition	Factors influencing in Sensemaking	Factors influencing Interpretation
Action/Interaction	*Action/Interaction*	*Action/Interaction*
Cognition Shapes Frame	Making Sense	Frames Shape Interpretation
Cognitive Frames Enable Sensemaking	Patterns of Sensemaking	*Outcome*
Outcome	Giving Meaning	Interpretation Impacts Decision
Cognition Shapes Decisions/ Action	*Outcome*	
Cognitive Factors Shape Action	Sensemaking Leader as Sharman	
Cognitive Framing Shapes Decisions	Sensemaking in Investment	

Core Concepts

| Cognition	Sensemaking	Managerial Interpretation
Reductionist	*Creating*	*Dependent*
Dual process	Construction	Shaped
Tensions	Ongoing	*Directing*
Thresholds	Creative	Advancing or constraining
Paradoxical	*Interpreting*	Determining
Dynamic	Categorising	
Evolving	Shaped	
Co-evolution	Trade-offs	
Malleable	Interpretation	
Interacting	*Leading*	
Shaped	Sharing	
Shaping	Communicating	
Determining	Acting	
Shaping	Change Agents	
Influencing	Transfer	
Enabling	Influencing	
	Redefining	
	Leading	

or societal in nature, the model presented in Fig. 4, illustrates the influence of experience and an individual's background on cognitive processes related to climate change. These processes, represented as an interconnection between cognition, cognitive framing, sensemaking and interpretation (discussed further below) have been reported to shape each other determining the eventual managerial decision, the outcomes of which may either be behavioural or cognitive, either facilitating or inhibiting further action on climate change (demonstrated in the model through dashed feedback lines). These feedback loops are supported by the references to temporal and spatial aspects impacting an individual's cognitive process (Haider & Mariotti, 2016; Plewnia & Guentha, 2018). We now discuss each model component further before raising issues that may be leading to a lack of action, identifying intervention points and potential tipping point characteristics.

Factor Foundation: The factors shaping an individual's cognitive process are linked to the individual themselves, through their inherited traits and their lives to date; their organisational environment; and, the society in which they live. Each area is represented as overlapping within the model, to demonstrate the interconnection and influence of factors on one another, for example societal norms will shape both

organisational and individual values. Examining these factors, some, such as an individual's abilities, may be difficult to alter; however, other factors can be influenced to promote greater action on climate change such as emotion (Eberhardt-Toth & Wasieleski, 2013), national culture (Liang et al., 2019), or an organisations financial situation (Peng & Liu, 2016; Schaltenbrand et al., 2018).

The Cognitive Process: Research on cognition, sensemaking and managerial interpretation is growing in frequency. Although often presented in isolation each plays an interconnected role in the cognitive process of decisions making on climate change with feedback, and at times cross-over, between the concepts. Diagrammatically, the concept of cognition has been separated into the processes of cognition and cognitive framing.
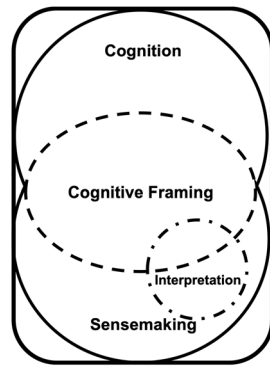
Examining the themes and core concepts from the literature we can make the following observations which have been utilised to construct the model:

- Cognition and cognitive framing are dynamic and complex processes which can shape action directly or via sensemaking by influencing attention, interpretation and response (Peng & Liu, 2016). Influenced by fixed and flexible factors cognition and cognitive framing are unique to an individual based on their nature and their experience including interactions with others (Haney, 2017). In addition to forming a foundation (as illustrated by references to cognition within other process literature), cognition itself shapes an individual's cognitive frame (Sharma & Jaiswal, 2018). Cognitive frames form filtering devices through which an individual can reduce complexity, guiding their sensemaking and interpretation processes (Groschl et al., 2019; Purdy et al., 2019).
- Sensemaking, contrary to its name refers to a biphasic process which involves both sensemaking and sensegiving. Although undoubtedly including the process of scanning, as highlighted by Hahn et al. (2014), the core concepts outlined in this review can be grouped under the headings of creating, interpreting and leading. Sensemaking has been reported to be the link between cognition and action (Wang, 2011), and is integrated with the process of interpretation (Fassin et al., 2011). The concept of interpretation is often discussed in the sensemaking literature, and although examined separately in the review process, it has been identified as an area of conceptual cross-over. Cognitive framing has also been reported to shape the sensemaking process by directing attention when scanning. Sensing new information gained through learning leads to new interpretation (Angus-Leppan et al., 2010). The process of sensemaking reshapes an individual's cognition and framing, increasing complexity as greater experience is gained by the individual.
- Managerial interpretation was observed to be a core part of the cognitive process (Haney, 2017) impacted by and

