

Survey of Thais' Mobile Phone-Battery Usage and Disposal

Oraphin Choochom¹ Wiladlak Chuawanlee² Ashara Sucaromana³
Pannee Boonprakob,⁴ Manat Boonprakob⁵ Tasana Thongpukdee⁶

Abstract

The purpose of this study was to investigate Thais' mobile phone-battery usage and disposal and to examine key psychosocial factor of Thais using different mobile phone-battery disposal methods. The sample consisted of 2, 176 Thai mobile phone users in Bangkok who responded on mobile phone-battery usage questionnaires. Research result revealed that non-student mobile phone users had changed –on average, 2 batteries; and that most people still kept degenerated batteries at home, while others mostly discarded them along with other garbage. Moreover, it was found that mobile phone users who discarded degenerated mobile phone batteries along with other garbage had low intention on, low attitude toward, and low knowledge of, proper mobile phone battery disposal; and had high external motivation on mobile phone battery disposal.

Keywords: Mobile phone usage; Battery disposal; Electronic wastes; Psychosocial factors

¹ Assoc.Prof. of Behavioral Science Research Institute, Srinakharinwirot University, Bangkok, Thailand

² Asst.Prof. of Behavioral Science Research Institute, Srinakharinwirot University, Bangkok, Thailand

³ Assoc.Prof. of Behavioral Science Research Institute, Srinakharinwirot University, Bangkok, Thailand

⁴ Lecturer of Behavioral Science Research Institute, Srinakharinwirot University, Bangkok, Thailand

⁵ Lecturer of Behavioral Science Research Institute, Srinakharinwirot University, Bangkok, Thailand

⁶ Lecturer of Behavioral Science Research Institute, Srinakharinwirot University, Bangkok, Thailand

Introduction

Nowadays, mobile phone usage has become an important part of daily lives in the general population, for the reason that it is a very efficient tool for quick and convenient communication. Mobile phone usage in Thailand has increased rapidly. Before 2002, there were 6 million registered numbers in total (Pollution Control Department, No date). But the mobile phone usage survey (2004) by Business Research Office, Krungthai Bank reported an estimated 21 million users of mobile phones in 2003; and a forecasted 28 million mobile phone users in 2004. The increased number of mobile phones included old phones' replacement and new ones. At the same time, advancement in communication technology has developed rapidly and continuously to satisfy a variety of users' requirements –besides the regular use for communication –i.e. camera-functions, live views, as a radio, a portable computer, etc., and the physical designs of handsets –i.e. shape, size, and weight, etc., change all the time by popular trends.

Mobile phone users thus alter usage in keeping with innovation of mobile phones and accessories. In most cases, the usage lifespan for mobile phone is 2 years, while the average usage lifespan for mobile phone battery is 1-2 years (Homsup, 2003). The ensuing problem is dealing with mobile phones and mobile phone batteries wastes. Although mobile phones are convenient and fast communication tools, many consequent impacts are evident, e.g. environmental impact from improper disposal of mobile phone wastes, and danger from improper use while driving automobile, etc.

Nonetheless, surveys of mobile phone-battery usage and disposal behaviors are limited, especially data from analysis of various factors leading to popular mobile phone waste disposal behaviors. Study of such data is therefore critical to find appropriate ways and methods to prevent and solve these problems from mobile phone usage.

Objective

The purpose of this research was to survey mobile phone-battery usage and disposal behaviors of Thai people, with the following specific objectives:-

1. To survey mobile phone usage.
2. To compare safe mobile phone usage behaviors and intention on proper disposal of mobile phone batteries when categorized by background.
3. To predict safe mobile phone usage behaviors and intention on proper disposal of mobile phone batteries.
4. To find key psychosocial factors differentiating people using different mobile phone-battery disposal methods.

