



Reconceptualising Sustainable Intelligence as a Multidimensional Psychological Capability

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ABSTRACT

Sustainable Intelligence (SI) has emerged as a crucial concept, particularly in sustainability and environmental studies. Despite its growing popularity among scholars across various fields, including education, organisations, community, tourism, and environment, SI still lacks a robust definition and confusing dimensions that can alter the content of studies. This paper aims to refine the SI framework by integrating perspectives from ecological intelligence, environmental ethics, systems intelligence, and cognitive sustainability. Through this integration, SI is presented as a multidimensional approach that can enhance environmental quality and improve practicality for stakeholders, promoting a long-term, positive impact on sustainability. The refinement provides a clearer context for sustainability, closing the gap between knowledge of sustainability and sustained behavioural change, and highlights its functionality across various sectors. By strengthening the SI framework, it can be applied by scholars, thereby reducing the research gap and increasing the likelihood of its application in future empirical research to foster sustainability-oriented thinking and behaviour.

Keywords: Sustainable intelligence, sustainability, pro-environmental behaviour, environmental

INTRODUCTION

The concept of sustainability is under pressure from various environmental issues, including climate change, pollution, uncontrolled development, and ecosystem degradation (Estoque, 2020). These challenges have led to the development of sustainable practices among individuals, institutions, and nations, with the goal of mitigating negative environmental impacts through increased environmental awareness. In response, the United Nations (UN) introduced the Sustainable Development Goals (SDGs), which serve as a global model to ensure the wellbeing of the ecosystem for both present and future generations (United Nations, 2015). The SDGs consist of targets and indicators that are monitored by global authorities including the World Health Organisation (WHO), the Food and Agriculture Organisation (FAO), the United Nations Development Programme (UNDP), and the World Bank (UN IAEG-SDGs, 2020).

Elkington (1997) referred to the Triple Bottom Line (TBL) as a fundamental concept of sustainability that encompasses the environment, economy, and society. Some researchers also refer to these dimensions as the three pillars of sustainability: people (social), profit (economy), and ecology (environment) (Barbier, 1987; Elkington, 1994; Elkington, 1997). According to Silvestre et al. (2014), sustainability can be achieved through effective management of these dimensions. Effective sustainability management can be achieved through the equilibrium and systematic integration of the three pillars of sustainability, which can be applied to a long-term strategic plan. It shows that strategic sustainability management cannot depend on a single dimension alone, but rather on harmonising those three concepts to maximise the development of humanity, the economy, and the environment. Other than that, effective management can be maximised through the concept of cognitive, applied through awareness and understanding of sustainability. However, the cognitive aspect in the context of sustainability still needs a deeper understanding and explanation, with its application, assessment, and action (Kaiser & Wilson, 2004; Kollmuss & Agyeman, 2002).

The TBL paradigm explains the element of environmental, social, and economic must be in a balance state

(Elkington, 1997). However, this paradigm does not explain how individuals cognitively balance these often conflicting demands (Hahn, 2014). Sustainability is not the only challenge that is faced by sustainable management, but also a psychological one. According to Bansal and Song (2017), complex integrative thinking must take into account social expectations, economic pressures, and ecological effects all at once. However, several factors hinder the individuals' decision-making process such as cognitive limits, short-term bias, and fragmented reasoning (Kahneman, 2011). As a result, the failures of sustainability may reflect limitations in psychological capability, rather than disorganisation alone. Hence, sustainable intelligence gains theoretical relevance within this cognitive gap. Therefore, sustainability does not only require structural integration of social, ecological, and economic, but also a psychological structure that can balance trade-offs under systemic complexity.