impacting the cognitive framing and sensemaking processes. Once an interpretation has been made by an individual, they can commence action, taking the interpretation to be reality (Fassin et al., 2011). The question needs to be considered as to whether the research on interpretation should be considered separately or incorporated as an area within the growing literature on sensemaking.

Unpacking the role of each cognitive process in decision-making can be challenging. From the systematic review we can see the concept of cognition underpins all aspects of the process, cognitive framing shapes sensemaking and ultimately interpretation, which is followed by a process of decision and sensegiving. An example from the authors professional experience is provided below to demonstrate the interactions and evolution within the cognitive process. The case is of a manager within an electricity utility. Where a manager has experience in the realities of managing carbon emissions within its organisational environment, experienced exposure to market trends and opportunities to purchase the credits from or work with developers of large-scale renewable generation assets, they will have an existing cognitive frame which they will apply when exploring another similar opportunity. This cognition and frame will assist them in knowing where to scan for information, make sense of it, interpret the option, and eventually decide whether or not to act. As decisions such as this are not made in isolation the process will also involve sensegiving prior to action. The outcome of this process will evolve the individual's cognition and initial cognitive frame on the issue. The evolved frame will then shape the individual's future strategic choices.

Management Complacency and Opportunities to Promote Action

This article has sought to understand why managers remain complacent given the accepted need for accelerated action on climate change. We find that given the complexity and interconnected nature of the cognitive decision process there are issues (and therefore potential intervention points) presented at the individual, organisational and societal levels.

All cognitive processes identified the role of experience in the decision-making process, particularly linked directly to cognition and cognitive framing (Hahn et al., 2014), through threat interpretation (Haney, 2017) and the scanning/ sensemaking process (Fontana, 2019). Through this research we may propose that a lack of experience in decision-making on climate change to date may be restricting further decision-making by limiting the cognitive process. The situation, however, is not so simple. Gond et al. (2017) referred to the role of affective process and emotion in CSR evaluations. In

our review we found that very few of the articles examining managerial level processes, other than Eberhardt-Toth and Wasieleski (2013) and Zhou et al., (2018a, 2018b) who made significant reference to emotion. This lack of inclusion of emotion may indicate a second significant issue preventing meaningful corporate action against climate change. Zollo (2021) and Eberhardt-Toth and Wasieleski (2013) discussed the formation of cognition through directed and automatic components. Without an emotional connection, the implicit aspect may be limited leaving individuals to fall back on the purposeful, directed cognitive process. Considering past social responsibility issues such as child labour, which was once seen by some as acceptable, but is now widely rejected, evoking an automatic emotion of disgust we can understand the power of emotion in strong action. The question remains whether action on climate change would be accelerated if damaging activities elicited a stronger negative emotion.

A third issue identified through the literature is associated with dominant market logics and cognitive framing. This area is linked to the work of Hahn et al. (2014) and Sharma and Jaiswal (2018) on cognitive framing and Waddock (2019) on sensemaking and leadership. While organisations continue to operate under a conceptualisation of value primarily linked to financial returns the cognitive decision-making process of managers will continue to be shaped away from significant proactive climate action.

Reviewing these three issue areas we propose below three potential tipping point situations linked to the issues above that may lead to overcoming managerial inaction on climate change each directed at a different level of intervention.