An Integrated Concept: *Psychological and Environmental Factors on Disposal of Battery-Wastes*

Hansmann et al. (2006) proposed a contextual psychological model for proper disposal of used batteries by identifying key variables of behaviors of used batteries disposal, i.e. knowledge on proper disposal of batteries, attitude toward ecological waste disposal, rationale for involvement in battery disposal, and individual methods of battery disposal –e.g. a special place for storage of used batteries at home. Model testing on 1,000 18-years and older Swiss population found that knowledge on proper disposal of batteries, individual

methods of battery disposal, and rationale for non-involvement in battery disposal can explain behaviors of used batteries disposal at 38%; and that specific knowledge on proper disposal of used batteries correlates positively with proper disposal of used batteries. Hansmann et al recommended that in order to encourage people to be involved in proper battery disposal, there must be a sufficient communication of concept-specific information to the intended group, such as various waste disposal methods and facilities. In addition, the research also suggested that individual methods of battery disposal (e.g. separate storage area at home, and combining battery disposal with buying new products) encourage behaviors of proper battery disposal. These activities should be promoted through public campaigns, and storage assistance should be provided for individual methods of battery disposal; for example, in Switzerland used-battery storages are disbursed free of charge. Regarding rationale for non-involvement in battery disposal, this information can be used in specific public campaign. Rationales were denial of responsibility on improper battery disposal, denial of environmental hazard resulting from improper battery disposal, and problem with forgetting to dispose old batteries. Therefore, public campaigns may promote environmental criteria to encourage individuals' awareness of responsibility to the environment and the impacts of threats from improper disposal methods. Hansmann et al also discussed that specific knowledge and rationale for battery disposal are more closely correlated to battery disposal behaviors than general psychological variables. Of psychological variables, attitude toward ecological waste-disposal may have indirect influence on battery disposal behaviors.

Most of research concerning battery disposal were survey research. For instance, Robinson & Read (2005) had surveyed household waste disposal behaviors in London, England, and found that waste disposal behaviors in 2003-2004 were below local targets, due to insufficient public knowledge and understanding of waste disposal. Robinson & Read suggested that lack of understanding did not mean lack of concern. That is, it may be interpreted that local authorities had failed to communicate the subject of waste disposal to the public effectively. Thus, communication of the issue can have a major impact on individual's obligation in waste disposal, implying that involvement in waste disposal can be increased if authorities communicate waste disposal encouragement effectively and continually. In addition, survey results also found that major impediments to waste disposal involvement were a lack of motivation for waste disposal or punishment for non-disposal, sluggishness of waste disposal, lack of awareness on waste-disposal services, and operational problems. From a waste disposal study in Hong Kong (Chi-sun Poon, 1998), it was found that avoidance of waste disposal and recycling was due to low level of environmental awareness. That research made suggestion to policy makers to be concerned about methods to persuade the public to separate wastes for environmental reasons, especially monetary rewards as important motive for waste-separation systems to encourage people's involvement, in addition to waste separation knowledge promotion campaign to the public

Attitude-survey research on disposal of small electronic devices, e.g. telephones, toys and appliances, in small houses in England found that people were still lacking awareness on disposal of small appliances, unconcerned, disregarded and discounted this matter; and considered it easy to dispose small appliances, unable to identify specific small-appliance disposal methods. Unlike the disposal of large/major appliances, on which people were more concerned and able to identify specific disposal methods. (Darby & Obara, 2005).

Research in Thailand on usage and replacement behaviors of mobile phones and batteries in Bangkok Metropolitan Area (Pollution Control Department, No date) found that the majority of people—60%, never disposed of mobile phone-battery scraps. And in cases of

government agencies' initiatives on mobile phone-battery recycling in which users brought used mobile phones-batteries to discard in pre-arranged containers, most people—75.25%, cooperated, feeling that convenience stores, supermarkets and mobile-phone shops were convenient places to collect discarded mobile phones-batteries. Also, the majority of people—67.50%, would cooperate in disposing battery scraps when rewarded. This study revealed problems and obstacles in administration of mobile phone-battery scrap recycling program as follows: lack of collection centers for electronic scraps –especially lack of knowledge in separating hazardous wastes from general wastes and lack of proper management, no agency with direct management responsibility, lack of budget for recycling administration and expenses, the need for specialized technologies in recycling and disposal, lack of proper recycle and disposal centers for scraps of electronic products.

