Report on

WiFi Adoption and Security Survey 2013

Hong Kong

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Wi-Fi Adoption and Security Survey 2013

Hong Kong

Prepared by:

Dr. Stanley Kam Sing WONG

In collaboration with

Dr. Ken Kin Kiu FONG

Covenor of SafeWiFi.hk Project and

Honorary Chairman (Life) of Hong Kong

Hong Kong Wireless Technology Industry Association

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Introduction

To most of us in Hong Kong, Internet access has become an integral part of our everyday lives. While the exploding popularity of mobile devices such as smartphones, netbooks, notebooks and computer tablets, has increased the demand for Internet connectivity, the use of cloud storage services (Dropbox and SkyDrive), the spread of communication Apps and software (e.g., WhatApp, WeChat and Skype) and social networking Apps and software (e.g., facebook and LinkedIn) that run on mobile devices, and the movement of a record-setting volume of data across the networks have fuelled the demand for reliable WiFi services which are seamless, secure and always-on.

To individual users of mobile devices, seamless Internet connectivity and mobility is a necessary convenience; to the business sector, it is a new marketing conduit and a new source of income, while to the WiFi service providers, both government and commercial, it represents a significant opportunity for more business and enhanced competitiveness.

Many Internet users who are enjoying WiFi at home and offices expect that the same level of convenience can be enjoyed in hotels, the airport, coffee shops, school campuses, public areas and shopping malls across the territory. But as our society evolves and develops, the expectation of our Internet users also grows and changes. Though general users may not be concerned about the technologies they use to satisfy their communications needs, they do expect that the WiFi networks they are using support mobility and there are some degree of consistency and a high level of security in the ways services are presented. It is of the utmost importance that both government and commercial WiFi network providers are well aware of these expectations and will work not only to meet them, but also to get ahead of them by providing reliable infrastructure and innovative services.

This report, which is the 2nd in a series of research complied by the Hong Kong Wireless Technology Industry Association (WTIA), investigates WiFi usage, WiFi accessibility, WiFi security and the knowledge of it in Hong Kong. Data collected from the research shall help stakeholders to understand more about the user experience, awareness and perceptions of WiFi service and security in Hong Kong.

By way of critical data analysis, it is hoped that findings of the research will assist both government and commercial WiFi network providers to identify gaps in the current service and help shed light on future directions and areas of improvement.

Conventional paper-and-pen self-administered questionnaire were used to collect data from a total of 208 respondents. To ensure continuity, most of the questions in the questionnaire are based on the Report on Wi-Fi Adoption and Security Survey 2012 (Zhan and Yen, 2012). One major finding of the 2012 report was that the majority of WiFi users in Hong Kong were using the WEP encryption which is considered as unsafe and highly vulnerable to cyber attack (Stimpson, Liu and Zhan, 2012). It was also found in the annual Wireless LAN War Driving Survey conducted by the Professional Information Security Association (PISA) and WTIA (PISA and WTIA, 2013) that 11.26% of the WiFi networks along the tramway on Hong Kong Island had no encryption and 15.47% of them used WEP encryption in 2012. To explore the reasons behind a user's adoption of WEP encryption technology, additional questions are devised to gauge the user perceptions and behaviours.

This report is divided into six parts, the first part is this introduction which sets the scene for the research and outlines the aims of the research. The second part is a descriptive summary of the demographic profiles of respondents. The third part is about WiFi usage in Hong Kong, covering essential details such as the types of WiFi network for Internet access, user profiles of the five main types of WiFi Internet access, how respondents use of WiFi network and WiFi tethering. The fourth part addresses the issue of WiFi security, including respondent perception and knowledge on WiFi security and the types of WiFi security settings they used. The fifth part details the respondent assessment of WiFi Internet access provided by both private and government service providers. The sixth part concludes the report with a detailed discussion of the research findings and recommendations on how to bring us closer to the vision of providing safe and continuous WiFi support to all users in Hong Kong.

Profiles of Respondents

A total of 208 respondents filled out the questionnaire. Among them, 8 respondents did not answered the question concerning their gender. Of the remaining 200 respondents who answered the question, 157 (78.5%) of them were male and 43 (21.5%) were female (Table 1).

Table 1: Gender of Respondents				
	Sample		Valid Response	
	No.	%	No.	%
Male	157	75.5	157	78.5
Female	43	20.7	43	21.5
No response	8	3.8		
Base	208	100.0	200	100.0

A total of 14 (6.7%) of the respondents did not answer the question concerning their marital status. Of the remaining 195 respondents who answered the question, 88 (45.4%) of them were single and 106 (54.6%) were married (Table 2).

Table 2: Marital Status of Respondents				
	Sample		Valid Response	
	No.	%	No.	%
Single	88	42.3	88	45.4
Married	106	51.0	106	54.6
No response	14	6.7		
Base	208	100.0	194	100.0

Table 3: Are you working in the IT related field?				
	Sample		Valid Response	
	No.	%	No.	%
Yes	75	36.1	75	37.9
No	123	59.1	123	62.1
No response	10	4.8		
Base	208	100.0	198	100.0

As regards the industry sectors in which the respondents were engaged, 10 (4.8%) of them did not respond to the question. Of the remaining 198 respondents who

answered the question, only 75 (37.9%) of them were engaged in IT-related sectors, while the rest of them (123 out of 198 or 62.1%) were engaged in non-IT related sectors (Table 3).

Table 4 illustrates the frequency distribution and percentage composition of the age of the respondents. Of the 198 respondents (94.7%) who answered the question, the majority (36.0%) of them were between 46 and 55 years old. Those were between 36 and 45 years old (25.9%) came second. Figure 1 illustrates the distribution of age among the respondents who answered the question concerning their age.

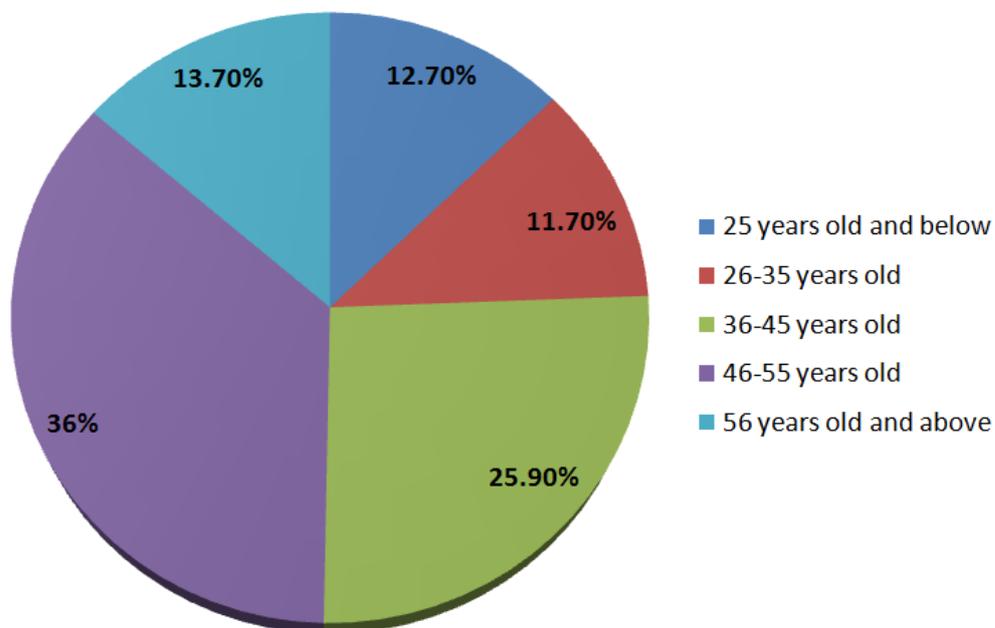| Table 4: Age of Respondents				
	Sample		Valid Response	
	No.	%	No.	%
25 years old and below	25	12.0	25	12.7
26-35 years old	23	11.1	23	11.7
36-45 years old	51	24.5	51	25.9
46-55 years old	71	34.1	71	36.0
56 years old and above	27	13.0	27	13.7
No response	11	5.3		
Base	208	100.0	198	100.0

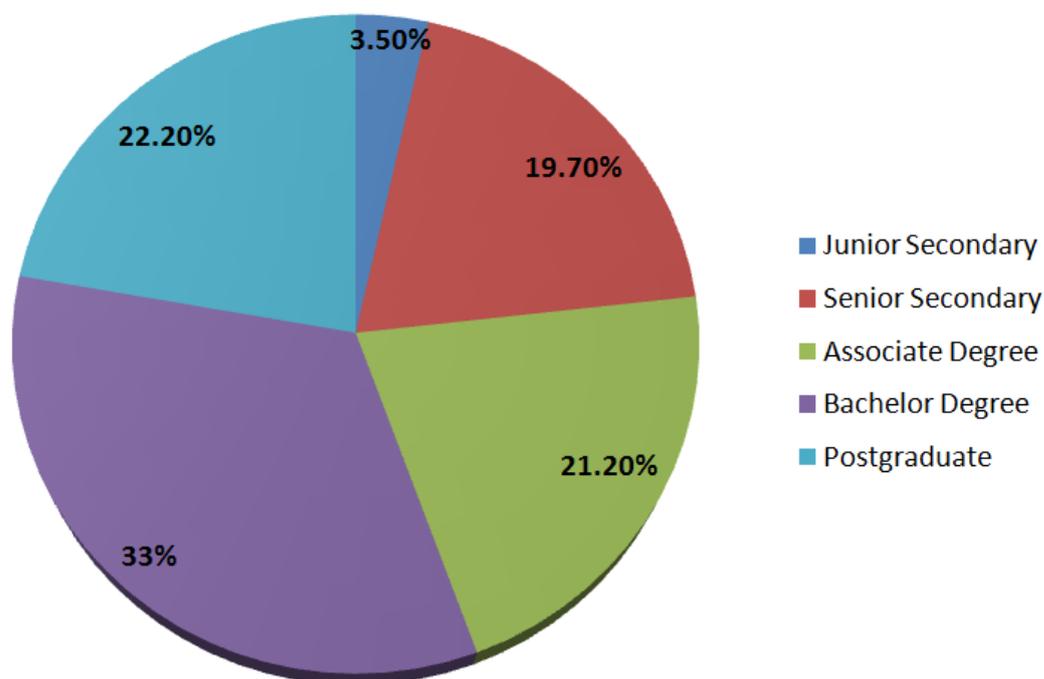**Figure 1: Age of Respondents**

Table 5 below illustrates the frequency distribution and percentage composition of the education profile of the respondents. The frequency distribution shows that the majority of the respondents (33.3% or 66 out of 198) had a bachelor degree. They were followed by those with a postgraduate degree (22.2% or 44 out of 198) and those with an associate degree (21.2% or 42 out of 198).

