Report on Students' Behaviour Toward E-waste Disposal and Recycling

Autumn 2024

Dr Xuan Feng

Dr Eric Evans Osei Opoku

Dr Jin'an Shao

Centre for Responsible Business and Innovation (CRBI)
University of Nottingham Ningbo China

CRBI
Centre for
Responsible Business and Innovation

Report on Students' behaviour toward E-waste Disposal and Recycling at University of Nottingham Ningbo China

1. Introduction

The Centre for Responsible Business and Innovation (CRBI) carried out a comprehensive survey on E-waste disposal and recycling during the autumn semester of 2023-2024, with participation from over 900 students at the University of Nottingham Ningbo China (UNNC). The survey results provided a detailed overview of students' behaviours and engagement in E-waste disposal and recycling. Additionally, the report identified both the challenges and opportunities of E-waste disposal and recycling at UNNC, which indicated some actionable strategies for E-waste management. The report concludes with strategic action plans developed to enhance the university's efforts in E-waste disposal and recycling.

2. Student engagement in the survey

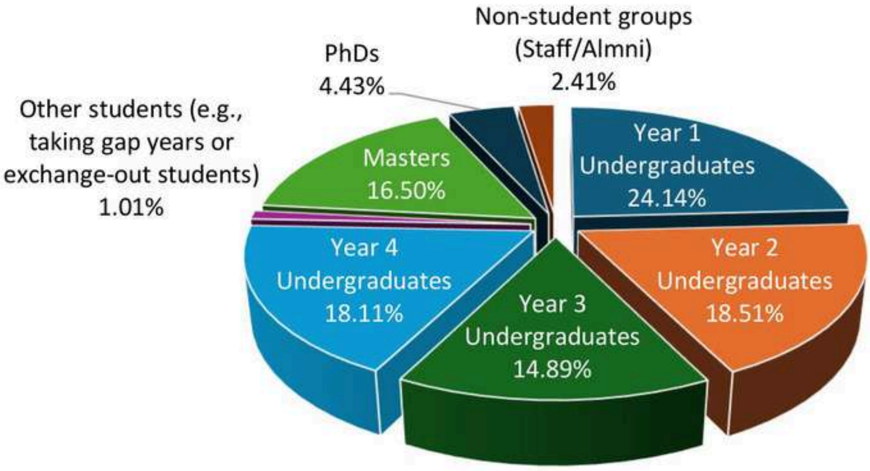

Figure 1. Survey Respondents' Distribution

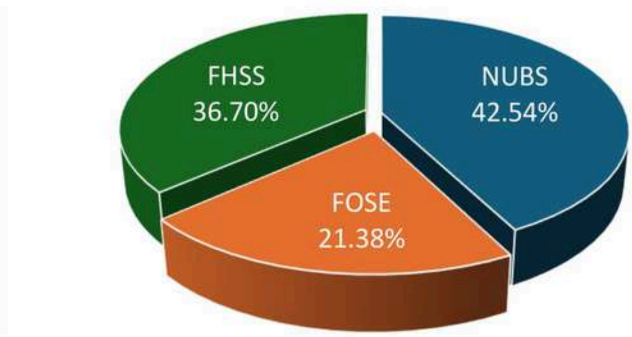

Figure 2. Distribution of Student Respondents by Faculty

The survey included students from all academic years and faculties, ensuring a diverse representation of the student body at UNNC. The participant demographic was balanced across different year levels and faculties. Figures 1 and 2 provide an overview of the distribution of student participants.

3. Research findings

The survey aimed to investigate the following objectives:

1) Primary sources of E-waste at UNNC
2) Understanding of E-waste disposal and recycling practices among students
3) Students' behaviour regarding E-waste disposal and recycling
4) Factors influencing students' engagement in E-waste disposal and recycling
5) Challenges associated with E-waste disposal and recycling at UNNC

The following sections will provide detailed discussions on findings related to each objective.

3.1 Primary sources of E-waste at UNNC

In the survey, students were asked to specify the variety and quantity of electronic devices they currently use and those that are in their possession but not actively used (stockpiled).

