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Exploring the motivation of sustainable commuting: a case study of international students in Otago Polytechnic Auckland International Campus

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1 Introduction and objectives

Sustainability has received increasing attention in many organizations globally, including universities. According to Epstein and Buhovac (2014), sustainability is defined as “a company contributing to the sustainable development of society, which includes economic growth, environmental protection and social progress” (p. 23). As a typical practice for sustainability, an increasing number of universities in various countries have started measuring and analyzing carbon footprints in order to enhance the sustainability of their operations (Ribeiro and Fonseca, 2022). Of this, indirect emissions coming with the commutes of staff members and students have become a concern due to their consequences on the environment (Dreijerink and Paradies, 2020). For example, the use of private vehicles to travel to campus, which is included in the university’s scope three emissions, has a large impact on overall GHG emission (Dreijerink and Paradies, 2020; Hamad et al., 2021; Ribeiro and Fonseca, 2022).

Universities and polytechnics in New Zealand, where a large number of international students pursue their undergraduate and postgraduate studies each year, play an important role in promoting sustainability to support the local government to achieve Net Zero Emissions by 2050 Scenario (Msengi et al., 2019; MBIE New Zealand, 2022). To achieve the objective, ensuring the academic community chooses sustainable commuting options is a key challenge. However, studies on international students’ commuting behaviors are very limited, particularly in the New Zealand context. Therefore, the objectives of this paper are to (a) identify commuting patterns and indirect carbon emissions produced by international students at Otago Polytechnic Auckland International Campus (OPAIC), a tertiary institution in New Zealand, and (b) examine the key motivation factors for sustainable commuting as a way to offset and minimize the impact of international students’ air travel emission through campus engagement.

2 Literature review

2.1 Students commuting behavior

Previous studies revealed that students' commuting behavior had interdependencies on personal characteristics (e.g., car availability and driving license), psychological factors (e.g., habit, attitude, and environmental concern), and was influenced by transportation mode factors (e.g., comfort, cost, and time) (Romanowsk et al., 2019). Additionally, social influence, personal biases, habits, and social comparisons impacted travel behavior (Maggi and Vallino, 2021). Research indicated that university staff in Italy considered cars as their primary mode of transportation (Angelis et al., 2020). Meanwhile, it was found that students were more inclined to use sustainable transportation modes such as public transport or carpooling for short to medium commuting distances (Angelis et al., 2020). In the Auckland context, previous studies identified that most of the students enrolling in the University of Auckland and Auckland University of Technology chose bus as transportation mode (51%–54%) and the rest preferred walking and carpooling (15 and 11%, respectively) (Syam et al., 2012; Mohammadzadeh, 2020). Concerning students' backgrounds and mobility needed in foreign countries, international students tended to travel by provided public transportation or prefer walking or using electric scooters for commuting, especially if they reside nearby (Ribeiro and Fonseca, 2022). Interestingly, students from Asian countries are the majority of public transport users compared to other ethnic backgrounds (Syam et al., 2012).

2.2 Sustainable commuting motivation

Sustainable behaviors, which include responsible waste behavior and sustainable commuting, are related to individual motivation (Molina et al., 2020). Yet, motivations are constructed through the norms in the society which promotes behavioral change and influence motivation (Cogut et al., 2019). Despite policies implemented for sustainable commuting among university students, there was a limited amount of research examining the motivation for sustainable commuting among international students from diverse backgrounds (Molina et al., 2020). Romanowsk et al. (2019) found that the potential to alter transport behavior relied on specific conditions, such as encouragement from universities to provide transport services and the provision of improved cycling infrastructure. Similarly, a study at the University of Western Australia revealed that students' motivation for sustainable commuting relied on the implementation of subsidized public transport passes (Molina et al., 2020). The city's infrastructure, including the implementation of shared spaces for pedestrians and cyclists, has also influenced the motivation of students to rely on bike-sharing and scooter-sharing services (Torrise et al., 2021). These shared mobility options emerged as sustainable solutions, promoting environmental benefits and offering the potential

to reduce car users (Romanowsk et al., 2019; Torrise et al., 2021).