Table 5: Education Profile of Respondents				
	Sample		**Valid Response**	
	No.	**%**	**No.**	**%**
Junior Secondary	7	3.4	7	3.5
Senior Secondary	39	18.8	39	19.7
Associate Degree	42	20.2	42	21.2
Bachelor Degree	66	31.7	66	33.3
Postgraduate	44	21.2	44	22.2
No response	10	4.8		
Base	208	100.0	198	100.0

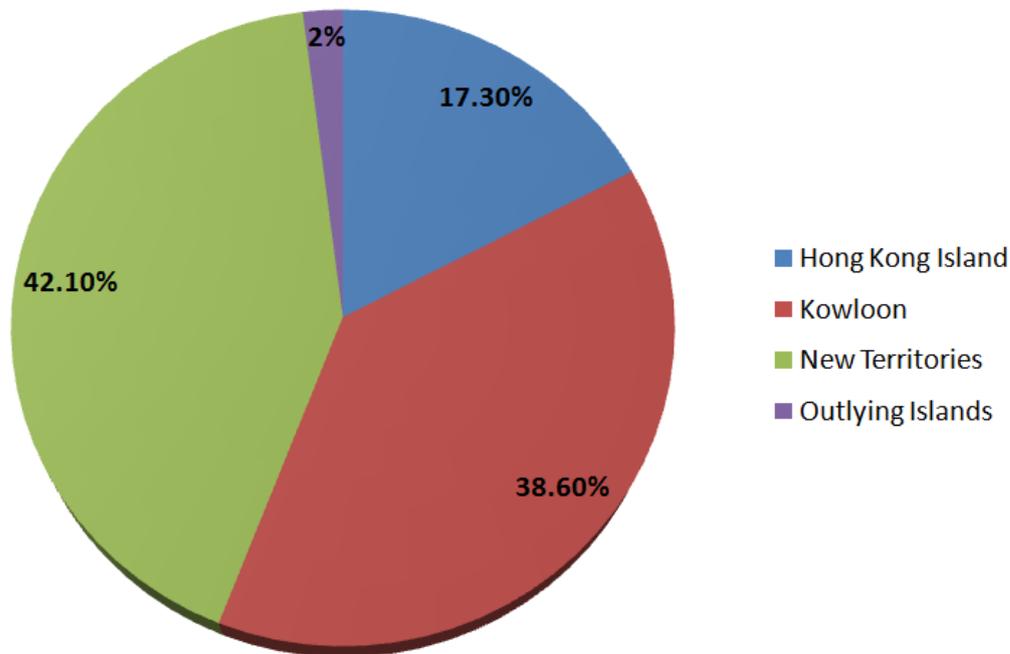**Figure 2: Education Profile of Respondents**

Table 6 below illustrates the frequency distribution and percentage composition of the place of residence profile of the respondents. The frequency distribution shows that the majority of the respondents (42.1% or 83 out of 197) lived in the New Territories. Those who lived in Kowloon (38.6% or 76 out of 197) came second and those who

lived on Hong Kong Island (17.3% or 34 out of 197) came third. Only 2% (4 out of 197) of the respondents lived on outlying islands (Figure 3).

Table 6: Place of Residence Profile of Respondents				
	Sample		**Valid Response**	
	No.	**%**	**No.**	**%**
Hong Kong Island	34	16.3	34	17.3
Kowloon	76	36.5	76	38.6
New Territories	83	39.9	83	42.1
Outlying Islands	4	1.9	4	2.0
No response	11	5.3		
Base	208	100.0	198	100.0

Figure 3: Place of Residence Profile of Respondents

Table 7 below illustrates the frequency distribution and percentage composition of the WiFi experience profile of the respondents. The frequency distribution shows that the majority of the respondents (67.2% or 137 out of 204) had more than 2 years of experience using WiFi. Those who had 1 to 2 years of experience using WiFi (13.2% or 27 out of 204) came second. 8.8% (18 out of 204) of the respondents had six months to one year of experience using it and 6.9% (14 out of 204) of them had used WiFi for less than six months. Only a small percentage (3.9% of 8 out of 204) of the respondents had never used WiFi before (Figure 4).

Table 7: Experience Profile of Respondents				
	Sample		**Valid Response**	
	No.	**%**	**No.**	**%**
Never used it	8	3.8	8	3.9
Less than six months	14	6.7	14	6.9
Six months to one year	18	8.7	18	8.8
One year to two years	27	13.0	27	13.2
Longer than two years	137	65.9	137	67.2
No response	4	1.9		
Base	208	100.0	204	100.0

Figure 4: Experience Profile of Respondents

WiFi in Hong Kong

Types of WiFi Network for Internet Access

Figure 5 below shows the types of WiFi network used by the respondents for Internet access. The bar chart shows that the majority of the respondents (85.6% or 178 out of 208) used WiFi at home, 59.1% (123 out of 208) of them used WiFi in business districts, 56.7% (118 out of 208) of them used GovWiFi, 48.6% (101 out of 208) of them used WiFi in offices and 26.0% (54 out of 208) of them used WiFi on campus.

Figure 5: Types of WiFi Network Used for Internet Access

User Profiles of the Five Main Types of WiFi Internet Access

WiFi Using Experience Profiles

Table 8 and Figure 6 below show the WiFi using experience profiles of the respondents' in terms of five main types of WiFi network. It is clear from the Table and the Bar chart that the experienced users (those with longer than 2 years of experience of using WiFi) accessed the Internet using all five types of WiFi network, while the majority of the less experienced users (those with less than six months of experience of using WiFi) accessed the Internet using the WiFi network on campus.

Table 8: WiFi Using Experience in Terms of WiFi Internet Network

	< 6 months	1/2 to 1 year	1-2 years	> 2 years
Use WiFi at home	4.6%	7.5%	11.0%	76.9%
Use WiFi on campus	9.3%	5.6%	11.1%	74.1%
Use WiFi in office	3.0%	5.0%	6.0%	86.0%
Use GovWiFi	2.6%	7.9%	13.2%	76.3%
Use WiFi in business districts	3.4%	9.3%	13.6%	73.7%

Figure 6: WiFi Using Experience in Terms of WiFi Internet Network

Gender Profiles

Figure 7 below shows the breakdown of the use of the five main types of WiFi Internet network by gender. The bar chart shows that the gender profiles of all five types of WiFi Internet network are similar.
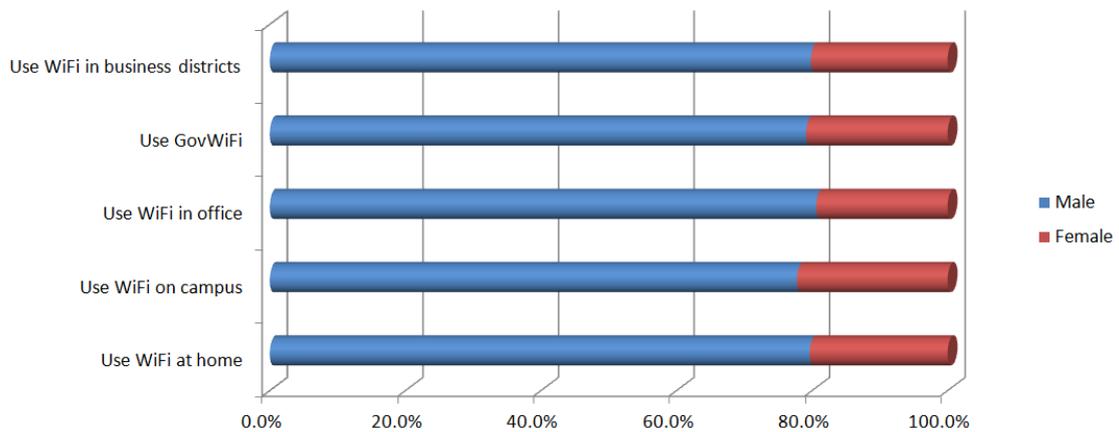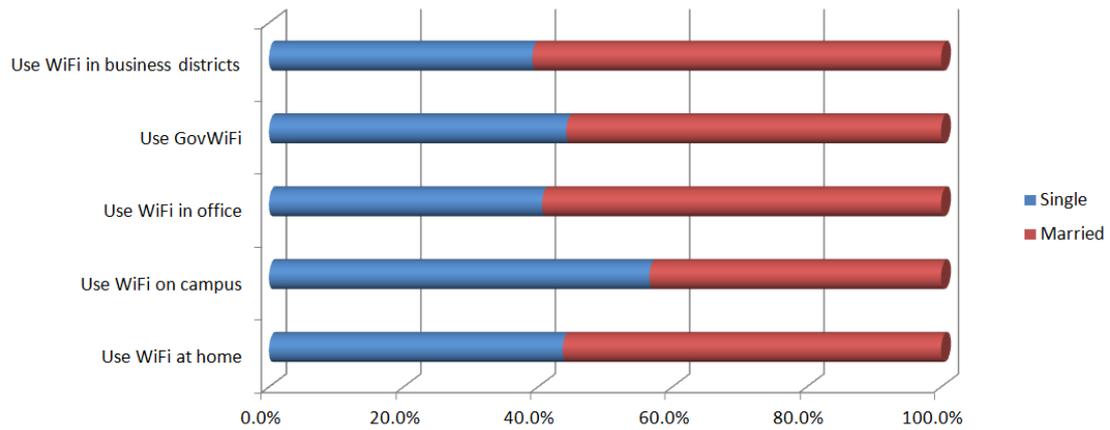

Figure 7: Use of WiFi Network for Internet Access by Gender

Marital Status Profiles

Figure 8 below show the breakdown of the use of the five main types of WiFi Internet network by marital status. It is clear from the Bar chart that the "Use WiFi on campus" category had more single users than married users, while the reversal was true for other four categories of WiFi Internet access.