For this reason, to understand and explain mobile phone-battery usage and disposal behaviors appropriately must rely on behavioral science concepts that connect a person's various characteristics –i.e. individual background, knowledge of mobile phone-battery usage and disposal, attitude, and value—with how a person can perceive environment impacts from various styles of mobile phone-battery usage and disposal. This research thus relies on behavioral science concepts that integrate the background, knowledge, attitude and impact factors to explain and predict mobile phone-battery usage and disposal behaviors of Thai people.

Research Hypothesis

1. Non-student mobile phone users have more proper mobile phone usage behaviors and intention on proper mobile phone-battery disposal than those mobile phone users who are students.
2. High-age mobile phone users have more proper mobile phone usage behaviors and intention on proper mobile phone-battery disposal than Low-age mobile phone users.
3. Women mobile phone users have more proper mobile phone usage behaviors and intention on proper mobile phone-battery disposal than men mobile phone users.
4. High-education mobile phone users have more proper mobile phone usage behaviors and intention on proper mobile phone-battery disposal than Low-education mobile phone users.
5. Age, mobile phone-battery knowledge, convenient value, responsibility to the environment, awareness of mobile phone usage benefits, and awareness of mobile phone usage damages can jointly predict safe mobile phone usage behavior.
6. Age, mobile phone-battery knowledge, attitude toward mobile phone-battery disposal, convenience value, external motivation on mobile phone battery disposal, responsibility to the environment, mobile phone-battery information awareness, awareness of mobile phone battery disposal benefits, awareness of mobile phone battery disposal damages, awareness of mobile phone usage benefits, and awareness of mobile phone usage damages can jointly predict intention on proper mobile phone battery disposal.
7. Age, mobile phone-battery knowledge, attitude toward mobile phone-battery disposal, convenience value, external motivation on mobile phone battery disposal,

responsibility to the environment, mobile phone-battery information awareness, awareness of mobile phone battery disposal benefits, awareness of mobile phone battery disposal damages, awareness of mobile phone usage benefits, awareness of mobile phone usage damages, safe mobile phone usage behavior, and intention on proper mobile phone battery disposal can jointly categorize people using various mobile phone disposal methods.

Research Methodology

Sample Group

The sample group used in this research comprises 2 groups:-

Group 1: Teenage mobile phone users in Bangkok; 400 Secondary grade 4-6 students, 200 vocational/advanced vocational students, 100 students of private universities, and 400 students of public universities; 1,100 in total.

Group 2: General mobile phone users not more than 60 years old in Bangkok; 550 civil servants and state enterprise employees, 200 private employees, 100 private business operators, 50 workers and 100 housewives; 1,100 in total.

Research Instruments

Research instruments used in the research comprise survey forms and questionnaires constructed by the researchers, all of which in the form of descriptions asked respondents to indicate to the extent to which they agreed with statement by using a 5-point Likert scale, except for the mobile phone-battery knowledge questionnaire. Details are as follows:

1. **General information Survey Form on mobile phone-battery usage.** This survey form consists of 4 parts:-
 - 1.1. **General information of mobile phone-battery usage.** Such as mobile phone expenses, mobile phone-battery changing, number of mobile phones/batteries changed, mobile phone use.
 - 1.2. **Mobile phone usage characteristics.** This survey form was an inquiry on respondents' mobile phone usage characteristics for various objectives, e.g. to listen to radio, for private conversations and for taking photographs.
Example of descriptions:
 - Mobile phone usage for private communication and conversation.
 - Mobile phone usage for taking photographs.
 - 1.3. **Mobile phone usage behaviors.** This survey form was an inquiry on mobile phone communication usage in various places which were circumstantially inappropriate for mobile phone use.
Example of descriptions:
 - Mobile phone usage for communication during meals.
 - Mobile phone usage for communication while crossing streets.

1.4. Safe mobile phone usage behaviors. This survey form was developed by the researchers from questionnaire of Safe Mobile Phone Usage Behaviors (Chanchanakit, 2004) on safe mobile phone usage and without harms to users.

Example of descriptions:

- I use mobile phone anywhere without consideration on the proximity to high-voltage power lines.
- If I need to take a shower, I often take the mobile phone into the bathroom with me so that when someone calls I can answer the phone instantly.

