

Evaluation of Hospital Pharmacy Personnel's Productivity through Work Measurement

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ABSTRACT

The objectives of this study were to determine the proportion of working time pharmacists and pharmacy staff used in performing their tasks, and to analyze the proportion of working time pharmacists used in carrying out the patient-care activities. The fixed-interval work sampling by a trained observer was used as a method of data collection at outpatient and inpatient pharmacy service units, Nakornping Hospital, Chiang Mai. From September 4 to November 28, 2003, a total of 34,328 observations were made. The results showed that, on average, pharmacists spent 65.3% of the total working time on work. The top two activities in which pharmacists spent most of their time were dispensing (14.7%), and patient counseling and education (14.4%). The inpatient-service pharmacists spent a significantly higher average percentage of total time on work (70.6%) than did the outpatient-service pharmacists (59.6%) ($F = 23.448$; p -value = .000). However, they did not differ in the average percentage of time spent on patient care or professional activities (44.7% for outpatient pharmacists versus 43.1% for inpatient pharmacists) ($F = 9.992$; p -value = .123). The pharmacy staff spent an average of 66.3% of the total working time on work. Compared to the outpatient-service staff, the inpatient-service staff spent a significantly larger proportion of time on work (73.4% for inpatient staff versus 58.7% for outpatient staff; $F = 193.296$; p -value = .000). The findings from this study could serve as a basis in planning the improvement of working efficiency and the manpower management for the pharmacy services at Nakornping Hospital, as well as a model for work measurement in other settings.

Key words: Work measurement, Work sampling, Pharmacy workload, Pharmacy productivity

INTRODUCTION

Under the current economic conditions, all administrators are challenged with the issue of cost containment. They must be able to slow the rate of increasing costs by operating in a manner that balances between the tradeoffs among efficiency, quality, and organization growth. The hospital pharmacy directors are among those managers who are expected to minimize costs while providing quality services efficiently. Work measurement serves as an aid in the evaluation and improvement of staff productivity.

Fixed-interval work sampling, which is a work measurement technique designed by industrial engineers, allows the indirect measurement of the proportion of time spent by employees on various activities during a specified period under actual working conditions (Richardson, 1976). A large number of instantaneous observations are taken at predetermined intervals (e.g. every ten minutes) to determine the proportion of time spent on any work and non-work activities. It is therefore possible to assess those activities of workers for productivity and professionalism. The later determination is also considered valuable to the hospital's pharmacy service department in deciding how pharmacists can be used to maximize time spent on professional or patient care activities. By reducing the time pharmacists spend on non-work and nonprofessional activities, more efficient use of personnel and of payroll money can be achieved.

The question of how pharmacists and pharmacy staff use their time has been the basis for several studies on pharmacy work measurement conducted in other countries (Summerfield et al., 1978; DiPiro et al., 1979; Dostal et al., 1982; Wellman et al., 1986; Barsness and Trinca, 1987; Nickman et al., 1996). However, the data specific to Thai pharmacy which operates in a quite different health-care system are limited to a few studies where work sampling was conducted over a short period of time. For example, in a work sampling study by Veraanuntavat et al., (2001) at Sena Hospital, only 25 days of observation was carried out. The observation of a small number of workdays would possibly provide inaccurate estimates since workloads might vary considerably from day to day. Furthermore, from our literature review, we are not aware of any literature in Thailand that reports the amounts of time hospital pharmacists spend performing patient care or professional activity. The purpose of this study was to document the extent of productive hospital pharmacist and pharmacy staff activities by using a work sampling technique, employing a large numbers of observations over an extended period of time. For the pharmacists, the extent of working time spent on professional activities was also reported. These data are necessary for task delegation or staff pattern improvement, and for assessment of the impact of future interventions aimed at improving working productivity and professionalism.

MATERIALS AND METHODS

This study was conducted at the Pharmacy Department, Nakornping Hospital in Chiang Mai province. The hospital is a public 500-bed institution. Its Department of Pharmacy consists of two patient service units, the outpatient and the inpatient units, which are directly involved in patient medication distribution. The outpatient unit is divided into three sub-units, OPD1, OPD2 and Emergency OPD. The inpatient unit consists of two sub-units, IPD1 and IPD2. At the time of the study, there were 5 pharmacists and 12 technicians providing patient services in the outpatient unit, and 6 pharmacists and 12 technicians in the inpatient unit.

Daily activities of the pharmacists and staff in each pharmacy service sub-unit were identified and compiled to construct an activity list for pharmacy personnel (Appendix A). The identification of activities was performed through a combination of methods to ensure that all activities were identified, including a review of written job descriptions for pharmacists and pharmacy staff, the observations made by the investigator (KA), and a consulta-

tion with the unit supervisors. After the list of activities had been finalized, the observation forms were made for pharmacist and staff observation. A pilot study was then conducted over a week (July 7-11, 2003) to acquaint the observer (KA) with using the forms and to see if any activities were left out.

The work sampling was conducted on 60 workdays, including meal periods, between September 4 to November 28, 2003. The activities of individual employees were observed and recorded by the investigator (KA) every 20 minutes, starting at 8:15 a.m. to 3:45 p.m. daily. If an employee was absent at the time of observation, his/her location and activities would be determined and appropriately noted. The sample size (i.e. the number of observations) was estimated by using a standard formula (Dostal et al., 1982). With a sampling error of 5% or less, at least 920 observations had to be made for each person. The data collection was not disguised, but the pharmacy personnel were not informed of the specific time that they would be observed.

The observed activities were grouped into productive (i.e. work) or non-productive (i.e. idle) category for individual pharmacists and staff. The proportions of the total number of productive activities to the total number of observations were computed to represent the productivity of personnel in each unit. The comparisons of the personnel productivity between the outpatient and inpatient units were carried out, using Analysis of Variance (ANOVA). The pharmacists' productive activities were then classified as professional or non-professional, based on whether or not such activities were related to patient care. This classification was carried out according to a review of related literature, and was finalized by a review by the unit supervisors. The proportions of the number of professional activities to the number of observations were calculated and compared between the two units. Data analysis was performed by using SPSS version 10.0. An a priori level of significance of .05 was used for all hypothesis testing.

RESULTS

During the study period, a total of 34,328 observations, or 960 to 980 observations per person, were made. An average percentage of productive activities across all pharmacists were 65.3% (Table 1). In other words, pharmacists spent an average of 65.3% of the total working time on work, while spending 34.7% on non-productive activities (i.e., idle activities). The inpatient-service pharmacists spent a significantly higher average percentage of total time on work (70.6%) than did the outpatient-service pharmacists (59.6%) ($F = 23.448$; $p\text{-value} = .000$). For working activity, the outpatient pharmacists spent most of the time on patient counseling and education, and dispensing whereas the inpatient pharmacists spent most of the time on screening and consultation, dispensing and management activities. For most of the nonproductive time, the outpatient pharmacists were present with no pharmacy function and were taking coffee and lunch breaks. The inpatient pharmacists also spent most of the idle time on breaks.

Table 1. Percentage of Time Pharmacists Spent on Activities.

		Activity	Percentage of time ¹		
			OPD	IPD	OPD & IPD
Work	Professional work	Screening & Consulting	1.11	24.32	12.72
		Reporting & Documentation	1.22	3.11	2.17
		Dispensing	16.92	12.43	14.68
		Counseling & Education	25.44	3.26	14.35
		Total (professional)	44.69	43.12	43.92
	Non-professional work	Teaching & Training	1.61	2.42	2.01
		Meeting	4.36	4.21	6.11
		Management	1.07	10.66	4.17
		Clerical work in dispensing	4.29	6.52	5.40
		Inventory control	0.50	0.32	0.41
		Miscellaneous	3.12	3.39	3.25
		Total (non-professional)	14.95	27.52	21.35
		Total (work)	59.64	70.64	65.27
Idle	Idle	Vacation & leaves	5.55	8.46	7.00
		Absence	3.53	2.84	3.19
		Presence with no pharmacy function	19.50	6.59	13.04
		Coffee and lunch breaks	11.19	11.38	11.29
		Total (idle)	39.77	29.27	34.52

¹Percentage may not add up to 100 because of round-off effect.

The pharmacist productive (i.e., work) activities were classified as professional or non-professional, depending upon whether or not such activities were directly related to patient care. The percentage of time pharmacists spent on professional activities was also shown in Table 1. On average, the outpatient and inpatient pharmacists spent similar proportions of time on professional activities (44.7% for outpatient pharmacists versus 43.1% for inpatient pharmacists) ($F = 9.992$; $p\text{-value} = .123$). However, the professional to non-professional activity ratios were 2.49 and 1.57 for outpatient and inpatient pharmacists, respectively.

The pharmacy staff spent an average of 66.3% of the total working time on work (Table 2). Compared to the outpatient-service staff, the inpatient-service staff spent a significantly larger proportion of time on work (73.9% for inpatient staff versus 58.6% for outpatient staff; $F = 193.296$; $p\text{-value} = .000$). Most of the working activities for staff in both units involved clerical work in dispensing, inventory control and miscellaneous work. The staff in outpatient unit spent most of the idle time on presence with no pharmacy function and breaks while the inpatient staff spent most idle time on breaks.

Table 2. Percentage of Time Staff Spent on Activities.

Activity		Percentage of time ¹		
		OPD	IPD	OPD & IPD
Work	Screening & Consulting	0.05	0.01	0.03
	Reporting & Documentation	0.00	0.00	0.00
	Dispensing	0.04	0.01	0.03
	Counseling & Education	0.77	0.07	0.41
	Teaching & Training	0.01	0.01	0.01
	Meeting	0.18	0.80	0.49
	Management	0.57	2.47	1.52
	Clerical work in dispensing	34.86	50.81	42.83
	Inventory control	18.35	9.46	13.91
	Miscellaneous	3.85	10.30	7.07
Total (work)		58.68	73.94	66.30
Idle	Vacation & leaves	7.96	4.14	6.05
	Absence	3.55	1.10	2.57
	Presence with no pharmacy function	17.46	8.39	11.89
	Coffee and lunch breaks	12.35	12.59	12.25
	Total (idle)	41.32	26.22	32.76

¹Percentage may not add up to 100 because of round-off effect.

