

MARKET REPORT FOR INDUSTRIAL HANDHELD WIRELESS DEVICES

by

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ABSTRACT

This report, as a preliminary market study of industrial handheld wireless devices, includes a market overview, a market research analysis based on the 5Cs (Customers, Company, Competitors, Collaborators, and Context), market characteristics (size, segmentation, vertical market applications, and demand), future opportunities projections, and an industry analysis using the five-forces model. The data, facts and evidence for this report were gathered through primary research with global design houses and from secondary sources. This report finds that the market for industrial handheld products has been and will be growing steadily due to increasing demand for productivity, communication, and service, supply and management applications at various market verticals, and enhancements in wireless and networking technologies. This market growth also provides business opportunities for independent software vendors to engage with industrial device manufacturers (customers) to provide them with complete software solutions.

Keywords: Five-Forces, Marketing Analysis, Telecommunications, Wireless Devices

Subject Terms: Industrial Handheld Wireless Devices; Marketing Analysis

EXECUTIVE SUMMARY

Global Engineering Operation division (GEO), a wireless systems engineering services organization within Company_X Software Inc., is planning to expand its operation and marketing domain as a part of a diversification strategy. Company_X is pursuing this diversification strategy to increase its overall revenue. One of the market sectors they are planning to explore is industrial handheld wireless products. GEO desires to allocate some of its firmware and software engineering knowledge and capabilities to develop the middleware layers, such as board support packages, telephony integration and power management application stacks and user interfaces, to potential customers: original equipment manufacturers (OEMs) and original device manufacturers (ODMs).

The industrial handheld wireless device (IHWD) market is a sector of the mobile computing market which overlaps with the telecommunication and computing industries. Many players from both industries, including semiconductor suppliers, independent software vendors, equipment manufacturers and service providers, have strong interest in the emerging IHWD market and see the potential to service vertical market applications, from the service sector to manufacturing, medical, logistics and transportation. This paper finds that the market size for the IHWDs was \$5.7 billion in 2005 and the growth in this market and the adoption dynamics and timing lead to expectations of a total market size for IHWDs of over \$10 billion by 2010.

All indications are that the IHWD market has not crossed “the chasm” yet to reach mass-market penetration. This is promising news for newcomers to the market, like

Company_X, as they have an opportunity to engage with equipment manufacturer customers and to benefit from the significant market growth as the technology is adopted by early majority (pragmatics) customers. The most important customer (ODM and OEM) requirements for IHWDs are that they are robust with a rugged casing, a lower cost of the bill of materials, modular design, lower power consumption, a user friendly interface, reduced development and research expenses, open source operating systems, powerful software utilities, easy access to distribution channels, and advanced technical support. For end users of IHWDs, low equipment cost and low power consumption, reliability, ease of use, generous warranty coverage and technical support are the most demanding requirements.

With Company_X's technological expertise and strength in mobile software engineering and system integration and the benefits that accrue from experience and economies of learning, the cost of developing the middleware and application software applicable for IHWDs should be much lower than for new startup software vendors entering the market. Company_X can also gain a competitive advantage over some of its competitors in this market through its expertise in usability and enabling wireless handsets based on Linux, Symbian and Windows CE and Mobile kernels. However, as a new player in the IHWD market, Company_X will need to plan an effective "go-to-market" strategy, particularly in designing a hybrid market channel system, to reach out and be a part of ecosystems of one or more "rising stars" or "cash cow" equipment vendors.

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LIST OF ACRONYMS

| List | Description |
|------|---|
| API | Applications Programming Interfaces |
| ASIC | Application Specific Integrated Circuit |
| ASSP | Application Specific Standard Product |
| BSP | Board Support Package |
| CAGR | Compounded Annual Growth Rate |
| CRM | Customer Relationship Management |
| DPM | Direct Part Making |
| EoS | Economies of Scale |
| ERP | Enterprise Resource Planning |
| FPGA | Field Programmable Gate Array |
| GEO | Global Engineering Operations |
| GPS | Global Positioning System |
| GUI | Graphical User Interface |
| IC | Integrated Circuit |
| IHWD | Industrial Handheld Wireless Device |
| ISV | Independent Software Vendor |
| LAN | Local Area Network |
| LBS | Location Based Systems |
| ODM | Original Device Manufacturer |
| OEM | Original Equipment Manufacturer |
| OS | Operating System |
| PCB | Printed Circuit Design |
| PDA | Personal Digital Assistance |
| QoS | Quality of Service |
| RFID | Radio Frequency Identification |
| RTOS | Real Time Operating System |
| SDK | Software Development Kits |
| SoC | System-on-Chip |
| TTM | Trailing Twelve Months |
| UHF | Ultra-High Frequency |
| VAD | Value Added Distributors |
| VAR | Value Added Resellers |
| VoIP | Voice over Internet Protocol |
| WAN | Wide Area Network |
| WIP | Work in Progress |

1: INTRODUCTION

Company_X Software's wireless systems engineering service division, called Global Engineering Operation (GEO), would like to diversify and expand its operations into new markets to increase its revenue. One of the new markets GEO is planning to enter is industrial handheld wireless device (IHWD) market. GEO plans to leverage its firmware and software engineering knowledge and capabilities to develop the middleware and applications software stacks and user interfaces to potential Original Equipment Manufacturer (OEM) and Original Device Manufacturer (ODM) customers in the industrial handheld wireless market.

The IHWD market is considered as a sector within the mobile computing market, which has overlaps with the telecommunications and computing industries. Many players from both industries, including semiconductor suppliers, independent software vendors, equipment manufacturers and service providers, are interested in competing in the emerging IHWD market. With increasing demands to faster and more secure telecommunications equipment and computers and more sophisticated information technology and business applications, the IHWD market is logically expected to grow and has potential to serve vertical market applications, from the service sector to manufacturing and including medical, logistics, hospitality and transportation sectors.

Company_X, relying on its core competency in mobile software engineering and system integration, would like to plan a strategy to enter the IHWD market, providing ODMs and OEMs with software solutions suited for devices used in this market.

However, as a new player in the IHWD market, Company_X will need to address some challenges. They will need to determine the potential size of the market segment and its growth rate as well as what the customers want. In addition, an entry should consider what software products to build that will fit the market. They will also need to ascertain how to reach out and establish a relationship with one or more “rising stars” or “cash cow” equipment vendors. Essentially, they need to determine how to reach the mass market within the IHWD industry.

This report is an outcome of an applied market research and analysis project focusing on the IHWD market. The project, sponsored by GEO’s product management and marketing team, was undertaken as a part of the Master of Business Administration program in Management of Technology at Segal Graduate School of business at Simon Fraser University. The objectives were to introduce the IHWD industry, the players and products in the market, address the problems and challenges mentioned above and provide GEO with some strategic guidance to assist them in undertaking appropriate planning for entry into this market. Additionally, this report contributes with a market analysis based on primary research from global design houses and secondary research on the latest available data from online sources and market reports for the IHWD industry. Market size, market demand and customer expectations and overall industry analysis are among the contributions this report makes. Finally, this report clarifies if there is a potential market growth in this industry and new opportunities for Company_X to benefit from this growth. The name of the company sponsoring the project and the names of companies contacted for primary research have been kept confidential at their request.

To meet the above goals, this report first presents some fundamental information about both the telecom and IHWD industries in chapter 1, followed by an overview of the company sponsoring the project in chapter 2. Chapter 3 includes a market overview based on the 5Cs (Customers, Company, Competitors, Collaborators, and Context) and an analysis of market concepts. The IHWD market size, market segmentation, vertical market applications, and anecdotal evidence of market demand are presented in chapter 4. Market attractiveness and future market opportunities for independent software vendors in the IHWD market are the focus of chapter 5. Next, strategies with regard to products and services that an independent software vendor (ISV) can offer in this market and distribution channel are discussed in chapter 6. Finally, an effective strategy for the ISV to reach the mainstream market in the IHWD industry is recommended in chapter 7.

The remainder of this chapter provides background information on the telecommunication and IHWD industries. Background on the telecom industry is relevant because of two main reasons: 1) IHWDs inherit the same wireless technologies and data, voice and video services used in the personal handheld and mobile telecommunication products, and 2) many of players operating in the telecommunication industry, particularly a number of the semiconductor vendors, ISVs, ODMs, OEMs and service providers, are also targeting the IHWD market. The IHWD industry is the main focus of this project, so both an introduction to the industry and an overview of current IHWD product attributes are provided.

1.1 Telecommunication Industry Overview

With the introduction of Application Specific Integrated Circuit (ASIC) design in the 80s and 90s, integrated semiconductor solutions dominated communications circuits,

and consequently new ASIC design houses and semiconductor firms entered the telecommunication industry to compete with traditional silicon firms such as Intel, Motorola Semiconductor and Texas Instruments. In addition, in the 90s, Application Specific Standard Products (ASSPs) emerged as direct competition to ASICs and attracted huge interest from OEMs due to cost, power consumption and development cycle advantages over ASICs. During these years, fabless firms such as Broadcom, Qualcomm, Marvell Technologies, Applied Micro Circuit Corporation (AMCC) and PMC-Sierra emerged as the main players in ASSP design and development. Figure 1 illustrates the current structure and value chain for the telecommunications industry. Starting with chip design and development, the upstream element of this industry is semiconductor solution providers, mainly fabless firms. These firms not only design, develop, test and market the processors, ASSPs and ASICs, but also provide software drivers and Application Programming Interfaces (APIs), normally without any additional cost, to configure the chips for certain operational modes.

The second element of the telecom industry is firms building Printed Circuit Boards (PCBs) from the ASSP and ASIC processors. These firms, known as original device manufacturers or ODMs, also integrate and combine software from different chips on a PCB to support the functionality of the board. Normally, ODMs design and build the PCBs based on proposals and requirements from the OEMs, the third element of the industry.