2. Measurement of proper mobile-phone battery disposal intent. This questionnaire measures individual's intention or will to properly dispose of depleted, unusable and expired batteries to avoid hazardous pollutions, i.e. air, water and natural environment.

Example of descriptions:

- I intend to engage in proper mobile-phone battery disposal.
- I will not dispose mobile-phone batteries in general garbage bins or public garbage.

3. Measurement of mobile phone-battery knowledge. This questionnaire measures individual's knowledge and understanding of proper and safe mobile phone usage, as well as proper disposal of mobile-phone batteries, without personal and environmental harms or pollution. The form consisted of 14 descriptions and a 2-choice response –yes and no.

Example of descriptions:

- Leaving a mobile phone in hot-temperature places may damage it.
- Mobile-phone batteries are not harmful to human or the environment.

4. Measurement of mobile phone-battery information awareness. This questionnaire measures individual's awareness and information update on mobile phone and battery disposal.

Example of descriptions:

- You know mobile phone maintenance methods to ensure long usage life.
- You know that there is a campaign to take mobile phone batteries for disposal in designated places.

5. Measurement of convenient value. This questionnaire measures the value individuals place on action or consumption that makes daily lives easier and effective, using less time and effort.

Example of descriptions:

- I prefer to dispose all types of garbage together, instead of sorting different types of garbage into separate bags.
- I like to use mobile phone to call a person whom I want to communicate with, even when I am at home which is equipped with a landline telephone.

6. Measurement of awareness of mobile phone usage impacts. This questionnaire measures individuals' awareness of mobile phone usage benefits from communication speed and from the many functions of mobile phone, including awareness of negative impacts of mobile phone usage on health, environment, culture, communication and personal relationship.

Example of descriptions:

- Can perform many functions with only a mobile phone.
 - Hazardous to one's health.
7. **Measurement of attitude toward mobile-phone battery disposal.** This questionnaire measures individuals' beliefs on values and benefits of proper disposal of mobile-phone batteries.
- Example of descriptions:
- You believe that sorting of wastes is useless.
 - Degenerated mobile-phone batteries can be discarded or disposed of anywhere.
8. **Measurement of responsibility to environment.** This questionnaire measures individual's care and concern on maintaining the environment in conditions that are balanced, sustainable, and providing utility to human; including constructive use of natural resources.
- Example of descriptions:
- Preservation of the environment is a government's concern; the general public does not need to be responsible for.
 - Reuse of recycled items is not appropriate.
9. **Measurement of external motivation on mobile-phone battery disposal.** This questionnaire measures individuals' desire to dispose of old mobile-phone batteries in designated containers in stores or at battery disposal spots, relying on external motivation, i.e. acceptance from friends and society, as well as rewards and compensation from that action.
- Example of descriptions:
- I will receive compensation such as money or items from this action.
 - I will take the action because someone coerces me to do.
10. **Measurement of awareness of mobile-phone battery disposal impacts.** This questionnaire measures individuals' awareness of benefits from proper mobile-phone battery disposal and damages from improper mobile-phone battery disposal.
- Example of descriptions:
- Sorting mobile-phone batteries helps reduce problems of environmental pollution.
 - Toxins in degenerated mobile-phone batteries can contaminate soil and water

Characteristics of questionnaires used in this research are shown in Table 1*Table 1*Number of questions, Cronbach's Alpha (α), and Item discrimination coefficients(r)

Variables	Number of questions	α	r
Mobile phone usage characteristics	23	.92	.10 — .73
Improper mobile phone usage behaviors	8	.71	.31 — .48
Safe mobile phone usage behaviors	10	.85	.43 — .65
Intent on proper mobile-phone battery disposal	8	.77	.10 — .67
Knowledge on mobile phone-battery	14	.74	.17 — .53
Convenient value	6	.72	.36 — .57
Awareness of mobile phone usage impacts	18	.88	.38 — .61
– Benefits	9	.88	.47 — .71
– Damages	9	.83	.39 — .67
Attitude toward mobile-phone battery disposal	8	.90	.57 — .78
Responsibility to the environment	7	.82	.50 — .69
Motivation of mobile-phone battery disposal	7	.84	.46 — .68
Awareness of mobile-phone battery disposal impacts	12	.81	.15 — .68
– Benefits	6	.81	.32 — .68
– Damages	6	.74	.22 — .68

Data Collection

The researchers compiled data with the following steps:-

1. Contacted agencies concerned with all sample groups by letter from the Director of Behavioral Science Research Institute, Srinakharinwirot University to agencies' heads to request cooperation in data compilation, during January – March, 2006.