DISCUSSION AND CONCLUSION

The comparison between the personnel’s percentages of time spent on work found in the current study and the results from previous studies conducted at other hospitals in Thailand is considered inappropriate since the discrepancy in activity categorization, work process, the number of employees, and the pharmacy department layout would yield different figures of time spent on work among settings. Therefore, the Office of the Civil Service Commission’s regulation is used as a gold standard. The regulation specifies that a government employee works in a period of 8 hours a day, which consists of 6 hours (75%) of actual working and 2 hours (25%) of breaks. The findings from this study indicate that, on average, pharmacists and pharmacy staff spent a lower percentage of time on work when compared to that specified in the regulation. Most of the idle time was breaks and presence with no pharmacy function. Considering that breaks are necessary for all employees, pharmacy administrators may need to investigate the flow or process of work in order to minimize the period in which pharmacy personnel, particularly those working in the outpatient-service unit, are present with no activity (e.g., waiting to perform the next step of work, etc.).

The results showed that pharmacists in the patient-service units, who were expected to spend most time on patient-care activities, spent less than half of the working time on such activities (mean: 43.9%). Furthermore, the pharmacists, particularly those in the inpatient unit, spent a considerable proportion of time on non-professional activities which could be delegated to pharmacy staff. If the efficient use of pharmacists involves maximizing the ratio of professional to non-professional activities, it is the duty of the administrators to eliminate obstacles which prohibit pharmacists from performing professional activities. This includes the improvement of staffing arrangement and job assignment.

Some limitations of the study must be acknowledged. Firstly, the observations in work measurement could cause subject reactivity, or in other words, pharmacy personnel might behave differently when observed. To minimize the reactivity, all pharmacy employees in the patient service units were informed about the purpose of the study which aimed at improving productivity and efficiency of the personnel as a whole, not of the individual person. Furthermore, the expansion of observations over a 3-month period as well as a large number of observations made for each person would help lessen the reactivity of the subjects. DiPiro et al., (1979) found that subject reactivity significantly decreased when the observation lasted longer than 1 week or the number of observations was larger than 750.

Secondly, work sampling through observations may suffer from an observer bias in which the observers must draw inferences from what they see in order to document the activity taking place (Nickman et al., 1996). Use of a group of observers, rather than one observer, may intensify the problem if there is a difference among observers in drawing inferences from a similar activity. Some cognitive professional activities, such as pondering over whether a therapeutic regimen is appropriate, may not be captured by observers. In the current study, only one trained observer was used in order to avoid inter-observer variation in recording the activities. In addition, an attempt was made by the observer to correctly determine the activities, such as by asking questions or moving closer to a subject.

Finally, since the study was conducted in only one hospital, its limited generalizability must be considered when one applying the findings from this study to other settings.

In summary, work sampling provided information about pharmacy personnel's use of time. The time was not used optimally since the idle portions were larger than that specified by the Office of the Civil Service Commission. For pharmacists, a substantial proportion of time was also spent on non-professional activities. This information is helpful in setting goals for future improvement and redirection of time. Further analysis of work flow and manpower needs should be undertaken to complement the results from this study.

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Appendix A – List of activities

Work category

- I. Professional: Working activities involve direct or indirect care of patients.
 - Screening & Consulting: Examining drug regimen of a patient for possible drug-related problems, communication with a physician or nurse concerning dispensing problems, and discussing dispensing question with other pharmacy staff
 - Reporting & Documentation: Writing and maintaining a patient medication profile, and recording medication error and counseling forms.
 - Dispensing: Inspecting drugs to be dispensed, handling drugs to a patient, and checking dispensing-related work done by pharmacy staff (e.g., checking unit dose carts filled by technicians, etc.)
 - Counseling & Education: Performing individual patient counseling, and providing drug information to individual patients.
- II. Non-professional: Working activities not involve direct or indirect care of patients.
 - Teaching & Training: Teaching pharmacy students, and giving a lecture to other health care providers
 - Meeting: Attending a seminar or meeting in the Pharmacy Department, other departments, or other organizations outside the hospital
 - Management: General coordination, planning and writing work schedule, and giving instruction to pharmacy technicians
 - Clerical work in dispensing: Typing labels for drugs to be dispensed, counting items (e.g., capsules, tablets, etc.) and placing them in a container, and computing patient charges

- Inventory control: Process returned medicines, and stock shelves
- Miscellaneous: Performing any activities related to Hospital Accreditation (HA) and other risk management, Maintenance and upkeep of pharmacy area, correcting computer data not specific to patient care, and reading literature for personal knowledge

Idle category

- Vacation & leaves: Taking a permitted vacation or leaves
- Absence: Not present in the Pharmacy Department and other areas in the hospital with unknown reasons
- Presence with no pharmacy function: Non-pharmacy related talk, and waiting to perform a pharmacy function
- Coffee and lunch breaks: Taking breaks for snack, coffee and lunch

A Survey on the Opinions of Malaysians Pertaining to Mobile Phone Features: Price, Feature, Function, Technology and Accessory

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ABSTRACT

Today, the mobile phone is no longer a luxurious item that only the high-income group can afford, but has become an important item of telecommunication and is affordable to people from all walks of life. Hence, knowledge of mobile phone purchasers' preferences is useful to the industry as it would impact the sales of mobile phones. This paper presents the outcomes of a survey on the purchasing preferences on the mobile phones. Data was collected from 200 respondents with age ranging from 10 years to 51 years and above via a questionnaire survey. Results show that the majority of Malaysians are willing to spend between RM401-RM600[†] to purchase a mobile phone; the short messaging service (SMS) is used widely by users aged 31 years and above; the ringtones is the most popular entertainment function preferred by all the five age groups surveyed; the personal organiser is most preferred by those aged between 10-50 years; the digital camera is the most popular embedded mobile phone technology by all the five age groups surveyed; and the battery is considered the most important accessory in a mobile phone.

Key words: Opinions, Mobile phone features, User preferences, Malaysians.

INTRODUCTION

A decade ago, mobile phones were considered luxurious items that were beyond the means of the medium and low income groups. Today, they have made their way into our daily lives as a considerably cheap and important means of telecommunication for people from all walks of life. Astoundingly, the growth of mobile phone usage and mobile networks has been so strong that it even weathered the financial crisis of 1997. In South East Asia, cellular mobile subscribers grew at an average of 63 per cent a year between 1991 and 1997. During the financial crisis in 1997, the number of subscribers continued to grow, though at a lower rate of 45 per cent a year. The growth rate increased sharply in the year 2000 to 75 per cent, the highest increase since 1995 (Datafile of Asia Pacific Telecommunication, 2002).

[†]1 US\$ = RM4.00 (approx.)

Mobile phones in Malaysia began to proliferate from 1980 to 1989 with the introduction of cellular phones. Multiple base stations were located relatively close to each other, and there were protocols for the automated hands-off between two cells when a phone moved from one cell to the other. During this period, mobile phones were somewhat larger than current ones, and many were designed for permanent installation in cars or as transportable phones (Koh, 2003). As technology improved, the larger phones evolved into smaller hand-held phones.

Two main technologies are used in mobile phones - cellular and satellite. Earlier mobile phones were analogue-based whereas newer ones are digital-based (Bellis, 2001). Presently, there are several different cellular technologies, which include Global System for Mobile (GSM), Code Division Multiple Access (CDMA), and Digital Enhanced Cordless Telecommunication (DECT). The mobile phone technology is often divided into several generations, the 1-generation (1G), 2-generation (2G), 2.5-generation (2.5G) and the 3-generation (3G). The evolution of the mobile phone can be depicted as in Figure 1 (Koh, 2003). There are different methods of classifying what constitutes a particular generation. One is chronological, based on the time of introduction with $\frac{1}{2}$ generations introduced for advances based on a particular technology. The second method is based on the data rate. One classification puts the boundaries between generations as follow: 2G is 7-28.8kbit/s, $2\frac{1}{2}$ G is 50-144kbit/s and 3G is 384kbit/s-2Mbit/s. The main drive in the evolution of mobile phones from 2G to 2.5G and 3G has been an increase in the available data rate. The fourth generation (4G) is expected to roll out in the year 2010 (Captick, 2004).

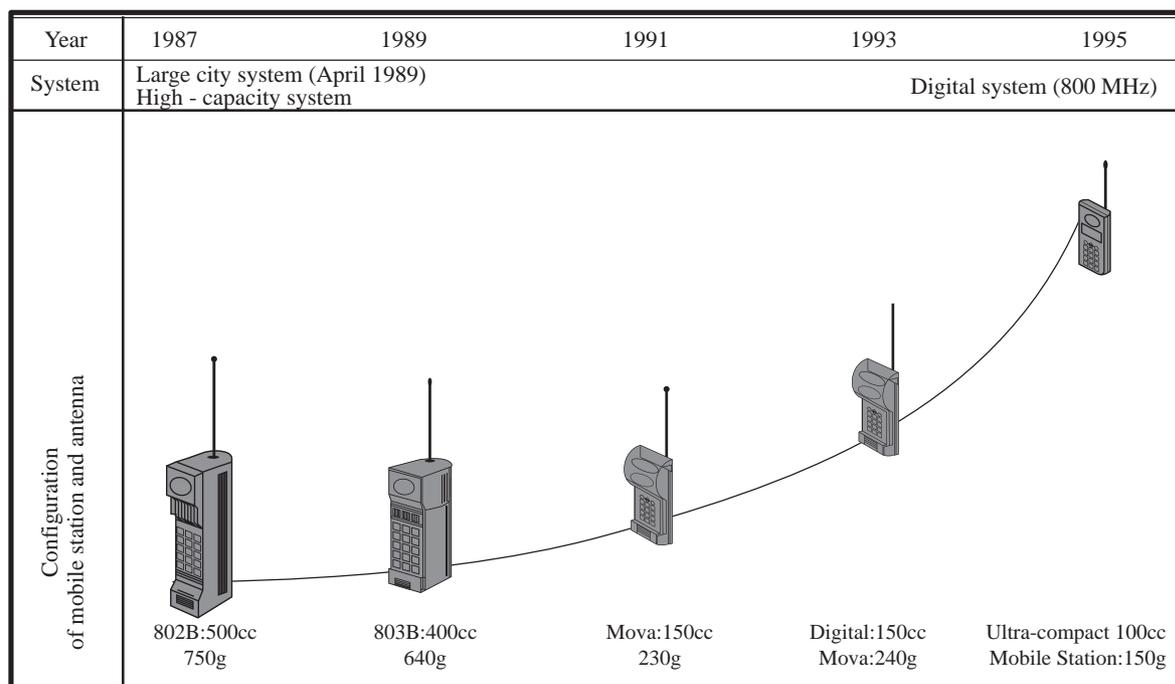


Figure 1. Evolution of the Mobile Phones (NTT DoCoMo Corporation, 2000).

