Finding Emergency Feminine Product Accessible Station in City Corners

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Abstract

This report, crafted as part of the INFO5000 project coursework, delivers a detailed analysis of the accessibility of emergency feminine products in public spaces, centering particularly on sanitary napkin stations. The study acknowledges the critical issue of menstrual poverty and stigma, and is committed to the ongoing mission of ensuring the availability of sanitary products in public places as a continuing effort into the foreseeable future. The research employs a comprehensive methodology that includes field studies, analysis of the Wechat database, web development, visualizations, and extensive surveys. We have developed an online version of our report, which is available at https://palaceparis.github.io/INFO5000Coursework/. This online version offers interactive functionalities and will be featured in our upcoming video presentation. These elements are cohesively integrated to provide a multifaceted view of the topic. Findings from the research are presented through an interactive map and scatter plot, offering an intuitive understanding of the data. The analysis not only sheds light on the present availability of sanitary napkin stations in Guangdong but also places it in context with global standards. The study is transparent about the limitations encountered in survey design, ensuring a balanced view of the results. Conclusively, the report brings together these insights and looks forward to future innovations, including sustainable vending machine designs, cost-effective procurement strategies via online suppliers, and the incorporation of environmental sustainability. This report is positioned as an invaluable resource for stakeholders in the INFO5000 course and beyond, aiming to contribute to the reduction of menstrual poverty and the promotion of gender equity in public health infrastructure.

1 Introduction

1.1 Background

For this project, we aim to tackle the pressing social issue of menstrual poverty and the stigma surrounding women's menstrual cycles. In China, approximately 40 million children live in areas of special hardship, as highlighted in the "National Plan for the Development of Children in Poverty Areas" by the General Office of the State Council of the People's Republic of China. This number is roughly double the population of New York. Within this group, about 10% are girls between the ages of 12 and 16, which means at least 4 million girls are grappling with menstrual poverty. Furthermore, a survey conducted by UU Public Welfare across over 70 schools in poverty-stricken areas in 11 provinces and autonomous regions of China revealed that around 5% of menstruating girls do not use sanitary napkins. The implications of menstrual poverty are far-reaching, including gynecological health issues, psychological distress, and increased risks of dropping out of school and the workforce. The situation is further exacerbated by data from the sanitary napkin brand MeBuEri, which states that 93% of Chinese women suffer from gynecological diseases, 63% of which are attributed to the use of low-quality sanitary products. This project aims to address these challenges and contribute to alleviating menstrual poverty in China.
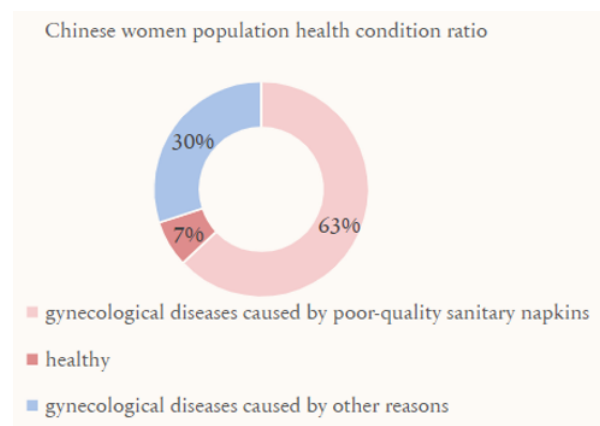

Figure 1.1: Chinese women population health condition ratio. According to the sanitary napkin brand MeiBuEr's website, 93% of Chinese women suffer from non-essential gynecological diseases, of which 63% are caused by poor-quality sanitary napkins.

1.2 Preliminary Findings

In our efforts to encourage our school to provide sanitary napkins, we encountered budgetary and responsibility ambiguities. The logistics department requires significant usage data to justify installing vending machines for essential items like sanitary napkins. Meanwhile, the Health Safety Environment department considers sanitary napkins as non-

emergency items, unsuitable for inclusion in first aid kits or clinics.

Our research, including literature reviews and news analysis, reveals that past initiatives for installing self-service sanitary napkin boxes in universities were unsuccessful. In contrast, personal electronic charging stations are widely available in public spaces. This disparity highlights the need for more accessible sanitary napkins in public areas.