2. Arrange group meetings of researchers and assistant researchers to plan data collection from 1,000 teenage mobile phone users in secondary schools, vocational colleges, state and private universities, and from 1,000 working-age general population not more than 60 years of age.

3. Researchers and assistant researchers divided up for data collection as planned, receiving returned questionnaires as follows:— Students mobile phone users at grade 4-6 Secondary, vocational/advanced vocational, year 1-4 universities: 1,100 questionnaires sent, returned and selected only completed questionnaires of 1,092, or 90.27%. General mobile

phone civil servants / state enterprise, private employees, private operators, workers and housewives: 1,100 questionnaires sent, returned and selected only completed questionnaires of 1,036, or 92.73%.

Analysis of Data

Data analysis was performed using SPSS application program to calculate basic descriptive statistics of samples and variables. Comparison of safe mobile phone usage behaviors and intent on mobile-phone batteries disposal grouped by backgrounds performed using the t-test and F-test. Prediction of safe mobile phone usage behaviors and intent on proper mobile-phone batteries disposal was performed by Multiple Regression analysis. And classification of people using various mobile-phone battery disposal methods was performed by Discriminant Analysis.

Summary of Research Results

1. Students spend an average of 505 Baht per month of mobile-phone expenses, use mobile phone approximately 39 minutes for each time. Non-student general users spend an average of 709 Baht per month of mobile-phone expenses, and use mobile phone approximately 17 minutes each time. Most users of mobile phone for communication never use mobile phones while crossing street and while in the presence of teachers, professors or superiors. The majority of mobile phone users use mobile phones for communication with families.

2. Most of student mobile-phone users have never changed mobile-phone batteries; while non-student users have changed on average 2 pieces of mobile-phone batteries. Of mobile phone users with degenerated batteries, the majority of have not discarded them – keeping them at home (47%), followed by discarded with other garbage (29.3%), left at stores when changing batteries (28.7%), disposed of in sorted waste (23.1%), and assembled to be disposed at designated disposal spots (14.8%).

3. Non-student mobile-phone users have higher safe mobile phone usage behaviors and intention on proper mobile-phone battery disposal than student mobile-phone users. Mobile-phone users 20-years and older have higher safe mobile phone usage behaviors and intention on proper mobile-phone battery disposal than younger mobile-phone users. Among non-student mobile-phone users, it is found that female mobile-phone users have more safe mobile phone usage behaviors than male, and users with higher education levels have more intention on proper mobile-phone battery disposal than mobile-phone users with lower education levels.

4. Convenient value, mobile phone-battery knowledge, age, and responsibility to the environment are critical variables for the prediction of safe mobile phone usage behaviors; all 4 variables jointly predict safe mobile phone usage behaviors in the whole group at 29%. When considered in each variable group, it is found that the psychological factors have the highest prediction power.

5. Mobile phone-battery information awareness, attitude toward mobile-phone battery disposal, awareness of mobile-phone battery disposal benefits, responsibility to the environment, age, and awareness of mobile-phone battery disposal damages are critical variables for the prediction of intention on proper mobile-phone battery disposal; all 6

variables jointly predict intention on proper mobile-phone battery disposal in the whole group at 33%. When considered in each variable group, it is found that knowledge and awareness factors have the highest prediction power.

6. The group that use mobile-phone battery disposal method of discarding along with other garbage have low intention on proper mobile-phone battery disposal, low attitude toward proper mobile-phone battery disposal, low mobile phone-battery knowledge, and high external motivation on mobile-phone battery disposal. This group can be correctly discriminated at 65.5%.