The evolution of mobile phones to today's 3G has contributed to the production of attractive mobile phone features and high-tech functions, not only in large quantity but also at competitive prices. Today, the affordable price and convenience in telecommunication brought about by the mobile phones have made it possible for almost every member in a family in Malaysia, ranging from the working parents, non-working modern housewives to even primary schoolchildren, to own a mobile phone.

The Growth of Mobile Phones Subscribers in Malaysia

One area of the Malaysian telecommunication sector that has been prospering is the mobile phone market. The Malaysian cellular phone penetration is about 7.48 million at the end of 2001, a 38 per cent increase over the previous year's figure of about 3.03 million. Based on the statistics from the DataFile of Asia-Pacific Telecommunication (2002), mobile telephony in Malaysia has exceeded the 4.6 million fixed line subscribers by about 0.78 million. Overall, the growth in mobile phone users has increased tremendously from 1990 to 2001, as shown in Table 1 and Figure 2. From Figure 2, it can be observed that there has been an exponential growth in mobile phone subscribers from 1990 to 2001. In the figure, the dotted line represents the actual growth while the solid line represents the extrapolated growth.

Table 1. Growth of Mobile Phone Subscribers.

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Subscribers ('000)	78	132	206	340	572	872	1514	1995	2184	3034	5384	7477

(Source: Malaysian Communication and Multimedia Commission: Operators, 2002)

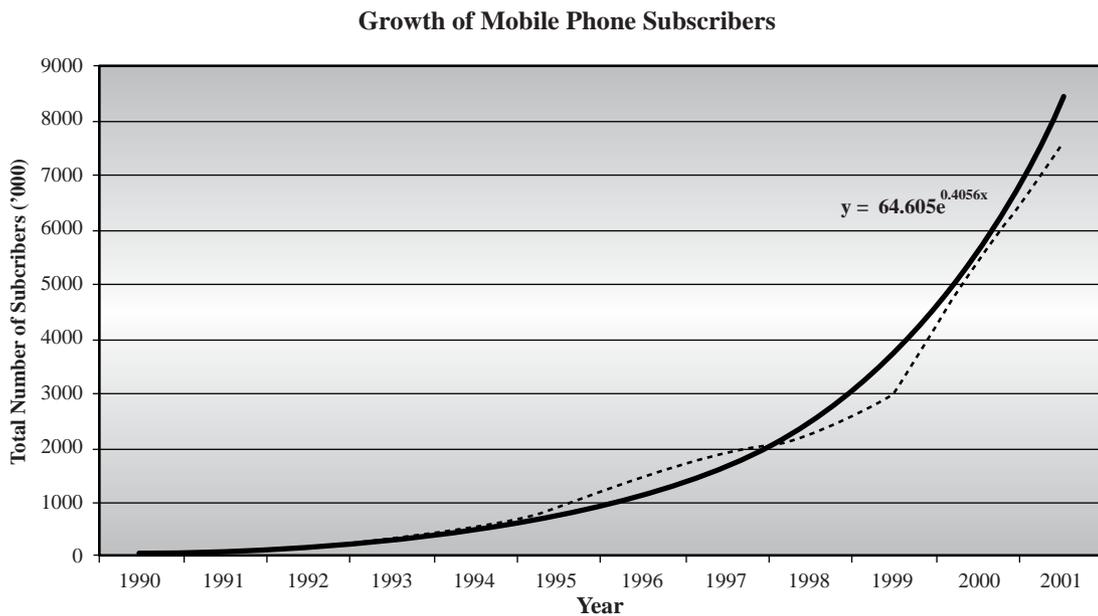
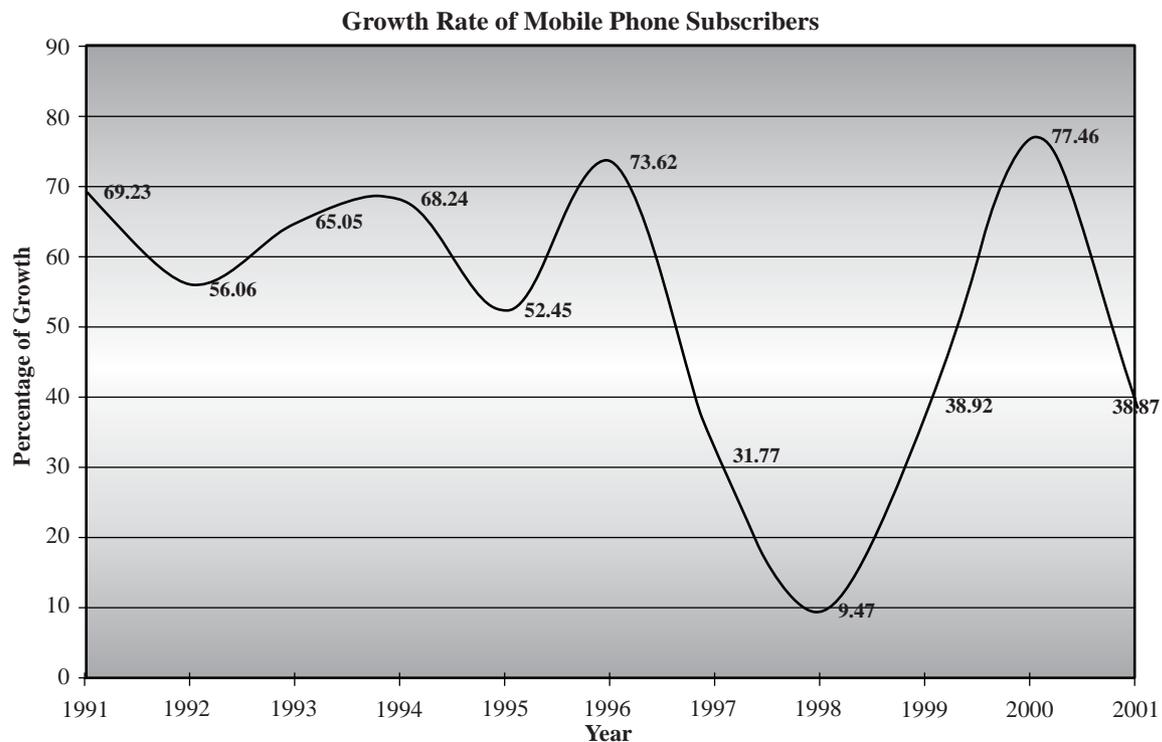


Figure 2. Growth of Mobile Phone Subscribers.

The percentage growth rate of mobile phone subscribers for a specific year is based on the difference in percentage between the current growth rate for the specific year and the growth rate of the previous year. The growth rate of mobile phone subscribers is represented graphically in Figure 3. In the calculations, the base year taken was 1990 (Koh, 2003).



(Source: Malaysian Communication and Multimedia Commission: Operators, 2002)

Figure 3. Growth Rate of Mobile Phone Subscribers.

SURVEY METHODOLOGY

In view of the significant growth of mobile phone subscribers in Malaysia, it would be interesting to investigate the preferences of users when purchasing of a mobile phone, as they would inevitably impact on mobile phone sales. Thus, a survey was conducted to collect data from the mobile phone users. The survey was conducted from 16-29 December 2003 (two weeks), covering Malaysians of age ten years and above from four states in Malaysia that include Kuala Lumpur, Selangor, Malacca and Kedah. This study involved a 5-member team in a project assignment for the second year software engineering students. It was aimed at understanding and applying the concepts and principles of project management and to gain a real life experience in conducting a questionnaire survey within one semester (12 weeks). Two weeks were allocated for the questionnaire survey as the students were required to allocate time for other tasks such as the questionnaire design, questionnaire screening, data entry, data analysis and project tracking and reporting.

Surveys can be conducted using the questionnaires or through interviews. Questionnaires are usually paper-and-pencil instruments that the respondent completes, while interviews are completed by the interviewer, based on what the respondent says. In a questionnaire survey, there are different ways to conduct such a study. These include mail survey, group-administered questionnaire, online Website survey, and telephone survey (American Statistical Association, 2004; Trochim, 2004). The advantages and disadvantages of using these various ways were carefully studied and analysed. The group-administered survey, using hardcopy questionnaires was chosen. This allows the questionnaires to be conducted in a group and collected on the spot. It saves time, is inexpensive and easy to conduct. These advantages are not present in other types of survey such as the online Website survey in which the data collected may not be reliable. Mail survey and telephone survey are tedious, time-consuming and costly to conduct (Fink and Kosecoff, 1985; Salant and Dillman, 1994).