1. ***Requiring individual managerial level change:*** *The conceptualisation of "leadership" is altered to the extent that maximising profit without action is personally catastrophic from a social and moral perspective.*

    Self-identity and the conceptualisation of what it is to be a leader may provide an avenue to trigger further decision-making. In our review we have seen a recent focus on leadership by Groschl et.al. (2019) and Waddock (2019). Outside academia we have also recently seen leadership called into question on ethical matters through the #BlackLivesMatter campaign. In line with increased links between company valuation and corporate social responsibility, sustainability actions and changes to expected gender and race representation in corporate leadership it is time to also reconsider what is good leadership. Waddock (2019) presented a view of a leader as a shaman. "*Traditional shamans typically work on healing individuals or aspects of the community that have fallen sick or are perceived to be dis-eased—out*

of ease or unharmonious, where cultural mythologies are no longer working well (Dow 1986; Walsh 1989)." As we seek to address climate change it seems we need more leaders bearing the traits outlined by Waddock (2019).

2. ***Requiring organisational level change:*** *The conceptualisation of what a successful business is altered to the extent that profit without action on climate change is highly socially unacceptable so much so that it is catastrophic from an investor (and therefore business) perspective.*

    Fontana (2019) demonstrated the potential for managers to override financial considerations where social recognition benefits could be achieved. The situation described by Fontana is linked to the particular context of the Bangladesh garment industry, whereas the wider moves to alter the expectations of business require extensive industry and investor led change in expectations. The challenge remains as to how to trigger this change. How can we as a society establish an emotional connection with the natural environment rather than wealth?
    The process of altering societal norms and institutional logics may be time consuming, however, recent experience with adjustments to the COVID-19 crisis has demonstrated the potential for widespread change on an accelerated basis. Additionally, as change is anticipated, but not yet enacted, sectorial stakeholder groups work to develop opinions on possible policy options (Buysse & Verbeke, 2003; Clark & Crawford, 2012; Martin & Rice, 2010) potentially changing institutional logics in advance of policy enactment. The process of developing progressive policy, not just the policy itself, can have positive impacts on achieving cognitive reform.

3. ***Requiring societal level change:*** *The standard parameters which measure and lead to business success are altered to the extent that action is inevitable (e.g. through pricing carbon, divestment, or new technology).*

    Altering the standard parameters and increasing transparency on an organisations impact and activities will force action to be taken even by conservative organisations. Action shapes cognition with cognitive progress developed through experiential engagement in the management of climate change issues, including reporting and stakeholder engagement programs. With frame complexity linked to prior experience, success-

ful solutions will likely be perceived as less risky to the managers involved with sustainability programs resulting in increased positivity regarding outcomes (Hahn et al., 2014). Engaging in these activities will naturally orient the cognitive process towards future action. The parameter adjustment may occur through government action to introduce a price on carbon or support clean-tech innovation. There is an established relationship between regulatory environmental reform and greater levels of environmental engagement (Dahlman & Brammer, 2011). It can also be supported by initiatives such as the Task Force on Climate-Related Financial Disclosures (TCFD).

To be successful all of these options require a paradigm shift in the way we manage ourselves, our businesses and our society. We will need to care more about and value non-financial impacts and outcomes. We will need to expect more from our leaders and companies.

Areas for Future Research

Through this analysis we have identified three areas that should be addressed by future research.

Research Challenge 1: Clarification of the Role Played by Affective Processes, Including Emotion, in Shaping Cognitive Evaluations.

As indicated by Gond et al. (2017), Eberhardt-Toth and Wasieleski (2013) and Zollo (2021) concentrating on the rationalist process of decision-making fails to account for the intuitive process. Seeking process clarity on the relative strength and operation of the intuitive rather than the directed will elucidate whether this process provides a potential avenue to accelerate change. This research can include retrospective analysis of progress on the normalisation of action on past sustainability-related issues and organisations where pro-climate change progress has been made.

Research Challenge 2: Evaluation of the Process of Interpretation Within Cognitive Dynamics.

Despite the extensive citations of Sharma's (2000) article on managerial interpretation and its linkage within literature to complementary cognitive processes, further examination is necessary to unpack the process of interpretation in relation to climate change and sustainability. Particular reference should be made to the connections and cross-over between the processes of sensemaking and interpretation.

Research Challenge 3: Understand the Dynamics of Climate Leadership at the Level of the Individual.

Examining the cognitive framing of proactive leadership on climate change issues within executive managers will assist with forming a baseline and identify any exemplars on which to mimic action in other organisations. Waddock (2019) focussed on leadership through sensemaking, while other researchers identified it as a key factor in the cognitive process of decision-making [either working for or against action, for example, where individuals overly rely on past experience (Schaltenbrand et al., 2018)].