OEMs, such as Motorola, Cisco Systems, Nokia, Huawei, and Fujitsu, design and build various network boxes, called network equipment, by mounting one or more PCBs to a backplane card and adding one or two microprocessor cards to program, control and

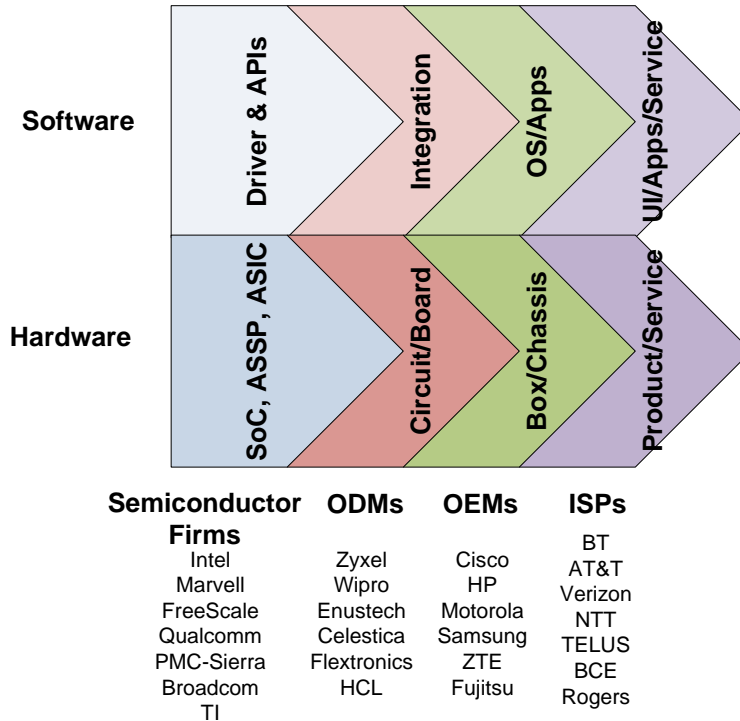
monitor the whole system via a real time operating system (RTOS) and some generic application level software. Cisco Systems is currently the biggest OEM in the router and access equipment space. ODMs and OEMs, directly or through their partner channels and vertical markets, also build various communication devices such as Personal Digital Assistances (PDAs), network cards, wireless routers, residential gateways, handheld wireless computers (also called mobile computers), and mobile phones. Samsung, Motorola, and Nokia currently hold the biggest market share in the mobile device market in both personal and industrial applications.

As the fourth and final element of the industry, carriers and service providers, such as British Telecom, China Mobile, China Unicom, Vodafone, Verizon, AT&T, and NTT Docomo (Japan), complete the equipment or wireless products by adding their own specific application software and a user interface. They market, sell, deploy, install, and maintain equipment throughout their telecommunication network. These firms' business models concentrate mainly on building telecommunication infrastructures and providing and managing data, voice, video and television services to businesses and individuals.

A direct dialog between the service providers or the OEMs and the chipmakers and software vendors is the essential approach in design and marketing of the devices, and this approach is constantly pursued by project managers and marketing staff in semiconductor, software and equipment manufacturing firms. Consequently, any change in capital expenditure by service providers directly affects all the elements in the value chain from equipment manufacturers and software developers to semiconductor companies. A number of the players operating in telecom industry leverage their

capabilities in other industries that use various telecommunication technologies. IHWD industry is one of them.

Figure 1: Telecommunications Industry Overview



*This figure was created by the author from analysis of the telecom Industry.

1.2 Telecom Market Analysis

The global telecommunication services industry group consists of the diversified telecommunication services industry and the wireless communications market. The increasing reliance of the world's population on telecommunications and networking has resulted in strong growth for the industry group in recent years. According to an industry profile report published in April 2007 by Datamonitor, a leading business information company specializing in industry analysis, the global telecommunication services industry group grew by 9.1% in 2006 to reach a value of \$1,517 billion. The leading

revenue source for the global telecommunication services industry group in 2006 was the diversified telecommunication services industry, which accounted for 53.3% of the industry group's value. The wireless telecommunication services market has, however, boasted a stronger compound annual growth. Rapid developments in mobile phone technology have driven growth in the global telecommunication industry. In the same report, Datamonitor predicts that, by 2011, the global telecommunication services industry will have a value of \$2,197 billion, an increase of 44.8% since 2006. It will be very interesting to know what portion of this growth forecast is expected from the wireless sector that services the IHWD market. Such a data or analysis is yet to be found.

1.3 IHWD Industry Overview

Industrial handheld wireless devices, also often called mobile computers, combine hardware and software, based on designs from various technologies in communications and networking, wireless computing, information systems and optical scanning. Naturally, the developers of these mobile devices operate their businesses in an amalgamated environment of multiple industries: computing, enterprise data, and telecommunications. These devices target vertical markets from retail, service and hospitality sectors to medical, manufacturing, logistics, and other enterprise and industrial applications.

Competition in the industrial handheld wireless device market is intense. The sector is characterized by rapid change and complex technology. The main competitors include mobile computing manufacturers such as Palm One, Linear Technologies, 4p Mobile Data Processing, and Data Logic, and mobile handset and smart phone manufacturers such as High Tech Computer (HTC), Motorola, Nokia, Research in

Motion, Samsung and Sony-Ericsson. The device developers also face competition from computing device companies such as Acer, Dell, Fujitsu, Siemens Computers, Hewlett-Packard and Mio Technology, ultra mobile personal computing companies such as FlipStart Labs, OQO and Pepper Computer, consumer electronics companies such as Apple, NEC, Sharp Electronics, Sony and Yakumo, and a variety of early-stage technology companies. The increasing consolidation in the telecommunication industry is also intensifying the competition. Intense competition could adversely affect these companies' operating margins and market share.

This overview indicates that there is no specifically unique and classified industry serving the mobile computing developers. Computing, enterprise data collection, imaging and telecommunications can all be considered as parent industries that have some inputs into the IHWD market. However, since this industry is closely related to the wireless and networking segments of the telecommunication industry, analysis of that industry will provide an understanding of the current structure of the market for IHWDs. Such analysis is provided in section 1.1 of this report.

1.4 Industrial Handheld Wireless Device Features

This section briefly describes some of the common attributes and features supported by the industrial handheld wireless devices used in the current market segment. Presently, most of the available devices include some or all of the attributes and features shown in Tables 1 and 2, respectively. As shown in Table 1, some of the attributes such as usability, user interface, physical design, power consumption, wireless communication, security and data integrity, and technical support and warranty are considered to have high value for end users according to secondary research data

collected for this report from some OEMs’ websites (such as Motorola, Honeywell, and Intermac). Depending on which applications (data, voice and video) are supported, the speed of the processing unit and memory capacity and storage units for these devices can become less important for the end users. The importance of these attributes for the device manufacturers is discussed in section 3.1.1 of this report.

Table 1: Attributes of Industrial Handheld Wireless Devices

| Attribute List | Characteristics | Importance |
|--|--|-------------------|
| Usability | Easy to learn “how to” and use | Differentiating |
| User Interface | User friendly and easy to and upgrade | Differentiating |
| Ergonomic Casing | Designed to easily fit work environment and comfortably used | Differentiating |
| Low Power Consumption | Low power design to work continuously for at least 10-12 hours without getting recharged | Essential |
| Rugged and Robust | Stand for harsh industrial environments (e.g., drops on hard surface, impact, temperature, and pressure) | Differentiating |
| Wireless Communication | Reliable wireless interface to Local Area Network (LAN) or broadband access to Wide Area Network (WAN) | Differentiating |
| Security | Secure network connectivity for data and voice exchange | Essential |
| Processing Speed | High processing speed from 100MHz to 2GHz, depending on the applications (data, voice or/and video) | Desirable |
| Data Storage/Memory | High capacity volatile memory for fast processing and low to high capacity non-volatile memory for storing instruction, configuration and data | Desirable |
| Technical Support, device and service warranty | “Best-in-class” technical support and comprehensive device and service warranty | Differentiating |

* Note that “Differentiating” implies that a firm will gain a competitive advantage over its competitors if includes the feature in its design.

**This table was created by the author with data from OEM websites.

Table 2: Hardware and Software Features of Industrial Handheld Wireless Devices

| Feature List | Description/Characteristics |
|--------------------------|---|
| GUI | Graphical User Interface software supported by some hardware features such as keyboard and touch screen panel |
| Keyboard | 19 numeric and functional push-button keys, backlight and customizable |
| Touch Screen Panel | Improved resolution e.g., 240x320 pixel (4" - 1/4 VGA) transfective LCD, adjustable contrast, and backlight |
| Wireless | WiFi, Bluetooth, cellular mobile communication protocol (GSM or CDMA/GPRS), EDGE, or WiMax |
| Clock/Calendar | Day/month/year, week day, hours/minutes/seconds, leap year, timer and programmable time interrupts, and wake up function |
| Communication | Programmable serial port (RS232) with various baud rates for data transfer, linear connectors, USB drives (type A or B), Ethernet connection RJ-45 and/or slide contacts |
| Memory | Internal memory (RAM + Flash ROM), add on memory (Flash or RAM PCMCIA Cards) |
| Compact Flash | One or two type I Compact Flash slots with lockable cover |
| Power Supply | Quickly replaceable and rechargeable battery pack, internal rechargeable back-up battery for SRAM and Clock Calendar Backup, and low battery alert |
| Bar code Laser scanner | Depth of field: 7 to 110 cm (2.5" to 43.3"), depending on barcode length and density, scanning rate: 36 scans/s |
| Printer | Built-in printer for fan fold or roll paper, optical auto-alignment for fan fold sheets, fan fold paper standard size: 57 x 152 mm (2.25" x 6"), and roll paper size: 28 mm (1.1") or 35 mm (1.37") external diameter, 57 mm (2.25") width |
| Environmental | Operating temperature 0°C to 50°C for commercial use (indoor) and -40°C to 85°C for industrial use (outdoor), storage temperature -30°C to 70°C, relative humidity 0 to 80% non-condensing. Dust and water proof and drop resistance: 1 m on concrete |
| Physical | WxHxD max. Example: 106x300x81.5 mm, hand grip (WxD): 86x47.5 mm, weight: 500 to 900 g depending on configuration, and battery pack: 100 to 155 g |
| Magnetic card reader | ISO 1,2 or ISO 2,3 tracks (ISO 1,2,3 optional) |
| Smart card reader/writer | 1 or 2 reader/writers for ISO 7816 and CP8 cards |
| IRDA | Infrared Optical communication interface (or IRDA compliant) |
| Multimedia | Camera, microphone and speaker |
| Accessories | Docking station and cradles, power supplies and battery chargers, and miscellaneous |

*This table was created by the author with data from OEM websites.

2: COMPANY OVERVIEW

Founded in 1992, Company_X Software, Inc. is a mobile software solutions and services company, serving the needs of consumers and partners worldwide. The company's core competency is in developing mobile software products and system integration expertise, aiming to help its customers, ODMs and OEMs, deliver better products with lower development risk and faster time-to-market cycles. Company_X specializes in providing smart mobile phone and telephony software licensing and supporting systems integration services to handset manufacturers and their partners.

Company_X has two main businesses: the wireless software business and the wireless systems engineering business. To better understand the company's capabilities, this section provides an overview of main products (section 2.1) and services (section 2.2) offered by the two divisions, the company's partners (section 2.3) and a summary of its financial data (section 2.4). Section 2.5 summarizes these aspects of Company_X.