Item	Number of electronic devices currently used by a student	Percentage of students selecting this item	Number of stockpiled electronic devices	Percentage of students selecting this item
Mobile phone	1-3	85%	1-3	51%
Ipad/tablet	1-2	80%	1	23%
Headphone/earpiece	1-2	65%	1	26%
Laptop/desktop computer	1-2	60%	0	73%
Computer accessories	1-2	60%	0	75%
Power bank	1-2	65%	0	65%

Table 1. Electronic Devices in Students' Possession

Among the various electronic devices in use, mobile phones are the most common ones among students, with eighty-five percent owning between one and three, and fifty-one percent having stockpiled one to three devices. Ipads/tablets follow closely, with eighty percent of the students owning one to two, and twenty-three percent keeping one spare device. Additionally, around sixty percent of the students own one to two pieces of other electronics such as headphones, laptops, computer accessories, and power banks. Overall, the most frequently stockpiled electronic devices on campus are mobile phones, iPads/tablets, and headphones/earpieces.

3.2 Understanding of E-Waste Disposal and Recycling Practices among Students

The survey results reveal that while approximately eighty percent of students understand the importance of E-waste disposal and recycling for environmental sustainability, and recognise the value of participating in these activities, only thirty-five percent of the students are aware of the specific environmental damage caused by E-waste. Additionally, they rarely take this into account when buying new electronic devices.

Students' understanding of E-waste disposal and recycling	Percentage of students demonstrating understanding
Aware of the importance of E-waste disposal and recycling to environmental sustainability	80%
Aware of environmental harm caused by E-waste when purchasing new electronic devices	35%
Aware of measures, options, and locations to dispose E-waste on campus	30%

Table 2. Students' Understanding of E-waste Disposal and Recycling

Furthermore, only thirty percent of the students understand the proper measures, options, and locations for E-waste disposal. The absence of adequate E-waste disposal and recycling facilities on campus may contribute to the general lack of awareness among students about proper E-waste management. Consequently, students rarely invest time in E-waste disposal and recycling.

3.3 Students' behaviours regarding E-waste disposal and recycling

Condition of old devices	Behaviour concerning the management of old electronic devices	Percentage of students displaying this behaviour
Unfunctional yet intended for future use	Opt for repair initially. If still unfunctional, buy a new one and stockpile the old one.	50%
Functional, intended for future use	Still buy a new device for accessing upgraded features	33%
	Still buy a new device as a backup	55%
Whether functional or not, items are obsolete and will not be used in the future	Stockpile the old device in the house	65%
	Sell to/exchange with others	25%
	Return to the manufacturer	20%

Table 3. Students' Behaviours Concerning the Management of Old Electronic Devices

The survey results indicate students' behaviours concerning the management of old electronic devices under different conditions. If the old device is unfunctional, fifty percent of the students initially choose to repair it, as they anticipate continuing to use it in the future. They will consider buying a new device only if the old device remains unfunctional after repair efforts. One-third of the students opt to buy a new device even though their current one is still functional, intending to reserve it for future use. The primary motivations for acquiring a new device include accessing upgraded features and keeping it as a backup. For obsolete devices that will not be used in the future, sixty-five percent of the students choose to stockpile the old devices in the house, whereas the rest choose to sell or exchange them with others or return them to the manufacturer. This indicates that 'stockpiling' old electronic devices has become the most prevalent behaviour among students for managing E-waste, suggesting a possible lack of knowledge and awareness regarding proper E-waste disposal options.

3.4 Factors influencing students' E-waste disposal and recycling engagement

In the survey, students were asked to indicate the factors that influence their engagement in

E-waste disposal and recycling. Table 4 presents the objective and subjective factors identified by the students, with the objective factors being recognised as more influential.

Sixty-two percent of the students expect financial incentives for E-waste recycling and anticipate cost-free E-waste disposal services. If the disposal and recycling services charge a fee, the maximal expense students are willing to pay is below twenty percent of the devices' original value. This implies that students are concerned about the potential high costs associated with E-waste disposal and recycling. Financial incentives or complimentary disposal services could promote responsible E-waste management practices among students.

Factors influencing students' engagement in E-waste disposal and recycling		**Percentage of students identifying this factor**
Objective factors	(Financial) incentives for recycling / free disposal of E-waste	62%
	Secured data privacy	58%
	Convenience (Short distance to the drop-off facility/ Recyclers coming to the door)	50%
	Multiple options to dispose	48%
Subjective factors	Commitment to environmental protection	40%
	Understanding of the E-waste recycling process for their contributed items	39%
	The necessity to clear out the stockpiled E-waste	38%

Table 4. Factors Influencing Students' Engagement in E-waste Disposal and Recycling

Data privacy was recognised as a second critical concern, with fifty-eight percent of the respondents emphasizing the importance of safeguarding personal information during the E-waste disposal and recycling process. If students are confident that their personal information will be securely managed and shielded from potential breaches during the recycling process, their motivation to responsibly recycle E-waste is significantly heightened.

