

Use and Disposal of Mobile Phones Among University Students

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Abstract

This study aims to identify the replacement and disposal of mobile phones amongst Malaysian university students. Data were collected from a sample of 620 students of 3 universities (two in Melaka and one in Kuala Lumpur), by means of a self-administered questionnaire survey. The results show that about 22% of the students replace their mobile phones annually, while most students (43%) replace their phones in more than 3 years. The most common reason for mobile phones replacement is the physical broken (58%) followed by poor function (35%). About one third of the students stockpile their retired phones and majority (37%) of them claim that they want to have them as spare units. Besides, a substantial amount of them (28%) actually do not know what to do with the retired phones. This reflects the low awareness amongst students and the lack of formal waste management system in Malaysia. Moreover, the findings show the rate of replacements of even functioning phones is high and a significant high stockpile of the retired phones, which in turn increase the generation of e-waste eventually. This study also provides evidence that the level of students' awareness towards mobile phones recycling is still low and waste management system in Malaysia is still inadequate. Thus, the time has come for the introduction of a recycling programme for these potentially harmful waste materials. The findings of this study also lead to implications for the theory-deficient of mobile phones recycling literature. In addition, several policy recommendations for policy makers to enhance mobile phones recycling response rate are also discussed.

Keywords: Electronic waste; Mobile phones; University students; Environmental management.



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1. Introduction

In our ever-changing technology age, mobile phone has turn out to be a very common and affordable product. In Malaysia, mobile phones usage has boosted enormously to approximately 17 million and a diffusion rate of 70% (whole country), and 100% in urban areas (E&E Solutions Inc, 2007). This shows that mobile phones are affordable to all Malaysians. This electronic hardware have now progressed toward becoming necessities and was never again deemed as extravagance thing as in the beginning period of Malaysia's economic development. Moreover, the advancement of mobile telecommunication in attractive features and stylistic expectations which include various new applications, such as fast charging feature, proprietary operating system, notable feature of 'Web browsing', bigger memory capacity, etc. has brought about a high replacement rate of mobile phones by consumers.

According to a study by Ho *et al.* (2015) in Malaysia, 28.7% of the households claimed that they replaced their mobile phones in less than 2 years. As for those changed their mobile phones between two to five years comprised of nearly half, i.e. 47.3%. The high changing frequency of mobile phones as seen in the study resulting to a substantial amount of waste in the form mobile phones are created in the nation.

University students, who have the lavishness to possess mobile phones, are the target group in this study. They could possibly become the biggest contributor for the e-waste generation. Generally, the objective of this study is to measure the behaviour and awareness of university students about their usage and discarding habit of mobile phones. On the whole, as a research of young people, university students were used.

In general, this study would give significant information to put together the sustainable management system of the waste mobile phones, particularly in Malaysia. It helps to provide policymakers with recommendations on ways to influence the behaviour of consumers. This would ensure that essential preliminary issues and factors are covered when policymakers are planning and developing policies and legislations concerning sustainable management system of the waste mobile phones.

2. Literature Review

Mobile phones are categorised as waste electrical and electronic equipment (WEEE) at their end of life (EU, 2003). These retired mobile phones are large in quantity and with high reuse/recycle value. It is estimated that compared to other e-waste, mobile phones and their rechargeable batteries are the largest contributor for the overall e-waste generation in Malaysia by the year 2020 based on the study done by [Perunding Good Earth Sdn. Bhd \(2009\)](#). In reaction to the ever increasing problem of e-wastes in the nation, Malaysia has put in place the e-waste regulation since 2005. On 15 August 2005 onwards, nobody is allowed to dispose e-wastes into landfills with the implementation of the Environmental Quality (Scheduled Wastes) Regulations, 2005. Besides, DOE has also initiated the e-waste collection programme, where people will be able to give off their e-waste (restricted to used mobile phones, mobile phones' batteries and their accessories, computers and their accessories, and television sets) to the e-waste gathering centres operated by Local Authorities, Alam Flora Sdn. Bhd or SWM Environment Sdn. Bhd ([Department of Environment, 2012](#)). However, mobile phones are able to be simply stockpiled or dumped together with the general waste due to their small physical sizes ([Darby and Obara, 2005](#)); ([Canning, 2006](#)).