Consequently, this gap has led to the emergence of sustainable intelligence (SI), which explains how this construct can help people better understand sustainability. According to López-Sánchez and Pulido-Fernández (2016), SI is widely described as an individual's capacity to think, interpret, and act on the basis of their knowledge and experience to perform specific behaviours. The early idea of SI emphasises the importance of systems thinking, raises awareness among people, and fosters empathy for the environment, which is a fundamental component in the formation of responsible behaviour (Goleman et al., 2010). According to Silvestre and Fonseca (2020), SI is a psychological skill that enables people to act as environmentalists and help build a sustainable environment. Therefore, SI acts as a cognitive-affective process that influences responsible environmental behaviour by combining awareness, value orientation, and responsibility, which in turn shapes individuals' environmental behaviour (Lee et al., 2021, 2023).

Despite the above premises, the conceptual boundary of SI remains conceptually complicated and unclear by recent literature, which also demonstrates that the current concept of SI overlaps with other related components such as sustainability literacy, environmental knowledge, and awareness of environment, which further complicates the conceptual boundaries of SI (De Jesus et al., 2024; Hossain et al., 2022; López-Sánchez & Pulido-Fernández, 2016; Silvestre & Fonseca, 2020). This issue has shown that the concept of SI should be standardised in terms of definition, concept, and indicator. Rather than having a fixed definition of SI, it should be grounded in a consistent concept so that SI can be applied systematically in theoretical development or future research.

Given the issues, the conceptual foundation of SI needs to be reviewed and clarified in light of these difficulties. Enhancing this idea will provide academics with a theoretical foundation and help develop more reliable analytical tools for future sustainability studies. Hence, this paper aims to enrich the existing literature by emphasising a deeper understanding and a more robust knowledge of the SI. To address the issues, this study will adopt a conceptual review approach, drawing on previous theoretical and empirical literature to refine the overlap of SI.

THEORETICAL BACKGROUND

Individuals with a strong concern for the ecosystem tend to act in an eco-friendly manner, which can have a positive impact (Kement & Bükey, 2020). It is related to environmental awareness among individuals, which can be linked through environmental intelligence to perform actions that reduce negative effects on the ecosystem (Kollmuss & Agyeman, 2002; Specq, 2016). Some early studies have discussed a few terminologies related to sustainable intelligence to promote pro-environmental behaviour (PEB), such as environmental knowledge (Hussain et al., 2022) and green knowledge (Khan et al., 2024). Conceptually, these constructs differ from SI, even though the study aims to examine environmental behaviour. Both concepts can be referred to as cognitive understanding and awareness of environmental behaviour, whereas SI is a broader concept that can be integrated across diverse contexts to support the development of PEB. This can be demonstrated by previous research, which shows that the foundation of SI focuses on systems thinking and ecological literacy (Goleman et al., 2010), while others incorporate sociocultural orientations (Kopnina, 2014; Lee et al., 2023). These findings indicate that SI is a multidimensional construct, yet its fundamental components remain largely unexplored across studies. Hence, the inconsistencies in the definitions used by previous studies underscore the need for clearer theoretical refinement.

Although its theoretical bounds remain unknown, SI has received greater attention in recent research (Lee et al.,

2021). For example, Lee et al. (2021) applied SI in VBN theory, in which SI plays a crucial role in the formation of PEB. Other than that, recent literature by Lee et al. (2023) also integrated SI into the theory of VBN and the Model of Goal-directed Behaviour. Previous literature has shown that the concept of SI can be implemented in behaviour-oriented models or theories. However, most scholars highlight that the individual level understanding of SI varies depending on their attitudes, practices, and the concept of sustainability itself, indicating that individuals who support sustainability are neither a homogeneous nor static group (Dolnicar & Grün, 2009; Higham et al., 2016). This indicates that SI is a diverse construct that encompasses various psychological elements, the precise structure of which remains unknown (Kaiser & Wilson, 2004; Stern, 2000). The conceptual contradiction, as highlighted earlier, indicates that SI requires further theoretical developments to establish its components and clarify how it can influence other related variables (Bamberg & Möser, 2007; Kollmuss & Agyeman, 2002).