1. Survey Sampling Technique

Before the survey was carried out, a sampling technique must first be determined to define a subset of the survey population. There are a few sampling techniques, namely, randomisation, stratification, cluster sampling and model-based sampling (Cochran, 1977; Garson, 2004). In this study, the randomisation sampling technique was selected and the questionnaires were distributed to respondents without predetermined pattern or plan to meet the survey's goal. The results of the sample survey from 200 respondents were used to make inferences. This sample size was decided in view of the constraints of the duration of survey (2 weeks) and the availability of manpower (5 people) to conduct the survey. The reason for taking a random sample is to maximise the probability that the sample is representative of the population from which it is drawn.

2. Design of Questionnaire

In a questionnaire survey, the results of analysis are highly dependent on a well-designed questionnaire. Thus, during the design of the questionnaire, issues pertaining to the type of question and question content were considered.

2.1 Determine the Type of Question

The survey questions can be divided into two broad types – structured (fixed-format question) and unstructured (free-format question). The questionnaire used in this study consists of two sections, namely, respondents' details and respondents' preferences in the mobile phones that comprised eleven structured questions and one unstructured question which allow the respondents to write down their opinions or comments freely. Of the eleven structured questions in section 2, three questions are of dichotomous type, that is, the questions ask for a yes/no response. Eight questions are of multiple-option format, that is, the respondents need to select only one among the options provided. There is no scale-based question in the questionnaire (Trochim, 2004). A sample of the questionnaire is included in Appendix I.

2.2 Determine the Question Content

The questions asked in the questionnaire elicit information relevant for analysis. The questions have been made simple and easy-to-understand to avoid confusion and misunder-

standing. The content of the questionnaire is limited to within two pages, as a lengthy questionnaire which exceeds four pages could decrease the response rate (Trochim, 2004). The questions focus on the aspects of mobile phone features in terms of size and colour, its functions and technology such as message sending services, digital camera, and the amount that the users are willing to spend when purchasing a mobile phone. Prior to the actual survey, a pilot test was conducted. From the test, weaknesses found in the questionnaire such as unnecessary questions were dropped; grammatical mistakes, typing mistakes and ambiguous questions were corrected and re-phrased.

3. Types of Error

As in any survey, opinion surveys are subjected to various types of error. Consequently, the survey results may incorrectly reflect the sample population. Errors in opinion surveys arise from two main sources: sampling and measurement (response) difficulties. There are four main types of sampling and measurement problems (Salant and Dillman, 1994; Som, 1996; Garson, 2004).

a. Coverage Error

Depending on the survey mode, contacting some members of the sample population might be impossible. The deviation between the sampling frame (those for whom surveyors have contact information) and the sample population causes coverage error. In this study, this error is difficult to overcome as it is not possible for five people to conduct surveys which cover all the fourteen states in Malaysia within two weeks. Hence, the data collected merely represent the opinions of the respondents surveyed from the four states covered in the study.

b. Sampling Error

Survey data will always have sampling error as only a small subset from the whole population is drawn as the sample. This error can be controlled by just increasing the sample size. In this survey, however, it is difficult and impossible to increase the sample size to include respondents from all the fourteen states as the project team members were given only two weeks to conduct the survey.

c. Non-response Error

In addition, because some people refuse to participate, survey data suffer from non-response error when a significant number of people in the survey sample do not respond to certain questions in the questionnaire and they are different from the other respondents who answered those questions. This problem was overcome by asking the respondents to answer the questionnaires on the spot, thus ensuring that all the questions are answered.

d. Measurement Error

Even if potential respondents can be contacted and agree to participate, they may not answer the survey questions accurately or completely, thus, causing measurement error. In this study, this error was eliminated by designing a simple, easy-to-understand and easy-to-answer questionnaire. As the questions are unbiased and related to respondents' opinions of the mobile phones that they are using, it is unlikely that measurement error will arise.

ANALYSIS OF SURVEY OUTCOMES

In this survey, altogether 200 sets of questionnaires were collected and used for analysis. Before analysis was carried out, the questionnaires were checked to ensure that all the questions were answered. Of the 200 respondents, 103 (51.5%) are male and 97 (48.5%) are female as shown in Figure 4. There are 39 (19.5%), 73 (36.5%), 29 (14.5%), 33 (16.5%) and 26 (13.0%) respondents from the age groups of 10-20, 21-30, 31-40, 41-50, and 51 years and above, respectively, as shown in Figure 5.

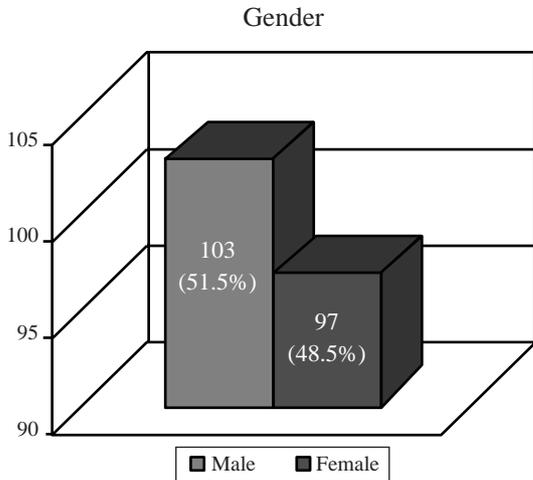


Figure 4. Gender of Respondents.

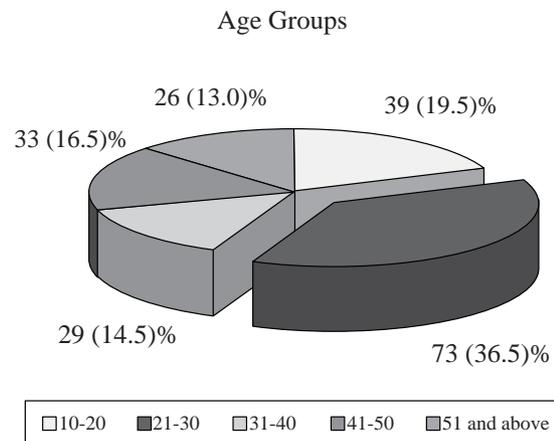


Figure 5. Age Groups of Respondents.

1. Brand of Mobile Phone

Among the 200 respondents, 48.3%-66.7% of them ranging from the age group of 10-21 years to the age group of 51 years and above, are using the Nokia phones (Figure 6). This trend is very obvious in the two age groups of 10-20 and 21-30 years old. An interview with a mobile phone sales executive was held on 31 March 2004 to understand the reasons for the popularity of the Nokia brand among the mobile phone users. According to him, Nokia offers a wide range of mobile phones and accessories at affordable prices which are competitive with other brands. In addition, Nokia phones batteries are readily available, unlike some brands of mobile phones that produce batteries in batches and stop production after a particular batch is sold out. Another reason for the popularity of the Nokia brand is durability. Mobile phone users who own different brands of mobile phones claimed that the Nokia phones are more durable compared to the other brands.

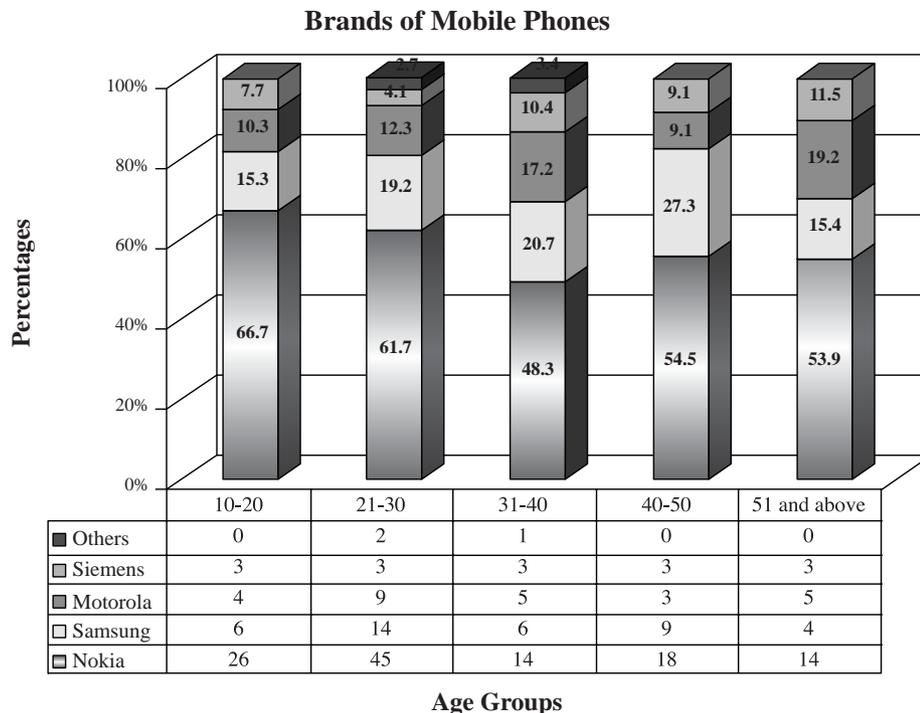


Figure 6. Mobile Phones Currently Used According to Brands.

2. Ways of Getting Mobile Phone

As shown in Figure 7, of the 200 respondents of the four age groups ranging from 21-30 years to 51 years and above, 63.0%-80.7% purchased the mobile phones themselves. These users are from the working group and hence, they can afford to purchase the mobile phone themselves. For the age group of 10-20 years, 23 (59.0%) out of 39 respondents stated that their purchases were sponsored by their family. These come from the non-working group and do not have a regular source of income. They would require sponsorship from the family members such as their parents, relatives or elder siblings to get the mobile phones for them. Indeed, besides providing the basic needs, parents today provide mobile phones for their children as a necessity as the mobile phone is the fastest means to track and locate the whereabouts of their children, especially when they have not yet returned home after the schooling hours. This new role played by the mobile phones is reflected by the fairly high percentage (59.0%) of mobile phones which are sponsored by family members. Some respondents, constituting about 3.5-13.7% from all the five age groups, received their mobile phone as a prize from competitions or as presents from friends.