Many studies have also revealed that a lot of end-of-life mobile phones are not discarded in a proper manner (by way of reusing or recycling) but stockpiled ([Ho et al., 2015](#)); ([E&E Solutions Inc, 2007](#)). Nonetheless, there are public disposing the end-of-life mobile phones to scrap collectors who are not regulated by DOE. Consequently, it is believed that illegal recycling and recovery processes, or illegal dumping is practised which would entail severe human and environmental threat ([Qureshi et al., 2016](#)).

E-wastes, in particular are recyclable. They should be segregated for dedicated collectors to deliver them to licensed recyclers. E-wastes should be segregated from general wastes and other recyclable materials such as glasses, plastics, papers, etc. The stress of the e-waste issue can be partially relieved only through proper disposal ([Huang et al., 2006](#)). On another note, the reusing of e-waste isn't simply to diminish the amount of waste requiring treatment, but also to promote the recovery of considerable quantities of valuable materials such as precious metals. As reported in *The Star* ([Cheang, 2009](#)), about 200,000 scrapped mobile phones would produce one kg gold ingot. This is because e-wastes consist of both toxic and valuable materials. Ultimately, conservation of some natural resources as well as protecting the environment can be achieved through the recycling of e-wastes.

Moreover, by 2020, it is anticipated that the yearly measure of disposed mobile phones will be about seven times more noteworthy than the sum in 2007 (UNEP, 2009). In order to offer recommendations for sustainable waste mobile phones management, there is a pressing need to analyse the consumers' disposal behaviour and awareness.

3. Methodology/Materials

This study is based on a questionnaire survey and applies quantitative approaches for data analyses. Some secondary data and the expert's opinion have been examined. This establishes the target for an effective survey plan before surveying the university students. The survey was conducted between May to July 2017, which focused on the students at 3 universities, where two are located in Melaka and one is in Kuala Lumpur. University students (spokesperson of young people and notable potential consumers) were the unit analysis and this study adopted the convenience sampling method to distribute the questionnaires.

Students' behaviour and awareness with regards to their usage and disposal habit of mobile phones were assessed through the development of a questionnaire. The first section of the questionnaire gathered the basic socioeconomic information. The second section collected the information about students' mobile phones replacement rate (multiple choice with single answer) and the primary reasons for those action (multiple choice with multiple answers). Furthermore, students were prompted on their methods used to dispose the unused and unwanted mobile phones (multiple choice with single answers). Lastly, the reasons for stockpiling the obsolete mobile phones were asked (multiple choice with multiple answers).

4. Results and Findings

Table 1 presents a summary of the students' information. There were 620 usable questionnaires collected with male students comprising 53.96% of the respondents. Besides, the data collected prominently Chinese students (59.35%) and age 20-24 (73.99%). For education levels, 76.94% are undergraduate students. Lastly, majority of the students are from management (31.94%) and IT (33.06%) fields.