2.1 Products

This section provides a summary of current products offering of Company_X's wireless software business division to its customers in telecommunication industry. This division provides software solutions to enable next-generation handheld products, including mobile handsets, smart phones and converged devices. The division has so far developed two software products: Product_S and Product_J. Product_S is a handset software solution that includes a high-level operating system, user interface generation

tool, application software and pre-certified telephony capability. Product_S is based on Windows Embedded CE operating system and is used in consumer handsets. Product_S' software platform provides a set of modular software components, an approach to developing wireless handsets that can be deployed across multiple form factor designs.

Product_J is a high performance middleware bridge software solution that enables enterprises running Java J2EE and Microsoft Exchange web servers to achieve efficient interoperability by integrating the two platforms. This product was designed to overcome the web servers' inefficiencies. Both Product_S and Product_J are production released and add significant contributions to the company's revenue.

2.2 Engineering Services

The wireless systems engineering business of Company_X, called Global Engineering Operation division (GEO), is an engineering services organization that provides a wide range of development and project management services for ODM and OEM customers that build wireless and mobile products such as Personal Digital Assistants (PDAs) and smart phones. GEO has the hardware and software expertise to provide assistance ranging from concept design and prototyping through to final production. The division claims that their long and in-depth experience helps customers deliver leading edge mobile and wireless products to market faster with reduced cost and risk. GEO also serves tier-one equipment and wireless carriers such as AT&T, Verizon, Sprint, TELUS, Bell and Rogers.

GEO's focus is helping these service providers and equipment manufacturers bring consumers the latest in handheld devices for the 3G world. 3G, which stands for

third generation, refers to mobile phone standards and technology based on the International Telecommunication Union (ITU) family of standards. Some of the types of services GEO provides include board support package (BSP), power management software utilities, telephony applications software, user interface design, and training and technical support. These are each described briefly below and related to the IHWD feature(s) which they enable.

Board Support Package (BSP)

Board support packages necessary firmware and software to bring up the boards and run any specific application. Board bring-up is the process of electrically and functionally validating a circuit board design. With its extensive experience in bringing up new silicon hardware platforms and in building production quality BSPs, GEO has developed from reference designs to final form-factor handhelds, enabling its device manufacturer customers to get to market faster. GEO's production quality BSPs frees up a big portion of their development time and enables customers to focus more on their core competencies and "go-to-market" strategies. The division's BSP competency is primarily based on Advanced RISC Machine (ARM) core processor technology (such as ARM9 and ARM11), baseband processors or field programmable gate array (FPGA) devices. However, Company_X's business objectives have recently changed. They are moving away from hardware design projects and support packages. Consequently, their current BSP does not support any solution for hardware design. It is expected that either processor vendors or hardware design houses will provide the necessary design and manufacturing files and printed circuit boards (or development platforms) for ISVs to develop software on.

Power Management

Managing power efficiently has become one of the most demanding features of handheld products. End users want the next generation handheld devices to consume less power and work without recharging for a whole work shift (at least 8 hours). Working with the ARM processor's intelligent energy management solution, GEO can build production quality software packages to optimize power consumption at the system level, prolonging battery life on mobile devices without compromising performance of the devices and the end user experience.

Telephony Application

Company_X has the technical capability to build a variety of handsets with any Operating System (OS) platform. They partner with Microsoft for both Windows Mobile and Windows Embedded CE operating systems. They also partner with Symbian, a company that develops open source operating systems for advanced data-enabled mobile phones. As well, they have extensive experience with Linux, another open source operating system, to build board support kits for customer platforms.

Company_X has integrated Windows Mobile and Windows Embedded operating systems with baseband processors via Radio Interface Layers (RILs). Working in conjunction with Microsoft's Cellcore telephony stack and the baseband processor, Company_X is able to seamlessly integrate voice and data applications, including push-to-talk, into the next generation of mobile handheld devices. They have also built a suite

of drivers and applications to enable telephony features on both Microsoft platforms, supporting a wide range of baseband processors across multiple network protocols including GSM, GPRS, EDGE, UMTS, CDMA, WCDMA, and CDMA2000. In addition, they have created their own custom Session Initiation Protocol (SIP) stack for Voice-over-Internet Protocol (VoIP) that integrates with third party audio coders/decoders (codecs) and echo cancellation APIs that can be customized for a customer's proprietary server.

User Interface Design

Company_X has created software tools and frameworks that allow maximum ease and flexibility in modifying the user interface. The user interface design can include a graphical user interface (GUI), software utilities, integrated drivers for a keypad or touch screen panel for any particular operating system software and its related application stack. As the ability to easily customize and brand the user interface is becoming very important to wireless operators and makers of smart handsets, Company_X can help them transition to the next stage of converged device interfaces.

Training and Technical Support

Training ODM and OEM customers and providing technical support is another value proposition that Company_X offers. Training services are part of the business model they developed to generate additional revenue. They offer several technical support and training options. These consist of Hotline incident support for customers, including up to 4 hours of engineering time at a charge of \$500 USD per incident and three levels of extended support plans (bronze for 90 days of online support, silver for

one year of telephone support and gold for one year of expedited telephone support by senior technical staff or R&D engineers when required).

The above engineering services and capabilities that GEO provides, with necessary adjustments based on product and market requirements, can also be leveraged in other market sectors (such as customer premises equipment and mobile handheld) within the telecom industry. Indeed, GEO's desire to a diversification strategy lies on the division's engineering service capabilities outlined in this section.

2.3 Partners

Company_X has long-standing relationships with global software leaders such as Microsoft and Symbian, and leading semiconductor integrated circuit (IC) technology firms such as Intel, Marvell Technology, Texas Instruments, Qualcomm and Freescale. The company is headquartered in Vancouver, Canada, and has development and business offices in Bellevue, Washington; Cupertino, California; Taipei, Taiwan; the United Kingdom and Barbados. These regions constitute to several clusters of telecom industry sectors: one of the two main wireless technology clusters in the United States (Washington), the semiconductor and equipment manufacturing sectors' clusters (California and Taiwan), and one of the two wireless ISV clusters in Canada (Vancouver). These clusters provide Company_X with an easier market access and long lasting partnerships with hardware and software companies operating in the telecom industry. The company can use this valuable partnership in entering to the IHWD market.

2.4 Financial Summary

Table 3 and Figure 2 show a summary of financial data for Company_X. While the company's revenue has increased steadily since 2001, the revenue growth is well below the ISV industry level. The company's returns on its assets and equity, for the twelve months prior to April 2008 (trailing twelve months), are not only below the industry level, but also are negative. However, its current assets and monetary current assets over current liabilities (current ratio and quick ratio) are higher than the industry level. Also, the percentage of long-term liabilities over shareholders equity is below the industry level. In short, although the company's long term finances seem stable, the company needs to implement strategies to increase its revenue and profit margin at a higher rate. As shown in Figure 2, the biggest portion (approximately 90%) of Company_X's revenue in 2007 is from Europe and the United States, with a very small portion of revenue from Asia. The company is a widely-held public company traded on the Toronto Stock Exchange; however, like any other ISVs operating in telecom market, the company's current stock performance does not look promising.

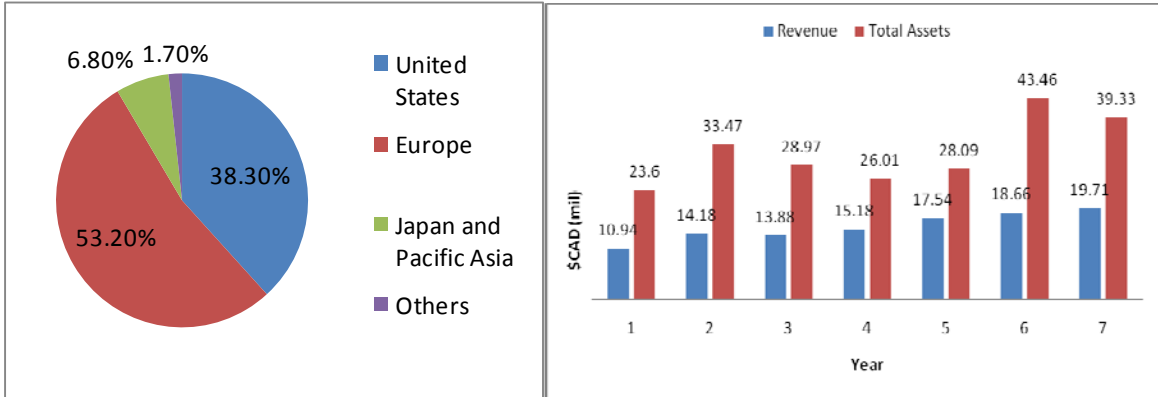
Table 3: Financial Data (as of April 2008)

| Key Ratios | Company_X | Independent Software Vendor (ISV) Industry |
|--------------------------|------------------|---|
| Current Ratio | 3.44 | 1.45 |
| Quick Ratio | 3.42 | 1.27 |
| Debt to Equity | 0.16 | 14.80 |
| Sales 5 Year Growth% | 6.81 | 16 |
| Net Profit Margin (TTM)% | -100.63 | 19.89 |
| Return on Assets (TTM)% | -63.30 | 15.72 |
| Return on Equity (TTM)% | -73.81 | 30.57 |

*TTM = Trailing Twelve Months

**Table created by the author with data from Reuters. Date of Financial Data: 31-April-2008

Figure 2: Financial Data



*Figures created by the author with data from Company_X Annual Reports and Reuters. Date of Financial Data: 31-Dec-2007

2.5 Summary of Company_X

As an ISV operating in the telecom industry, Company_X has complete software solution products serving both wireless and server sectors. One of their products is an integrated system solution working with Microsoft Windows CE operating system to provide functionality for next-generation handheld products, and the other product is a middleware software stack to overcome performance problems with Microsoft Exchange web servers. The company's GEO division has hardware and software expertise to provide various engineering services that include board support packages (BSP), power management software utilities, telephony applications software, user interface design, and training and technical support. In addition, the company has solid alliances with major semiconductor, software and equipment manufacturing firms operating globally. While some of the Company_X's financial indicators are below the ISV industry level, the company's long term finances are stable. Furthermore, the company needs to increase its revenue and contribution margin to become financially stronger and more competitive.

Consequently, the GEO division is looking to expand its operation and marketing domain. The new market sector they are planning to explore is industrial handheld wireless products. Therefore, GEO wants to allocate some of its firmware and software engineering knowledge and capabilities to develop the middleware layers and applications stacks for potential OEM and ODM customers in this space.