Theoretically, SI falls within the broader category of intelligence concepts. For example, the cognitive and emotional elements present in SI overlap with naturalistic, intrapersonal, and interpersonal intelligence as discussed by Gardner's theory of multiple intelligences (Gardner, 2011). Although the theory does not include sustainability as a main idea, SI can still be related to the system itself. As Saarinen (2004) noted, this context concerns how SI can facilitate alignment between humans and nature. Similarly, SI is also related to ecological or environmental intelligence, which emphasises awareness of human impacts on the environment (Goleman, 2009). However, SI goes beyond ecological cognition by integrating values, attitudes, and behaviour orientations. These overlaps suggest that SI may function as an integrative type of intelligence, combining several psychological attributes.

This can be supported by recent literature that has sought to integrate SI within a broader sustainability context. For example, Lee et al. (2021) examined the integration of SI with destination social responsibility, and their results showed that SI significantly influences tourists' behaviour. Another study by Lee et al. (2023) also discussed how integrating SI and cultural worldview can serve as psychological factors influencing tourists' intentions to preserve heritage tourism. This study highlights SI as a psychological predictor with a deeper sociocultural and moral orientation. In contrast, the study by López-Sánchez and Pulido-Fernández (2016) discussed SI operationalised through cognitive and affective indicators, highlighting differences with this study and other conceptual studies related to SI. These inconsistencies across studies show that SI lacks a standard definition, making it difficult to optimise study robustness.

The differences in SI's definition point to the constructs theoretically under development. Collectively, each dimension exists in SI, like sustainable literacy, environmental knowledge, and environmental intelligence, which require a more thorough and rigorous understanding. When considered collectively, the differences in SI's definition and measurement point to the construct's continued theoretical underdevelopment. To differentiate SI from comparable concepts, such as sustainability literacy, environmental knowledge, and environmental intelligence, a more thorough and lucid conceptualisation is required. This, in turn, highlights the theoretical ambiguity surrounding SI and underscores the need for a clearer and refined conceptual framework.

METHODOLOGY APPROACH

This study employs a conceptual research design to improve and clarify the theoretical underpinnings of SI. The conceptual research design is frequently used in fields of study that aim to clarify concepts and resolve conceptual uncertainty, thereby improving conceptual coherence within a developing field (Jaakkola, 2020; MacInnis, 2011). A conceptual methodology is an appropriate approach for addressing definitional overlap, dimensional inconsistency, and construct ambiguity, as SI is theoretically fragmented and inconsistently operationalised across disciplines. A thorough assessment and comparative synthesis of peer-reviewed literature on sustainability, environmental psychology, intelligence theories, and applied sustainability research act as the foundation of the refinement process, which applies a structured theory-building and theory-integration strategy.

FINDINGS AND DISCUSSION

Theoretical Refinement

Despite the growing research in this field, the conceptual boundaries of SI are still ambiguous and inconsistently

defined. Prior research used different dimensions to identify the characteristics of SI, such as ecological literacy and systems thinking (Goleman et al., 2010), cognitive and affective indicators (López-Sánchez & Pulido-Fernández, 2016), future-oriented awareness (Meditati et al., 2018), moral and ethical sensitivity (Kopnina, 2014), and socio-cultural value orientations (Lee et al., 2023). Frequently, past research has shown that SI is integrated with other variables, such as destination social responsibility, environmental knowledge, sustainability, and cultural worldview, further blurring the core concept of SI (Lee et al., 2021). This pattern of operationalisation led to overlap between SI and other sustainability constructs, further complicating SI's distinctiveness as a psychological concept. This conceptual overlap has raised questions about the theoretical meaning of SI and how it should be differentiated from the related concepts.

Through refinement, SI is defined as a psychological capacity that integrates cognitive sustainability, affective-emotional orientation, ethical-moral sensitivity, and systemic integration with integrative thinking, rather than being loosely related to sustainability literacy or environmental knowledge, which reflects informational awareness or the acquisition of sustainability-related facts. The term sustainable intelligence is a measurable, multidimensional psychological skill that allows people to integrate their thoughts, experience, assess their morality, connect emotionally, and systematically balance conflicting sustainability needs under complexity and uncertainty conditions. Unlike environmental literacy, which largely reflects informational awareness and knowledge acquisition, SI focuses on more integrative cognitive processing and the capacity to balance competing sustainability demands under complexity and uncertainty. Through this conceptual improvement, SI can be summed up as a measurable psychological ability, which combines cognitive sustainability, affective-emotional orientation, ethical-moral sensitivity, and systems orientation with integrative thinking.