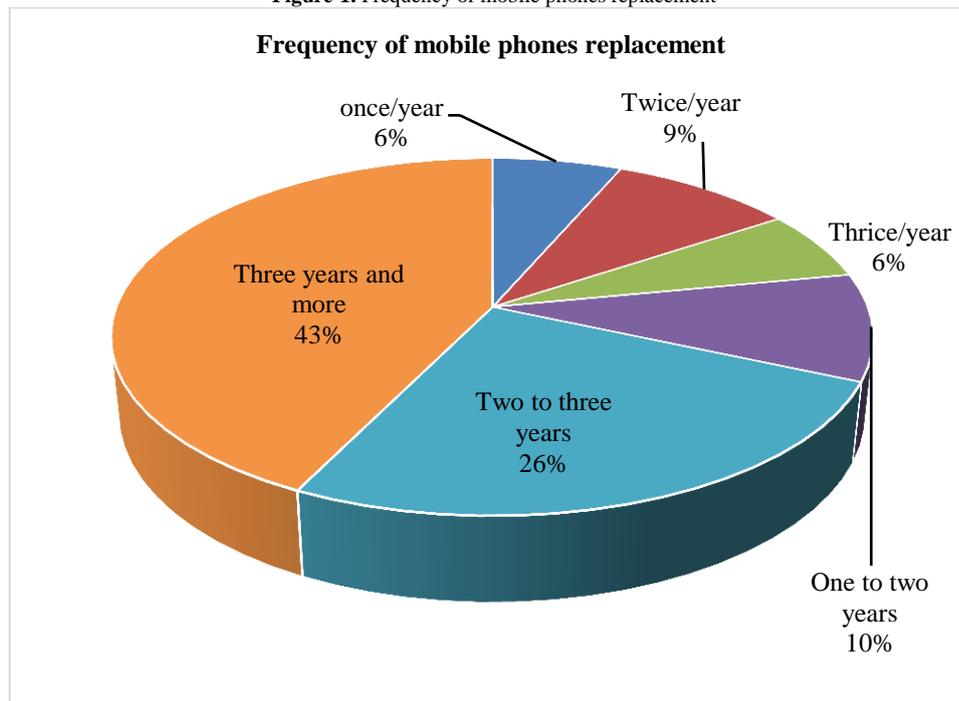
Table-1. Students' Information Profile

Information Profile		%
Gender	Male	53.96
	Female	46.04
Age	under 20	25.04
	20 to 24	73.99
	25 to 29	0.97
	30 – 34	0.00
	35 - 39	0.00
	40 and above	0.00
Ethnic	Malay	35.97
	Chinese	59.35
	Indian	3.55
	Others	1.13
Education Level	Foundation/Diploma	21.29
	Undergraduate	76.94
	Post-graduate	1.77
Study Field	Engineering	11.45
	Science	8.23
	Law	0.32
	Management	31.94
	IT	33.06
	Others	15.00
Total (%)		100
Total number of students		620

4.1. Frequency of Mobile Phones Replacement

The frequency with which students replace their mobile phones is summarised in Figure 1.

Figure-1. Frequency of mobile phones replacement



Based on the data collected, about one fourth (25.65%) of the students made a claim that they changed their mobile phones between 2 to 3 years and nearly half, i.e. 42.74% of the students changed their mobile phones three years and more. This finding is not in line with the study on Chinese university students by Li *et al.* (2012) where majority of students (38%) claimed that they change their phones in two to three years. It is notable that, a substantial amount of students (21.93%) replace their phones once, twice or even thrice in a year, while majority of the students acknowledged that they don't replace their phones on yearly basis. This finding is in line with the studies done by Li *et al.* (2012) and Ongondo and Williams (2011) for students in China and UK. This group of students might be formed from those who have adequate financial support and are fascinated of new technology and the hunt of fashion. However, this study shows only 9.68% of the students change their phones in one to two years. This finding is also inconsistent with the study done by E&E [13], where the rate of replacing mobile phones is

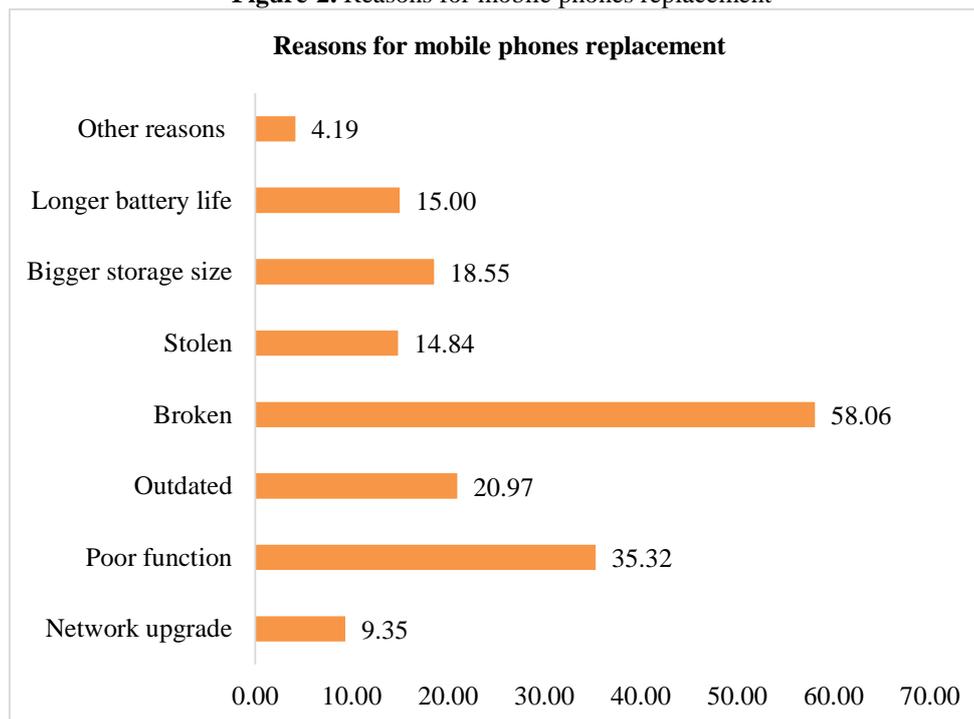
noticed at once per 12-18 months on an average. A possible interpretation of this is that the consumption pattern between students and householders are different.