Figure 8: Use of WiFi Network for Internet Access by Marital Status

Age Profiles

Figure 9 below show the breakdown of the use of the five main types of WiFi Internet network by age. The bar chart shows that more young users used WiFi on campus while more of those WiFi users who were in the 56 or above age bracket preferred to use WiFi at home.
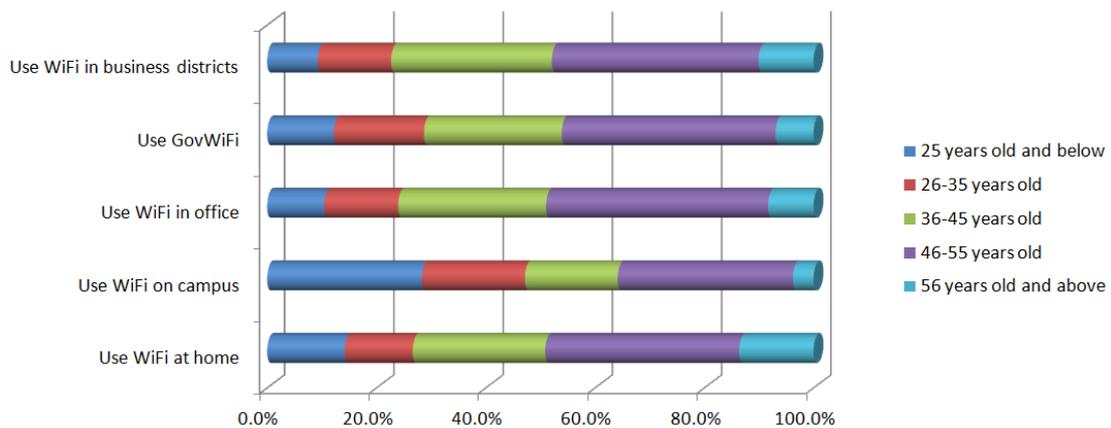

Figure 9: Use of WiFi Network for Internet Access by Age

Education Profiles

Figure 10 below shows the breakdown of the use of the five main types of WiFi Internet network by education level. The Bar chart shows that those who used WiFi in office were more highly educated than those who used WiFi via other featured networks, i.e., in business districts, on campus, at home or via GovWiFi.
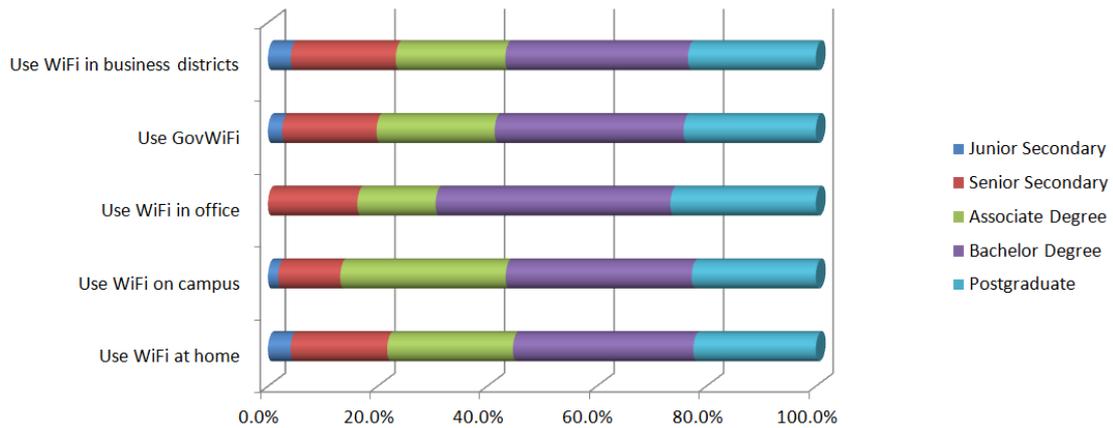
Figure 10: Use of WiFi Network for Internet Access by Educational Level

Place of Residence Profiles

Figure 11 below shows the breakdown of the use of the five main types of WiFi Internet network by' place of residence. The Bar chart shows that the respondents' place of residence profiles of all five types of WiFi Internet network are similar..
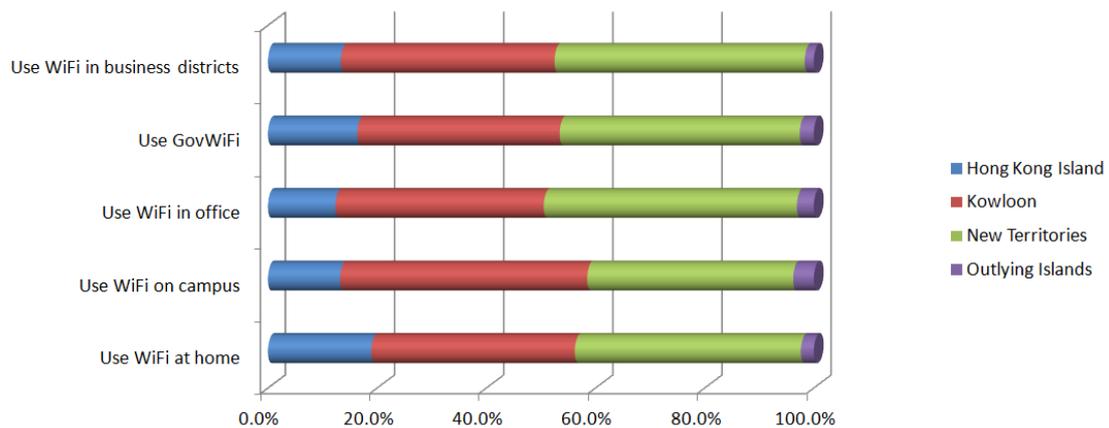

Figure 11: Use of WiFi Network for Internet Access by Place of Residence

Use of WiFi Network

Table 9 illustrates the frequency distribution and percentage composition of the amount of time the respondents spent on WiFi connection. Of the 208 respondents who completed the questionnaire, 4 (1.9%) did not answer the question on the amount of time they spent on WiFi connection and 5 of them (2.4%) indicated that they had never used WiFi connection. Of the 199 respondents (95.7%) who stated that they

used WiFi connection (see Figure 12), the majority (52.26%) of them were frequent users of WiFi, who spent more than 4 hours per day on using it. They were followed by the occasional users (31.66%) who spent less than 10 hours on WiFi connection per week. Those who used WiFi connection when necessary accounted for 16.08% of the total only.

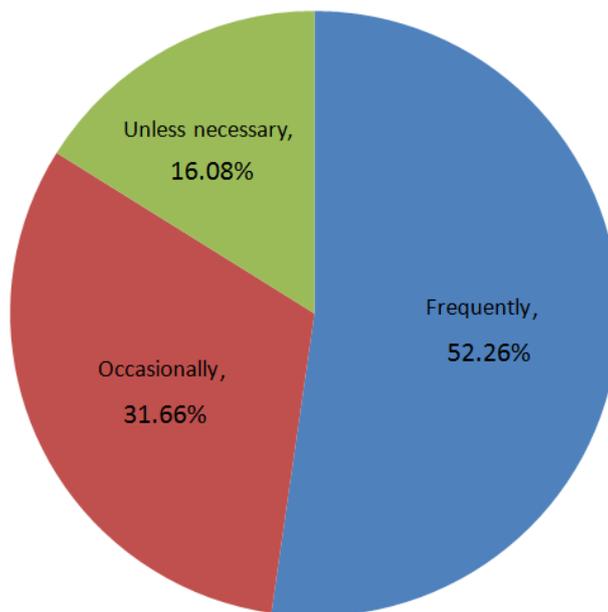| Table 9: Time Spend on WiFi Connection				
	Sample		Valid Response	
	No.	%	No.	%
Frequently (e.g. 4 hrs/day)	104	50.0%	104	52.26%
Occasionally (e.g. < 10 hrs/wk)	63	30.3%	63	31.66%
Unless necessary	32	15.4%	32	16.08%
Never used it	5	2.4%		
No response	4	1.9%		
Base	208	100.0	198	100.0

Figure 12: Time Spend on WiFi Connection

Figure 13 shows the kinds of device used by the respondents to connect to WiFi network. It is revealed that the majority of WiFi users used Smartphones (76.9%) and personal computers (66.8%) to access WiFi. About half (47.1%) of the respondents used tablets, such as iPads, to access WiFi. Very few (6.7%) respondents use PDAs to access WiFi.
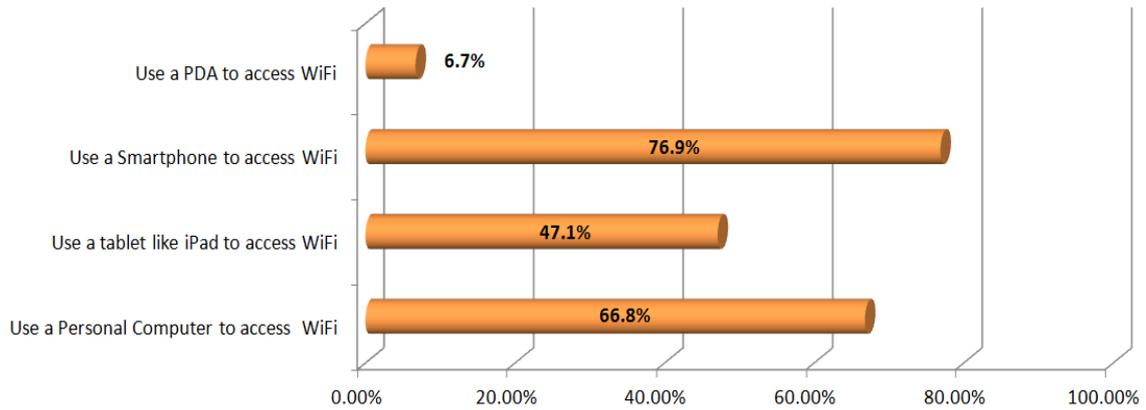
Figure 13: How do you access WiFi?