Convenient access to disposal facilities and the availability of various disposal options also emerged as significant motivators for students' E-waste disposal engagement. Students expressed a preference for convenient E-waste disposal options, indicating that the proximity of a drop-off site or the provision of door-to-door collection services would increase their likelihood of clearing out stockpiled electronic devices.

Subjective factors refer to students' intrinsic motivation and demand for E-waste disposal and recycling, which could influence their engagement in E-waste disposal and recycling. Forty percent of the students are motivated by a strong commitment to environmental protection when it comes to contributing their E-waste. Thirty-nine percent of the students reported that their participation in E-waste disposal and recycling is impacted by their knowledge of the E-waste recycling process. Thirty-eight percent of the students also place importance on the necessity to clear out their stockpiled E-waste.

3.5 Challenges associated with E-waste disposal and recycling at UNNC

3.5.1 Individual-level challenges in E-waste disposal and recycling

Students identified four primary challenges they face regarding E-waste disposal and recycling. As displayed in Table 5, the primary personal challenge faced by seventy percent of the students in the context of E-waste disposal and recycling is their insufficient knowledge on how to sort E-waste and a lack of information about the available options and locations for E-waste separation. Nearly two thirds of students have not yet developed clear awareness of the environmental damage caused by E-waste. A similar amount of the students reported that they feel unmotivated to engage in E-waste disposal. Additionally, forty-five percent of the students are reluctant to pay for E-waste disposal and recycling services.

Individual-level challenges in E-waste disposal and recycling	Percentage of students identifying this challenge
Insufficient knowledge about E-waste sorting and unfamiliarity with disposal options and locations	70%
Inadequate awareness of the environmental damage caused by E-waste	65%
Low motivation to engage in E-waste disposal and recycling	64%
Reluctance to spend on E-waste disposal and recycling services	45%

Table 5. Individual-level challenges indicated by students

The results suggest a significant barrier to effective E-waste management, highlighting the need for improved educational initiatives to increase awareness of the environmental and health consequences of inadequate E-waste disposal. Specifically, developing comprehensive educational programs and strengthening information dissemination are crucial steps to ensure that students are fully informed and equipped with the necessary knowledge to actively participate in E-waste disposal and recycling initiatives. Additionally, the development of cost-effective or cost-free disposal solutions could be critical in motivating more students to participate in E-waste disposal and recycling.

3.5.2 University-level challenges for E-waste disposal and recycling

In addition to the individual-level challenges, students also pointed out the challenges at the university level. Over seventy percent of the students reported that the university does not provide sufficient training related to E-waste disposal and recycling, nor does it offer easily accessible E-waste collection bins or centres. More than forty percent of the students identified two important barriers to E-waste disposal and recycling: a deficit in awareness campaigns and educational outreach for E-waste management, coupled with the scarcity of policy and incentives to support these actions. These findings indicate a pressing need for the university to take a more proactive role in E-waste management by upgrading training, improving accessibility to disposal infrastructures, and developing comprehensive policy and financial strategies to support sustainable E-waste disposal and recycling practices on campus.

University-level challenges in E-waste disposal and recycling	**Percentage of students identifying this challenge**
Lack of training for E-waste disposal and recycling	73%
Insufficient designated disposal bins and collection centers (appropriately distributed and easy to be found)	70%
Absence of awareness campaign /publicity of E-waste disposal	47%
Absence of clear policies and financial incentives to encourage E-waste disposal and recycling	44%

Table 6. University-level Challenges Indicated by Students

Beyond the identified challenges, several advantages have been recognised for the implementation of E-waste disposal and recycling initiatives at UNNC.

First, students generally exhibit:

- a strong consciousness regarding environmental sustainability and their personal responsibility in E-waste disposal.
- a positive attitude toward using second-hand devices and strong willingness to clear out their stockpiled E-waste.

Figure 3 presents the top three motivators for students to exchange old devices. Two-thirds of the students are content with acquiring second-hand devices at no cost or at a reduced price. This implies a positive trend where second-hand devices are recirculated among students, thereby potentially reducing the amount of E-waste on campus.