Early foundations were discussed by Goleman et al. (2010), who emphasised the emotional intelligence framework that explained the emotional engagement and empathy between humans and nature. López-Sánchez and Pulido-Fernández (2016) later discussed SI by examining different levels of concern and operationalising SI as the primary construct through cognitive and affective indicators among tourists. Although the result indicates a significant difference among tourists, the study overlooks other fundamental psychological elements within a broader concept, such as systems-based thinking or moral-ethical reasoning. Recent research also applies SI, which incorporates emotional attachment, sociocultural values, and responsibility beliefs (Lee et al., 2021, 2023); however, it still overlooks broader aspects of sustainability. These results, in conjunction with prior studies, underscore the need to establish a more comprehensive conceptual framework for SI that extends beyond discrete dimensions.

From a cognitive perspective, individuals are restricted in their ability to assimilate information and frequently rely on cognitive heuristics when navigating sustainability trade-offs (Gigerenzer & Gaismaier, 2011; Kahneman, 2011). Such cognitive constraint commonly results in short-term bias, fragmented reasoning, and difficulty integrating ecological, social, and economic factors (Bansal & Song, 2017; Gifford, 2011). These limitations imply that sustainability urges for an integrated psychological capacity that capable of handling systemic complexity, rather than only awareness.

Drawing on these inconsistencies, this paper proposes a theoretical refinement of SI that integrates the most essential psychological dimensions across the sustainability literature. SI is refined as a multidimensional psychological capability composed of four interconnected dimensions: cognitive sustainability (López-Sánchez & Pulido-Fernández, 2016), affective-emotional intelligence (Goleman et al., 2010), ethical-moral sensitivity (Kopnina, 2014), and systems orientation and integrative thinking (Saarinen & Hämäläinen, 2007). Theoretically, these four dimensions were chosen rather than at random. Understanding the concept of cognitive sustainability, affective-emotional intelligence, ethical-moral sensitivity, and systems orientation and integrative thinking which these psychological concepts play a crucial role in sustainability-oriented decision-making. Collectively, these dimensions can describe how people perceive, assess, and respond to sustainability-related challenges. These four basic dimensions also encompass, conceptually, characteristics found in the literature, such as pro-environmental attitudes and sustainability awareness. On the other hand, with an exception any of these dimensions represents an incomplete conceptualisation of SI, indicating a theoretical and practical gap.

The term intelligence suggests a measurable psychological ability rather than a normative ideal. According to earlier studies, SI can be operationalised as a latent construct that is assessed through validated psychometric