As shown in Figure 14, only 7.7% of the respondents were not users of Smartphones and notably, for those who used Smartphones, the majority of them were Android Smartphone users (65.4%). They were followed by the iOS (Apple iPhone) users (21.2%). Only 7.2% of them used Smartphones other than Android or iPhone.
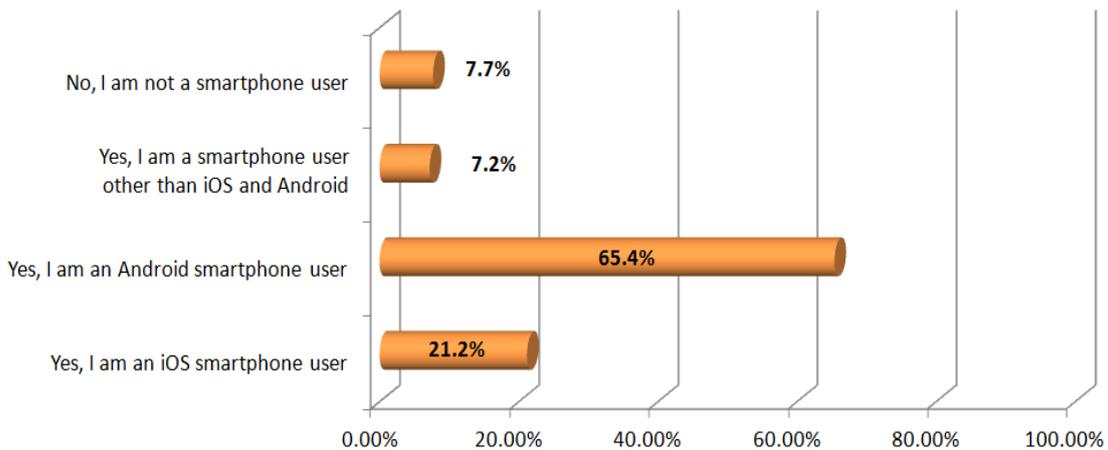

Figure 14: Are you a smartphone user?

Figure 15 shows the reason of why the respondents access WiFi network. The majority of the respondents used WiFi to obtain information from the Internet (74.5%). They were followed by those who used WiFi to conduct activities online (62.0%) and to contact friends (58.7%). About half (49.0%) of the respondents used WiFi to complete their work. Slightly less than half (44.2%) of the respondents used WiFi to support their learning.
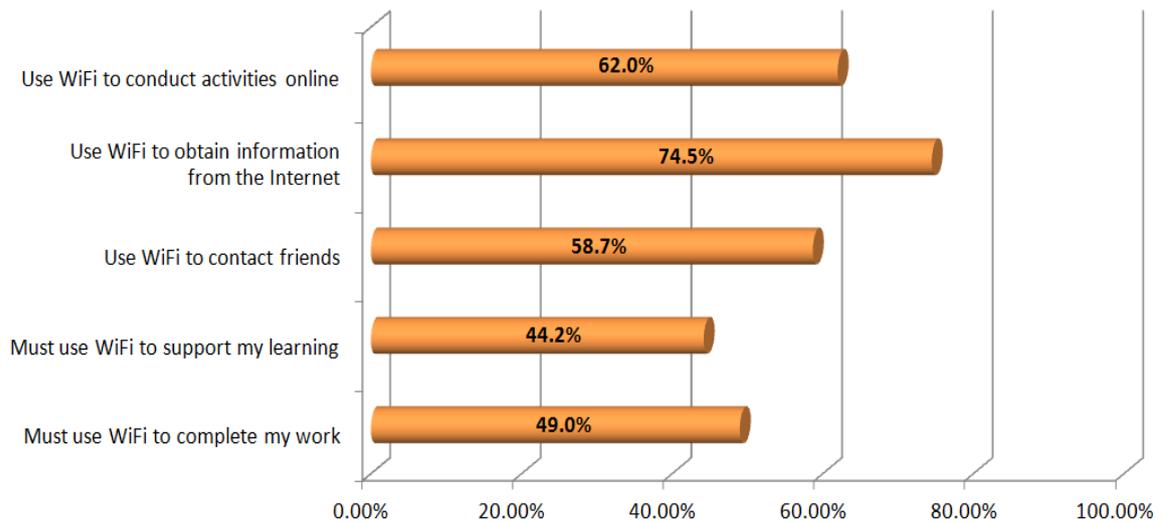
Figure 15: Why do you use WiFi to access the Internet?

Figure 16 below shows the breakdown of the reasons of using WiFi network by gender. It is revealed that both male and female users used WiFi network to obtain information from the Internet, but other than that, male users used WiFi network to conduct activities online while female users used it to contact friends.
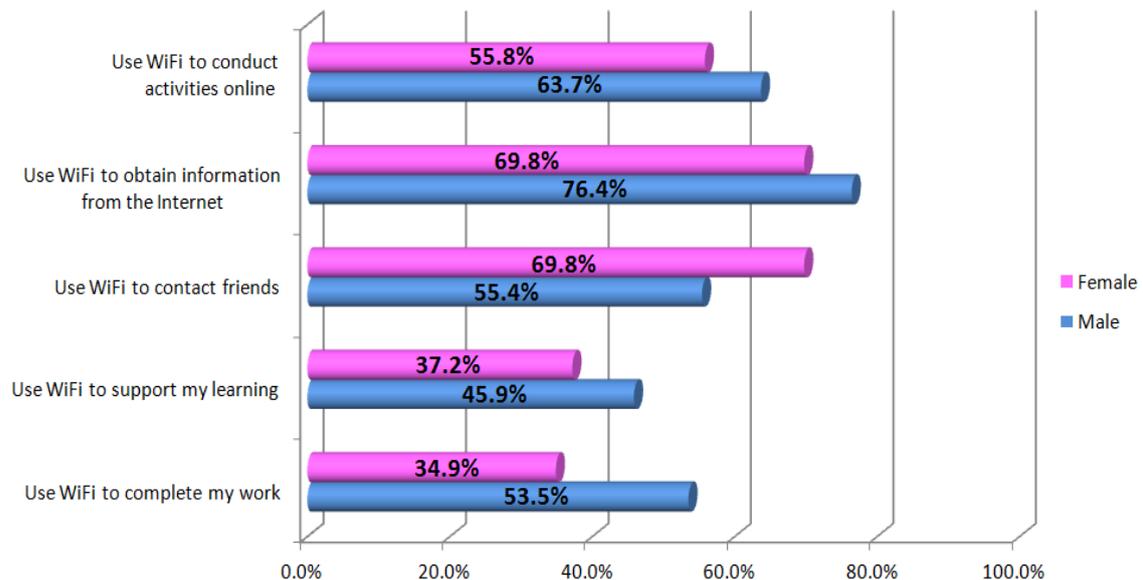

Figure 16: Reason of Use of WiFi Network by Gender

Figure 17 shows the activities the respondents conducted using WiFi network. The majority of the respondents used WiFi to check and answer emails (81.3%). They were followed by those who used WiFi to search and download information (69.2%), social networking, such as facebook, WhatsApp and WeChat (65.4%) and download free-of-charge mobile apps (60.1%). About one-third of the respondents used WiFi to

perform financial transactions (37.0%), do on-line purchasing (34.6%) and play on-line games (28.8%). About a quarter of the respondents used WiFi network to perform investment activities, like on-line brokerage (26.4%) and buying mobile apps, ringtones, images and music (24.5%). A small percentage of respondents (5.8%) used WiFi to perform other activities.
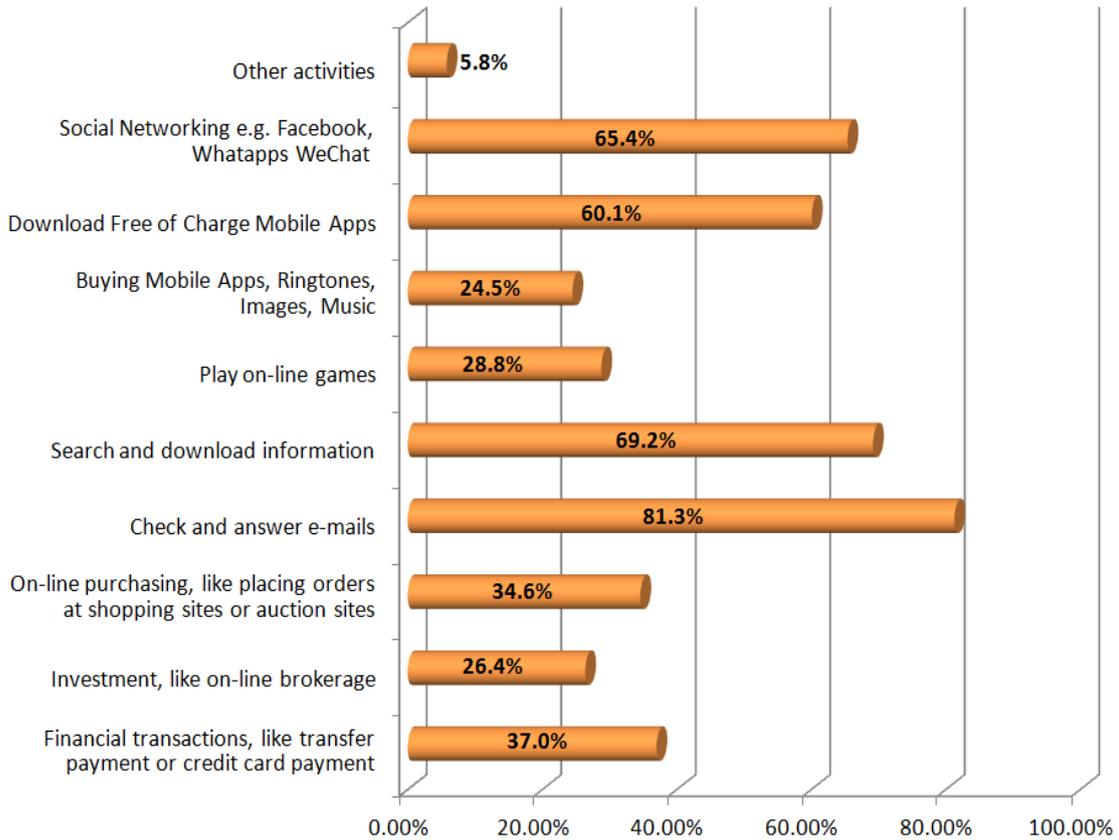

Figure 17: What activities have you conducted using the WiFi network?