3: 5CS MARKET RESEARCH AND ANALYSIS

Preparing an effective marketing plan requires in-depth assessment and analysis to support a marketing strategy based on five major areas, the so-called 5Cs: customers, company, competitors, collaborators and context. According to Alvin J. Silk, a Harvard Business School professor, in his book, *What is Marketing*, initially this marketing analysis leads to specification of a target market and a desired positioning of the firm. As it is further developed, the marketing analysis leads to the appropriate marketing mix, the 4Ps (Product and Service, Place or Channel, Promotion and Price). To begin, chapter 3 elaborates the five major areas of a marketing analysis. Next, industry trends and vertical market applications are introduced.

3.1 Customer Analysis

The customer analysis examines who the customers are for an ISV like Company_X in the IHWD market and what requirements those customers are looking for. Based on the results of primary research information from several of the ODMs contacted by the author of this report, as well as secondary research, the degree of importance for the various requirements is summarized. In addition, Symbol Technologies, a company acquired recently by Motorola, is analyzed as they are the leading OEM player in the handheld market.

Company_X's customers in the IHWD market are ODMs and OEMs with global operations selling electronic products in the telecommunications, handheld and

computing sectors and providing support and services in the vertical markets around the world. Like the telecommunication and computing industries, diversification and consolidation are also big trends in these market sectors although the pace is not as fast as the telecom market. Some of the major OEMs in this market are Motorola (Symbol Technologies) Inc., Honeywell (Hand Held Products), Palm Inc., Intermac, Metrologic, Fujitsu Limited, Rockwell Automation, ThyssenKrupp AG, Joy Global Inc., Pentair Inc., Esterline Technologies Corporation, Zebra Technologies Corporation, and Flow International Corporation. Others in this category include EMS Technologies Inc., Kyro Oyj, Avery Denison, Cisco Systems Inc., Hewlett-Packard Company, Printronix Inc., Datalogic, Opticon, Advantec Computers, Olympus Technologies Singapore and Juniper Systems. The list of ODMs and engineering design service firms serving in this market, mainly operating in India, China, Korea and Taiwan, is even longer. Notable among them are Unitech, GSPDA, Inventec Appliances, Portable Innovation Technology Ltd., E-Ten, Olympus Technologies Japan, Wipro Technologies, and HCL Technologies.

3.1.1 Customer Needs

As with other electronic industries, the equipment manufacturers in the IHWD industry generally must meet some requirements demanded by their customers in the value chain. According to the analysis of the primary and secondary research data gathered for this project, some of their most important requirements have been identified. They are robust and rugged casing, lower cost of bill of material, modular design, lower power consumption, user friendly user interface, reduced development and research expenses, open source operating systems, powerful software utilities, easy access to distribution channel, and technical support. The importance of the above needs for the

OEMs and ODMs in the IHWD industry varies among the firms and is dependent on their financial and technical assets.

Robust and Rugged Casing

Robust and rugged enclosure design and casing of the IHWDs is one of the most demanding features that OEMs require. Depending on which vertical market application these devices are targeted, the design and packaging of the device enclosure must comply with certain specifications proposed by the standard bodies and be certified. In general, IHWDs must withstand drops from a 1.5 – 2 m height onto a hard surface, such as concrete, and tolerate vibrations and hard impact.

Low Cost Bill of Material

ODMs and OEMs in all electronic sectors are always looking for ways to reduce unit costs. In the case of handheld devices, a lower hardware cost is an attractive goal, and to achieve that they require board designers to reduce the cost of components used in the design and manufacturing. Generally, the firms with high volume production that achieve Economies of Scale (EoS) are able to reduce the hardware cost per product unit.

Modular Design

The use of modular design principles involves designing standardized sub-components, sub-systems or modules of a product or service that can be combined and assembled with minimal effort in different ways to create a high degree of variety. Standardized modules or subsystems can be produced in higher volume to reduce the production cost. The modular design is an innovative approach that facilitates easily

customizable products and fast delivery to the market with minimal engineering effort and low cost.

ODMs and OEMs prefer to have the hardware and software architecture of their products modularized. The modular design is an essential methodology in software engineering that has been implemented in software development for many embedded electronic products, including IHWDs, to enhance reusability. A modular software product can be developed as a platform and customized for various product lines as long as the products use the same processing core.

Modularized hardware design can also be an ideal development approach for the ODMs and OEMs. Many versions of IHWDs in the market share two or more features. Subsystems such as wireless components, peripherals, and communication interfaces can be designed based on standard protocols, and some of the subsystems, such as printing, scanning and power supply modules can be built on separate printed circuit boards (cards) attached to the main printed circuit board (base card) through standard connectors. Even microprocessor integrated circuit design has shifted toward the System-on-Chip (SoC) approach to provide modularity at the chip level. Modular design has been an efficient design approach for the computer hardware industry and used by companies such as Dell to assemble and deliver a customized computer in the shortest time possible after the customer's purchase orders is received.

Low Power Consumption

Lower power consumption and prolonged battery life for handheld products has been demanded by the end users and, therefore, by equipment and device manufacturers. Next generation electronics usually consume less power than the previous generation due

to advances in technology and design. The conduct of the semiconductor industry is primarily driven by innovation and rapid change from one generation of chip technology to the next. Better processes and increased scale have exponentially driven down power consumption and prices with increases in performance. The entire semiconductor industry is witnessing rapid changes in technology – moving towards 65 nanometer geometries and beyond until the limits of the laws of physics are reached. This rapid change is characterized by Moore’s Law, which states that the computing power of semiconductors doubles every 18 months.

The same pattern is seen in the design of subcomponents for devices. Hardware developers are continuously improving their designs to lower power consumption while, at the same time, adding more features and improving performance. Software developers for handheld devices are working on optimizing their code to reduce instruction cycles and to consume less power. They are also working on developing specialized power management software modules to efficiently manage the processing power of the systems. These modules may also include subroutines to disable or put subcomponents into an idle or sleep mode when they are temporary not in use.

User Friendly User Interface

In handheld products, usability and user experience matter. Equipment manufacturers want to make IHWDs with simple, user friendly, yet comprehensive, user interfaces. Developers are challenged to harness not only state of the art graphical user interfaces but also multifunctional data collection capabilities for these devices, including keypad and touch panel input, one and two dimensional bar code scanning and image capturing. With the power, flexibility and ease-of-use of these devices, they can create a

wide range of data collection solutions for vertical market applications such as retail, warehousing, inventory control, production tracking and many more.

Reduced Development and Research Cost

The equipment manufacturers, particularly OEMs, want to reduce the cost of product development and research. To achieve that, the most common strategies are partnerships with other engineering and design firms, and equipment manufacturers (ODMs in particular), and outsourcing. The OEMs want to concentrate their efforts on marketing and sales activities to promote their products through their distribution channels and benefit from faster time to market cycles for new devices. Partnerships with ODMs also free up technical resources for innovative differentiation based on market needs.

Open Source Operating System

One cost saving strategy recently taken by equipment manufacturers is to get rid of licensing fees. As well, they are abandoning loyalty to a specific operating system (OS) or special applications such as security management and Quality of Service (QoS). The recent trend in the telecommunication industry is to use open source software solutions, such as the Linux kernel, as the operating system of choice for residential gateways, wireless routers and handheld products. To put this into perspective, for each unit of the product built that enters the downstream value chain, licensed software can be considered as an addition to the unit variable cost. Alternatively, using an open source software solution will reduce the unit cost.

Powerful Software Utilities

Equipment manufacturers need a powerful set of software to run different applications on handheld devices. The application software modules may include telephony applications for voice communication, text messaging, email, web access from any location, mobile access to Service Access Point (SAP), Global Positioning System (GPS) navigation applications and Location Based System (LBS) applications using GPS technology for personal tracking. As well, modules may enable Voice over Internet Protocol (VoIP) and include utility software stacks as well as software stacks for direct part making (DPM) that utilizes a two-dimensional data code application for lifetime part making and production quality control from manufacturing throughout the supply chain. They also need a comprehensive suite of integrated tools and utilities providing configuration scripts, upgrades, application development and management.

Easy Access to Channel

While focusing on tier one customers, OEMs need help from distribution channel partners or resellers who can easily reach users from different demographics. These partners not only contribute to sales and marketing activities, but also, on some occasions, provide front line technical support, training, maintenance and consulting services to the end users. Beside reselling partners, Value Added Distributors (VADs), as wholesale providers of technology products and services to resellers, offer critical financing and logistics support, combined with technical and professional services competency.

Technical Support

Pre and post design technical support is one of the most important needs of equipment manufacturers and electronic design houses. In general, some of the developers working for the manufacturers, particularly at outsourced ODMs, lack in-depth knowledge related to one or more of the components used in an IHWD's hardware or modular software packages. Technical support is a part of services software firms either offer as a paid service or free of charge. The ISVs normally provide their customers with technical support as a paid service.

3.1.2 Symbol Technologies: The Market Leader in IHWDs

Symbol Technologies, now a subsidiary of Motorola, was acquired for about \$3.9 billion USD at the end of 2006 and is engaged in the manufacture and sale of enterprise mobility solutions. Its product portfolio includes IHWDs, mobile computing platforms, software management tools, wireless infrastructure and radio frequency identification (RFID) systems. According to Datamonitor's company profile report, published in March 2006, the company is considered the market leader for IHWDs and recorded revenues of \$1.766 billion during the fiscal year ending December 2005. This represents an increase of 1.9% over 2004. The operating profit of the company during fiscal year 2005 was \$53.5 million, a decrease of 61.9% from 2004. Their net profit was \$32.2 million in fiscal year 2005, a decrease of 60.6% from the fiscal year 2004.

Symbol Technologies has an extensive portfolio of patents, which has helped to capture IHWD market leadership. However, some class action suits adversely affected the company's ability to hire and retain management talent. The company's strengths and

weaknesses and the new opportunities and threats they face are summarized in Table 4. Each aspect is discussed briefly in the following text.

Table 4: Symbol Technologies SWOT Summary

| Strengths | Weaknesses |
|--|---|
| <ul style="list-style-type: none"> • Market leadership • Extensive patent portfolio • End-to-end Solutions | <ul style="list-style-type: none"> • Inefficient internal controls • Weak performance outside North American market • Low return on equity • Low operational efficiency |
| Opportunities | Threats |
| <ul style="list-style-type: none"> • Growing RDIF market • Expanding retail industry in emerging markets • Growth in wireless infrastructure market | <ul style="list-style-type: none"> • Supply chain problems • Slump in retail industry |

*This table was created by the author from analysis of Symbol Technologies.