Limitations

Due to the exact nature of phrasing used in the search terms some articles may have been overlooked and therefore excluded from the review process. Further, some articles will exist in journals not included in the review process.

Conclusions

Understanding cognitive processes that shape decision-making on sustainability and climate change is vital to assist companies in their transition to a low-emissions sustainable future. It has become clear through this review that these decisions challenge managers on multiple fronts, largely going against the business-as-usual operation of a firm, requiring the ambidexterity to manage potentially conflicting short- and long-term drivers. Requiring long-term investment under increasingly uncertain conditions, existing frames constructed during stable market conditions are proving insufficient to enable climate-related action (Slawinski et al., 2015). It is now time for academics to also break our own cognitive frames to consider how we cannot just promote sustainability, but a step change towards a paradigm shift in action.

Declarations

References

Aguinis, H., & Glavas, A. (2019). On corporate social responsibility, sensemaking, and the search for meaningfulness through work. *Journal of Management, 45*(3), 1057–1086. https://doi.org/10.1177/239700221102500204

Ancona, D. (2011). Sensemaking: Framing and acting in the unknown. In S. Snook, N. Nohria, & R. Khurana (Eds.), *The handbook for teaching leadership* (pp. 3–19). Sage Publications.

Angus-Leppan, T., Benn, S., & Young, L. (2010). A sensemaking approach to trade-offs and synergies between human and ecological elements of corporate sustainability. *Business Strategy and the Environment*. https://doi.org/10.1002/bse.675

Babalola, M. T., Bligh, M. C., Ogunfowora, B., Guo, L., & Garba, O. A. (2019). The mind is willing, but the situation constrains: Why and when leader conscientiousness relates to ethical leadership. *Journal of Business Ethics, 155*(1), 75–89. https://doi.org/10.1007/s10551-017-3524-4

Babua, N., De Roeckb, K., & Raineri, N. (2020). Hypocritical organizations: Implications for employee social responsibility. *Journal of Business Research., 114*, 376–384.

Barr, P., Stimpert, J., & Huff, A. (1992). Cognitive change, strategic action, and organizational renewal. *Strategic Management Journal, 13*, 15–36. https://doi.org/10.1177/014920639502100304

Basu, K., & Palazzo, G. (2008). Corporate social responsibility: A process model of sensemaking. *Academy of Management Review, 33*, 122–136.

Benn, S., Edwards, M., & Angus-Leppan, T. (2013). Organizational learning and the sustainability community of practice. *Organization and Environment, 26*(2), 184–202. https://doi.org/10.5465/amle.9.3.zqr520

Bergman, J.-P., Hajikhani, A., & Blomqvist, K. (2019). Emergence and development of the cleantech industry: A cognitive construction approach. *Journal of Cleaner Production, 233*, 1170–1181. https://doi.org/10.1016/j.jclepro.2019.05.369

Bien, C., & Sassen, R. (2020). Sensemaking of a sustainability transition by higher education institution leaders. *Journal of Cleaner Production, 256*, 120299.

Bowen, F. (2007). Corporate social strategy: competing views from two theories of the firm. *Journal of Business Ethics., 75*, 97–113. https://doi.org/10.1007/s10551-006-9240-0

Buysse, K., & Verbeke, A. (2003). Proactive environmental strategies: A stakeholder management perspective. *Strategic Management Journal, 24*, 453–470. https://doi.org/10.1002/smj.299

Child, C. (2019). Whence paradox? Framing away the potential challenges of doing well by doing good in social enterprise organizations. *Organization Studies*. https://doi.org/10.1177/0170840619857467

Chung, J. O. Y., & Hsu, S. H. (2017). The effect of cognitive moral development on honesty in managerial reporting. *Journal of Business Ethics, 145*(3), 563–575. https://doi.org/10.1007/s10551-015-2834-7

Clark, C., & Crawford, E. (2012). Influencing climate change policy the effect of shareholder pressure and firm environmental performance. *Business and Society, 51*(1), 148–175. https://doi.org/10.1177/0007650311427594

Cook, J., Nuccitelli, D., Green, S. A., Richardson, M., Winkler, B., Painting, R., et al. (2013). Quantifying the consensus on anthropogenic global warming in the scientific literature. *Environmental Research Letters, 8*(2), 1–7.