WiFi tethering

When being asked whether they had ever shared their Smartphones as a WiFi Hotspot, i.e. WiFi tethering, the majority (51.0%) of the respondents answered in the affirmative but 43.3% of the respondents answered in the negative. A small percentage (5.8%) of respondents were not sure whether they had ever shared their Smartphones as WiFi Hotspots (Figure 18).
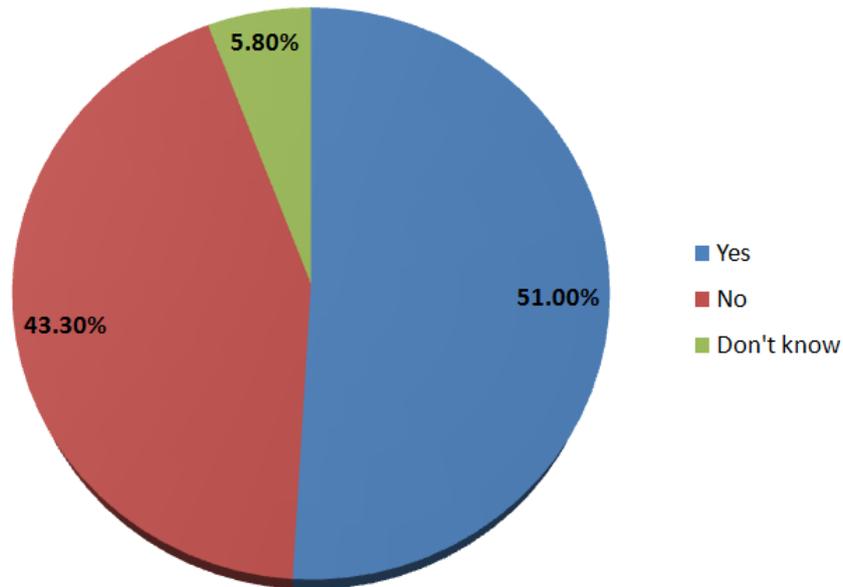
Figure 18: Have you ever shared your Smartphone as a WiFi Hotspot?

When being asked whether they had ever enabled WiFi security setting when sharing their Smartphones as a WiFi Hotspot, about half (47.3%) of the respondents answered in the affirmative, while nearly a third (31.9%) of them answered in the negative. More than one-fifth (20.7%) of respondents were not sure whether they had ever enabled security setting when they sharing their Smartphones as a WiFi Hotspot (Figure 19).
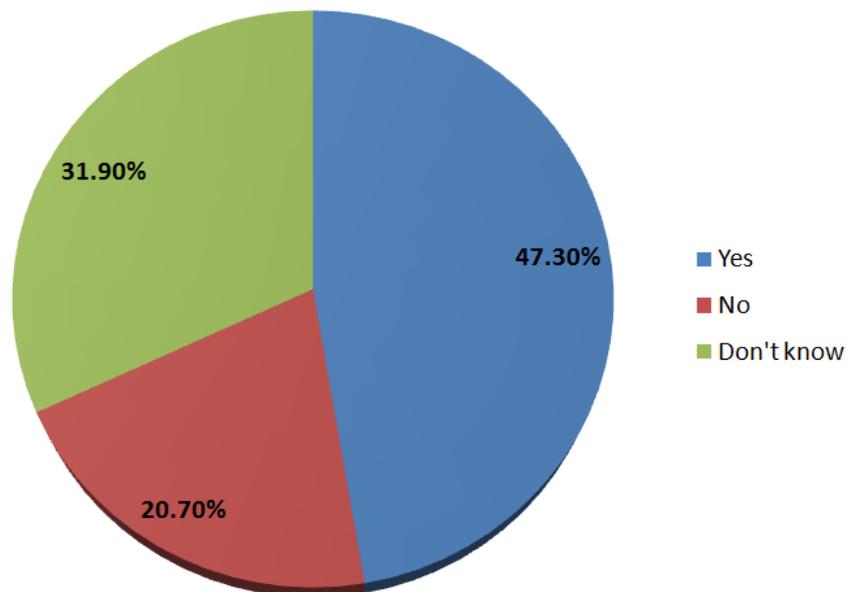

Figure 19: Have you ever enabled WiFi security setting when you shared your smartphone as a WiFi Hotspot?

Figure 20 below is a breakdown of the respondents' use of WiFi tethering and their use WiFi tethering enable security setting by gender. It shows that 57.6% of the users who used WiFi tethering were males and 39% were females and the percentage of male users who would enable the security setting when using WiFi tethering was higher than that of their female counterparts (52.4% vs. 28.9%).
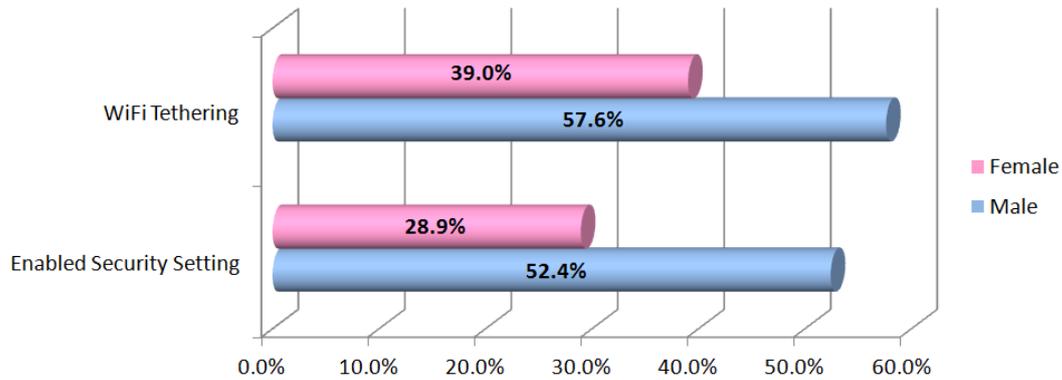

Figure 20: WiFi Tethering and Security Setting by Gender

Figure 21 is a breakdown of the respondents' use of WiFi tethering and their use WiFi tethering enable security setting in terms of the respondents' experience of using WiFi. It shows that those respondents who had used WiFi for a longer time (more than 2 years of using WiFi) tended to use WiFi tethering more than the less experienced users (less than 1 years of using WiFi). The majority of users with more than 2 years WiFi using WiFi (68.2%) used WiFi tethering and 64.0% of them would enable the security setting of their devices when using WiFi tethering. Only small percentage of the less experienced users who used WiFi (17.1%) used WiFi tethering. Among this particular group of less experienced users, only 12.1% of them would enable the security setting of their devices when using WiFi tethering.
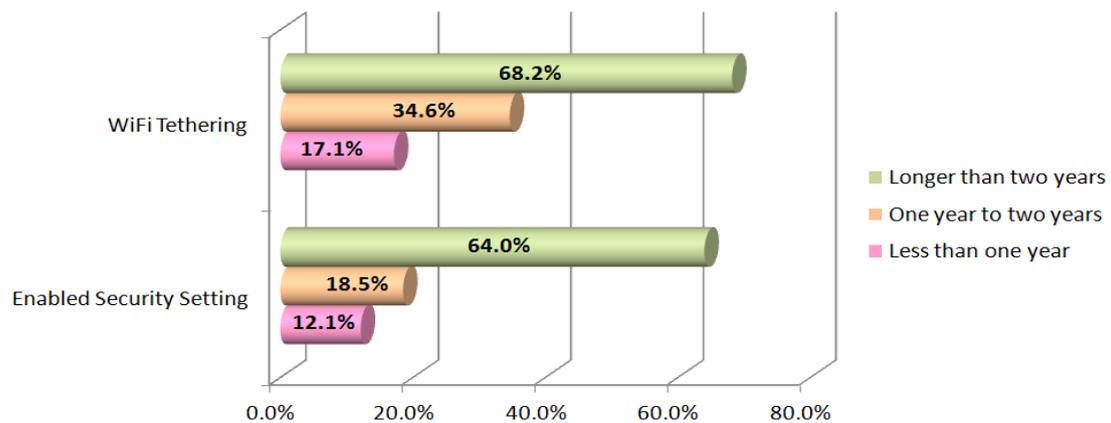

Figure 21: WiFi Tethering and Security Setting by Respondents' Experience of Using WiFi

WiFi Security

Table 10 and Figure 22 below show that half (50.0%) of the respondents expressed concerns over the use of WiFi to access the Internet as they were worried that their personal privacy might be disclosed as a result. On the contrary, 30.39% of the respondents were not worried that using WiFi to access the Internet would lead to disclosure of their personal privacy. The respondents who believed that security measures provided by WiFi were adequate is close to half (49.75%), which is considerably higher than those who believed that the security measures were inadequate (19.99%). More than half of the respondents (55.13%) believed that using WiFi to access the Internet was safe, while 20.97% of the respondents thought otherwise.

Table 10: WiFi Security

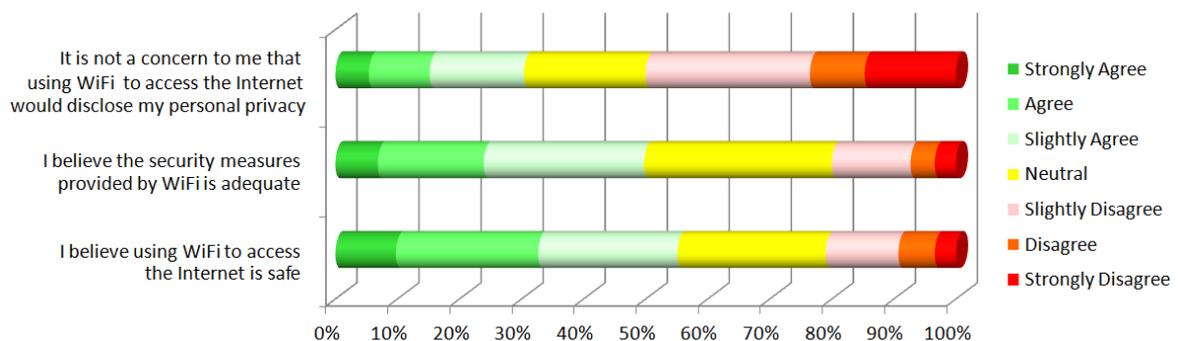|	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
It is not a concern to me that using WiFi to access the Internet would disclose my personal privacy, for example, my physical location	5.39%	9.80%	15.20%	19.61%	26.47%	8.82%	14.71%
I believe the security measures provided by WiFi are adequate.	6.83%	17.07%	25.85%	30.24%	12.68%	3.90%	3.41%
I believe using WiFi to access the Internet is safe.	9.76%	22.93%	22.44%	23.90%	11.71%	5.85%	3.41%

Figure 22: WiFi Security

Table 11 and Figure 23 below shows the breakdown of the respondents' perceptions of WiFi security by gender. It reveals that, comparing with the female respondents, the male respondents had a greater tendency to give neutral responses to the three questions on WiFi security. It also reveals that the female respondents were more concerned about the possible disclosure of personal privacy while using WiFi to

access the Internet than the male respondents (60.47% for females vs. 47.1% for males). As regards the adequacy of security measures provided by WiFi and the safety of using WiFi to access the Internet, the female respondents were slightly more doubtful about the adequacy and safety of the Wifi network than the male respondents (23.26% and 25.58% for males vs. 20.0% and 20.65% for males).