Strengths

Symbol Technologies captured market leadership in IHWD (market share: 31%), handheld barcode scanners (30%) and passive Ultra-High Frequency (UHF) RFID readers (41%) in 2005. The company has also gained a strong competitive position in RFID systems after acquiring Matrics, a provider of electronic product code-compliant RFID systems. A global presence, in over 60 countries, further strengthens the company’s competitive advantage. Market leadership in important segments of enterprise

mobility solutions helped Symbol Technologies win business from multinational clients such as Wal-Mart and Procter & Gamble.

Symbol has an extensive patent portfolio, including 910 US patents and 680 international patents for product ideas and designs across all of its business segments in the IHWD market from mobile computing to advanced data capture. The company has been particularly strong in laser and imaging scan technology where it holds over 350 patents. It also has significant patents in micro-electro-mechanical systems and liquid injection moulding. The strong patent portfolio has helped the company capture a market leadership position in key segments. The company has also earned royalties by licensing its patented technologies to other companies. Besides generating licensing fees, the strong patent portfolio has provided a competitive edge for the company. Symbol has provided end-to-end solutions in the IHWD market. The company has the capability to provide integrated solutions at the platform and systems level to capture and manage information across the business value chain. The company operates in all the IHWD vertical market segments, providing both integrated solutions and individual devices. It has also partnered with companies such as IBM and Avaya to strengthen its end-to-end solutions. Symbol and Avaya, for example, offered a joint mobility solution that allows employees to access enterprise applications. End-to-end solutions have helped Symbol differentiate itself from competitors in the market place. In addition, it also has increased the cross-selling opportunities for the company.

Weaknesses

Insufficient internal controls led to accounting irregularities at Symbol Technologies, according to the Datamonitor report (2006). Symbol Technologies inflated

revenue by \$230 million between 1998 and 2002 to meet analyst expectations. Key management personnel were accused of stalling two internal investigations by US legal authorities and a subsequent investigation by the Securities and Exchange Commission (SEC). In June 2004, the company announced a settlement with the SEC wherein it agreed to pay \$37 million to investors and \$3 million to the United States Postal Inspection Service Consumer Fraud Fund. However, the company continued to indulge in questionable accounting practices. Symbol announced its third quarter results in October 2004, but a month later, revised revenues for the nine months ending September 2004, down by \$13.6 million due to certain discrepancies.

Symbol's revenues from outside North America declined in fiscal year 2005. Revenues from this region fell by 0.6% to \$484.4 million in fiscal year 2005. As well, revenues from Europe, the Middle East and Africa accounted for 27.4% of total revenues in fiscal year 2005, down from 28.1% in fiscal year 2004. In contrast, Intermecc, a competitor of Symbol, managed to improve its revenues from Europe by 2.9% to \$244.1 million in fiscal year 2005. Continued weak performance of Symbol in this region could adversely affect the top line growth.

Symbol has provided low return on equity in recent years. Return on equity improved from 0.4% in fiscal year 2003 to 7.6% in fiscal year 2004, but declined to 2.7% in fiscal year 2005. The company reported a net loss in 2002 and 2001. Low return on equity is largely due to a lower operating margin in operations, which improved from 0.5% in fiscal year 2003 to 8.1% in fiscal year 2004, but fell to 3% in fiscal year 2005. Their 1.5% five-year operating margin also trails the industry average of 2.8%. Low return on equity affected investor confidence.

The company has recorded low efficiency levels in the recent past. For the trailing twelve month (TTM) period ending December 2005, the company's revenue per employee stood at \$339,544, which is lower than the industry average by about 59%. Also, for the same period, the company recorded inventory turnover of 5.1, compared to the industry average of 9.1. Low operational efficiency reflected inefficient utilization of resources by the company, which put it at a competitive disadvantage.

Opportunities

The use of radio frequency identification (RFID) technology is growing, particularly in the retail market. RFID technology, as an advanced data capture technology, uses small tags that emit radio signals. This technology is expected to replace conventional bar code technology in the coming years. Demand for RFID consulting, implementation and managed services is expected to rise to about \$2000 million in 2008. That represents an increase of about five times since 2005. The demand for RFID systems is likely to be driven by retail chains and governments. In 2005, Wal-Mart asked its top 100 suppliers to put RFID tags on cases and pallets of consumer goods shipped to select distribution centers and stores. Symbol has already supplied RFID systems to Wal-Mart. The US Department of Defence has also directed its suppliers to adopt RFID systems. Because of advanced technological gains in this field and economies of learning from operating in the IHWD industry, Motorola, previously Symbol Technologies, is currently well positioned to capitalize on the rising demand for RFID systems.

The expanding retail industry in emerging markets, such as China, India and South American countries such as Brazil, provides opportunities for both old-generation bar code technology and advanced RFID systems. The retail industry in emerging

markets has the potential to boost Motorola's revenue growth. The entry of big retail chains into India, following a possible relaxation of foreign direct investment norms, could improve demand for Motorola's products. The Chinese retail market is also growing rapidly. In 2005, Wal-Mart had 42 super stores, three Sam's clubs and two neighbourhood markets in China according to the Datamonitor report (2006).

Symbol completed the acquisition of Seal Sistemas e Tecnologia da Informacao, a distribution and customer entity, in 2005. Motorola now has a wholly owned subsidiary, once owned by Symbol, in India and several offices in China. Leveraging opportunities in these markets, Motorola can further strengthen its revenue growth.

The growth of vertical markets such as transportation and logistics, government, manufacturing and health care provides opportunities for the company. In the transportation and logistics segment, key players have begun to deploy sophisticated technologies for tracking shipments. UPS and FedEx have shifted from old generation scanners to wireless devices and have installed thousands of wireless LAN points in their facilities. The migration from bar code technology to wireless devices in the transportation and logistics sector provides new opportunities for Motorola. Increasing use of IHWDs in key vertical markets would help the company further strengthen its market position.

Threats

Symbol Technologies has been sourcing a significant percentage of its products and components from Olympus Optical of Japan. An estimated 10-20% of its product sales in any given quarter contain products and components supplied by Olympus. Some of these products have been manufactured by Olympus exclusively for Symbol. These

products and components either incorporate patented technologies developed by Symbol or have been jointly developed by the two companies. Therefore, any interruption in supplies from Olympus could adversely affect Motorola.

A slump in the retail industry could also adversely affect Motorola. According to Symbol's financial report, in fiscal year 2005, sales to the retail industry accounted for 15% of total revenues. Sales to the retail industry are understated as resellers account for a significant portion of total revenues. Resellers derive a substantial part of their sales from the retail industry. A fall in consumer demand, following higher interest rates, could force retailers to cut back on their spending on information technology. If the weakness in US retail sales persists, the company's revenues from the retail industry could decline.

3.2 Company Skills: Company_X

Marketers and product managers must understand the corporate strengths and weakness because the product-company fit for new products and services is as important as the product-market fit. Understanding a company's core competency, finances, research and development capabilities, product and project management skills and other assets helps to assess the company's strength and weakness and develop a proper strategy. Relevant information about Company_X's current strengths and weakness, gathered from the project sponsor, are outlined in this section.

3.2.1 Strengths

Company_X Software Inc. is an ISV and its strengths are in application software development and system integration expertise for mobile handheld devices, user interface design, hardware and firmware knowledge, customer technical support, and innovation.

Company_X has in-depth technical expertise in handheld technology and platform engineering. The company's core competency, gained over the past twelve years, is in developing software solutions for mobile products and system integration expertise services to handset manufacturers and their partners. Company_X is specialized in developing application software for mobile products such as smart mobile phone and telephony applications and power management software for handsets designed specifically with SoCs and powered by ARM9 and ARM11 series microprocessors. They are also experts in integrating software systems based on Microsoft's Window CE and mobile operating systems and, more recently, on Linux, an open source operating system, commonly used for customer premises equipment and mobile systems. The expertise in modifying, redesigning or customizing the user interface for mobile handsets and converged devices is also a significant technical asset for the company. In the mobile handset market, converged devices have dual wireless protocol modes: for instance, GSM for the Wide Area Network (WAN) connectivity and VoIP for Local Area Network (LAN) connectivity.

Company_X's software expertise is not limited to high-level application software; they have technical staff knowledgeable in hardware and firmware design that contributes to delivering a whole system solution. Therefore, the company is not only capable of delivering turnkey software solutions, but can also develop customized application software for a variety of wireless and mobile systems for equipment manufacturers and their partners to speed up market entry cycles. These factors constitute a competitive advantage for the company (relative to other ISVs) in formal partnerships with ODMs or OEMs or as a part of their business ecosystems.

Another area of strength for Company_X is providing various level of technical support for its customers. The three level customer technical support program the company offers is not only a source of revenue for the firm, but also helps the customer solve their technical problems with the products and achieve their milestones. In technology areas, providing “best-in-class” customer support and exceeding the customers’ expectations have been a key to success for many high tech firms.

Finally, Company_X is adapting its technical expertise to meet the fast pace of technological evolution in the wireless field. As new applications are emerging and the very competitive telecommunications service industry is demanding that these state of the art applications to be provided with the handsets, the ISVs are rushing to meet these rising market demands. Applications such as Location Based Systems (LBS) to track mobility and location of individuals carrying the handset, multi mode (GSM, VoIP, Bluetooth) wireless converged handsets, video sharing and conferencing on handsets will become additional features for the next generation of mobile devices. Company_X, as an innovative ISV, is planning to import the LBS navigation and tracking design knowledge through an acquisition to meet this accelerating demand for the application. Also, continuous focus and work on the next version of the open source Linux kernel and developing and integrating a new wireless software stack, for WiMax, LTE, Bluetooth and wireless USB on Linux platforms are parts of Company_X’s innovative strategic plans.

3.2.2 Weaknesses

This section focuses exclusively on the technological and market experience weaknesses of Company_X in the IHWD market. Weakness in this market should be

considered as an opportunity for learning and growth for the company. Lack of market share positioning, in-house hardware expertise, and current partners in the IHWD market are some visible weaknesses of the company.

As a new entrant to the IHWD market, Company_X lacks pioneer experience, market share, customer knowledge, related development experience, and software application patents for the industrial equipment that would protect the intellectual properties of company. However, as sometimes occurs in other technological fields, late entrants, or followers, are in an advantageous position because they benefit from the lessons learned by pioneer companies and are able to develop better products and services. Lack of market share in the IHWD market may be considered as a weakness by customers because it could indicate inadequate knowledge about market and customer needs. In order to compete successfully, the company needs to invest in training and development of knowledge to catch up with current players in the market. Lack of patents and significant intellectual properties in software applications for IHWDs is also a weakness because the company may need to pay royalties to the original patent holders.