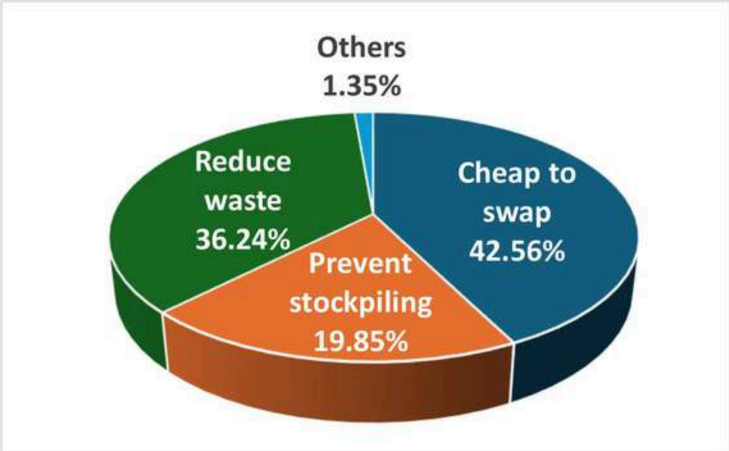

Figure 3. Top Motivators for Exchanging Old Electronic Devices

Second, the university is currently equipped with:

- infrastructure such as waste-sorting bins and collection units, laying the groundwork for advanced facility improvements to better support E-waste management;
- faculty and staff with strong expertise and networks to provide strategic guidance on E-waste disposal and recycling practices;
- student communities that are highly motivated to engage in sustainability-related events and can actively support E-waste disposal and recycling activities and campaigns.

With these valuable resources at its disposal, the University has an advantageous position to exemplify leadership in E-waste management, fostering a culture of environmental responsibility and innovation through strategic E-waste disposal and recycling initiatives.

4. Summary of the research findings

Table 7 summarizes the main findings of this research.

Key research components	Main Findings
Primary sources of E-waste at UNNC	Mobile phones – with 1-3 owned by each student
Understanding of E-Waste disposal and recycling practices among students	Although the majority of students acknowledge the environmental damage caused by E-waste and concur on the necessity of proper disposal and recycling, they frequently lack knowledge about the appropriate practices and available options.
Students' behaviour regarding E-waste disposal and recycling	Most students choose to stockpile second-hand devices, while fewer opt to dispose of them properly and recycle them.
Factors influencing students' E-waste disposal and recycling engagement	More than half of the students are driven by financial incentives and are unwilling to incur additional fees for E-waste disposal and recycling. Ensuring data privacy, providing convenient access to disposal facilities, and offering a range of disposal options are also important considerations. Offering insights into the recycling process of the contributed E-waste could enhance students' participation in E-waste disposal initiatives.
Challenges associated with E-waste disposal and recycling at UNNC	The primary challenges include students' insufficient knowledge and awareness of E-waste disposal procedures and facilities, along with a shortage of designated E-waste recycling bins at UNNC. Students' concerns about data privacy also constitute a significant challenge.

Table 7. Summary of the Key Research Findings

5. Suggested Actions

5.1 Upgrade of the E-waste management infrastructure

In response to the challenge of identifying E-waste disposal sites on campus, the university could establish specialized E-waste disposal stations, bins or collection points strategically placed in high-traffic areas frequented by students, especially within or near the library, teaching buildings and student dormitory areas. By situating these facilities in locations that students regularly visit, the university can significantly improve the convenience of E-waste disposal and recycling for students.