Table 11: WiFi Security

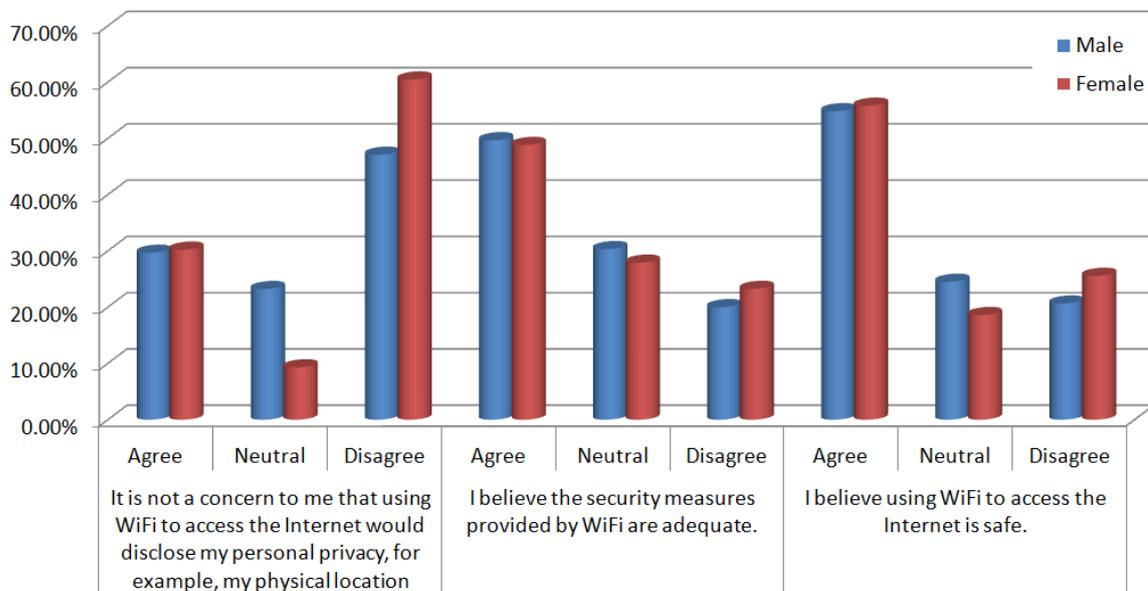|	Male			Female		
	Agree	Neutral	Disagree	Agree	Neutral	Disagree
It is not a concern to me that using WiFi to access the Internet would disclose my personal privacy, for example, my physical location	29.68%	23.23%	47.10%	30.23%	9.30%	60.47%
I believe the security measures provided by WiFi are adequate.	49.68%	30.32%	20.00%	48.84%	27.91%	23.26%
I believe using WiFi to access the Internet is safe.	54.84%	24.52%	20.65%	55.81%	18.60%	25.58%

Figure 23: Respondent Perceptions of WiFi Security by Gender

Figure 24 below shows the types of WiFi standard that the respondents used at home. It shows that more than one-third (35.6%) of the home WiFi users did not know what kinds of WiFi standard they were using. For those who know what standards they were using, 33.7% of them used 802.11n. They were followed by those who used 802.11g (23.6%). The share of home WiFi users who used older standards, i.e., 802.11a standard and 802.11b standard, were 7.7% and 13.0% respectively.
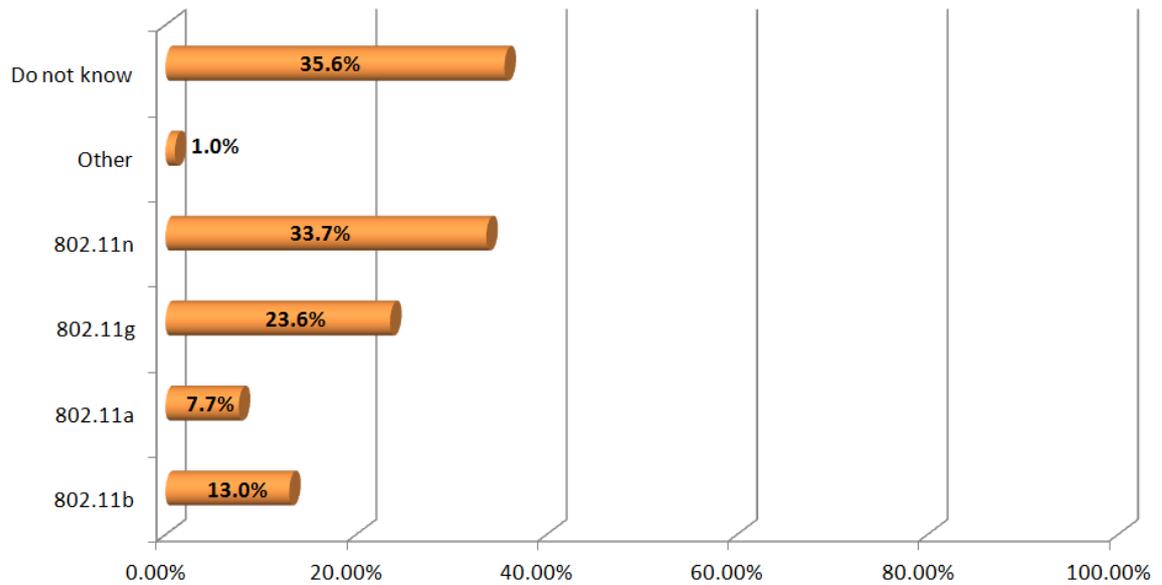
Figure 24: WiFi Standards Used by Home WiFi Users

Figure 25 below shows the types of WiFi encryptions used by the respondents at home. It shows that 5.8% of the home WiFi users did not use any WiFi encryptions in their home WiFi networks and 17.8% of the home WiFi users did not know what kinds of WiFi encryption they were using. For those home WiFi users who used WiFi encryptions, the majority of them (37.5%) used "WPA/WPA2 using AES". They were followed by those who used "WPA/WPA2 using TKIP" (27.9%). Only 8.7% of the home WiFi users used WEP (Wired Equivalent Privacy).
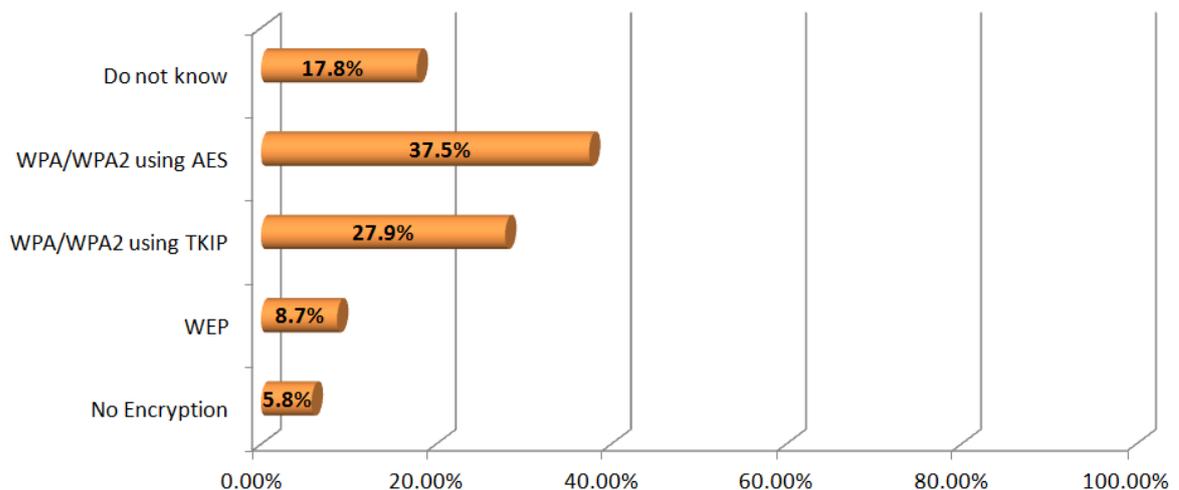

Figure 25: WiFi Encryptions Used by Home WiFi Users

Figure 26 shows that 34.9% of the female WiFi users did not know what kinds of encryption method they were using at home, which is much higher than the 13.4% share of male home WiFi users. Moreover, 7.0% of the female WiFi users did not use any encryption in their home WiFi network, which is considerably higher than the 4.5% share of male home WiFi users.

It also shows that 42.7% of the male WiFi users used the most advanced WPA/WPA2 with AES encryption technology at home, whilst only 20.9% of the female WiFi users used the same technology at home. The percentage of male home WiFi users who used WPA/WPA2 using TKIP encryption technology is also higher than that of the female users (29.9% vs. 23.3%).