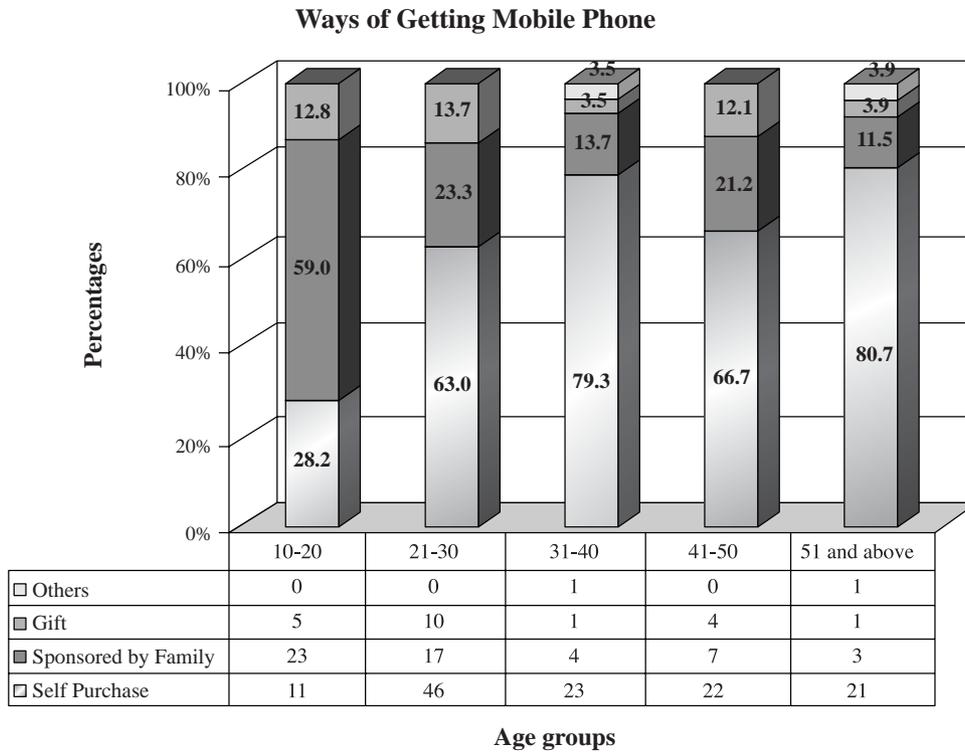


Figure 7. Ways of Getting Mobile Phone.

3. Amount Willing to Spend to Purchase a Mobile Phone

In Figure 8, in the age group of 10-20 years, 11 (28.2%) out of 39 respondents are willing to spend from RM201-RM400 to purchase a mobile phone. There are 10 (25.6%) and 9 (23.1%) respondents who are willing to spend from RM401-RM600 and RM600-RM800, respectively to purchase a mobile phone. This shows that the majority of them are willing to spend from RM201-RM800 for a mobile phone. In the age group of 21-30 years, 21 (28.8%) out of 73 respondents are willing to spend from RM401-RM600 and RM600-RM800, respectively, to purchase a mobile phone. Also, there are 13 (17.8%) respondents who are willing to spend from RM201-RM400 and a similar number of respondents willing to spend RM800 and above. Only 5 (6.8%) respondents are willing to spend below RM200 to purchase a mobile phone. This could imply that the respondents of this age group are willing to spend a reasonable amount to purchase a fairly good mobile phone at a price from RM401-RM800.

In the age group of 31-40 years, none of the respondents would spend below RM200 to purchase a mobile phone. This implies that the respondents of this age group are willing to spend more than RM200 to purchase a fairly good mobile phone. Also, in this competitive market, mobile phones that are priced below RM200 might not be equipped with the necessary features and embedded technologies that the users desire. Thus, 11 (37.9%) out of 29 respondents are willing to spend from RM401-RM600. Indeed, some are willing to spend from RM601-RM800 (8, 27.6%) and even RM800 and above (8, 27.6%). This age group is willing to invest more to purchase a fairly high-tech mobile phone as they could be of the high-income group from the age group of 31-40 years old.

For the age group of 41-50 years, 7 (21.2%) out of 33 respondents are willing to purchase a mobile phone at price below RM200, and another 7 (21.2%) respondents are willing to spend from RM201-RM400, and similarly another 7 (21.2%) respondents from RM601-RM800. Six (18.2%) respondents from this age group are willing to spend from RM401-RM600, and another 6 (18.2%) respondents are willing to spend RM800 and above to purchase a mobile phone. For the age group 51 years and above, 9 (34.6%) and 6 (23.1%) out of 26 respondents are willing to purchase a mobile phone at price from RM401-RM600, and RM800 and above, respectively. Also, 5 (19.2%) respondents from this age group are willing to spend from RM201-RM400 and another 5 (19.2%) respondents are willing to spend from RM601-RM800. Only 1 (3.9%) respondent will spend below RM200 to purchase a mobile phone.

In general, irrespective of the age group, the respondents are willing to spend from RM401-RM600 to purchase a mobile phone. Most respondents who are willing to spend from RM601-RM800 and RM801 and above, are from the age groups of 21-30 (28.8%) years and 31-40 (27.6%) years, respectively. This implies that respondents of age between 21-40 years are willing to invest more to purchase a good and high-tech mobile phone.

4. Features Considered When Purchasing a Mobile Phone

The advancement in science and technology (S&T) has contributed to the great reduction in size and weight of mobile phones. Mobile phones today can be as small as a palmtop and weigh from 750g (in the 1980s) to 150g (in the 1990s) (Koh, 2003). Hence, the size of mobile phone is certainly one of the factors that the users would consider when purchasing a mobile phone. Of the 200 respondents, 169 (84.5%) indicated that they would consider the size when purchasing a mobile phone (Figure 9). For obvious reasons, they would prefer to have small and slim mobile phones which are light and easy to carry.

Besides the size, the latest technology has enabled mobile phones to have full-colour screen instead of a monochrome screen such as a blue or green screen. Today, colour screen has become a popular feature in a mobile phone. In this survey, 149 (74.5%) respondents indicated that they would consider the colour of the screen when purchasing a mobile phone. When this feature is compared with size, it is obvious that the size takes precedence as it relates to the weight of a mobile phone. In addition, a mobile phone with full-colour screen is still considerably expensive in Malaysia.

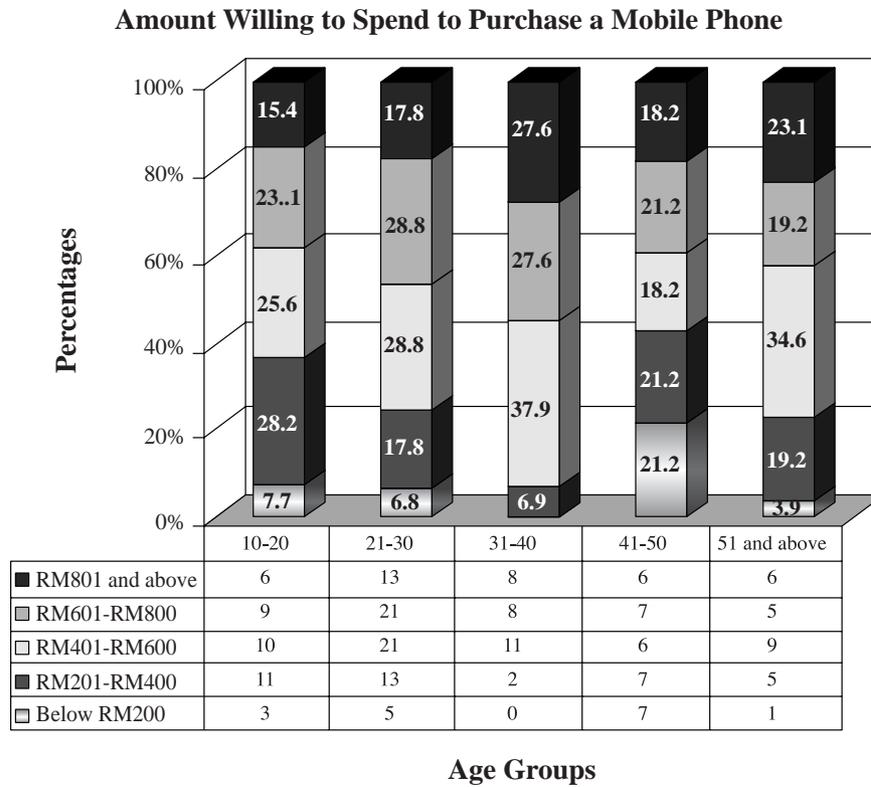


Figure 8. Amount Willing to Spend to Purchase a Mobile Phone.

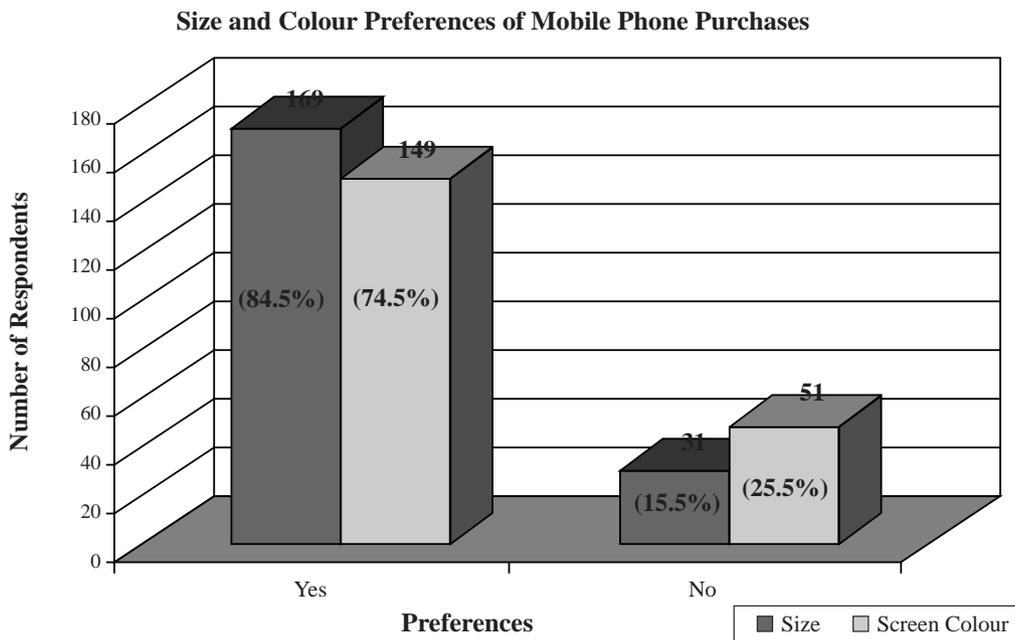


Figure 9. Size and Screen Colour Preference of Mobile Phone Purchases.