Lack of IHWD hardware experience among the system developers, particularly firmware engineers, may create issues in integration of the software components with the firmware and OS kernel, and the overall system. To overcome this weakness, the company will rely on technical support and knowledge about the hardware from external firms or will need to ramp up internal levels of expertise. Learning takes time and prolongs the development cycle, which may be a competitive disadvantage for the firm.

Not being part of the ecosystem of an equipment manufacturer or having partners in the IHWD market will negatively impact the firm in going to market. To gain fast

access to the market, Company_X will need to engage with equipment manufacturers, ODMs and OEMs, and be an integral part of their supply chain. Collaborating with partners may also open up other opportunities in the market for the company to engage with more customers and have access to more channels.

3.3 Competition

A competitive analysis should identify the competitive landscape of current and potential competing firms in the industry. The strengths, with an emphasis on core competency, and weaknesses of the competition need to be identified. In addition, to formulate and execute successful strategies, the business objectives and strategies of competitive firms must be assessed thoroughly. This assessment enables a firm to anticipate the competition's strategies and shape their own strategies to meet their goals.

In the IHWD industry, the closest competition for Company_X is mainly the same players, i.e., the independent software vendors that compete with Company_X in the wireless application software and system integration sectors. Most of these firms have strong capabilities in one or more main mobile operating systems software as summarized in Table 5. As well, they have in-depth knowledge in at least one of the major microprocessor cores used in mobile systems and customer premises equipment (such as ARM, MIPS, and XScale) and technological capabilities in system integration on the platforms developed that are based on these microprocessors and operating system kernels.

Table 5: List and Comparison of Major Mobile Operating Systems

| Customized Operating System (OS) Kernel | Parent OS | Open Source or Proprietary | Managed Code Support? | Native Code Permitted? | Embedded Security? |
|--|------------------|-----------------------------------|------------------------------|-------------------------------|---------------------------|
| Symbian | Symbian | Proprietary | √ | √ | √ |
| OpenMoko Linux | Linux | Open Source | | √ | |
| Access Linux Platform | Linux | Open Source | | √ | √ |
| LiMo Platform | Linux | Open Source | √ | | |
| Qtopia | Linux | Open Source | √ | √ | |
| Windows Mobile | Windows | Proprietary | √ | √ | |
| Windows CE | Windows | Proprietary | √ | √ | |
| Palm OS | | Proprietary | | √ | |
| iPhone OS | Mac OS | Proprietary | | √ | |
| Blackberry OS | | Proprietary | √ | | |

*This table was created by the author with data about operating systems from OEM and software vendors websites.

For the purpose of this report, two of Company_X’s close competitors, Bsquare and Trolltech, are examined. Bsquare is an ISV in the mobile industry based in Bellevue, Washington. Like Company_X, Bsquare’s main business focuses on mobile software development and engineering services, but, unlike Company_X, a part of their engineering service relates to developing hardware platforms such as reference designs and hardware prototyping. They also offer project management and consulting as a source of revenue. Software board support packages, application software development, including customization of user interface and software development kits (SDK), system integration and testing, including power and audio management, software development tools for Microsoft Windows Mobile and CE version 5.0, and customer support and training are included in the company’s product and service portfolio. The company claims some work in the IHWD market as it has developed reference designs for rugged handheld devices using Marvell Technologies PXA270, an XScale based Application processor (previously owned by Intel), Windows Mobile and CE operating systems,

personal navigation systems with GSM/GPRS cellular capability using EDGE technology, which has one of the fastest data transfer protocols in cellular networks.

Bsquare's business alliances are with Microsoft, Intel, Marvell Technologies, Freescale, AMD, Texas Instruments, Adobe, Dialog and third party software vendors. Some of the company's main customers are Palm, Motorola, Honeywell, Intermecc, Hewlett-Packard, Casio and Philips Mobile Computing Group. While the company's current market capital is lower than Company_X's (\$47m versus \$90m), Bsquare has a better return on average assets (annual TTM 12.95%) and a current ratio (1.88).

Trolltech, a Norway based ISV, is the other competitor in the IHWD market analyzed for this report. This company's main business is in developing software solutions, applications frameworks and user interfaces for Qtopia (Linux based) handsets. In addition, the company has recently announced plans to port its software solutions to Windows CE operating system. Among the main customers for Trolltech's products, are Adobe, Motorola, Samsung, NASA and Skype. However, their return on average assets (annual TTM -17.96%) is much lower than Bsquare's. While both Bsquare and Trolltech will be considered as potential competitors for Company_X in the IHWD market and have strong capabilities in software development and system integration for mobile products, Company_X is the only ISV with strong capabilities in system integration with three major mobile operating systems (Linux, Symbian and Windows Mobile and CE). This difference can be considered a differentiating factor between Company_X and the others.

3.4 Collaborators

Partners and alliances play major roles in the success of high technology firms, most obviously in the telecommunication and computing industries. Partners not only provide technological expertise and support, but also can be an interface to customers and facilitators in marketing and distribution of the firms' products and services. In today's very competitive industries, where the technological advantage is temporary and skills are transferable, relying on the partners' abilities and contributions in either downstream trade and distribution or upstream supply is essential. In many business affairs, having reliable partners is the only strategy for fast to market access and a sustainable advantage if the switching cost from both joint technology and market access is too high.

Marketers must assess their partners' positions and strategic goals. In the downstream trade, cost model, contribution (margins) expectation, customer training and support capabilities and the nature of the partners' relationship with the firm's competitors must be understood. With respect to upstream suppliers, the concerns about their lead-time to deliver products and services, willingness to share technological knowledge and technical support, and ability to deliver high quality and reliable products must be addressed.

Company_X has a wide range of partners. It has alliances with semiconductor and processor vendors, such as Intel, Texas Instruments, Qualcomm and Marvell Technologies, independent hardware solution vendors, operating system vendors like Symbian and Microsoft, as well as business, enterprise and supply management software vendors, such as SAP, Oracle, and IBM. It also has relationships with third party software vendors, and resellers and value added distributors (VADs). This expansive range of

partners is all within the company's business ecosystem. With these partners, not only should Company_X be able to successfully complete its products in the new business line of IHWDs, but is also able to access all market segments as the products become mature.

The "go-to-market" strategy changes at different stages of the technology adoption cycle. Geoffrey Moore, in his books *Crossing the Chasm* and *Inside the Tornado*, emphasizes that during the technology adoption cycle, a firm will need to recruit partners to market its first prototype product not only to visionary customer firms, but it will also need to "cross the chasm" to reach the pragmatist customers (early majority). Moore suggests that as the whole product is built, tested, recognized and "crosses the chasm" and the margin decreases from high to medium for the mainstream market of pragmatist and conservative, or late majority, customers, the firm should reduce or eliminate its partnerships. As the technology approaches its end of life, and the product is targeted for sceptics, or laggards, when the margin is at the lowest, the firm should find channel caretaker partners or resellers.

3.5 Context

Context analysis is another aspect of developing an appropriate market strategy. The context is always subject to change and firms must be able to anticipate and spot significant changes ahead of their competitors. The context can be cultural, regulatory or social. Technology has cultural aspects. Products and services accrue meaning in people's daily lives, and thus an economic value is derived from this meaning. However, with a shift in culture, the economic value is vulnerable. Therefore, a systematic analysis of cultural trends should also be an essential part of developing technology firms.

In the handset market, cultural trends change rapidly and convergence of a wide variety of services and applications is evident. Many users of handsets would like to have a digital camera, web access, email access, MP3, and, lately, tracking and LBS applications integrated in their handsets to respond to the changes in cultural trends. The cultural shift has also impacted the technologies behind IHWDs. Demand for increased productivity requires that IHWDs, depending on their vertical market applications, have enhanced performance, speed, security and usability. Converged wireless solutions and “cool” new applications designed with low power consumption and lead free (RoHS) components are responses to technology shift in the handset and computer markets. While this shift also applies to IHWDs, the demand for new applications mainly comes from businesses needing optimized and lean operations to reduce expenses while increasing productivity and efficiency.

The regulatory environment and the social context, which derives from regulations and policies, politics and social norms, also impacts developing marketing strategies. These factors should be monitored by marketers for changes in behaviour and demand patterns, as well as signs of potential disruption. Industries with unstable settings, such as pharmaceuticals, are most vulnerable to change in the regulatory context. Although it enjoys a more stable environment, the IHWD industry, and the telecommunication industry in general, are also subject to changes in the regulatory and social context. Increased networking behaviour has increased demand for bandwidth, broadband access, secure and reliable communication devices, especially high performance mobile handsets. While change in cultural, regulatory and social context has rapidly been enhancing the feature and performance of mobile handsets and changing the

competitive landscape in the telecommunication industry, the change in technology or features of IHWDs seems rather slower than other mobile handsets. One of the potential reasons for this may be the higher cost of IHWD hardware, compared to other mobile handsets.

4: MARKET SIZE, SEGMENTS, APPLICATIONS, AND DEMAND

This chapter provides an estimate of total market size for the IHWD market. In addition, market segmentation from the point of view of customers for ISVs and their functional relationship with each other in this market, as well as ISV contributions with regard to market segments, is discussed. Various vertical market applications for IHWDs are also listed. Finally, in this chapter, anecdotal evidence of market demand for ISVs' products and services in the IHWD industry is listed from primary source interviews conducted with four ODMs and design houses. This information is presented to provide readers with a clear picture of the IHWD market, its players, and their relationships.

4.1 Market Size

Due to lack of market reports on the industry market size, either for revenue or volume of units of IHWDs sold, this section presents an estimate of the market size based on manipulating data from the global mobile phones market and a company report for the market leader, Symbol Technology (Datamonitor, 2006). According to an industry profile of global mobile phones (Datamonitor, 2008), the global mobile phone market generated total revenues of \$104.3 billion in 2006, which represented a compound annual growth rate (CAGR) of 11.6% for the period spanning 2002-2006. The performance of the market has been forecast to accelerate, with an anticipated CAGR of 15.2% for the five-year period 2006-2011, and is expected to drive the market to a value of \$211.9 billion by the end of 2011. The mobile phone market consists of all analog and digital handsets used

for mobile telephony. Market production volumes increased, with a CAGR of 17.6% between 2002 and 2006, to reach a total of 800.2 million units in 2006. In 2011, the global mobile phones market is forecast to have a volume of 1,804.1 million units, an increase of 125.5% since 2006.