Cook, J., Oreskes, N., Doran, P. T., Anderegg, W. R. L., Verheggen, B., Maibach, E. W., et al. (2016). Consensus on consensus: A synthesis of consensus estimates on human-caused global warming. *Environmental Research Letters, 11*(4), 048002. https://doi.org/10.1088/1748-9326/11/4/048002

Cornelissen, J., & Werner, M. (2014). Putting framing in perspective. *The Academy of Management Annals, 8*, 181–235. https://doi.org/10.1080/19416520.2014.875669

Crilly, D., Hansen, M., & Zollo, M. (2016). The grammar of decoupling: A cognitive-linguistic perspective on firms' sustainability claims and stakeholders' interpretation. *Academy of Management Journal, 59*(2), 705–729. https://doi.org/10.5465/amj.2015.0171

Dahlmann, F., & Brammer, S. (2011). Exploring and explaining patterns of adaptation and selection in corporate environmental strategy in the USA. *Organizational Studies, 32*(4), 527–553. https://doi.org/10.1177/0170840611403670

Dwyer, G., & Hardy, C. (2016). We have not lived long enough: Sensemaking and learning from bushfire in Australia. *Management Learning, 47*(1), 45–64.

Eberhardt-Toth, E., & Wasieleski, D. M. (2013). A cognitive elaboration model of sustainability decision making: Investigating financial managers' orientation toward environmental issues. *Journal of Business Ethics, 117*(4), 735–751.

Farmer, J., Hepburn, C., Ives, M., Hale, T., Wetzer, T., Mealy, P., et al. (2019). Sensitive intervention points in the post-carbon transition. *Science, 364*(6436), 132–134.

Fassin, Y., Van Rossem, A., & Buelens, M. (2011). Small-business owner-managers' perceptions of business ethics and csr-related concepts. *Journal of Business Ethics, 98*(3), 425–453.

Felin, T., Foss, N., & Ployhart, R. (2015). The microfoundations movement in strategy and organization theory. *The Academy of Management Annals, 9*(1), 575–632. https://doi.org/10.1080/19416520.2015.1007651

Fontana, E. (2019). pioneering environmental innovation in developing countries: The case of executives' adoption of leadership in energy and environmental design. *Journal of Cleaner Production, 236*, 117675. https://doi.org/10.1016/j.jclepro.2019.117675

Furrer, B., Hamprecht, J., & Hoffmann, V. (2012). Much ado about nothing? How banks respond to climate change. *Business and Society, 51*(1), 62–88. https://doi.org/10.1177/0007650311427428

Gavetti, G., & Levinthal, D. (2000). Looking forward and looking backward: Cognitive and experiential search. *Administrative Science Quarterly, 45*, 113–137.

Goffman, E. (1974). *Frame analysis: An essay on the organization of experience*. Northeastern University Press.

Gond, J.-P., El Akremi, A., Swaen, V., & Babu, N. (2017). The psychological microfoundations of corporate social responsibility: A person-centric systematic review. *Journal of Organizational Behavior, 38*(2), 225–246.

Gond, J.-P., & Moser, C. (2019). The reconciliation of fraternal twins: Integrating the psychological and sociological approaches to "micro" corporate social responsibility. *Human Relations*. https://doi.org/10.1177/0018726719864407

Green, T., & Peloza, J. (2015). How did the recession change the communication of corporate social responsibility activities? *Long Range Planning, 48*(2), 108–122. https://doi.org/10.1016/j.lrp.2014.07.004

Grewatsch, S., & Kleindienst, I. (2018). How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability. *Long Range Planning*. https://doi.org/10.1016/j.lrp.2017.03.004

Gröschl, S., Gabaldón, P., & Hahn, T. (2019). The Co-evolution of leaders' cognitive complexityand corporate sustainability: The case of the CEO of Puma. *Journal of Business Ethics, 155*(3), 741–762. https://doi.org/10.1007/s10551-017-3508-4

Hahn, T., Preuss, L., Pinske, J., & Figge, F. (2014). Cognitive frames in corporate sustainability: Managerial sensemaking with paradoxical and business case frames. *Academy of Management Review, 39*(4), 463–497. https://doi.org/10.5465/amr.2012.0341

Haider, S., & Mariotti, F. (2016). Unfolding critical events and strategic decisions: The role of spatial and temporal cognition. *Management Decision, 54*(7), 1813–1842.