3 Methodology

This paper employed a mixed-methods research design. It used the quantitative survey and qualitative interview data, which were previously collected by Green Office Toitu at OPAIC. By employing a convenience sampling method (Bell et al., 2022), the survey sample included 278 international students (i.e., around 50% of the total number of students at OPAIC), and 10 students were interviewed. Descriptive analysis was used to describe the characteristics of the population in the survey, which covered country of origin, mode of transportation, and commuting distance. This aimed to identify patterns in data that express meaningful information to interpret the perception of sustainable commuting and the motivation factors behind it, focusing on the geographical origins of students (Loeb et al., 2017; Bell et al., 2022). The result for the commuting distance was calculated using the Carbon Emission Calculator to provide the total emission contributed from each mode of transportation and acknowledge the significantly lower emission compared to individual car usage, as shown in Table 1 (Carbon Footprint, 2023). Meanwhile, the interview covered questions relating to the awareness and motivation of sustainable commuting. In searching for the recurring ideas from the interview, thematic analysis was employed by understanding the interviewees' perspective and providing interpretations (Riger and Sigurvinsdottir, 2016; Bell et al., 2022).

4 Findings and discussion

4.1 Understanding indirect carbon emissions from international students to identify commuting patterns

International students' home-campus commuting behavior was analyzed, focusing on scope three of greenhouse gas (GHG) calculations of OPAIC (see Table 1). Among the 278 surveyed students, 56% used buses for their trips between home and campus, while 29% relied on private vehicles, indicating that the bus is the preferred mode of transportation for more than half of the students. This finding was concerning as a significant portion of students still heavily depended on private vehicles, despite the higher emissions associated with conventional fuel-powered vehicles compared to buses (Logan et al., 2020). Notably, Auckland Transport (2023) had initiated a transition to a fully electric fleet for its latest 24 routes, presenting an opportunity to eliminate 14.5 tons of CO₂-e emissions previously generated by conventional buses, potentially motivating students to opt for public transport over private cars (see Table 1).

It has been previously explained that this commuting pattern is influenced by the distance from the students' accommodations, such as flats or apartments. The fact that the campus is located in the CBD area tends to encourage students to rely on public transport, or to opt for active commuting modes like cycling or

TABLE 1 CO₂ emissions generated by the student cohort by a variety of home-campus commuting options.

	Transport option	kg CO ₂ -e/unit	Total distance (32 weeks)	Total CF calculation (annually)
Land travel*	Bus (average)	0.155	93,840 km	14.5 ton CO ₂ -e
	Train (electric)	0.013	47,642 km	0.62 ton CO ₂ -e
	Ferry	0.0187	1,984 km	0.037 ton CO ₂ -e
	Car (petrol)	0.209	35,094 km	7.34 ton CO ₂ -e
	Walking	–	15,797 km	–
	Scooter	0.051	1,264 km	0.06 ton CO ₂ -e

*Based on average travel of three times per week.

walking (Soltani et al., 2019). This is in line with the finding that the location of the OPAIC campus in the Auckland CBD is a primary reason students use public transport for commuting. However, factors such as comfort, accessibility, and availability also influence the choice of transportation mode (Ayobami et al., 2019).

4.2 Motivational factors influencing students' choice for sustainable commuting

This paper also investigated students' motivational factors for choosing sustainable commuting by analyzing the qualitative interview data from 10 international students at OPAIC, who come from diverse backgrounds, with the majority originating from developing countries. A previous study showed that international students' country of origin can affect the knowledge on sustainable mobility, climate change, and emissions (Ferreira and Liu, 2023). The conducted interview revealed the distinctions between students who were merely aware of sustainable commuting and those students who have previously practiced sustainable behavior in their home countries, persisting in these habits during their studies in New Zealand. Representative quotes are provided below.

"I'm aware of sustainable commuting as we built employee awareness around this in India" (P01, India).

"I'm aware that [sustainable commuting] in my country or actually my capital city Tirana in Albania. In the council, they have regulation between 2–3 years having electric buses that circulate around the city" (P05, Albania).

"I'm aware of sustainable commuting but in Indonesia, we don't have proper public transportation. So I'm not a regular passenger of bus, even in Auckland I still feel uncomfortable and the bus isn't reliable" (P06, Indonesia).