Symbol Technologies, the leader in the IHWD market in 2005, with a 30% market share, recorded \$1.766 billion in revenue during the fiscal year ended December 2005, an increase of 1.9% over 2004 (Datamonitor, 2006). The operating profit of the company during fiscal year 2005 was \$53.5 million, a decrease of 61.9% from 2004. The net profit was \$32.2 million in fiscal year 2005, a decrease of 60.6% from fiscal year 2004. The company captured market leadership in small rugged mobile computers with a market share of 31%, handheld barcode scanners (30%) and passive UHF RFID readers (41%).

From the above information, it is possible to estimate the size of the IHWD market size in 2010 under two growth scenarios. Using Symbol's revenue and market share in 2005 as a reference point, the total market size for IHWDs in 2005 can be estimated to be \$5.7 billion. Using the 2004-2005 IHWD CAGR of 1.9% as the lower growth scenario, and the 2002-2006 mobile phone market CAGR of 11.6% as the higher growth scenario, the expected total market size for IHWDs would be \$6.2 and \$9.9 billion respectively in fiscal year of 2010. Table 6 shows the estimates over time of total market size for IHWDs based on 1.9% and 11.6% CAGR, representing least and most optimistic market size value. Comparing with the growth estimate of the mobile handset market, one can say that the IHWD market is expected to have a modest growth within the next couple years.

Table 6: Market Size Estimate for IHWDs

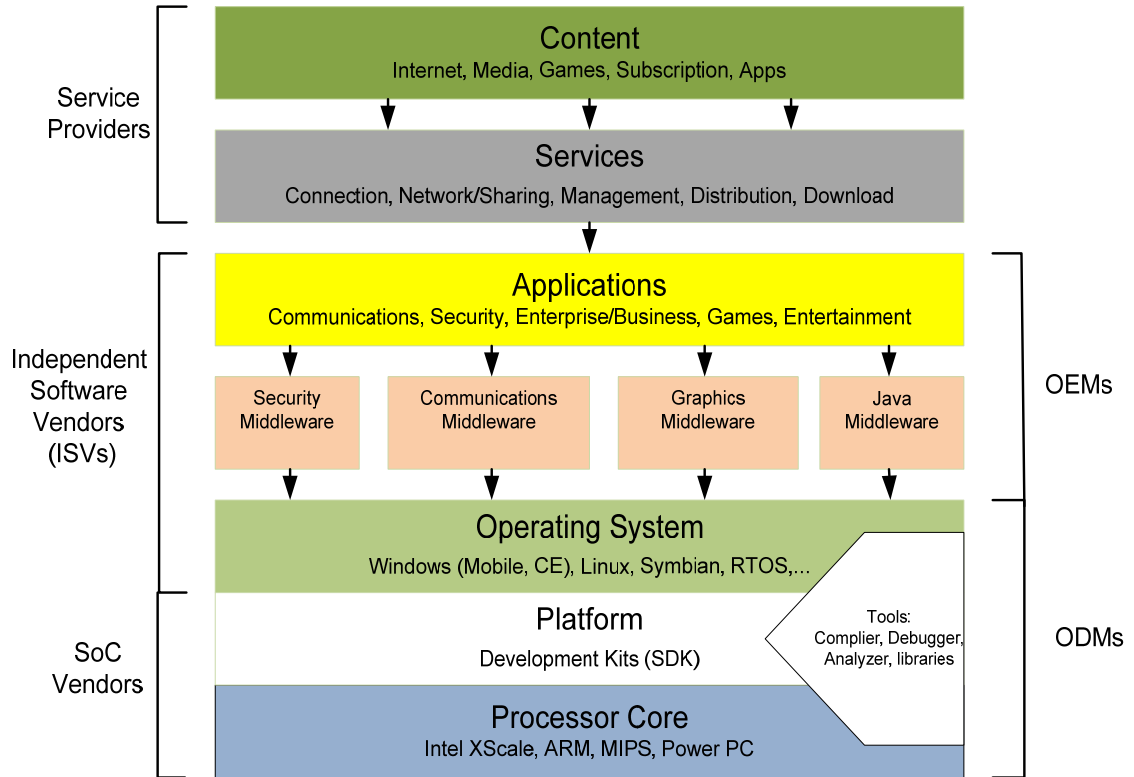
| Year | Market Size (\$B) with 1.9% CAGR | Market Size (\$B) with 11.6% CAGR |
|-------------|---|--|
| 2005 | 5.7 | 5.7 |
| 2006 | 5.8 | 6.4 |
| 2007 | 5.9 | 7.1 |
| 2008 | 6.0 | 7.9 |
| 2009 | 6.1 | 8.8 |
| 2010 | 6.2 | 9.9 |

*This table was created by the author with data from Datamonitor 2006 and 2008 reports and the author's analysis.

4.2 Market Segments

Market segmentation is grouping and clustering customers in a particular market based on their distinct behaviours, needs and characteristics. Each group of customers, or market segment, is clearly different from each other, but within the group, they have homogenous behaviours, characteristics and needs. Market segments for Company_X in the IHWD market are ODMs and OEMs operating in the mobile computing or telecommunications industries. In chapter 1 and section 3.1 of this report, market operations function and needs of the ODM and OEM firms have been described. This section examines segmentation of these customers based on what contribution each has made to the product development landscape. Figure 3 illustrates product development segment mapping of the main players, except for channel distributors and outsourcing, in the IHWD market.

Figure 3: Market Segments – Product Development Mapping



*This figure was adapted by the author from analysis of the telecom and IHWD industries.

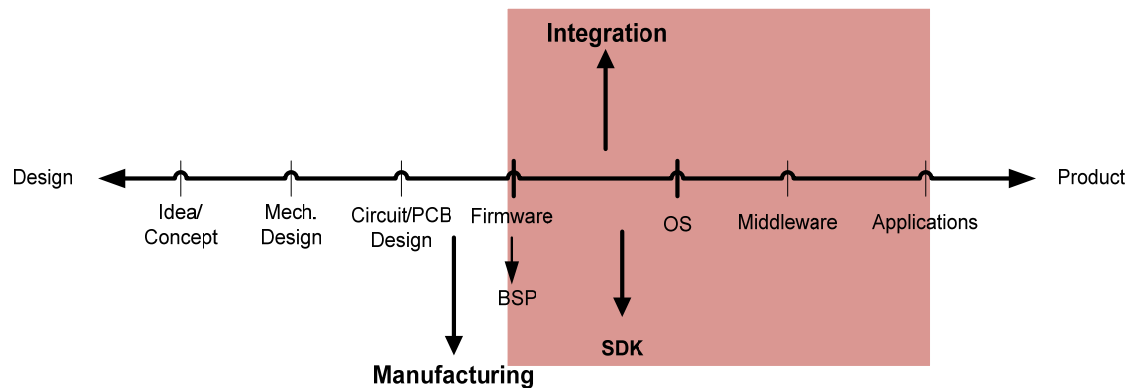
In general, ODMs in this market develop a generic platform suitable for any of the vertical market applications, either by building it from scratch, starting with the design of the circuit based on an appropriate processor, or by reusing an existing development kit (SDK) or reference design platform from SoC vendors. As shown in Figure 3, the ODMs are responsible for integrating an Operating System (OS) and low-level applications. OEMs, on the other hand, integrate middleware and applications stacks to transform the platform to a product ready for a service provider’s contribution.

Although some of the OEMs, like Motorola, used to have capabilities and resources to perform many of the activities that ODMs do, they have gradually preferred to reduce their system development activities by outsourcing them through ODM channels. The outsourcing option has been preferred primarily because of higher operational expenses that have occurred over the past two decades. Today, the system development model shown in Figure 3 is the dominant model in the consumer electronics, telecommunication and computing industries. Within this model, the SoC vendors not only sell microprocessors and provide ODMs with reference designs for hardware design, but also provide them with necessary firmware and other low-level software components such as drivers. Some SoC vendors can provide their ODM customers with development kits that include PCB, BSP and other necessary software and tools, such as compilers, debuggers and libraries of code used for software development, debugging and optimization. ISVs provide ODMs with integrated systems that add the capacity of additional operating system kernels to development platforms. ISVs provide OEMs with a variety of additional middleware and applications stacks. Although the model tries to map the development activities within each functional category as clearly as possible, in practice there are activity overlaps within these functional groups.

Figure 4 shows a more detailed breakdown of the development milestones from design to product delivery, ending with the OEMs' contribution (i.e., excluding contributions from the service providers). The shaded area represents where ISVs can contribute to the product development cycle. Targeting the ODM and OEM market segments, Company_X is well positioned to serve both segments in the IHWD market.

As an ISV, Company_X has expertise in firmware, BSP and SDK development and OS, middleware and applications integration, represented by the shaded area in Figure 4. The independent software firms competing in the telecom and IHWD markets, analyzed in section 3.3, also currently target the same development activities within the same market segments that Company_X should target. Based on the capabilities of each ISV currently competing in the IHWD market, the degree of contribution an ISV firm can provide will be a differentiating factor in winning projects and gaining market share within the market segments. ISV firms that can provide a more complete solution package that serves more of the vertical market applications will have more potential customers, and thus, will likely achieve greater market share.

Figure 4: Design-to-Product Development Milestones



*This figure was created by the author from analysis of the telecom and IHWD industries.

4.3 Vertical Market Applications

The following section presents some examples of how IHWDs or mobile computers can successfully help users reduce costs and increase productivity. In the market verticals, users are retailers, logistics hubs, manufacturing workers, service providers, government organizations, and the travel and hospitality sectors. The use of

IHWDs is extremely widespread, particularly in retail, transportation and logistics, and manufacturing sectors. Without these devices, the productivity level in these sectors would degrade very significantly.

Retail

Retailers boost their profits by automating the flow of goods and data in every step of the supply chain, from manufacturing and shipping to warehouse management and on the shop floor. Inventory control and price management can be carried out automatically and without errors, thus improving customer service. In route accounting and door-to-door sales, handheld devices are used as a mobile inventory and point-of-sale system. Delivery personnel use IHWDs to scan product bar codes, accept credit card payments, and print customer receipts. Purchased products are immediately delivered from the stock inside a truck. IHWDs contain a full sales and inventory management application program, which is linked to a corporate database. Similar procedures can be carried out on commercial airlines for in-flight duty free sales.

In general merchandise retail, store workers can enter new orders, check inventory and prices automatically when they load the shelves, thus reducing the time and eliminating the cost of paper work. Store managers can get real time data on sales, labour scheduling and shelf space planning. Warehouse workers use IHWDs for inventory procedures. Warehouse management systems give instructions to anticipate replenishment and keep the warehouse running at maximum productivity. In the distribution chain, goods are kept in continuous motion. Truck drivers' schedules and routes are automatically loaded into IHWDs, which can also verify that the right goods are loaded on the right truck, and collect and send real-time data on driver performance.