Interestingly, family planning supplies like condoms are freely distributed in hospitals and clinics, raising the question of why menstrual products, crucial for women's health and well-being, are not similarly provided. The demand for sanitary napkins on high-speed trains in China, which garnered significant social media attention in 2022, underscores the urgency and public interest in this issue.

Furthermore, the societal stigma around menstruation exacerbates the problem. Menstruation is often treated as taboo, with euphemisms used in place of direct language, and period products are discreetly packaged in stores. A survey among undergraduate students at Hong Kong University of Science and Technology (Guangzhou) revealed that 43% are uncomfortable discussing menstruation publicly, with 56% associating it with negative emotions like shame and embarrassment. This stigma not only persists among students but also in their familial and educational environments, indicating a deep-rooted issue that requires substantial effort and social welfare interventions to overcome.

1.3　Purpose and Vision

It is necessary to make more people aware that sanitary napkins are daily hygiene products like paper towels and call on more people to pay attention to the needs of women. Women should get used to talking about menstrual circles and buying sanitary napkins with dignity and convenience in vending machines in public places.

Build a female-friendly and children-friendly society with humanistic care. The provision of free period items with easy access embodies the fundamental principle of equality and dignity of women and is a fundamental human right.

This project is an ongoing project. We will first set up an emergency feminie product accessible station in the female restroom of maker space at our school HKUST Guangzhou. We plan to run the pilot project for one year. Starting from the Guangzhou campus of HKUST in Nansha District, we will then expand to other cities in the greater bay area such as Shenzhen, Hong Kong, and Dongguan.

To narrow down our vision, we aim to first sell sanitary napkins via emergency feminie product accessible station and then provide free emergency sanitary napkins once a month after securing sponsorship.

1.4　Scope for This Course

Our project's scope extends beyond constructing a vending machine prototype, which will be showcased in our video presentation. We are analyzing Internet of Things (IoT) systems within vending machines and developing a data visualization map. This map identifies locations of emergency stations that provide feminine hygiene products in Guangzhou, Shenzhen, Foshan, and Dongguan. A rating system has been devised to assess these stations, with the ultimate goal of influencing legislation. Additionally, we have explored the feasibility of eco-friendly vending machines powered by solar panels for dispensing feminine pads. This initiative is part of an educational effort to combat the stigma surrounding menstrual cycles. The distribution of tasks within our team is detailed in Table 1.1.

Team	Contributions
Info Hub (2 people)	- Website development - Advising on IoT system for vending machines - Layout and design - Production of the presentation report
SEE Thrust (1 person)	- Advising on solar panel usage for vending machine power - Drafting the availability report for her advising
Society Hub (3 people)	- Securing vending machine sponsorship - Data collection - Website content creation - Drafting surveys and policy recommendations

Table 1.1: Distribution of Work Among Teams

2　Methodology

Our method mainly refers to Key Techniques in DSA Lectures of INFH 5000, including but not limited to data preparation/collection, exploratory data analysis, interactive plot design, and data visualization.

2.1　Data Collection

The data collected could be accessed here.

2.1.1 Field Studies

We visited the shopping mall Taikoo Hui and Landmark in Guangzhou as well as QingHuiYuan in Foshan to conduct field studies regarding the availability, number, location and affordability of emergency feminie product accessible station in their locations.

2.1.2 Wechat database analyses

We searched keywords such as "sanitary pad self-service box" on Wechat to gather data on emergency feminie product accessible station of other school locations in Guangdong province to build the database for visualization map website.

2.1.3 Surveys

To gauge the budgetary preferences and consumption patterns for sanitary pads within the university, we developed a survey with a focus on understanding the community's awareness and attitudes towards the availability and affordability of sanitary pads. This survey, conducted via Tencent vote, targeted both female staff and students at HKUST(GZ). We employed a Stratified Random Sampling approach, ensuring diverse representation across various academic years and departments, to obtain a comprehensive understanding of the perspectives within the university.