Haney, A. B. (2017). Threat interpretation and innovation in the context of climate change: An ethical perspective. *Journal of Business Ethics, 143*, 261–276. https://doi.org/10.1007/s10551-015-2591-7

Henry, A. D., & Dietz, T. (2012). Understanding environmental cognition. *Organization and Environment, 25*(3), 238–258.

Hiekkataipale, M., & Lamsa, A. (2019). (A)moral agents in organisations? The significance of ethical organisation culture for middle managers' exercise of moral agency in ethical problems. *Journal of Business Ethics, 155*, 147–161. https://doi.org/10.1007/s10551-017-3511-9

Kaplan, S. (2008). Framing contests: Strategy making under uncertainty. *Organizational Science, 19*(5), 729–752.

Kaplan, S. (2011). Research in cognition and strategy: Reflections on two decades of progress and a look to the future. *Journal of Management Studies, 48*(3), 665–695.

Khan, S. N. (2018). Making sense of the black box: An empirical analysis investigating strategic cognition of CSR strategists in a transitional market. *Journal of Cleaner Production, 196*, 916–926. https://doi.org/10.1016/j.jclepro.2018.06.075

Laing, T., Sato, M., Grubb, M., & Comberti, C. (2013). *Assessing the effectiveness of the EU emissions trading system*. London: Centre for Climate Change Economics and Policy.

Lefsrud, L., Graves, H., & Phillips, N. (2019). "Giant toxic lakes you can see from space" A theory of multimodal messages and emotion in legitimacy work. *Organization Studies., 41*(8), 1055–1078.

Lei, L., Voss, H., Clegg, L. J., & Wu, X. (2017). Climate change strategies of multinational enterprises in China. *Journal of Cleaner Production, 160*, 98–108. https://doi.org/10.1016/j.jclepro.2017.03.150

Lenton, T. M., Rockström, J., Gaffney, O., Rahmstorf, S., Richardson, K., Steffen, W., & Schellnhuber, H. J. (2019). Climate tipping points—too risky to bet against. *Nature, 575*, 592–595.

León, C., & Araña, J. (2015). Context-dependent evaluation of climate change policies: Competing policies, knowledge and emotions. *Journal of Environmental Planning and Management, 59*(4), 687–707.

Liao, Z. (2016). Temporal cognition, environmental innovation, and the competitive advantage of enterprises. *Journal of Cleaner Production, 135*, 1045–1053. https://doi.org/10.1016/j.jclepro.2016.07.021

Lin, H.-Y., & Hsu, M.-H. (2013). Using social cognitive theory to investigate green consumer behavior. *Business Strategy and the Environment, 24*(5), 326–343.

Lin, H., & McDonough, E. (2014). Cognitive frames, learning mechanisms, and innovation ambidexterity. *Journal of Product Innovation Management, 31*(1), 170–188.

Linnenluecke, M., Griffiths, A., & Mumby, P. (2015). Executives' engagement with climate science and perceived need for business adaptation to climate change. *Climatic Change, 131*, 321–333.

López-Navarro, M. Á., Llorens-Monzonís, J., & Tortosa-Edo, V. (2016). Journal of Cleaner Production. *Journal of Cleaner Production, 112*, 1645–1657. https://doi.org/10.1016/j.jclepro.2015.03.071

Madhavaram, S., Badrinarayanan, V., & Granot, E. (2011). Approaching global industrial marketing from a managerial cognition perspective: A theoretical framework. *Journal of Business and Industrial Marketing, 26*(7), 532–541.

Martin, N., & Rice, J. (2010). Analyzing emission intensive firms as regulatory stakeholders: A role for adaptable business strategy. *Business Strategy and the Environment, 19*, 64–75.

Meyer, M. A., Cross, J. E., & Byrne, Z. S. (2016). Frame decoupling for organizational change. *Organization and Environment, 29*(2), 231–251.

Ocasio, W. (2011). Attention to Attention. *Organization Science, 22*(5), 1286–1296. https://doi.org/10.1287/orsc.1100.0602

Okereke, C., & Kung, K. (2013). Climate policy and business climate strategies: EU cement companies' response to climate change and barriers against action. *Management of Environmental Quality: An International Journal, 24*(3), 286–310.