Nonetheless, with the high frequency of changing as perceived in the study, increasing amount of mobile phones waste are projected to be produced in the country. Likewise, a study done by PGE [1] discovered that, compared to other e-wastes, such as TVs and PCs, which are usually used for much longer, mobile phones comprised the biggest amount of the total e-waste generation.

The research findings also indicate that a significant amount of mobile phones which have been replaced are actually less than the intended product or service life. The short service life would be a key factor contribute to a huge amount of waste mobile phones, which may possibly damage the environment and human health. On the other hand, there will be an increasing amount of energy and resources that would be used to make new mobile phones with the rapid replacement of these electronic items. In order to conserve energy and resources, consumer should expand the service life of their mobile phones.

4.2. Reasons for Mobile Phones Replacement

Figure-2. Reasons for mobile phones replacement



A variety of reasons for replacing mobile phones was put forward by the students. These are summarised in Fig. 2. Above all, replacing a broken phone is the most prolific reason for changing mobile phones. This finding is similar to the students of China [Li et al. \(2012\)](#); [Yin et al. \(2014\)](#) and UK([Ongondo and Williams, 2011](#)). The detailed information with regard to in what way the phones destroyed or the level of the damage was not collected. This is dissimilarity to the proclamation that the technical life-span of a mobile phones is 10 years (Nokia, 2005). Likewise, this can direct to the issue whether there is a connection between broken phones and their generally short life expectancy of phones. For example, does it imply that the mobile phones nowadays are inferior in design and quality? Nonetheless, it could be argued that the possible cause of the damage to mobile phones is very much owing to the life style of young people.

This study is also contrary with the study done by [Ho et al. \(2015\)](#) on households, where the prevailing factor for mobile phones disposal is 'outdated'. This indicates that, unlike the consumption structure of households, most of the university students do not discard mobile phones as long as they still worked perfectly. This scenario also reflects that many university students are thrifty and more careful in spending or perhaps could not afford to change new phones before the shelf life.

The second and third reasons for mobile phones disposal are 'poor function' and 'outdated' which contributed to 35.32% and 20.97% respectively. These two reasons may recommend that, in actuality, the mobile phones are retired early in spite of the fact they are still in great condition. This may possibly be driven by the craving to have the most up-to-date functionality and stylistic expectations. This scenario also reflects that the affordability of university students to own new mobile phones is progressively increased. Above all, it is undoubtedly more sensible to guide and shape what the students do with the phones upon replacing them, since it is unlikely to adjust this kind of behaviour. This finding also showed a similar consumption structure between Malaysia and China ([Li et al., 2012](#)).

The desire to have a phone with a bigger storage size (18.55%) positioned modestly high as one of the rationales students changed mobile phones. This finding may imply that students are prone to keep all those pictures, videos and apps that eat up the device's storage. The replacement taken by network operators (contract with new mobile

phones or network upgrade) is equally low (9.35%) as in China (10.58%), *Li et al. (2012)*. However, a study in the developed country (*Ongondo and Williams, 2011*) showed that by getting an upgrade from network operators contribute to 41% of the students to replace their phones. It is perhaps the distinction of consumption structure between Malaysia and developed countries that caused this difference.