2.2 Interactive Visualization Map Design

Our study utilized the collected dataset detailing the locations of Emergency Sanitary Pad Stations across various city corners. This dataset included key variables such as the type of location (e.g., shopping malls, universities), the district in which the station is located, the number of available stations, and the distance to the nearest metro station. To facilitate our analysis, we converted these data points into geographical coordinates. The interactive plot for the project can be accessed at https://palaceparis.github.io/INFO5000Coursework/.

2.2.1 Data Transformation

In order to address data inconsistencies and enhance the visualization, we undertook several preprocessing steps:

- **Handling Missing Values:** Instances where the number of stations was not reported ('NA' values) were set to zero. This approach ensures continuity and completeness in our analysis.

- **Normalization:** Considering the high variance observed in the number of stations across different locations, we applied a logarithmic normalization. This transformation not only stabilized the variance but also improved the interpretability of our data in the visual representation.

2.2.2 Interactive Map and Scatter Plot Creation

We employed ECharts, a powerful, interactive charting and visualization library, for creating our visualizations. The methodology for developing these interactive plots is described below:

1. **Initializing the Containers:** The interactive map and scatter plot are displayed in separate containers within the webpage. These containers are dynamically sized and aligned for optimal viewing.

2. **Loading and Parsing Data:** Using jQuery, we loaded our dataset from a JSON file. The data was then parsed to create a structured representation, where each station's location was associated with its respective data points such as distance to the metro, quantity, and type.

3. **Chart Initialization and Configuration:** Two ECharts instances were created for the map and the scatter plot. The map visualization utilized a GeoJSON of the relevant city areas to plot the station locations. The scatter plot was designed to display the log-normalized number of stations and their distance to the nearest metro station. Different types of locations were color-coded for better differentiation.

4. **Data Grouping and Representation:** The data was grouped by location type to facilitate comparative analysis across different categories. Each group's data was represented as a series in the scatter plot, with individual data points reflecting the number of stations and their metro proximity.

5. **Interactivity and Responsiveness:** Click events on the map trigger updates in the scatter plot, showing data corresponding to the selected area. The scatter plot dynamically adjusts its display based on the selected map region, providing an interactive experience that allows users to explore data in specific city areas.

6. **Styling and Customization:** We customized the styling of the map and scatter plot for clarity and ease of use. This included adjustments to the layout, color schemes, labels, and tooltips to enhance user interaction and data comprehension.

Through these methodological steps, we successfully developed an interactive visualization tool that enables users to explore the distribution and characteristics of Emergency Sanitary Pad Stations across different city areas.

3   Results

3.1   Survey Result Interpretation

We collected 62 answers in total, with 48% master students, 29% PhD students, 13% bachelor students and 6% university staff. The majority (85%) prefer purchasing sanitary pads through third-party online platforms (e.g., Taobao, JD.com, Pinduoduo). Supermarkets and convenience stores are also popular, with 56% of respondents using these channels. These population who have habits to purchase off-line are our target early adopter customers.

As for the budget preference, there is a huge disparity. A significant portion of respondents (40%) spends between 1-2 RMB per pad. Another substantial group (39%) spends between 2-3 RMB, indicating a habit for moderately priced options. Period poverty does not seem to be an issue on campus as only 10% spends below 1RMB per pad.
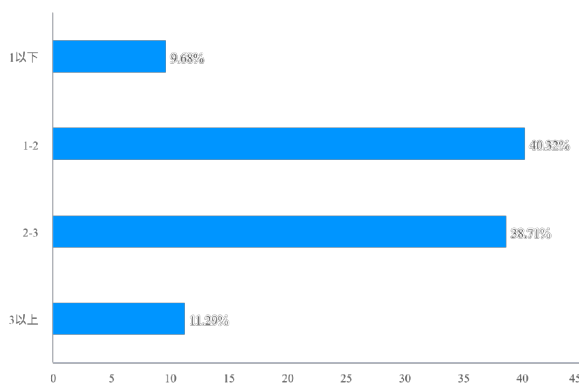

Figure 3.1: Budget per sanitary pad piece at HKUST(Guangzhou) unit: RMB

Brand loyalty is high, with 83.87% of respondents considering the brand as an important factor. Top brands include Kao Laurier (42%), Kotex (40%), P&G Whisper (35%), and Sofy (35%). The majority (84%) consider quality (absorption capacity, leak prevention) as the most important factor. This indicates that we better collaborate with these brands to start with instead of developing our own products. If we were to develop our own new products, we need to focus on quality.