5. Preference of Messaging Functions, Entertainment Functions, Miscellaneous Functions, Embedded Technologies and Accessories of Mobile Phone

Although mobile phones allow users to establish communication at any time and any where, the cost in making a voice call within the country or abroad, using a mobile phone is rather expensive, especially for a call of long duration. Sending a message via short messaging service (SMS), multimedia messaging service (MMS), and electronic messaging service (EMS) have enabled users to pass messages (communicate) at a very much cheaper rate than voice calls. Besides, the entertainment functions such as the games, ringtones, radio and MP3 players have helped keep users entertained and occupied while waiting for a friend in a restaurant or cinema, during lunch break, or after schooling or working hours.

In addition, creativity and innovations in the mobile phone telecommunication industry have added to a wide range of high-tech functions such as taking pictures, using a built-in digital camera, effective and efficient transmission of data at higher speed and at cheaper rate without a dial-up modem, connection to make it possible to watch TV news, using the General Packet Radio Service (GPRS) and surfing the Internet via wireless application protocol (WAP) (Koh, 2003). Furthermore, other miscellaneous functions such as incorporating a calculator, stop watch, personal organiser and clock into a mobile phone have made it a comprehensive and useful tool, not only for telecommunication but also fulfilling the daily needs. Mobile phone users from the working group, especially the sales executives do not need to carry a personal organiser, calculator or a telephone directory of their customers, as the mobile phone can store all the information required and offers all the functions provided by the other tools. This survey investigated which of these functions and technologies are most preferred and important to the mobile phone users. It also considered which accessories the users deemed to be most important in a mobile phone. These include the housing, battery, hands-free kit and charger. The outcomes of these investigations are presented in detail in the following sections.

5.1 Preference of Messaging Functions

Among the messaging functions, it is obvious that short messaging service (SMS) is most preferred as indicated by 10 (34.5%), 17 (51.5%), and 14 (53.8%) out of 29, 33 and 26 respondents of the age groups of 31-40 years, 41-50 years, and 51 years and above, respectively (Figure 10).

The multimedia messaging service (MMS) seems to be the most-preferred messaging function of those in the age group of 21-30 years as indicated by 31 (42.5%) out of 73 respondents. This messaging service is also fairly preferred by 12 (30.8%), 10 (34.5%), 12 (36.4%) out of 39, 29 and 33 respondents of the age groups of 10-20, 31-40, and 41-50 years, respectively. For electronic messaging service (EMS) which incorporates text and picture message, it is preferred by 14 (35.9%) respondents in the age group 10-20 years. This messaging service is also fairly preferred by 9 (31.0%) and 8 (30.8%) respondents from the 31-40 and 51 years and above age groups, respectively.

Overall, SMS, MMS and EMS are used mostly by those in the 51 years and above (53.8%), 21-30 (42.5%), and 10-20 (35.9%) years age groups. This implies that the mobile phone users of these three age groups send more messages than users from the other two age

groups. Among the three messaging services, SMS is most preferred as it is very much cheaper than MMS and EMS. In addition, there are many contests and enquiry services that require participants to submit the answers or enquiries via SMS. These include the SMS quizzes and contests organised by various companies and advertised over the television or mobile phones, and the enquiry on the polling centres provided for the voters during the 11th General Election which was held on 21 March 2004. These SMS contests and enquiries have further popularised the use of SMS among the three messaging services. On the other hand, EMS is generally of lower preference as indicated by the low percentage among the users from the two age groups of 21-30 (13, 17.8%), and 41-50 years (4, 12.1%). This could be due to the fact that EMS is still a rather new messaging function which has low user awareness and yet to be widely accepted. Nevertheless, it is expected to become increasingly popular as sending a picture would become a trend of tomorrow in situations where a picture explains better than text.

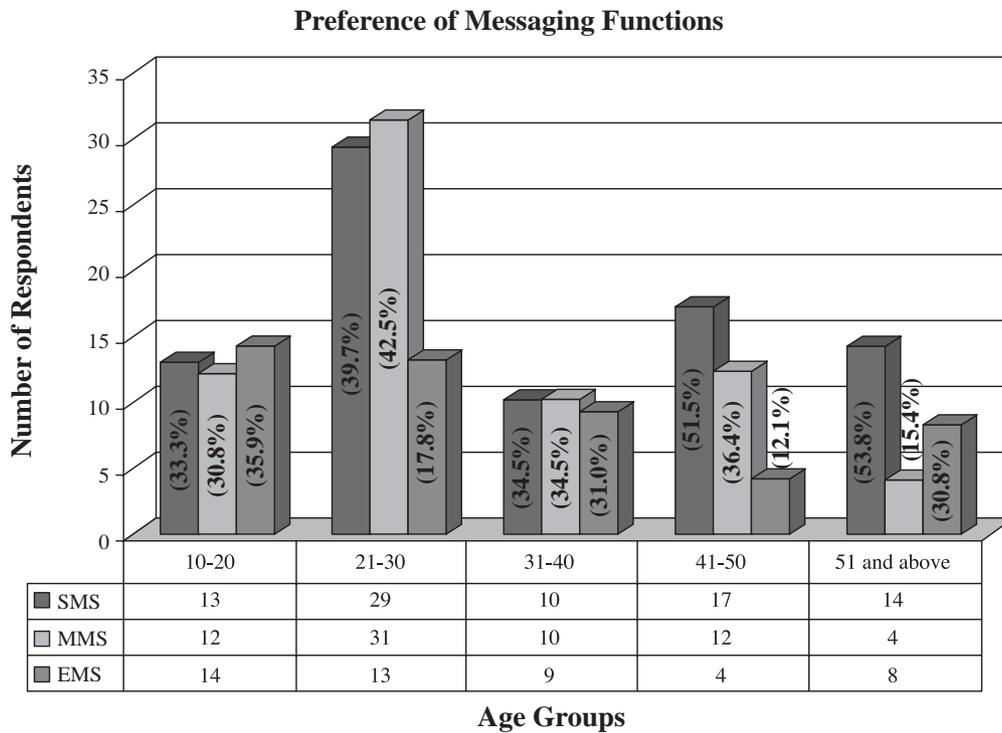


Figure 10. Preference of Messaging Functions in a Mobile Phone.

5.2 Preference of Entertainment Functions

Among the four types of entertainment functions that include games, ringtones, radio and MP3 player surveyed, ringtones appears to be most preferred. This is indicated by 14 (35.9%), 22 (30.1%), 10 (34.5%), 11 (33.3%), and 10 (38.5%) out of 39, 73, 29, 33 and 26 respondents of the age groups of 10-20, 21-30, 31-40, 41-50 and 51 years and above, respectively (Figure 11). For the 21-30 years age group, 22 (30.1%) out of 73 respondents indicated that besides ringtones, MP3 player is also the most-preferred entertainment function. This shows that irrespective of the age group, the ringtones function is generally the most-preferred entertainment function.

It is also interesting to note that mobile phone games seem to be least popular among the four entertainment functions surveyed. Nevertheless, they are most popular in the 21-30 years age group as indicated by 15 (20.5%) respondents, and least popular among the other four age groups, in particular those in the age group of 51 years and above, as indicated by 2 (7.7%) respondents only.

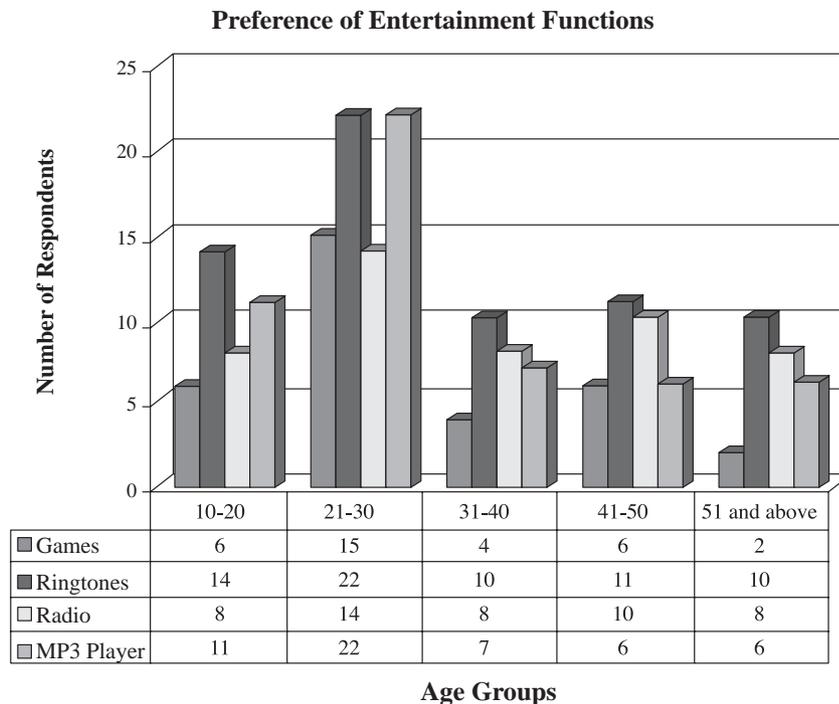


Figure 11. Preference of Entertainment Functions in a Mobile Phone.