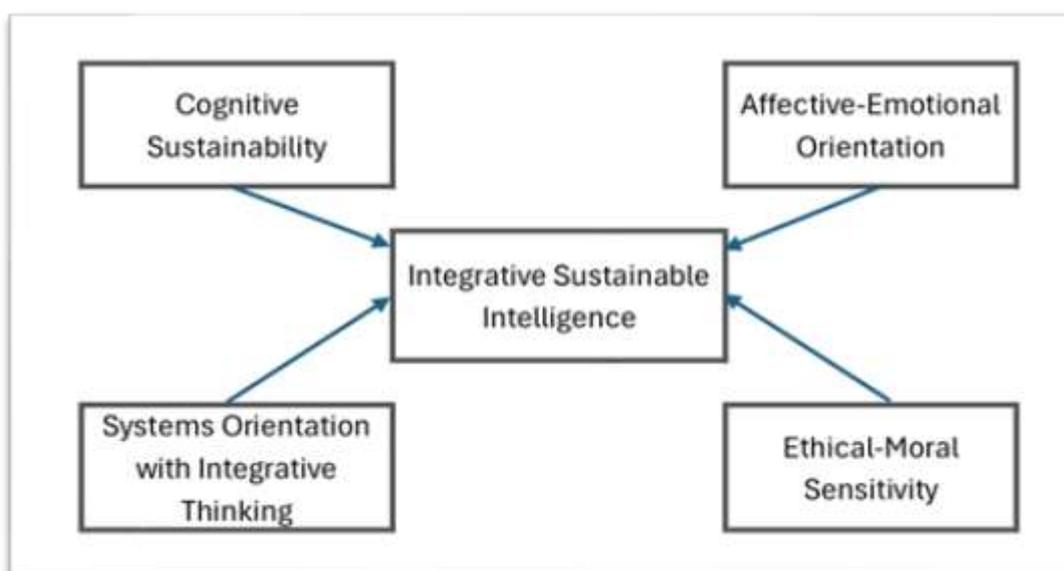
indicators that show individuals' capability to apply ethical reasoning, systems thinking, and sustainability-related knowledge in decision-making contexts (López-Sánchez & Pulido-Fernández, 2016; Lee et al., 2023). As example, Silvestre and Fonseca (2019) defined integrative sustainable intelligence as a structured capability guiding strategic sustainability integration, while Lee et al. (2023) conceptualised SI as a predictor of pro-environmental behaviour intentions within cultural tourism settings using structural equation modelling. In order to evaluate SI as a measurable psychological skill, future empirical research may create multidimensional measures that capture cognitive integration, long-term orientation, and value-consistent activity. Examining SI's four interconnected dimensions is essential as it builds upon its operationalisation. These dimensions serve as the foundation for creating accurate and valid measurement tools in empirical research.

First, cognitive sustainability refers to someone who understands the issues surrounding environmental concerns, the impact on ecosystems, and the relationship between humans and nature. This component aligns with the cognitive indicators applied by López-Sánchez and Pulido-Fernández (2016), in which knowledge and awareness play a prominent role in differentiating a tourist segment. Second, an affective-emotional orientation refers to feelings of empathy, connection to nature, and emotional responses that motivate sustainable action. These components can reflect how individuals can motivate themselves towards sustaining the environment by implementing the principle of ecological intelligence (Goleman et al., 2010).

Next, the refinement includes the dimension of ethical-moral sensitivity, encompassing morality, feelings, perceptions of justice, and value-based assessments of social and environmental responsibility. In environmental psychology, moral sensitivity is recognised as a critical component of sustainability-related actions, although this indicator is rarely included in SI measurement (Kopnina, 2014). Including this dimension in the SI construct can not only strengthen awareness but also ethical judgement. Finally, the systems' orientation and integrative thinking enable understanding of the relationships among environmental, social, and economic systems. Although the dimensions have already been highlighted by Saarinen and Hämäläinen (2007), they were not discussed in the SI construct.

Collectively, integrating these four dimensions into the SI construct provides a more comprehensive foundation for understanding the concept of SI. This refinement includes all the elements from earlier research to avoid confusing definitions and to differentiate the concept of SI from other literacies, such as sustainable knowledge or environmental intelligence. This refinement also yields a stable construct of SI that can be applied across fields, while providing a more robust framework for future studies. Figure 1.1 below illustrates the refinement framework of SI, which comprises cognitive sustainability, affective-emotional orientation, ethical-moral sensitivity, and systems orientation with integrative thinking. Based on Figure 1.1, sustainable intelligence acts as integrative psychological core where cognitive, emotional, moral, and systemic capacities work together dynamically instead of functioning separately.