These examples demonstrate that while some international students understand the concept of sustainable commuting, they have not utilized public transportation in their home countries due to significant barriers such as limited travel time, indirect routes, and the distance from home to the bus stop (Yumita et al., 2021). This highlights that students possess the knowledge necessary

to grasp the concept of sustainability. Increased awareness can motivate them to implement sustainable practices in their daily lives, especially when supported by ready infrastructure (Garbie, 2015). Therefore, *awareness of sustainability* is a motivator for students in Auckland, reinforced by the availability of public transportation options.

Sustainability awareness has influenced international students' choices regarding sustainable commuting, aligning with previous studies that link awareness to behavior. Awareness acts as a motivational factor toward sustainable behavior and influences international students to use public transportation. This usage is facilitated by reduced barriers, such as proximity of accommodation to campus and infrastructure readiness, and by social norms within the community (Cogut et al., 2019). Environmentally conscious students are likely to reduce car usage in favor of public transport and active commuting, which also saves costs associated with vehicle maintenance, fuel, and parking fees (Sivasubramaniyam et al., 2019; Torrisi et al., 2021). However, the current study reported that 29% of students still travel by private car due to reasons such as the higher costs of public transport, the need to travel to multiple places, and convenience. This is particularly the case in Auckland, where public transport is perceived as less reliable compared to Wellington and Christchurch (Murray et al., 2010). Therefore, to increase international students' awareness of sustainable commuting, the role of universities remains crucial in engaging students as a strategy to reduce emissions (Cogut et al., 2019).

Two main recommendations, sustainability literacy programmes and carbon emission tracking, were provided to increase international students' sustainability awareness, in order to better promote sustainable commuting. First, through online training and assessment tools for sustainability literacy, tertiary institutions can cultivate graduates equipped with sustainability knowledge, fostering a transition toward sustainable behaviors to combat climate change (Décamps et al., 2017). For instance, the carbon literacy program imparts an understanding that every action affects the environment, leading to individual reductions in GHG emissions. However, students participating in the carbon literacy program retain the right to choose whether to adopt green behaviors (Howell, 2018). Hence, it can be inferred that sustainability literacy initiatives may hold the potential to enhance awareness and encourage low-carbon behaviors and lifestyles, thereby offsetting students' emissions from international mobility.

Second, carbon emission tracking serves as a crucial tool for students, enabling them to comprehend the emissions generated through activities such as air travel, energy consumption, and commuting (Paterson and Stripple, 2010). This tracking approach allows students to compare their emissions against standard benchmarks. Additionally, research suggests that carbon calculators have the potential to instigate behavioral change by stimulating psychological capacities and serving as a motivational tool for making low-carbon decisions (Dreijerink and Paradies, 2020). Similarly, several studies have reported that carbon calculators significantly impact raising awareness and reducing footprints in commuting, consumption, household activities, and waste management (Dreijerink and Paradies, 2020).

5 Conclusion

In achieving a green campus through sustainable commuting, this paper identified the commuting pattern and examined the motivation behind the choice of transportation mode of international students. Through a mix-methods methodology, the finding revealed a significant portion of international students relied on public transportation such as bus (56%), followed by train and ferry. This result is in line with previous research conducted in two universities in Auckland (Syam et al., 2012; Mohammadzadeh, 2020). A small percentage of students chose active commuting, either walking or riding a scooter, to campus, which is influenced by the distance of their accommodation to campus (Soltani et al., 2019). There was still a considerable percentage utilizing private vehicles (29%) despite the environmental concerns associated with such modes of transportation. The motivation for sustainable commuting was found to be influenced by awareness of sustainability practices (Cogut et al., 2019). Thus, the paper highlights the importance of increasing awareness through actively promoting and implementing sustainability initiatives through engagement in the campus' carbon literacy program and individual carbon emission tracking programme, which can stimulate behavioral change as suggested in previous studies (Howell, 2018; Dreijerink and Paradies, 2020).

However, the study acknowledges potential limitations regarding the small size interview respondents, specifically within the context of OPAIC, and the depth of analysis concerning commuting patterns and motivational factors. Additionally, the research findings may be biased by the use of convenience sampling

methods and the measurement of awareness (Bell et al., 2022). Therefore, further research is needed, especially to explore the effectiveness of sustainability initiatives on changing commuting behavior in the context of international students.

Author contributions

NP: Conceptualization, Writing – original draft. DM: Supervision, Writing – review & editing. JS: Conceptualization, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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