Only 6% consider convenience of purchase location as the most important factor. This implies that although we have some enthusiastic buyers, installing multiple stations on campus might be unnecessary.
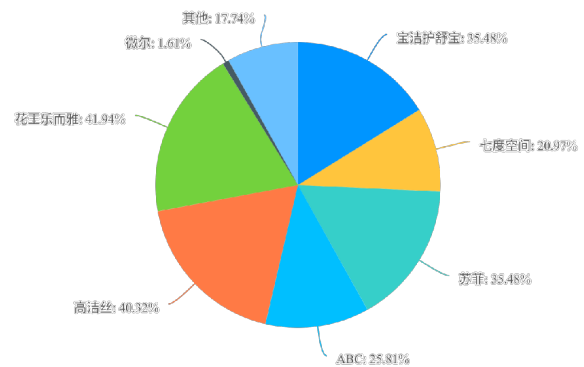

Figure 3.2: Sanitary pad brand preference at HKUST(Guangzhou)

When asking their willingness to buy in other products at emergency feminie product accessible station, there's an interest in purchasing cleaning products (73%), disposable underwear (56%), and snacks (19%). Some people put "no interest" as the answer indicating that it is also OK to not include other products.

People also showed habit of using tampons and interest in learning and educating about it. Cloth pads is also mentioned as an alternative both due to its affordability and environmental benefit.

3.2   Comparative Study - A Macro Level Perspective between China and Other Countries

In 2021, a member of the National People's Congress suggested to the Treasury Department these three policies:

1. the inclusion of the basic version of sanitary napkins into medical insurance;

2. establish a designated fund to provide free period to certain group of women;

3. promote the national reduction of value-added tax on feminine hygiene products.

These policies were not sponsored, and the Treasury Department redirected the topic to the National Health Commission.

Internationally, Scotland became the first region to offer menstrual supplies free of charge in 2020. India, our less developed neighbor, abolished the tax on sanitary products in 2018 and is promoting a program of cheap sanitary napkins for one rupee (RMB 0.09) a piece. Korea doesn't have a nationwide program but started to distribute free sanitary napkins in 10 public areas in Central Seoul starting from 2018.

Table 3.1 is a summary of the 20 countries and regions that provide different levels of free menstrual supplies.

4   Limitations

Survey Improvement. The survey design is not yet complete and might cause bias. The way questions are framed influences how respondents interpret and answer them, leading to results skewed in a way that assumes certain preferences. For example, "no interest in buying other products" is not an option in the question to explore additional products.

Acquiescence bias can also be caused by a tendency to agree with statements regardless of their content, especially relating to personal habits (sanitary issues, price, conflict of interest, cultural issues, etc.) as well as location selection.

Vending Machine IoT System We have consulted PhD professionals in IOT and an expert. The interaction flowchart of the vending machine IoT System is as Figure 4.1 shows.
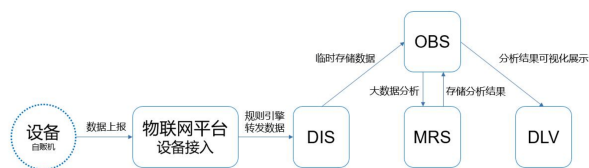

Figure 4.1: Interaction flowchart between Vending Machine and IoT System

The process can be concluded as follows: After each sale of goods, vending machines report the type, quantity, time, and region of the sold goods to the Internet of Things platform. The Internet of Things platform provides rule engine capabilities, supporting the forwarding of data reported to other cloud services such as Huawei Cloud. It can achieve the forwarding of massive data to MapReduce Service (MRS) through Data Ingestion Service (DIS), After processing the data, it is read and presented as a visual report by the Data Lake Visualization (DLV), achieving one-stop data collection, processing, and analysis.