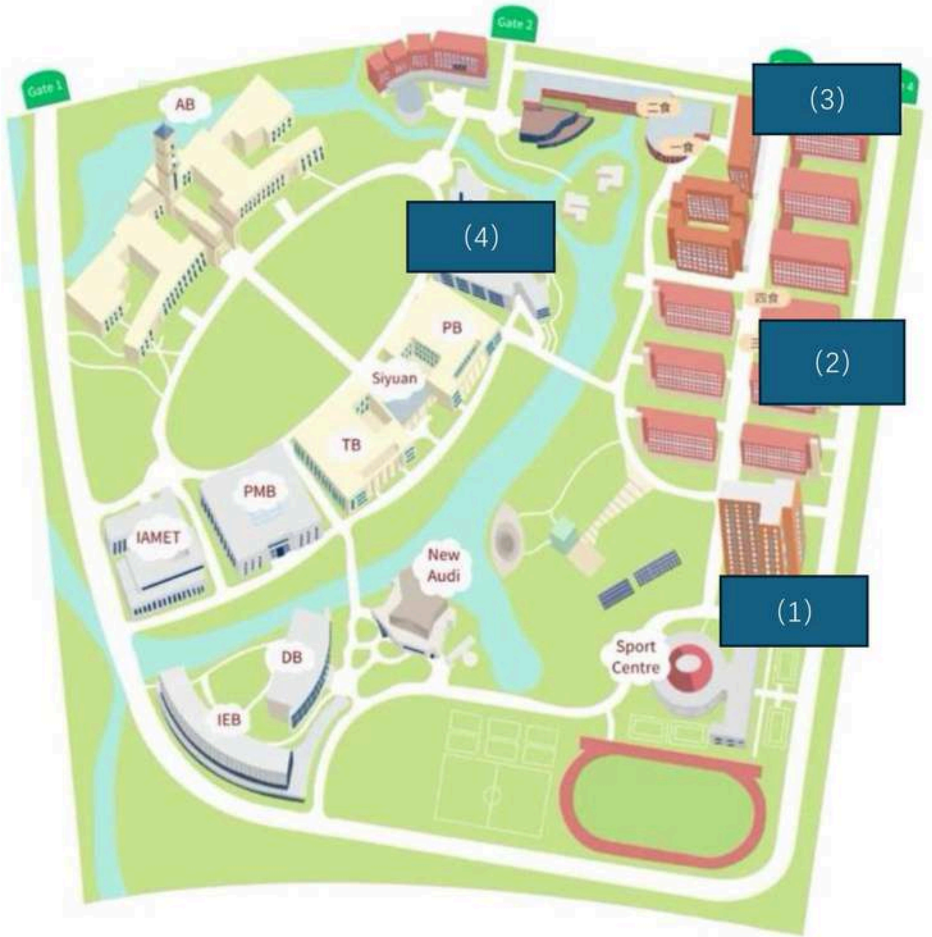

Figure 4. Locations Selected by Students to Dispose and Recycle E-waste

The survey identifies four preferred locations (see Figure 4) for students to dispose of and recycle their E-waste, providing the university with valuable reference points for infrastructure enhancement:

(1) Near the Residential Building 23 or The Sports Centre:

The current segregated waste bins situated near Building 23 have led students to suggest that this area could be further developed to incorporate an E-waste disposal and recycling bin.

(2) Near the Residential Building 20 and the SF Express:

Students consider the proximity of this location to be fairly equal from all residential buildings, allowing them to conveniently dispose of their E-waste during visits to the canteens.

(3) Near the Residential Building 13 and Gate 4:

Students consider this area convenient for the university to transport E-waste off-campus, and find it easy to drop off their E-waste while passing by Gate 4.

(4) Near or in the library:

The library serves as the primary study area for most students, making it a convenient spot for E-waste disposal.

5.2 Establishment of an E-waste management framework to promote a circular economy on campus

Students' motivation to engage in E-waste disposal and recycling is likely to increase if they obtain a clear understanding of the underlying purpose of E-waste disposal and recycling and feel that they can actively contribute to the E-waste management process. Specifically, understanding the post-collection trajectory of E-waste and recognizing the value each subsequent action contributes to societal well-being and environmental sustainability can significantly boost student involvement and commitment to E-waste management practices. We recommend adopting a comprehensive educational strategy aimed at increasing student awareness and understanding of E-waste management. This strategy should be coupled with the development of practice-oriented learning activities that enhance their knowledge and skills for effective E-waste management. These initiatives should emphasize collaboration with internal stakeholders, such as university management, interdisciplinary faculty experts, and administrative staff, as well as external stakeholders, including companies involved in the entire value chain and relevant governmental departments.