Discussion

Results of the research that compared safe mobile phone usage behaviors and intent on proper mobile-phone battery disposal among sample groups of different bio-social characteristics mostly support hypothesis #1: non-student mobile phone users have more proper mobile phone usage behaviors and more intention on proper mobile phone-battery disposal than those mobile phone users who are students. The characteristics of sample groups were that of the non-student mobile phone users group, most are highly educated – bachelor degree or higher, and most are civil service or state-enterprise officers. This is possibly due to the fact that individuals with higher education tend to possess higher knowledge and understanding of proper and safe mobile phone-battery usage, as well as knowledge of proper mobile phone-battery disposal, than students with less knowledge and understanding of such matters. Additional analysis revealed that the group of higher than bachelor degree has higher safe mobile phone usage behaviors than the group of lower than bachelor degree ($t = -2.657$, $p < .01$), and has more proper mobile-phone battery disposal behaviors ($t = -5.648$, $p < .01$). This corresponds with the research of Tong-un, Cholticha (Nilachati, 2002: 43 cited from Tong-un, 2000) and Dokthian, Somrudee (2000), which found discrepancies between educational levels in the subject of garbage disposal. This research result also supports hypothesis #2: higher-age mobile phone users have higher proper mobile phone usage behaviors and intention on proper mobile phone-battery disposal. Non-students are also of higher average ages than students. And from additional analysis by the researchers, it was found that the higher-age group has more knowledge of mobile phone usage than the lower-age group; resulting in a higher level of proper mobile phone usage and more intention on proper mobile phone-battery disposal.

Research results that have not fully supported hypothesis are differences between male and female –hypothesis #3, about which this research found difference only on safe mobile phone usage behaviors: the non-student female group have higher safe mobile phone usage behaviors than male. In other groups, no differences between genders were found. This shows that only working women are more careful about safe mobile phone usage than working men; but among male and female students, mobile phone usage behaviors are similar, and intention on proper mobile phone-battery disposal are alike.

From the aforementioned research results, it is not surprising that both mobile phone-battery knowledge and age can predict safe mobile phone usage behaviors which partly supports hypothesis #6. Convenient value can predict safe mobile phone usage behaviors but in a negative manner, because a person who likes convenience, resource and energy saving often prefers to use mobile phone as convenient for speed in every occasion, thus less safety considerations. That responsibility to the environment is another good predictor may be

because persons who are responsible to the environment will ensure lasting environment for the benefits of all people, they will use things—including their mobile phones—considerately, with concerns for the safety of themselves and others.

That mobile phone-battery information awareness cannot predict safe mobile phone usage behaviors was due to the fact that measurement of information awareness on mobile phone-battery in this research was mostly matters of updating on mobile phone operations and maintenance, while safe mobile phone usage behaviors concern safety of users and mobile phones. In the same way, awareness of mobile-phone battery usage benefits and damages cannot predict safe mobile phone usage behaviors, because awareness of benefits refers to the many uses and functions of mobile phones; thus not connected with safe mobile phone usage behaviors. When considering correlation coefficient, no correlation was found ($t = .008$, $p < .73$). Even though awareness of mobile-phone battery usage damages has some correlation to safe mobile phone usage behaviors, the correlation is low ($t = .10$, $p < .01$), but compared with other variables with higher correlations, awareness of mobile-phone battery usage damages is not a good predictor variable.

On variables that can predict intention on proper mobile phone-battery disposal, the research results mostly support hypothesis #6: that age, attitude toward mobile phone-battery disposal, responsibility to the environment, mobile phone-battery information awareness, awareness of mobile phone battery disposal benefits, and awareness of mobile phone battery disposal damages can jointly predict intention on proper mobile phone battery disposal. Research results also found that impact variables—i.e. mobile phone information awareness, awareness of mobile-phone battery disposal benefits and awareness of damages have the highest prediction power among all variables that can predict. Because awareness of information enables people to know about methods or of campaigns for battery disposal in proper or designated locations, thus enables them to know how to dispose batteries properly, and possibly leads to intention on proper mobile phone battery disposal. That a person is aware of benefits of proper mobile-phone battery disposal benefits and aware of damages from improper mobile-phone battery disposal because of the belief that an action (in this case, battery disposal) will lead to positive or negative results, influencing attitude in predicting behaviors. And attitude toward behavior leads to intention or will to perform that behavior, in accordance with the Theory of Planned Behavior (Ajzen, 2002).