Okereke, C., Wittneben, B., & Bowen, F. (2012). Climate change: Challenging business, transforming politics. *Business and Society, 51*(1), 7–30.

Olazabal, M., & Pascual, U. (2015). Journal of Cleaner Production. *Journal of Cleaner Production, 109*, 336–346. https://doi.org/10.1016/j.jclepro.2015.08.047

Peng, X., & Liu, Y. (2016). Behind eco-innovation: Managerial environmental awareness and external resource acquisition. *Journal of Cleaner Production, 139*, 347–360. https://doi.org/10.1016/j.jclepro.2016.08.051

Plewnia, F., & Guenther, E. (2018). Mapping the sharing economy for sustainability research. *Management Decision, 56*(3), 570–658.

Purdy, J., Ansari, S., & Gray, B. (2019). Are logics enough? Framing as an alternative tool for understanding institutional meaning making. *Journal of Management Inquiry, 28*, 409–419. https://doi.org/10.1177/1056492617724233

Rockström, J., Steffen, W., Noone, K., Persson, A., Chapin, F. S., Lambin, E., Lenton, T., Scheffer, M., Folke, C., Schellnhuber, H., Nykvist, B., De Wit, C., Hughes, T., van der Leeuw, S., Rodhe, H., Sorlin, S., Snyder, P., Costanza, R., Svedin, U., … Foley, J. (2009). Planetary boundaries: Exploring the safe operating space for humanity. *Ecology and Society, 14*(2), 32.

Rousseau, D., Manning, J., & Denyer, D. (2008). Evidence in management and organizational science: assembling the field's full weight of scientific knowledge through syntheses. *Academy of Management Annals, 2*(1), 475–515.

Schaltenbrand, B., Foerstl, K., Azadegan, A., & Lindeman, K. (2018). See What we want to see? The effects of managerial experience on corporate green investments. *Journal of Business Ethics, 150*(4), 1129–1150. https://doi.org/10.1007/s10551-016-3191-x

Selsky, J. W., & Parker, B. (2011). Platforms for cross-sector social partnerships: Prospective sensemaking devices for social benefit. *Journal of Business Ethics, 94*(S1), 21–37. https://doi.org/10.1177/0899764000291009

Shang, H., Huang, P., & Guo, Y. (2010). Managerial cognition: The sources of sustainable competitive advantage in hypercompetition. *Nankai Business Review International, 1*(4), 444–459.

Sharma, G., & Bansal, P. (2017). Partners for good: How business and ngos engage the commercial-social paradox. *Organization Studies, 38*(3–4), 341–364.

Sharma, G., & Jaiswal, A. (2018). Unsustainability of sustainability: Cognitive frames and tensions in bottom of the pyramid projects. *Journal of Business Ethics, 148*(2), 291–307. https://doi.org/10.1007/s10551-017-3584-5

Sharma, S. (2000). Managerial interpretations and organizational context as predictors of corporate choice of environmental strategy. *Academy of Management Journal, 43*, 681–697.

Simon, H. (1957). *Models of man, social and rational: mathematical essays on rational human behavior in a social setting*. John Wiley and Sons.

Siqueira, R. P., & Pitassi, C. (2016). Journal of cleaner production. *Journal of Cleaner Production, 139*, 1181–1190. https://doi.org/10.1016/j.jclepro.2016.08.056

Slawinski, N., Pinkse, J., Busch, T., & Banerjee, S. (2015). The role of short-termism and uncertainty avoidance in organizational inaction on climate change: A multi-level framework. *Business and Society*. https://doi.org/10.1177/0007650315576136

Starbuck, W. (2009). Cognitive reactions to rare events: perceptions, uncertainty, and learning. *Organization Science, 20*, 925–937.

Štumberger, N., & Golob, U. (2016). On the discursive construction of corporate social responsibility in advertising agencies. *Journal of Business Ethics*. https://doi.org/10.1007/s10551-015-2575-7

Tisch, D., & Galbreath, J. (2018). Building organizational resilience through sensemaking: The case of climate change and extreme weather events. *Business Strategy and the Environment, 27*(8), 1197–1208.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management, 14*, 207–222.