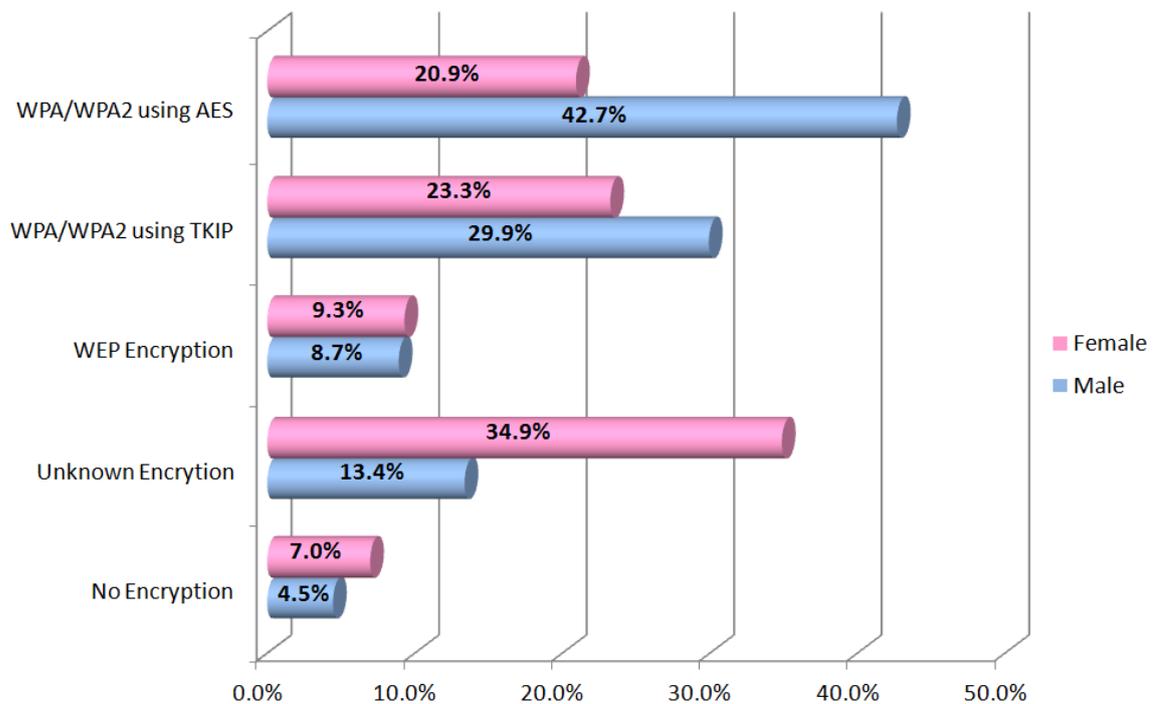**Figure 26: WiFi Encryptions Used by Home WiFi Users by Gender**

Of the 8.7% WiFi users who were using WEP at home, those who answered that they were aware of the fact that the technologies were not safe in a follow-up question on the safety of WEP encryption technologies accounted for 54.2%, while those who indicated that they didn't know that the technologies were unsafe accounted for 45.8% (Figure 27).
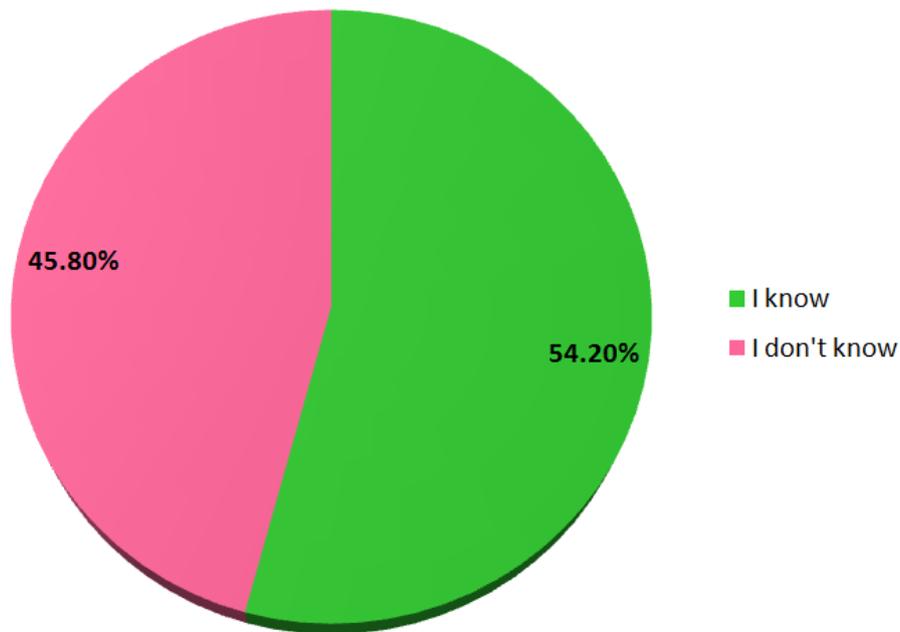
Figure 27: WiFi Encryptions Used by Home WiFi Users

Of the 54.2% of respondents who said that they were aware of the fact that WEP technologies were not safe, 30.1% of them said that they still used WEP WiFi encryption technologies because they didn't know how to change to a more secure technology (Figure 28). They were followed by those who said that they were still using WEP because the devices on the customer end did not support more secure technologies (27.3%). Other reasons for not changing to safer alternatives include the respondents' lack of time to change to another technology (12.7%), their routers do not support more secure technologies (12.7%) and they cannot change the setting because the router settings were done by suppliers (12.7%).
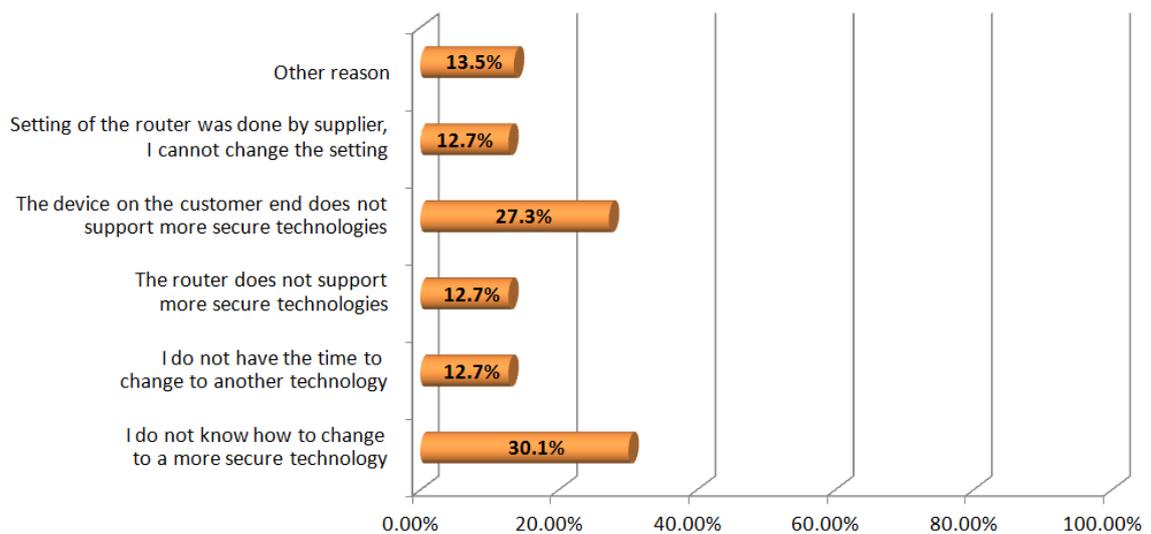

Figure 28: Reasons of still using WEP Encryption technologies

Figure 29 below shows the additional WiFi security measures that the respondents used at home other than encryption. It shows that 21.2% of the WiFi users did not use any additional WiFi security measures in the WiFi networks at home, and 19.2% of the home WiFi users did not know what kind of additional WiFi security measures they were using. For those home WiFi users who used additional WiFi security measures, 33.7% of them changed the administrator password of their WiFi devices. They were followed by those who change the default SSID of their WiFi devices (30.3%). About one-fifth of the home WiFi users disabled SSID broadcasting of their WiFi devices and 16.8% of them enabled MAC address filtering. Only 6.7% of home WiFi users used VPN.

Figure 29: Additional WiFi Security Measures Used by Home WiFi Users

WiFi Security Knowledge

Table 12 and Figure 30 below show that is a breakdown of respondents regarding to questions on knowledge of WiFi security. In responding to the question of whether they have good knowledge on WiFi security, 58.7% of the male respondents believed they have while only 41.9% of the female respondents believed so. In responding to the question of whether they can explain WiFi security to others, 57.4% of the male respondents believed they can while only 30.2% of the female respondents believe so.

In responding to the question of whether they know how to use the security setting in WiFi, 63.2% of the male respondents believed they know while only 30.2% of the female respondents believed so. In responding to the question of whether they know how to teach others to use the security setting in WiFi, 53.5% of the male respondents believed they know while only 23.3% of the female respondents believed so.

Table 12: WiFi Security Knowledge

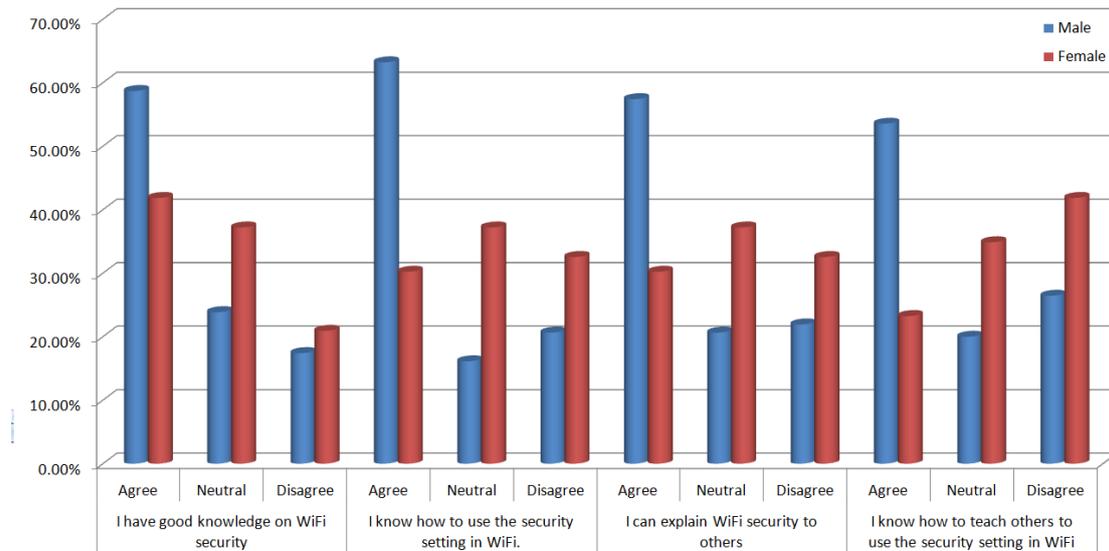|	Male			Female		
	Agree	Neutral	Disagree	Agree	Neutral	Disagree
I have good knowledge on WiFi security	58.7%	23.9%	17.4%	41.9%	37.2%	20.9%
I know how to use the security setting in WiFi	63.2%	16.1%	20.6%	30.2%	37.2%	32.6%
I can explain WiFi security to others	57.4%	20.6%	21.9%	30.2%	37.2%	32.6%
I know how to teach others to use the security setting in WiFi	53.5%	20.0%	26.5%	23.3%	34.9%	41.9%

Figure 30: WiFi Security Knowledge

Public WiFi Access

Figure 31 below shows the respondent comments and suggestions on the public WiFi hotspots provided by commercial service providers. Inadequate WiFi access points (64.9%), unstable service quality (50.5%) and inadequate bandwidth (42.3%) were the

top three comments given by the respondents. These were followed by inadequate transparency in service pricing (26.4%) and service charge (23.1%).