5.3 Preference of Miscellaneous Functions

Of the various miscellaneous functions surveyed, the personal organiser is most preferred by those of age ranging from 10-50 years as indicated by 17 (43.6%), 40 (54.8%), 14 (48.3%), and 15 (45.5%) out of 39, 73, 29, and 33 respondents of the four age groups of 10-20, 21-30, 31-40 and 41-50 years, respectively (Figure 12). For the age group of 51 years and above, however, the most-preferred miscellaneous function in a mobile phone is the clock as indicated by 9 (34.6%) out of 26 respondents. This preference is the next-preferred miscellaneous function of the other four age groups with age ranging from 10-50 years.

The next preferred of the miscellaneous functions of the age group of 51 years and above are the calculator and personal organizer as indicated by 8 (30.8%) respondents each. Again, in this survey, there is a similarity in the most-preferred miscellaneous function in the four age groups with ages ranging from 10-50 years but differs from the age group of 51 years and above. Besides the four miscellaneous functions considered, there is a very small number of users from the age groups of 10-21 (1, 2.6%), 41-50 (3, 9.1%), and 51 years and above (1, 3.8%), who prefer other miscellaneous functions such as the chat and reminders.

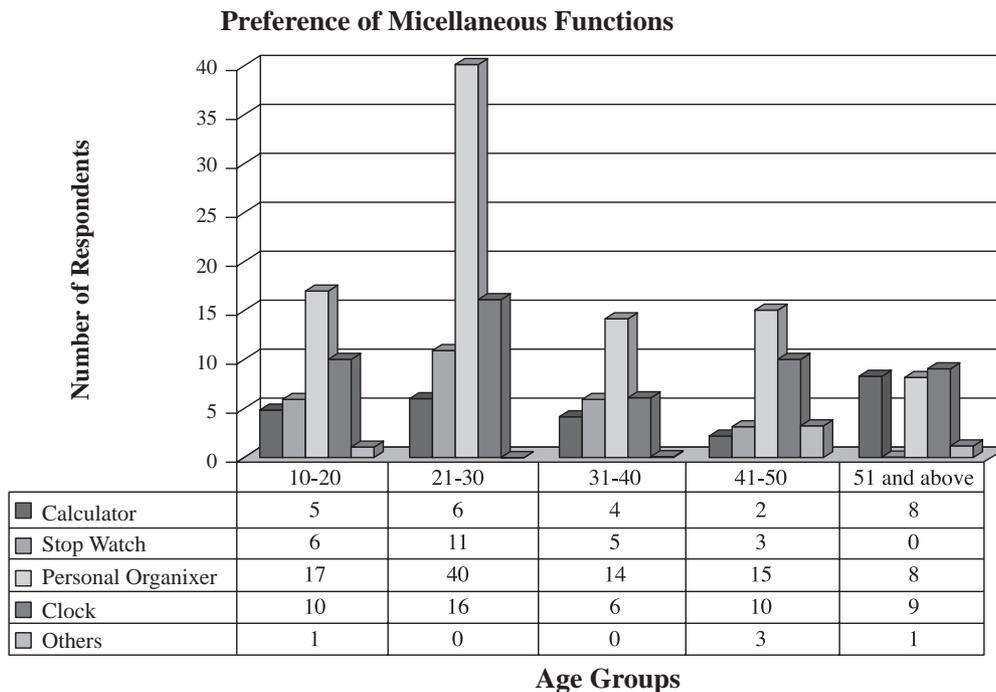


Figure 12. Preference of Miscellaneous Functions in a Mobile Phone.

5.4 Preference of Embedded Mobile Phone Technologies

Among the technologies incorporated into mobile phones, digital camera is most preferred among the five age groups as indicated by 16 (41.0%), 28 (38.4%), 13 (44.8%), 13 (39.4%), and 12 (46.2%) out of 39, 73, 29, 33 and 26 respondents, respectively (Figure 13). Today, the digital camera in a mobile phone is used not only to capture pictures of items, people or scenery, but also has many other uses.

The next-preferred embedded technology in a mobile phone is the General Packet Radio Service (GPRS)/Wireless Application Protocol (WAP). This is true among the four age groups with ages ranging from 10-50 years, specifically those in the age group of 21-30 years (26, 35.6%). For the 41-50 years age group, besides GPRS/WAP technology, Bluetooth (9, 27.3%) is also the technology of equal preference. On the other hand, for the age group of 51 years and above, the next-preferred embedded mobile phone technology is infrared connectivity (6, 23.1%). Indeed, compared to the other four age groups, this technology is most preferred by this age group after the digital camera. Hence, it is obvious that the digital camera and GPRS/WAP are the two latest embedded mobile phone technologies that are

more favoured by the young mobile phone users from the 21-30 years age group. The latest technologies which include the GPRS/WAP and Bluetooth are not preferred by the 51 years and above age group. This implies that the younger generation is able to keep up with and accept the new technologies, compared to the older generation.

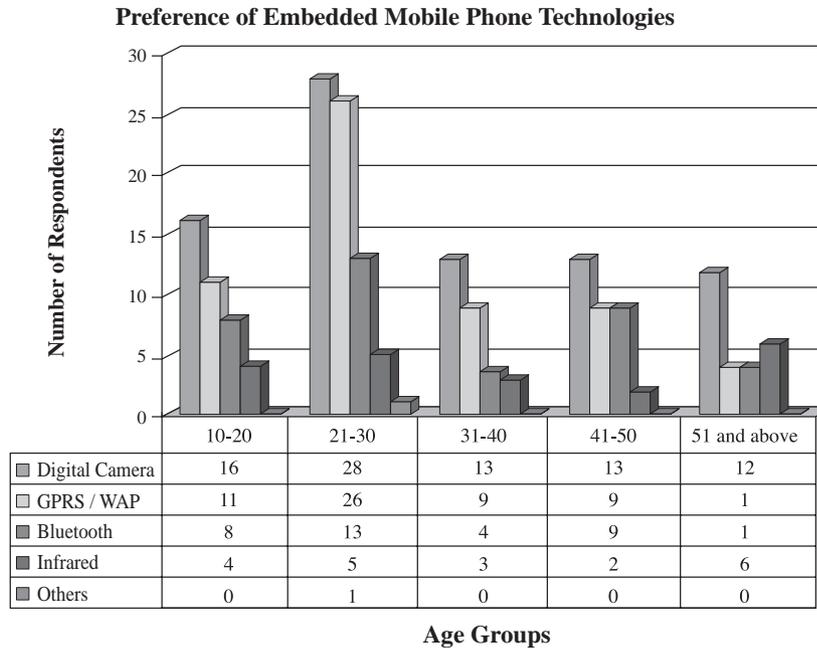


Figure 13. Preference of Embedded Mobile Phone Technologies.

5.5 Preference of the Most Important Accessory

Of the four types of mobile phone accessories surveyed, all the age groups agreed that battery is the most important accessory of a mobile phone. This is indicated by 12 (30.8%), 46 (63.0%), 19 (65.5%), 26 (78.8%) and 24 (92.3%) out of 39, 73, 29, 33 and 26 respondents of the five age groups, respectively (Figure 14). This finding is obvious as the battery determines how long a mobile phone can be used when the users are out of the house or office. Without a battery or a 'dead' battery, the mobile phone would not be able to function at all. Hence, it is important for the mobile phone manufacturers to produce good quality batteries which not only can offer longer supply of power without having to re-charge but also one that has longer life span before replacement.

Besides the battery, the next important accessory is the battery charger as indicated by the two age groups of 10-21 years (11, 28.2%) and 41-50 years (4, 12.1%). For some respondents, however, the "hands-free kit" (HFK) which consists of an earpiece, microphone, lapel clip, interconnection cable and connector, is also of importance. It facilitates answering phone calls while both hands are busy. This is indicated by the respondents from the two age groups of 21-30 years (10, 13.7%) and 31-40 years (6, 20.7%). This could be due to the fact that these respondents often receive phone calls while traveling on the road or busy working with both hands. For the age group of 51 years and above, however, the next important accessory to the two remaining respondents is the charger (1, 3.8%) and HFK (1, 3.8%), respectively.

It is also obvious that the housing which is the casing (appearance) of the mobile phone and comes in various attractive colours, is least preferred by all the five age groups. It is only preferred by the younger generation of the two age groups of 10-20 (6, 15.4%) and 21-30 years (9, 12.3%). Indeed, it is of very low preference to the age group of 41-50 years (1, 3.0%) and not preferred at all by both the age groups of 31-40 years and 51 years and above.

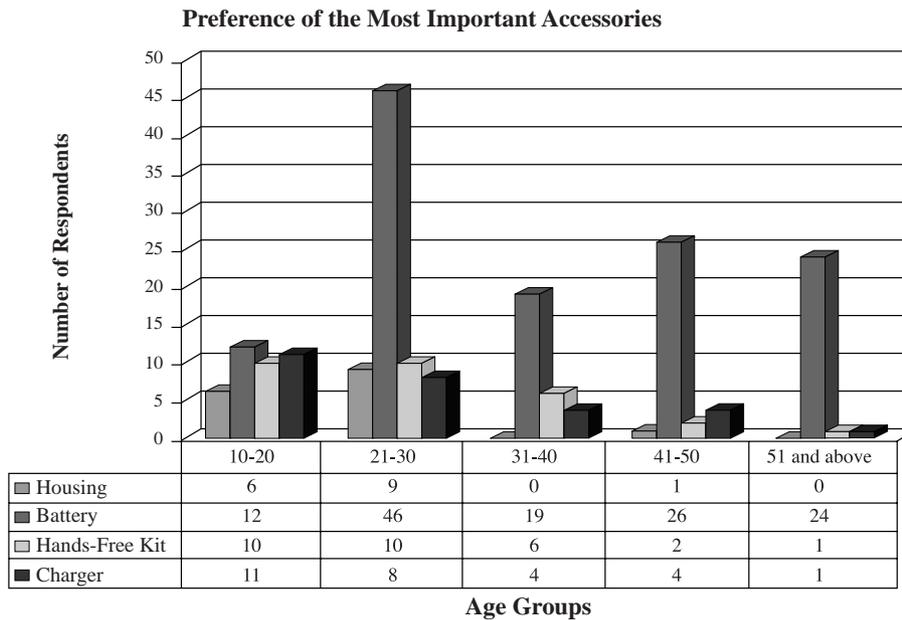


Figure 14. Preference of Most Important Accessories in a Mobile Phone.