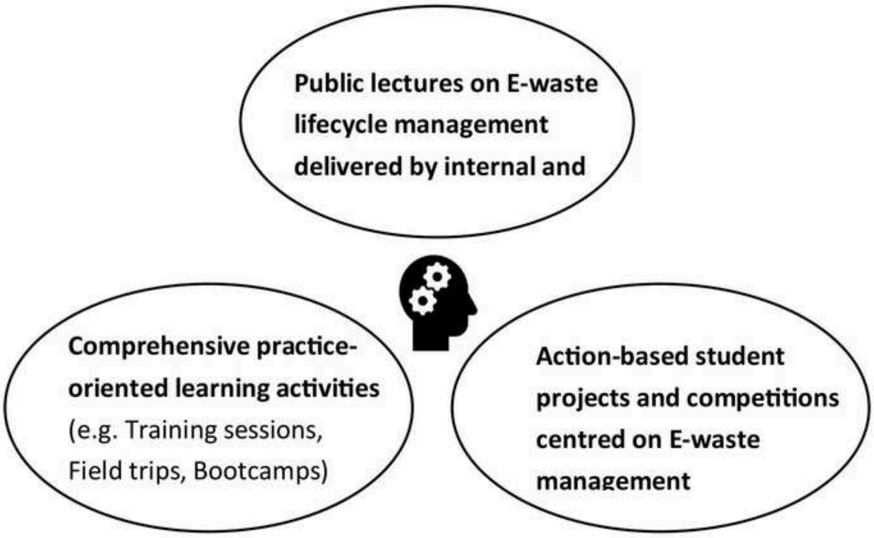

Figure 5. Proposed Educational Initiatives

The proposed educational initiatives shown in Figure 5 include:

a) Public lectures on E-waste lifecycle management delivered by both internal and external experts in the field. These sessions could serve as part of a new lecture series within existing and new curricula, or be provided as optional extracurricular activities.
b) Comprehensive practice-oriented learning activities with hands-on experience. These could be facilitated through specially designed training sessions, field trips to companies and organizations involved in various stages of the E-waste value chain, and immersive bootcamps designed to provide in-depth operational insights and experience.
c) Action-based student projects and competitions with immediate effects on E-waste management and circular economy. The projects and competitions could focus on a range of practical initiatives, such as designing E-waste disposal stations and collection points on campus, developing applications and platforms to facilitate the exchange and resale of second-hand electronic devices, and launching entrepreneurial projects and ventures that tackle the E-waste challenges and champion the sustainable practices of a circular economy.

5.3 Creation of an official university digital platform dedicated to E-waste management and circular economy

To amplify awareness and promote sustainable practices both within the university and beyond, we propose the creation of an expansive digital platform focused on circular economy education and responsible E-waste management practices. This platform is envisioned to act as a central hub for disseminating knowledge on E-waste disposal and recycling, including critical topics like data security in E-waste management. It is designed to foster student engagement and collaboration, providing a virtual space where students can connect, co-create, and coordinate initiatives, projects, and programs that focus on E-waste management and drive innovation within the circular economy. The proposed functions are presented in Figure 6.