4.3. Dispose Options for the Retired Mobile Phones

Figure-3. Dispose options for the retired mobile phones

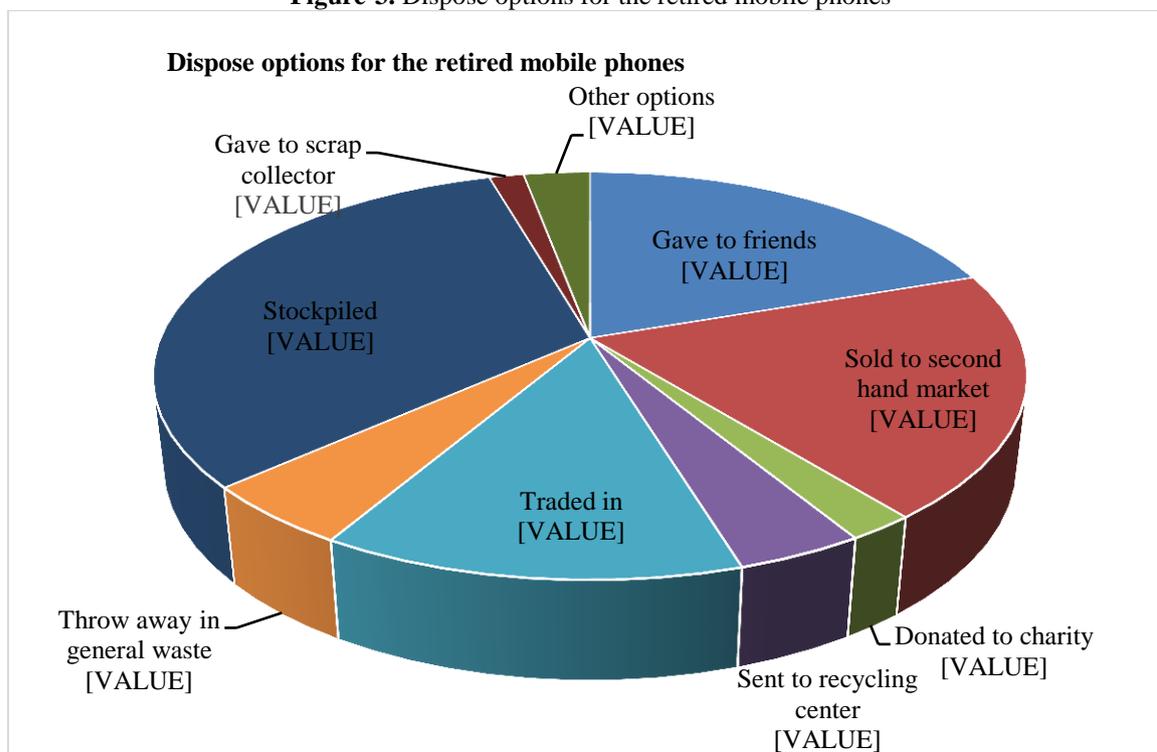


Fig. 3 summarises the methods the students applied to discard of their retired mobile phones. The results imply that majority of the students (32.16%) chose to stockpiled their retired mobile phones. This is concurred with previous research in some other countries, such as China and UK (*Li et al., 2012*), *Yin et al. (2014)* and (*Ongondo and Williams, 2011*). Similarly, most end-users stockpile their unwanted or damaged electrical and electronic equipment for years before reselling or disposing of the equipment, according to a large number of literature (*Perunding Good Earth Sdn. Bhd, 2009*); *Saphores et al. (2009)*. Nevertheless, this finding goes against prior research in Malaysia (*Ho et al., 2015*) which have reported that ‘traded in’ is the most prevalent disposal method amongst household in Malaysia. The disparities between the finding most likely due to the individualities of the survey sample. The *Ho et al. (2015)* study did not restrict itself to a specific age group. Unexpectedly, this present study reports discoveries to a particular targeted group.

The fact that storage method is chosen instead of reuse or other disposal method is alarming the situation of waste management and recycling system in this country. This likewise implies the conviction that e-waste has some value (psychological factors) and absence of awareness and know-how to discard undesirable mobile phones. Notably, the perceived value is deemed as sentimental value or a concern to protect personal data (*Ongondo and Williams, 2011*) and may not inevitably be monetary.