Figure 1.1 Refinement Framework of Sustainable Intelligence



Implications for Future Research

This paper develops a rigorous conceptual framework by establishing four additional dimensions under the SI construct. According to Field (2009), a suitable framework can be employed to assess the study's confidence and its interpretations. The development of four-dimensional frameworks for SI can significantly contribute to future research. This paper aims to provide a clearer conceptualisation of SI to create a more rigorous theoretical model, enhance measurement accuracy, and extend SI's functionality across various sustainability-related fields. First, future studies should focus on building and evaluating a reliable measurement instrument that accurately reflects all four dimensions of SI. The current measurement items of SI do not encompass the moral and systemic context related to cognitive and affective components (López-Sánchez & Pulido-Fernández, 2016). Hence, to create a more comprehensive scope of SI, measurement development should include multi-item instruments and address moral and ethical issues, such as psychometric validation techniques which include exploratory and confirmatory factor analysis. This technique is important to ensure the internal consistency and construct across diverse populations.

Second, numerous studies should be conducted to determine the causal mechanisms by which SI affects behaviour related to sustainability. Although prior research has investigated the integration of SI with other variables, such as destination responsibility, environmental behaviour, or ecosystem preservation (Lee et al., 2021, 2023), the specific mechanism underlying SI remains unclear. Future research should investigate some of the SI dimensions, such as systems orientation with integrative thinking, or ethical-moral sensitivity, which provide a better indicator of long-term sustainable behaviour than cognitive or affective elements alone. These causal mechanisms can be made clearer by using experimental methods, longitudinal designs, or structural equation modelling. This method will demonstrate the varying effects of each SI dimension and strive beyond correlational findings.

Third, the refined framework of the SI concept should be discussed across multiple culture and contextual settings, to determine which dimensions of the framework are context-dependent and which are universal. It is essential to determine whether the four SI dimensions perform similarly across various fields, despite differences in nations, cultures, organisations, and demographics, through cross-cultural comparative studies, measurement invariance testing, and context-specific scale adaptations. Such studies will improve the construct's generalisability and strengthen its construct globally.

Finally, the new SI framework can help improve the development of urban planning, tourism management, organisation, and education. Future studies could create and analyse a tool or programme to strengthen SI among stakeholders. Through these efforts, the gap between sustainability knowledge and sustained behavioural change may be bridged by understanding which dimensions are most reliable, flexible, and influential to be practised in real-world context.

Overall, refining the SI concept provides a more coherent foundation for future research. Based on the outcome, the researcher can gain a better understanding relating to sustainability, behaviour, and social situations by using a multidimensional approach. Through this advancement, the framework not only provides a clearer framework but also offers practical guidance for enhancing sustainability across disciplines.

CONCLUSION

The aim of this paper is to expand research on sustainability by identifying conceptual gaps in SI, which has been widely applied, but whose definition remains inconsistent across disciplines. Past research has shown that SI has been applied using a variety of divergent characteristics, including systems thinking, ecological literacy, cognitive-affective indicators, moral sensitivity, and socio-cultural dimensions. These inconsistencies in the dimensions of the SI concept led to conceptual ambiguity, which, in turn, limited the practical implications and theoretical coherence in this field.

To overcome these issues, this paper aims to refine a new multidimensional framework of SI that integrates four main psychological dimensions, as mentioned earlier. The integration of these four dimensions helps improve the foundation of the SI concept, providing a comprehensive understanding that encompasses emotional,

cognitive, moral, and systemic aspects. To tie together the diverse definitions from earlier studies, this refinement establishes a more distinctive boundary that distinguishes the concept of SI from related concepts, such as environmental knowledge, sustainability literacy, and ecosystem awareness.

This refinement also has practical implications for future research. Future researchers can develop a reliable measurement instrument, analyse SI across cultural and contextual settings, and combine the concept of SI into related models. This finding also helps scholars to close the gap between the concept of SI and sustainable behavioural change by identifying which dimensions of SI are more influential. Other than that, scholars can also apply the theoretical framework across various fields, such as tourism management, urban planning, education, and organisational sustainability initiatives.

In conclusion, this paper highlights the need for a more universal and rigorous foundation for the SI concept to better understand the contextual and theoretical aspects of sustainability. Through this refinement, scholars can conduct further research related to sustainable intelligence across diverse sectors. A well-established framework is essential to help academics discuss precisely and contribute to other societies in fostering a sustainable orientation in thinking and attitudes.

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