Figure 31: Respondent Comments/Suggestions on Commercial WiFi Services

Figure 32 below shows the respondent comments and suggestions on the public WiFi hotspots provided by the HKSAR government known as GovWiFi. Inadequate WiFi access points (72.1%), inadequate bandwidth (50.0%) and unstable service quality (47.1%) were the top three comments given by the respondents. These were followed by inadequate contents or services (25.0%).
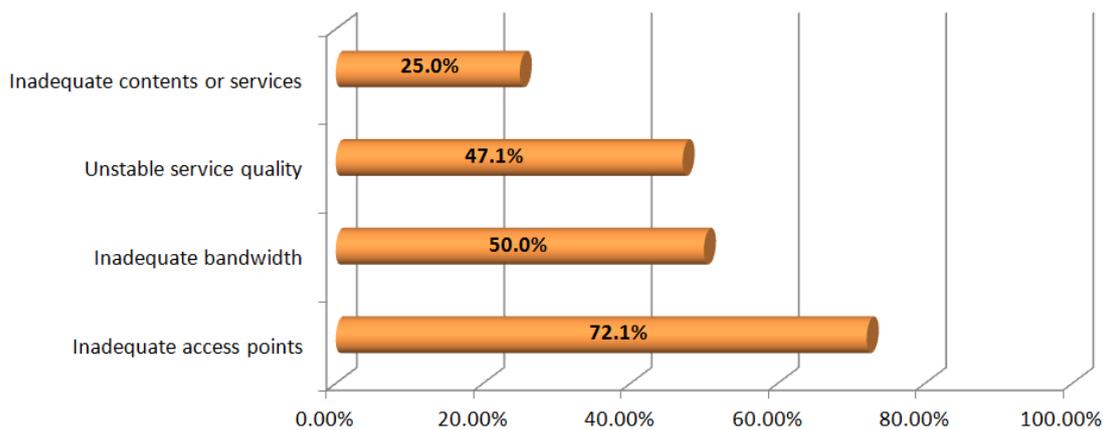

Figure 32: Respondent Comments/Suggestions on GovWiFi

Discussion

WiFi connection is a necessity today for all of us. WiFi allows us to access the Internet from any enabled spot without the need to plug in. It allows us to connect several devices to one network wirelessly and makes it possible for us to maintain constant contact with family, friends and clients. Setting out to examine WiFi usage, accessibility, user knowledge and security in Hong Kong, this report provides an empirical assessment of user perceptions on a number of key issues of Information and Communications Technology (ICT) development in the territory.

WiFi usage

On WiFi usage, it is found that the majority of respondents use WiFi to obtain information from the Internet, contact friends and conduct online activities. A close scrutiny of the data reveals that there is a gender difference in the purposes of obtaining WiFi connectivity, with females showing a greater tendency to use WiFi for social networking purposes while males for addressing work-related issues and for learning purposes.

While the gender difference in WiFi usage may offer clues about the differences in the positions and roles of men and women in Hong Kong, it may also suggest that WiFi, in a certain way, has enabled women in Hong Kong to maintain or extend their social circle or even to assist some of them, especially the working mothers, to reduce work-life conflicts, so that they can cope better with their increasingly demanding roles as a parent, a spouse and an employee. How to leverage this for more business opportunities is a challenge for all stakeholders in the ICT industry.

Over half of the male respondents use WiFi to complete their work, and close to 80% of the male respondents use WiFi to access the Internet at home. While these findings may suggest an increasing blurring of the divide between work and life among men, it may also mean that steps must be taken to enhance WiFi security and awareness of the risks involved in view of the growing trend of performing work-related tasks from home among users.

Despite the wide variety of mobile devices available in the market, the research

reveals that smartphone is the most prominent and dominant device used by the people in Hong Kong to access the Internet via WiFi. Small, sleek, user-friendly and highly addictive due to their entertaining apps and games, the growing popularity of smartphones as a leading mobile device means that people need connectivity all the time, whether at home or on the go. It will just be even tougher for WiFi service providers to live up to that connectivity requirement, especially in view of the fact, as highlighted later in the report, that connectivity problems, i.e., inadequate WiFi access points, inadequate bandwidth and unstable service quality, top the list of main concerns over public WiFi service in Hong Kong.

WiFi Security – Knowledge and WiFi Tethering

The respondents are generally satisfied with WiFi security in Hong Kong but like WiFi usage, there is a significant gender difference in the respondent perception of WiFi security in Hong Kong. Female respondents are more worried about the security implications of using WiFi than the male respondents. They are less sure of the adequacy and safety of the Wifi network. The perception of higher risk may probably reflect the fact that some women are less familiar with ICT technicalities, hence the more cautious mood felt by them when answering a question which they believed they didn't seem to know as much as their male counterparts.

The female respondents' lack of confidence is evidenced by the significantly lower percentage shares of women who believe that they have good knowledge of WiFi security, or they have the ability to explain to others what does it mean by WiFi security, or they are less capable of using the security setting in WiFi. In addition, only 20.9% of female respondents used "WPA/WPA2 using AES" and over a quarter of the female respondents answer they have no idea what type of encryption technology they are using.

As on the issue of using smartphones to share WiFi connection to other mobile devices known as WiFi tethering, gender difference also exists. 57.6% of the male respondents indicate that they have used WiFi tethering and 52.4% most of them have enabled security setting when doing this. The respective shares of women who are in the affirmative in answering the same questions are 39.0% and 28.9% only.

The significant gender differences with regard to WiFi security, knowledge of the security vulnerabilities in WiFi and WiFi tethering are worrisome and call for concern from all stakeholders in the industry. To avoid making women an easy and vulnerable target for cyber attack, promotional activities should be organized to raise awareness of WiFi security among women. Work must be done to provide women with the means to receive the training they need so that they can use WiFi safely and more confidently.

Encryption and Extra Security Measures

While it is encouraging to find that those who use no encryption at all only accounts for 5.8% of all responding home WiFi users, it is however, alarming to see that 17.8% of those who do use encryption have no knowledge of the type of encryption they are using; and for those who know what they are using, 8.7% are using the WEP encryption, which is old and unsafe and which can be easily breached by a hacker (Sharma, Mishra and Singh, 2013; Stimpson et al., 2012).

In addition, over one-fifth of the respondents take no extra security measures when using WiFi at home. Worse still, of those who take extra security measures, close to one-fifth of them have no knowledge of what are the extra precautions taken, well over half of them do not take the simplest precautionary measures to protect their data such as changing the administrator password (66.3%), changing the SSID (69.7%) or disabling the SSID broadcast (78.8%).

It is the industry's concern that WiFi users in Hong Kong have limited knowledge of WiFi encryption. It is clearly important that stakeholders should work together to educate WiFi users of the need to protect their own data and the various means of achieving it. For those home WiFi users who do not use any encryption or are still using WEP encryption, targeted measures should be taken by stakeholders to teach them of the imperative need to use or change their encryption to WPA (Wireless Protected Access) or WPA2 encryptions so as to ensure that data can be transferred from the router to the mobile devices in a more secure manner.

It is also important to teach users of the technical differences between encryption technologies and the different effects they have on usability, transparency and security.

There are two encryption technologies in use in WPA and WPA2, namely Temporal Key Integrity Protocol (TKIP) and Advanced Encryption Standard (AES). Though AES is considered as faster and more advanced than TKIP encryption, it requires more computing power to run than TKIP encryption. It is important to help users to understand these differences in operating requirements so that they can make the best choice against data loss or theft (Stimpson et al., 2012).

It appears also that many home users of WiFi in Hong Kong are oblivious of the fact that protecting personal data through encryption alone is not enough. Steps must be taken to raise the awareness of the users of the importance of changing their WiFi network SSID and administrator password. Moreover, as home WiFi networks are mainly used by family members, there is no point to broadcast the networks' SSID. It should be part of education to teach users to disable their SSID broadcasts to protect their data.

WiFi Accessibility

Inadequate WiFi access points, inadequate bandwidth and unstable service quality top the list of problems that frustrate WiFi users in Hong Kong. These problems occur not only with public WiFi access run by commercial service providers but also with GovWiFi hotspots provided by the HKSAR government (HKSAR Government, 2013). The slight difference in user evaluation of the service provided by commercial operators and that of the government is that more users agree that GovWiFi service is better in terms of service stability, while WiFi access provided by commercial operators is better in terms of bandwidth and adequacy of access points.

The findings, in particular those on respondent perception of GovWiFi accessibility, echo the findings of the Director of Audit's report on GovWiFi service published in March 2013. The report highlights the inadequacy of GovWiFi coverage, bandwidth and service quality and recommends that measures be taken "to enhance the connection to the GovWiFi service, the accessibility to the Internet websites and the connection speed, where appropriate" (HKSAR Audit Commission, 2013, p.ix).

To turn Hong Kong into a truly wireless city requires the joint efforts of both government and the private economy. Both sectors should work together to increase

the number WiFi hotspots and eliminate the blind spots, i.e., locations where no WiFi signal can be received, by installing, as appropriate, additional WiFi hotspots or WiFi signal boosters.

It is also important for the public WiFi hotspot providers to take into account the number of simultaneous connections a hotspot can serve at a given time so that the number of public WiFi users connecting to a particular WiFi hotspot will not exceed the designed threshold. In other words, a more systematic study needs to be conducted to estimate the number of public WiFi users in each region and their WiFi using pattern so that a more strategic and effective approach can be achieved when selecting WiFi hotspots.

Lastly, inadequate transparency in service pricing has also caused concern among those who use commercial WiFi hotspots in Hong Kong. Transparency in pricing is important for fair competition and the creation of lasting customer partnerships. This report calls upon that commercial service providers to increase pricing transparency and urges the government to play an active role to see that this is achieved.

~ END ~

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