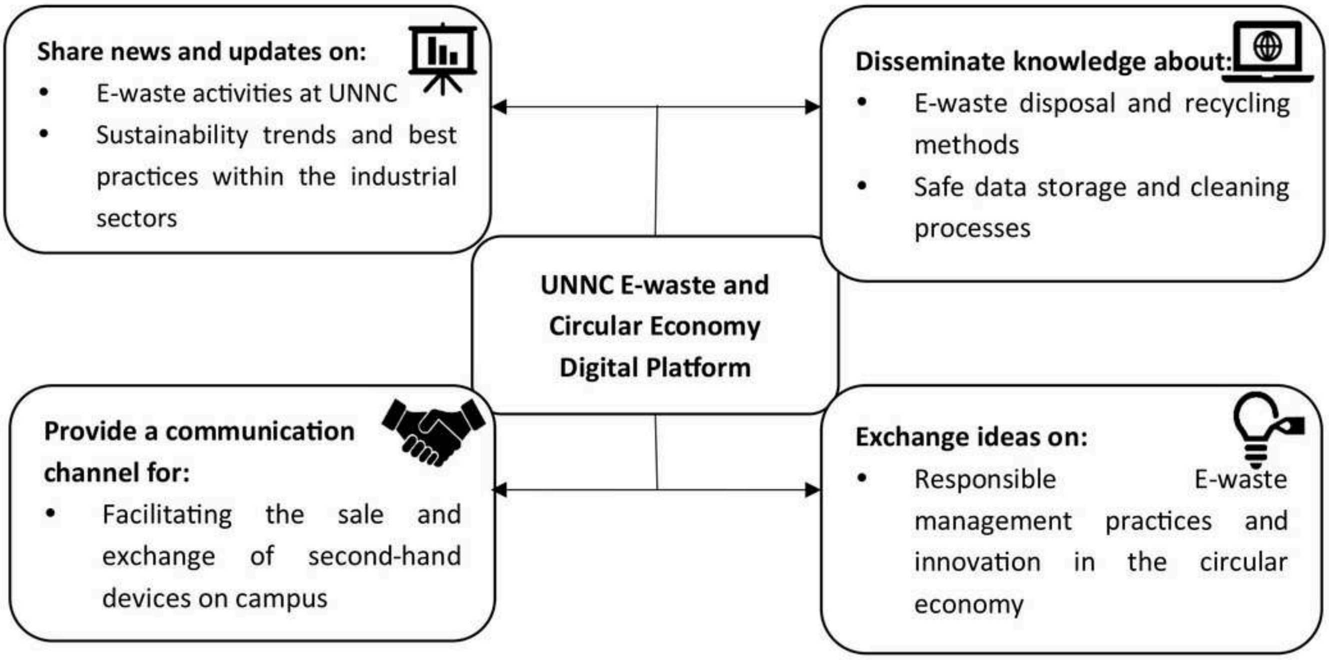

Figure 6. Main Functions of the UNNC E-waste and Circular Economy Digital Platform

Appendix

1. Industry Review & Feedback

Industry	Strategy
Manufacturing	1. Environmental-friendly raw materials used in products (e.g. Lenovo) 2. Green innovation and improvement for new products R&D 3. Redevelop recycled accessories and devices for future use (e.g. Tesla)
Retailing	1. Match sales and recycling data to forecast market demands and adjust inventories 2. Recycle the accessories of devices that are unable to repair
Logistics	1. Develop "Delivery – Assembly – Recycle" services and stations (e.g. GREE, Midea) 2. Efficient and environmental-friendly design of delivery route and packaging
Internet Recycling	Step 1: users submit equipment information through the online platform. Step 2: the platform evaluates quotes, arranges logistics recycling, equipment testing and data removal, refurbishment or dismantling processing. Step 3: users receive corresponding incentives or payments. Step 4: the platform resells the second-hand devices and the dismantled accessories. (e.g. Aihuishou, Xianyu, Zhuanzhuan...)

Table 8. E-waste disposal and recycling strategies in industries

Table 8 summarizes various industrial strategies that offer valuable insights for UNNC to enhance its E-waste disposal and recycling efforts:

- **Technological support**

  Strong technological support is the basis of developing the recycling platform and forecasting the data flow in the E-waste recycling process. However, the current technological support might not yet be sufficient to fully support the university's E-waste recycling platform. Therefore, to sustain E-waste disposal and recycling efforts, it may be necessary to seek assistance from external technological experts.

- **Cooperation with industries**

The disposal and recycling process of E-waste require specialized expertise and experience, suggesting that collaboration with a specialized company possessing an established recycling infrastructure could be beneficial. Such a partnership could assist with the on-campus disposal of E-waste components and potentially facilitate the establishment of dedicated recycling stations on the university campus.

- **Convenience of facilities:**

The strategic placement of E-waste recycling bins and stations is crucial for optimizing the efficiency of the E-waste value recovery cycle. Additionally, the convenience of these facilities is a key factor influencing students' decisions on E-waste disposal

2. Impact Assessment: Evidence from Other Universities

Actions of other universities	**Feasibility at UNNC**	**Critical evaluation**
Fairs and booths organized by student clubs and organizations	High	Effectively disseminate E-waste knowledge and foster second-hand devices exchange.
Temporary recycling station at the university (University example: Taiyuan University of Technology)	Medium	Student participation in the program increased when incentivized with small gifts. However, effective operations of the recycling station may require additional staffing support.
E-waste collection by a specialized company (University example: Beijing University of Chemical Technology)	Medium	Regular collection poses challenges, but organizing E-waste collection, for example, once per semester, could be a feasible approach.
An E-waste recycling platform on campus (University example: Xi'an Jiaotong University)	Relatively more difficult	The platform requires strong forecasting and monitoring systems, therefore the strategy is still at the conceptualization stage.

Table 9. Current E-waste Disposal and Recycling Actions at Other Universities

Table 9 presents a summary of E-waste disposal and recycling measures implemented by other universities, offering a benchmark to assess the viability of this report's recommendations for advancing UNNC's E-waste management practices.

Autumn 2024

Dr Xuan Feng
Dr Eric Evans Osei Opoku
Dr Jin’an Shao

CRBI
Centre for
Responsible Business and Innovation

Centre for Responsible Business and Innovation (CRBI)
University of Nottingham Ningbo China