The second preferred disposal method is ‘gave to friends/relatives’ (19.72%), followed by ‘sold to second hand market’ (19.48%). It can be deduced that a number of percentage of mobile phones is in fact still in good condition with regards to these two disposal methods. This also indicates that there are demands for second hand mobile phones and widely accepted by teleshops. Moreover, the two methods can extend the life cycle of mobile phones, ultimately. Through reusing of mobile phones, the amount of e-waste can be decreased generously and at the meantime the movement of e-waste into landfills can be deferred.

Nonetheless, most second hand market could not dispose of mobile phones in a sound method although some phones would sooner or later be recycled. These second hand market would savage valued and expensive parts, then trade the phones in rural neighbourhood as soon as reassembly or refurbishment. After that, the unused parts would probably be thrown to the nearby environment. Moreover, low and outdated technologies, such as acid bath or open incineration are most likely used in these private workshop for dismantlement, which would entail severe secondary pollution (*Yin et al., 2014*).

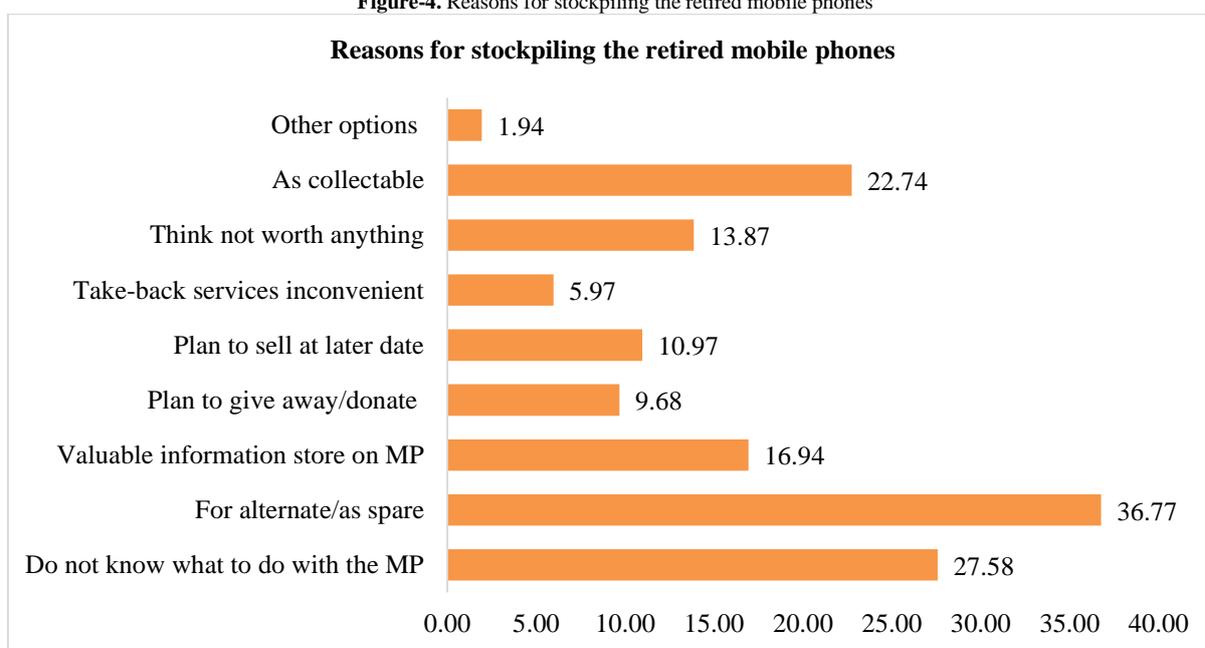
Recycling is the essential e-waste disposal method but it did not appear to be prevalent amongst students, where only about 4% of the students claimed to practice this method. This exposed that just a very small portion of obsolete mobile phones turn out in recycling facilities. It is likewise appeared from the circumstance that a few organizations struggle to get adequate old mobile phones to feed the recycling plant. This may be due to poorly

organised take-back scheme is currently in practice. It is also very likely that in this case, these students did not know the prominence of recycling from the aspect of the 'environmental value' of the phones, where resources implanted within the phones would be able to recover. Nonetheless, a study by Yin *et al.* (2014) found out that the prime elements behind the low rate were the absence of laws and regulations, as well as government management, weak environmental awareness, and lack of publicity on the need of waste mobile phones recycling.