Building this commercial system includes but is not limited to difficulties and challenges in IoT development and mobile payments. Firstly, integrating mobile payment methods such as WeChat QR code payment involves understanding the API and protocol of the payment system. Our project members need to develop and debug under the manufacturer's guidance. Secondly, we hope to achieve the business logic of providing free sanitary napkins to users when using vending machines for the first time every month, as well as real-time inventory updates and inventory replenishment and allocation algorithms,

which are equally crucial. It can be foreseen that this is a long-term interdisciplinary project, so the development and cooperation of the software and hardware team are essential.

5   Conclusion

Our project uses teamwork, creative thinking, and resource connections to make sanitary pads available to those in need. We built an IoT vending machine prototype for our emergency geminie product accessible station network. We also built a website data visualization analyzing existing stations in Guangdong province. We further developed a rating system, conducted school user survey to implement the station on campus, and proposed multiple policy recommendations. By implementing these suggestions, any institution can effectively address period stigma and period poverty issues, manage potential conflicts of interest, and uphold a progressive and inclusive image. These steps not only improve the immediate environment for students and staff but also contribute to broader societal changes regarding menstrual health and gender equality.

6   Future Work

6.1   Sustainable Vending Machine

Off-grid power generation systems provide a sustainable energy solution for areas distant from the traditional power grid, offering reliable electricity for remote regions, mobile facilities, or temporary needs. In a solar off-grid power generation system, solar energy is captured by solar panels, converting sunlight into electrical energy. The structure of the solar panel is as shown in Figure 6.1.
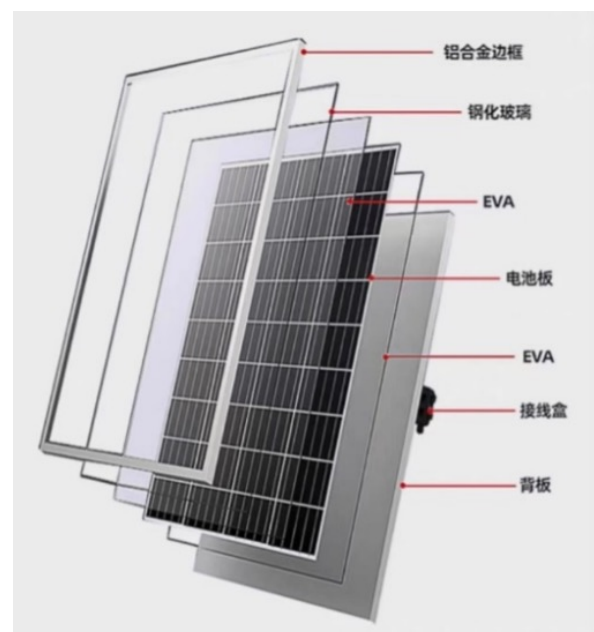

Figure 6.1: The structure of the solar panel

Table 3.1: 20 countries and regions that provide different levels of free menstrual supplies.

Free to all in all public areas	No tax	Free in certain regions or public areas
Scotland (community centers, youth clubs, and pharmacies etc)	India	New Zealand (school)
	Kenya	Australia (school in New South Wales and Victoria)
	South Africa	United States (school in Illinois, Washington, New York, New Hampshire, and Virginia)
		France (school in Île-de-France)
		Kenya (school)
		South Africa (school)
		Botswana (school)
		Korea (public areas, e.g., library in Central Seoul)
		Uganda (school)
		Zambia (rural school)
		Canada (schools and federal agencies in British Columbia, Ontario, Nova Scotia, and Prince Edward Island)

After regulation by a controller, the generated electricity is stored in batteries for later use by the end-user. The main components of a solar power generation system include solar panels, charge controllers, batteries, and inverters. The schematic diagram is shown in Figure 6.2.

Figure 6.2: The schematic diagram of the solar off-grid power generation system

Taking a small vending machine as an example, with a rated power of 15 W and a device voltage of 220 V, if we want to ensure its continuous operation for 24 hours and standby for about 5 days during rainy weather, and assuming the battery voltage is 12 V, through rough calculations, we would need to configure a solar power system of around 300 W and 160 Ah. The solar panel's area would be approximately 1700*885 mm² (300 W). If space is limited, two solar panels with an area of 1150*670 mm² each (150 W) can be used to power the vending machine. And if the power is insufficient in practical applications, we can also consider adding solar panels in parallel later, which is also convenient. Currently, we have been gradually purchasing the related equipment to set up a vending machine integrated with solar panels for power generation.