Awareness of mobile-phone battery usage benefits and damages cannot predict intent on mobile-phone battery disposal, because it is about mobile phone use, which concerns little on mobile-phone battery disposal. Aware of mobile-phone battery disposal damages is more related and thus can predict. Regarding mobile phone-battery knowledge, even though correlates to intent on proper mobile phone battery disposal ($r = .235$, $p < .01$), but because the knowledge variable has a high correlation with other predictor variable—i.e. attitude toward mobile-phone battery disposal ($r = .529$, $p = .001$), the standard error of coefficients is high, making these coefficients of no statistical significance when tested individually (Pedhazur, 1997; 106-107). Similarly, external motivation is highly correlated with attitude ($r = -.490$, $p = .001$), and thus may be interpreted likewise. That is, the statistical method to select a critical predictor-variable will predict only one variable in the case that those predictor pairs have a high correlation between them and each is highly correlated to independent variables, to eliminate redundancy of predictors.

As for the convenience variable (convenient value)—which was expected to be a variable that can predict intent on proper mobile phone battery disposal—because persons with

preferences for convenience are likely to discard batteries at their own convenience. But this value cannot predict, perhaps due to the fact that the measurement of this value was to measure value that is of general trait, not specific in context. For subsequent research, it may be necessary for preliminary verification whether the measured convenient value can be generalized in all contexts or in some specified contexts only.

In searching for variables that can classify persons with mobile phone battery disposal behaviors of discarding them along with other wastes from those with other disposal methods, results found partially support hypothesis #7. The results are consistent with the Theory of Planned Behavior (Azjen, 2002), which found that variables that can predict or discriminate behaviors are intention, attitude, and knowledge –which is a component of attitude. Of external motivation, it may be considered other supporting factors arising from external motivators and creating incentive for action.

In summary, the research results mostly support research hypotheses. That is, the critical variables to predict behaviors of mobile phone-battery usage and disposal are knowledge, information awareness, and responsibility to the environment. Concerning other variables – which although may not be predictors, some deserve attention because they correlate with predictors. In addition, they may also be important in applications; for example, a promotion or campaign to get mobile phone users with degraded batteries to bring in for proper disposal by external incentives, combined with request for people cooperation.

Recommendation

1. Recommendations on using research results.

Recommendations to organizations or agencies concerned with providing mobile phone services, which can utilize the research results in policy formulation of services and quality of life promotion in mobile phone users, are as follows:-

Utilization of data from surveyed mobile phone of youths –who are teenage students, and the usage behaviors of working persons; which showed different usage behaviors, is beneficial to provide services consistent with needs and evident situations. For instance, reduction of fees for communication with family members, setting the mobile phone fee-rate structure charging varying rates on usage time of day.

Promotion or campaign to raise awareness of mobile phone users with degraded batteries on risks and dangers of keeping them –chemicals leakage, or not properly disposed. For example, warnings on mobile phone leaflets/manuals, general announcement in mass media, etc., including urging those responsible to arrange mobile-phone battery disposal spots in clearly noticeable mobile phone shops and public locations.

There should be more regular campaigns on safe mobile phone usage to inform general public, in schools, education institutions and communities.

There should be a stipulation of clear and serious measures on administration and disposal of mobile phone batteries, to prevent problems that are ever increasing due to increasing battery usage.

2. Recommendations on subsequent research.

Area of research scope should be expanded, beyond the Bangkok metropolitan area; probably research in one single region of the nation or in several areas simultaneously.

There should be research using qualitative method, or participatory action research on mobile-phone battery disposal direction, by the various parties concerned –e.g. distributors, Ministry of Natural Resources and Energy, to obtain more detailed and comprehensive data. In addition, experimental research may be used to study effects of dissemination of knowledge, information and news on dangers of mobile phone usage and improper battery disposal, and development of responsibility to the environment.

Researchers should consider studying other independent variables or predictors, aside from those studied in this research; for example, personality, conducts of those close to mobile phone users in usage and disposal of mobile phones-batteries.

Studies should be done on businesses that are sellers of mobile phones-batteries –who are closest to the source, on finding avenues to solve this problem, including the involvement of selling stores.

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