5.6 Necessary to Have All the Latest Features in Mobile Phone

When the 200 respondents were asked whether it was necessary to have all the latest features in a mobile phone when purchasing one, 136 (68.0%) respondents replied in affirmative while the remaining 64 (32.0%) respondents said that it was not necessary (Figure 15). This shows that as more attractive features and better functions and technologies are being created and invented, the demand of the users for high-quality mobile phones also increases. They would not use a mobile phone that cannot meet their requirements. Many users are willing to invest an amount which is within their means to purchase a mobile phone that is equipped with all the latest features, functions and technologies that they need to use daily, especially those that can help them in their work. Only users who do not need to use such attractive features and high-tech functions would be willing to use a mobile phone that is equipped with the very basic features and functions only.

Necessary to Have All the Latest Features in Mobile Phone

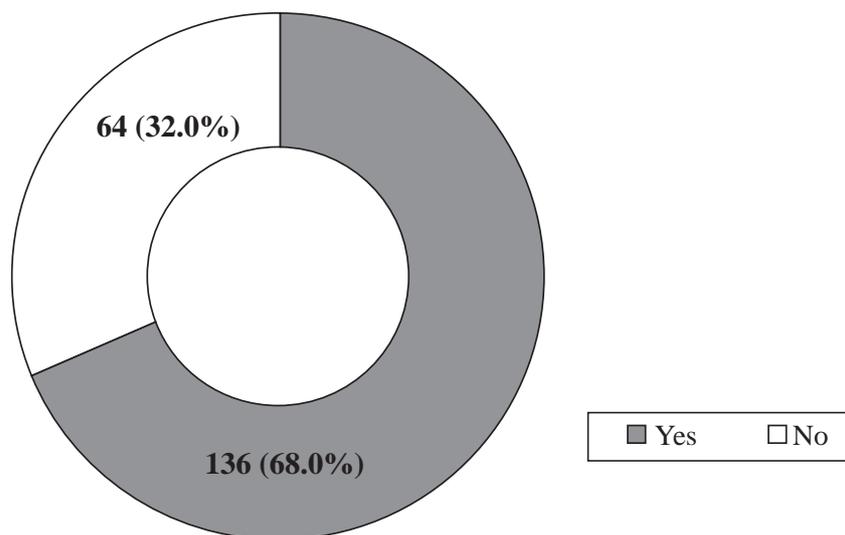


Figure 15. Preference of Most Important Accessory in a Mobile Phone.

DISCUSSION AND CONCLUSION

The outcomes of the questionnaire survey reveal some of the important opinions of the mobile phone users which are very useful to the mobile phone telecommunication industry, specifically the mobile phone manufacturing industry. Analyses of the survey give an overview of the opinions and expectations of mobile phone users of the five age groups ranging from 10 to 51 years and above. Findings from the survey would help the mobile phone manufacturers to produce the type of mobile phones that meet the requirements and preferences of the users.

The questionnaire in this study has been designed to achieve unbiased responses. All the 200 respondents answered all the structured questions but none of them wrote any comments for the unstructured (open-ended) question. This indicates that all the respondents prefer to save time by choosing from the options provided rather than writing down their opinions on the questionnaire which requires them to think and at the same time is time-consuming.

Table 2 shows a summary of the survey outcomes in terms of the amount (in RM) that the users are willing to invest when purchasing a mobile phone, the most preferred messaging functions, entertainment functions, miscellaneous functions, embedded mobile phone technologies, and the accessories that are most important to the mobile phone users. It is obvious that the outcomes reflect only the opinions and preferences of the 200 respondents from the four states surveyed in Malaysia. It cannot be taken as the opinions and preferences

of mobile phone users from all the fourteen states in Malaysia. In order to obtain country-wide opinions, data need to be collected from a reasonable sample size of respondents from all the fourteen states in Malaysia. Nevertheless, the outcomes have achieved the survey objectives and are very useful to the mobile phone manufacturing industry.

Table 2. Summary of the Preferences of Mobile Phone Users.

Opinions (Most Preferred)	Age Groups				
	10-20	21-30	31-40	41-50	51 and above
Amount a User is Willing to Spend to Purchase a Mobile Phone	RM201- RM400 (28.2%)	RM401- RM600 RM601- RM800 (28.8%)	RM401- RM600 (37.9%)	Below RM200 RM201- RM400 RM601- RM800 (21.2%)	RM401- RM600 (34.6%)
Messaging Functions	EMS (35.9%)	MMS (42.5%)	SMS (34.5%) MMS (34.5%)	SMS (51.5%)	SMS (53.8%)
Entertainment Functions	Ringtones (35.9%)	Ringtones (30.1%) MP3 Player (30.1%)	Ringtones (34.5%)	Ringtones (33.3%)	Ringtones (38.5%)
Miscellaneous Functions	Personal Organiser (43.6%)	Personal Organiser (54.8%)	Personal Organiser (48.3%)	Personal Organiser (50.0%)	Clock (34.6%)
Embedded Mobile Phone Technologies	Digital Camera (41.0%)	Digital Camera (38.4%)	Digital Camera (44.8%)	Digital Camera (39.4%)	Digital Camera (46.2%)
Most Important Accessories	Battery (30.8%)	Battery (63.0%)	Battery (65.5%)	Battery (78.8%)	Battery (92.3%)

In addition, besides the aspects surveyed in the questionnaire, there are also other interesting issues to be investigated. These include the opinions on the rates charged to make a call and sending messages via SMS, MMS and EMS. Also, it is important to investigate the problems encountered by the users when using a mobile phone. These include limited coverage, misconnection, no connection during heavy rain, limited memory size for sending and storing messages, message sent but not received, hacking, to name a few. Certainly, the outcomes from such investigations would be very useful and crucial to the mobile phone service providers as a means to further improve services to the mobile phone users in Malaysia.

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APPENDIX I

Survey on the Purchasing Preferences of Mobile Phones

Purpose: This survey aims to collect mobile phone users' opinions on aspects related to: the amount they are willing to spend to purchase a mobile phone, the most preferred features, functions, embedded technologies, and most important accessories in a mobile phone. The feedback would be confidential. Upon completion of analysis, all the questionnaires collected would be duly destroyed.

Section 1: Personal Details:

Please indicate your choice by ticking (✓) the appropriate box.

- Gender : Male Female
- Occupation : _____
- Contact No. : _____
- E-mail : _____
-
- Age Group : 10 - 20
 21 - 30
 31 - 40
 41 - 50
 51 and above

Section 2: Mobile Phone Survey:

Please indicate your choice by ticking (✓) the appropriate box. Choose one answer only.

1. Do you have a mobile phone? Yes No
 If yes, what brand?
 Nokia
 Samsung
 Motorola
 Siemens
 Others, please specify: _____

2. How do you get your mobile phone?
 Buy Yourself
 Sponsored by Family
 Gift (through competition or from friend)
 Others, please specify: _____

3. How much you would spend to purchase a mobile phone?
- Below RM200
 - RM200 – RM400
 - RM401 – RM600
 - RM601 – RM800
 - RM801 and above
- Others, please specify: _____
4. Do you consider the size of a mobile phone when purchasing a mobile phone?
- Yes
 - No
5. Do you consider the screen colour when purchasing a mobile phone?
- Yes
 - No
6. What messaging function do you consider when purchasing a mobile phone?
- SMS
 - MMS
 - EMS
- Others, please specify: _____
7. What kind of entertainment function do you prefer to have in a mobile phone?
- Games
 - Ringtones
 - Radio
 - MP3 Player
- Others, please specify: _____
8. Which of the following miscellaneous functions do you prefer to have in a mobile phone?
- Calculator
 - Stop Watch
 - Personal Organiser
 - Clock
- Others, please specify: _____
9. What embedded technology do you prefer in a mobile phone?
- Digital Camera
 - GPRS / WAP
 - Bluetooth
 - Infrared
- Others, please specify: _____

10. Which accessory is most important in a mobile phone?

- Housing
- Battery
- Hands-Free Kit
- Charger

Others, please specify: _____

11. Do you think a mobile phone should have all the latest features?

- Yes
- No

12. If there is anything that you would like to add or comment, please write in the space below.

Comments:

Thank you very much for your participation in this survey.

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4. Introduction

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Use tables, graphs, diagrams, and photographs to provide a clear understanding of the results. Data included in illustrations and tables should not be discussed extensively in the text, but significant findings should be pointed out. Show how the objectives have been achieved. The results should be connected to one another. Some times this causes the results section to be combined with the discussion section.

7. Discussion and Conclusion

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Dissertation

Senthong, C. 1979. Growth analysis in several peanut cultivars and the effect of peanut root-knot nematode (*Meloidogyne arenaria*) on peanut yields. Ph.D. Dissertation. University of Florida, Gainesville, Florida, USA.

10. Acknowledgements

Any acknowledgements should be typed as text and placed before the references. The word ACKNOWLEDGEMENTS should be capitalized and centered above any citation.



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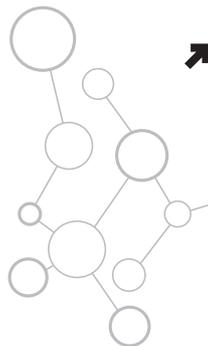
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