6.2 Leverage online supplier & Lowering Cost

To maintain a sustainable business, it is important to explore partnerships with popular online platforms for discounts or special offers for students and staff. Implement programs to provide free or subsidized sanitary products to students, especially those in financial need.

6.3 Sustainable Design & Environmental Awareness

Promote the use of sustainable menstrual products like menstrual cups, cloth pads, or biodegradable pads. For example, we could add survey questions about awareness and usage of eco-friendly sanitary products to gauge environmental consciousness. Raise awareness about the environmental burden of sanitary waste disposal practices and implement proper disposal methods to minimize environmental impact. We have also been in touch with profes-

sors and students in the Material Science field to collaborate and potentially make sanitary napkins recyclable.

In addition, we aspire to attach solar panels to the vending machine to make it functional off-grid outside. This design is beneficial to under-developed rural areas in China. We could even attach it to tricycles and distribute it free of charge after securing donations. Big brands like Cola have already been using solar panel vending machines in Japan. Thus, it also has an overseas market.

6.4   Health and Hygiene Education

Organize workshops and seminars on menstrual health and hygiene. Include information on sustainable practices and proper disposal methods. This not only provides essential gender and health education for young girls and women in the community but also could raise awareness about women's rights in society.

6.5   Managing Conflicts of Interest

1. **Transparent Procurement Processes:** Ensure transparency in the procurement of sanitary products, avoiding any appearance of favoritism or conflicts of interest, and use open tenders and clear criteria for selecting suppliers.

2. **Diverse Committee Involvement:** Form a committee with diverse representation (students, faculty, administrative staff) to oversee initiatives related to sanitary issues. This committee can also review potential conflicts of interest. Regarding the implementation of stations on campus and validating the rating system, we plan to consult experts such as staff members trained in electricity safety and handicap people association regarding their user experience.

3. **Regular Audits and Reviews:** Conduct regular audits of procurement processes and initiatives. Ensure funds allocated for sanitary issues are used effectively and transparently.

6.6   Upholding University Image

1. **Positive Communication Strategy:** Publicize efforts and initiatives related to improving sanitary facilities and promoting gender inclusivity. Use the university's platforms to highlight commitments to sustainability and social responsibility.

2. **Community Engagement:** Involve the university community in decision-making processes related to sanitary issues. Encourage feedback and suggestions from students and staff.

3. **Collaboration with External Organizations:** Partner with NGOs, governmental organizations, and corporations that focus on menstrual health and gender equality. These collaborations can enhance the university's reputation as a socially responsible institution.

4. **Regular Updates and Reporting:** Provide regular updates to the university community about ongoing initiatives and improvements. Transparency in actions and communications helps maintain a positive image.

6.7   Legislation Recommendations

We plan to expand to other high schools, middle schools, and even primary schools. For the beneficiary students that do not have income, such as those younger than 18, it is likely that they cannot afford the education program or the sanitary napkin product.

We can find alternative 'customers' such as those people affiliated with the school:

- asking alumni, the investment office, or logistics office from the schools to sponsor an emergency sanitary napkin station;

- inviting the sanitary napkin producers to give the products to the schools;

- inviting local businesses to sponsor local schools to get the products and education program as a community goodwill project;

- asking donors to fund the sanitary napkins, e.g., through an online donation page at crowdsourcing websites, Red Cross, or Tencent Charity.

We also would like to promote the inclusion of the basic version of sanitary napkins into medical insurance and promote the national reduction of value-added tax on feminine hygiene products. We plan to model the policy details after the example of the baby care room legislation in Guangzhou.

In the future, we will find our advocate from members of the National People's Congress and the National Committee of the Chinese People's Political Consultative Conference. We will collaborate with them and other locations that implemented the Emergency Feminine Product Accessible station to suggest to the Health Commission office in Guangzhou to share our experiences and demand legislative laws to mandate the delivery of sanitary napkins in public places.

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