Besides, a small segment of the unwanted phones (5%) are dumped in the household general waste, which is somewhat higher than global study (4%) (Nokia, 2008) and this will definitely set potential environmental risks to the human health and environment. As claimed by (Kalana, 2010), most of the waste electrical and electronic equipment are believed to end up in the landfill site with improper handling since there is insufficient system of segregation or disposal to motivate the Malaysian to recycle and dispose of e-waste, presently.

4.4. Reasons for Stockpiling the Retired Mobile Phones

Figure-4. Reasons for stockpiling the retired mobile phones



The reasons for stockpiling are summarised in Fig. 4. This round out the results shown in Fig. 3 that 'broken phones' are the primary reason why students change their phones. The most common reason is the students stockpiling the retired mobile phones as spare (36.77%). Surprisingly, this finding is somehow consistent with (Ongondo and Williams, 2011) in UK, the developed country. On the contrary, students from China who are supposed to have similar consumption structure claimed that they have no idea on how to deal with their retired mobile phones as the main reason for stockpiling.

It is instructive to perceive that nearly 28% of them did not know what to do with the mobile phones although most of the students hoarded phones for fear that a spare handset is in need. This may be due to this group of students can't really make up their mind whether to stockpile the phone, give away or trade them. Some possible factors that add to the hoarding of unwanted electrical and electronic equipment are:

- i) Students don't know how to discard it securely and advantageously.
- ii) Students may believe that a portion of the inside segment of the equipment can in any case be utilised and therefore are kept for future savage purpose.
- iii) Students confront hesitance in discarding their unwanted mobile phones as they had spent a lot of money to buy these things.
- iv) Students are anticipating for hoarders to buy the unwanted mobile phones from them.

The destiny of these obsolete mobile phones which are still owned by students ought to be given extraordinary concern in light of the fact that on the off chance that they are inappropriately discarded, their toxicity and growing volume will definitely portray an adverse impact to human health as well as the environment. Nonetheless, mobile phones as collectable ranked fairly high as one of the reason students stockpiled the retired mobile phones. University students do this perhaps for sentimental value or personal pleasure which includes appreciation of beauty and pride of ownership.

5. Conclusion

Generally, it is the intention of this study to derive implications for both research and public policy. The development of utilization and disposal of mobile phones among university students in this study would be able to offer an insight into the sustainable management of unwanted mobile phones. Besides, the empirical insights from this study would also enrich the literature on the disposal habit and awareness of mobile phones recycling among university students. This would be helpful to provide a foundation for more thorough future studies for researchers.

This study has ascertained that most students replaced their phones three years and more, mainly due to replacing broken phones or poor function phones. Replacing 'outdated phones' and longing for a handset with a larger storage size are some other principle reasons behind the high changing rate of mobile phones amongst students. This study has also stressed the potentially huge stockpile of mobile phones, where 3 in 10 replaced phones are not sent to reuse or recycling but are instead stockpiled by the students with 'keep as spare' as the key excuse for this practice. A situation could arise whereby when the students grow older, they would be in ownership of a substantial amount of unwanted phones if this habit carries on. What's more, an extensive amount of the students have no clue what to do with their retired phones.

Obviously, the findings of this study implied that the recycling rate of waste mobile phones among university students is notably low. Hence, the need to enhance the awareness of waste management is an unquestionable fact. However, to enhance the recycling rate, it is critical to establish a well organised and efficient recycling system. Above all, special focus must be directed towards the improvement of awareness amongst university students. Besides, launching of educational campaigns to disseminate the sound methods to recycle and reuse e-waste is mandatory too. In short, it is essential to create awareness and promote environmental education among university students. Also, it is up most important to foster e-waste recycling habits of our children. This can be done through the enrichment of elementary education in environmental protection and resource conservation. Unfortunately, there is still no formal subject dedicated to achieving this aim in the existing education system at primary and secondary school level in Malaysia.

Currently, recycling campaign of mobile phones such as take-back scheme seems to have small and of little significance in salvaging all these handsets. This is due to the students' desire to stockpile a spare phone. Therefore, there is a pressing need for further study to explore the students' willingness to involve themselves in mobile phones take-back services and factors influencing their willingness.

Acknowledgement

This research is funded by the Mini Fund (2016/2017) from Multimedia University, Malaysia

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