United Nations (2015). Adoption of the Paris agreement. united nations framework convention on climate change. Conference of parties twenty-first session, Paris, France

UNEP (2018). The Emissions Gap Report 2018. United Nations Environment Programme, Nairobi

van der Heijden, A., & Cramer, J. M. (2017). Change agents and sustainable supply chain collaboration: A longitudinal study in the Dutch pig farming sector from a sensemaking perspective. *Journal of Cleaner Production, 166*, 967–987. https://doi.org/10.1016/j.jclepro.2017.08.074

van der Heijden, A., Driessen, P. P. J., & Cramer, J. M. (2010). Making sense of Corporate Social Responsibility: Exploring organizational processes and strategies. *Journal of Cleaner Production, 18*, 1787–1796. https://doi.org/10.1016/j.jclepro.2010.07.024

Waddock, S. (2019). Shaping the shift: Shamanic leadership, memes, and transformation. *Journal of Business Ethics, 155*(4), 931–939. https://doi.org/10.1007/s10551-018-3900-8

Wade, B., & Rekker, S. (2020). Research can (and should) support corporate decarbonization. *Nature Climate Change, 10*, 1064–1065. https://doi.org/10.1038/s41558-020-00936-0

Walsh, J. (1995). Managerial and organizational cognition: Notes from a trip down memory lane. *Organizational Science, 6*(3), 280–321.

Wang, R., Qi, R., Cheng, J., Zhu, Y., & Lu, P. (2020). The behavior and cognition of ecological civilization among Chinese university students. *Journal of Cleaner Production., 243*, 1–10.

Wang, Y. (2011). Mission-driven organizations in Japan: Management philosophy and individual outcomes. *Journal of Business Ethics., 101*, 111–126. https://doi.org/10.1007/s10551-010-0712-x

Wang, Y., Li, Y., Zhang, J., & Su, X. (2019). How impacting factors affect Chinese green purchasing behavior based on fuzzy cognitive maps. *Journal of Cleaner Production., 240*, 1–10.

Weick, K. E. (1988). Enacted sensemaking in crisis situations. *Journal of Management Studies, 25*(4), 305–317.

Weick, K. E. (1993). The collapse of sensemaking in organizations: The Mann Gulch disaster. *Administrative Science Quarterly, 38*(4), 628–652. https://doi.org/10.2307/2393339

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization Science, 16*(4), 409–421.

Whiteman, G., & Cooper, W. H. (2011). Ecological sensemaking. *Academy of Management Journal, 54*(5), 889–911. https://doi.org/10.5465/amj.2008.0843

Williams, A., Kennedy, S., Philipp, F., & Whiteman, G. (2017). Systems thinking: A review of sustainability management research. *Journal of Cleaner Production, 148*, 866–881. https://doi.org/10.1016/j.jclepro.2017.02.002

Wright, C., & Nyberg, D. (2015). *Climate change, capitalism, and corporations processes of creative self-destruction*. Cambridge University Press.

Yang, D., Wang, A. X., Zhou, K. Z., et al. (2019). *Journal of Business Ethics, 159*, 1147. https://doi.org/10.1007/s10551-018-3830-5

Zhou, Y., Chen, H., Xu, S., & Wu, L. (2018a). How cognitive bias and information disclosure affect the willingness of urban residents to pay for green power? *Journal of Cleaner Production, 189*, 552–562. https://doi.org/10.1016/j.jclepro.2018.03.222

Zhou, Y., Hong, J., Zhu, K., Yang, Y., & Zhao, D. (2018b). Dynamic capability matters: Uncovering its fundamental role in decision making of environmental innovation. *Journal of Cleaner Production, 177*, 516–526. https://doi.org/10.1016/j.jclepro.2017.12.208

Zhou, Z., Nie, L., Ji, H., Zeng, H., & Chen, X. (2020). Does a firm's low-carbon awareness promote low-carbon behaviors? Empirical evidence from China. *Journal of Cleaner Production., 244*, 118903.

Zollo, L. (2021). The consumers' emotional dog learns to persuade its rational tail: Toward a social intuitionist framework of ethical consumption. *Journal of Business Ethics, 168*(2), 295–313. https://doi.org/10.1007/s10551-019-04420-4

Zuzul, T. W. (2019). "Matter battles": cognitive representations, boundary objects, and the failure of collaboration in two smart cities. *Academy of Management Journal, 62*(3), 739–764. https://doi.org/10.5465/amj.2016.0625