Wireless networks like cellular technology (e.g., GSM/GPRS) transmit data between the warehouse management system and workers equipped with IHWDs. Trucks can also be equipped with Global Positioning Systems (GPS) and a wireless network to achieve E-sales delivered on the fly.

Logistics

Speed and flexibility are crucial elements to staying ahead of competitors, especially in the field of express carriers. Tracking goods online anytime, anywhere is a valued feature and speeds up business. With IHWDs, couriers and shippers can boost productivity, by knowing the exact minute when trailers will arrive, the size and type of their loads, and what resources they will need for tomorrow's shipments. Mobile computing allows shippers and dock workers to track shipments from dock, to yard, to truck. They do not lose track of freight because of IHWDs that show single and multiple shipments simultaneously. Supervisors with IHWDs have the information they need to find equipment and determine shipment location and status. They save time by using IHWDs to communicate job assignment details to workers anytime, anywhere.

IHWDs are successfully used in tracking bags and boxes that are individually bar coded. Pickups and deliveries are traced by scanning each bag's bar code. If needed, a receipt can be printed for both driver and recipient. Signatures and other pen or touch-entered data are efficiently captured and transmitted. Data is sent to the host terminal as the truck is being loaded instead of collecting and forwarding documents when the trailer is closed and ready to depart. The bar code-based dockside eliminates keystroke errors and the need to search for forwarding documents. Truck drivers' schedules and routes are automatically loaded into IHWDs, which can also verify that the right goods are loaded

on the right truck. Wireless networks transmit data between the warehouse management system and workers equipped with IHWDs. Trucks can also be equipped with GPS and connected to a wireless network to achieve on-line deliveries.

Manufacturing

Industrial handheld wireless devices used in mobile computing provide a solution for Work in Progress (WIP) tracking, batch control, lot tracking, materials management, production scheduling and other manufacturing activities. Enterprise Resource Planning (ERP) systems control every aspect of the manufacturing supply chain. The latest data helps decision-makers react swiftly when demand rises, put labour into action efficiently, control costs, deliver the right goods at the right time, and stay ahead of competition. Mobile computing plays a major part in enterprise resource planning implementations. Data is captured right where the activity happens, and is immediately linked to enterprise planning suites. Real time inventory and manufacturing process data supports better decision making.

Services

Today, modern service companies usually have considerable data about their customers collected through customer relationship management (CRM) programs, sales forecasts and other back-office applications. However, utility meter readers, repairmen, delivery personnel, inspectors, sales agents and other field service workers often do not have enough accurate information about the customers they deal with everyday. By making information available at the frontline, workers can spend more time solving problems, which increases operational efficiency, profits, and customer satisfaction.

When fast in-field service is essential, mobile computers combined with vehicular GPS and a wireless network can offer the ultimate in real-time field services.

Health Care

With handheld wireless computers, physicians and other health care personnel can track vital patient data everywhere at anytime in real time.

Government

Government organizations use handheld devices and computers in postal services, law enforcement, and debt collection, to name just a few of the application fields. Parking tickets can be issued on the spot and relevant data transmitted to a host computer. Police officers on patrol can use their mobile computers to collect and communicate vital data from an accident site, a roadside vehicle inspection, or the scene of a crime.

Travel/Mass Transit

Mobile computers are used for mobile fare collection on trains, busses and ships. Some wireless palm computers feature a comprehensive portable travel management system that allows workers to look-up schedules, manage real time seat reservations, check-in boarding passengers and update manifests. Travel tickets, upgrades, and fines can be issued on the spot and credit card payments can be processed.

Hospitality

With handheld wireless computers connected to the host main computers, guests experience a higher standard of service and hospitality. For example, check-in can occur at the hotel's front door just by swiping a guest's credit card. A coded room key is generated on the spot, eliminating line-ups at reception. At the beach or other site

facilities, guests can pay for food and beverages with a personal hotel pre-paid contactless card; removing the need for cash or credit cards that can be lost or stolen. When returning a rental car, the guest can just scan the contract number and immediately receive a receipt.

4.4 Anecdotal Evidence of Market Demand for ISVs in the IHWD Industry

Demand analysis determines the level of demand in the market for a proposed product or service based on findings from secondary and primary research. For the IHWD market segment, which Company_X would like to target, as anecdotal evidence, primary source interviews were conducted with four ODMs and design houses -- two Indian, one Taiwanese and one Canadian. This section outlines the questions asked and answers received during the primary research.

The research results indicate that ODMs and design houses will be planning to develop, or are in the process of developing, platforms such as Software Development Kits (SDK) for their OEM customers. The highest demand is for platforms customized for various market verticals. The ODMs would prefer to use open source OS and applications software if possible, but this is not an essential requirement. As with any handset or customer premises equipment, low cost production is important, but fulfilling product requirements, product delivery and contract fulfilment, and generally making sure that OEMs stick to the plan, take precedence. Table 7 lists the questions asked and collective answers received from the primary source interviews.

Table 7: List of Market Demand Questions and Answers

| List | Question | Answer |
|-------------|---|---|
| 1 | What is the average development cycle for your company to work on development of an IHWD project, from design to delivery of a Software Development Kit (SDK) or other platform solution? | <i>12-18 Months</i> |
| 2 | What added value will your company bring in the development cycle that can edge your company over the competition? | <i>Design and engineering</i> |
| 3 | How much support do you need in either stage of hardware and software development from the chip or device manufacturers? | <i>Need full technical support and collaboration from all SoC and chip vendors during hardware and ISVs during software development phases</i> |
| 4 | Do you use ISVs or outsourcing in the development of software solutions | <i>50% yes, 50% no</i> |
| 5 | If you use ISVs, how much support do you need in software integration stage from them? | <i>Need full technical support and collaboration from ISVs for software development integration.</i> |
| 6 | What is your preferred main processing core for the IHWD design your firm is/was working on? Which of a dual processor solution (combination of a DSP and a microprocessor) or single chip System-on-Chip (SoC) is preferred? | <i>75% Intel XScale core; 25% ARM and a DSP. Single SoC solution is preferred.</i> |
| 7 | What OS kernel will you use in your IHWDs? | <i>90% Open source (Linux) is preferred.</i> |
| 8 | What wireless solution(s) would you design in? | <i>Any type, depending on the customer (OEM) request; Generic wireless interfaces such as PCI are used.</i> |
| 9 | Will you provide a post design technical support for your customer? | <i>Yes, as needed.</i> |
| 10 | Does your firm manage the project by its own project management team? | <i>Yes, the medium and large size ODM firms have their own project management teams following generic project management guidelines, but small size ODMs, due to limited resources, do not have project managers to manage the project life cycle; their lead engineers act as the project lead to manage the project scope, schedule and sometimes the budget.</i> |

*This table created by the author with data from primary source interviews with ODMs conducted in June 2008.

What is clear from the interview answers is that some ODMs and design houses, which do not have enough resources or complete software solutions, use ISVs to supply

some software components and help with system integration. The ODM and design houses rely on full technical support from ISVs during software development or integration cycles. Project management can be an area of involvement to help some of the ODMs deliver their products within scope and budget and on schedule. Some of the ODMs have specific product requirements, such as an open source OS kernel or a particular SoC or wireless subsystem. In all the areas of software development, system integration with an open source OS, technical support and project management, Company_X's GEO division has the required capabilities and resources to support customers in the IHWD market.

5: MARKET ATTRACTIVENESS AND FUTURE MARKET OPPORTUNITIES FOR IHWD

Mobile computing, particularly the IHWD market, is not yet a mainstream market. It seems that, for the past decade, the technology has been trying to “cross the chasm,” but that has not happened yet. Since 1993, the early adopters of mobile computing and IHWDs, such as Federal Express, UPS, IBM, and Xerox, have demonstrated both the potential of the technology in the vertical market of logistics and its ability to increase productivity and efficiency in their business environment. However, despite this early adoption, penetration of mobile computing as a mainstream technology into organizations of various other vertical market applications (see section 4.3) has fallen behind the forecasts of many industry analysts.

Enhancements to the wireless network infrastructure in the past several years have given mobile computing a new meaning and an area of potential growth in the wireless market. The three major enhancements that are likely to accelerate growth in the wireless market can be identified as the followings. First is the movement from 2.5G to 3G, with extensibility to 4G in the near future, to deliver aggregated multi-services (voice, video, data and TV). Second is the expanding deployment of wireless LAN and WAN IP technologies (WiFi and Mobile WiMAX). Third is the increasing demand in developing countries to substitute current and future plans for higher cost wireline infrastructure with lower cost broadband wireless infrastructure.

Additionally, according to Mobile Computing & Wireless Information at mobileinfo.com website, many wireless industry experts believe that the future demand for the next generation IHWDs is high. Such next generation IHWDs would include high performance features, enhanced security, dependable usability, reliable wireless broadband access and converged wireless solutions for applications such as web access, email, SAP, navigation and LBS. As well, these next generation devices would consume less power. According to Paul Leung, CEO and Chairman of Empower Technologies, a local design house firm that has signed a 40 million dollar contract with Advantec Computer Systems to supply industrial handheld computers to their Value Added Resellers (VAR), “the future demand for IHWDs in all the vertical market applications is huge and the market will grow fast.”

Evidence from technological enhancements and business and economic justification, indicated by both primary and secondary research sources, also points to a promising growing demand for IHWDs in the near future. Advanced technologies, such as availability of faster wireless networks, especially 3G & 4G wireless networks, Internet convergence, wireless and e-commerce technologies, and the adoption of location-specific and mobile commerce applications, especially by socially-upscale and mobile population, combined with the availability of inexpensive hardware (especially, PDAs and smart phones with pre-packaged vertical industry application solutions) all contribute toward developing relatively inexpensive but improved IHWD products. Substantial increases in the number of workers telecommuting, the need for improved customer service and the growing adoption of Internet-based horizontal and vertical applications such as wireless e-mail, workgroup applications, corporate information

access, and online financial transactions are considered as driving business factors that will increase the demand for advanced IHWDs. Finally, productivity gains and competitive advantages gained by early implementers of IHWDs are the economic justification for mobile computing solutions in today business environments.

For an ISV, like Company_X, with expertise in the areas shown in Figure 4, the future market opportunities seem appealing. Company_X can also use its core competency in delivering BSP, telephony and power management applications, user interface design and system integration to develop product and services for ODMs' platforms and OEMs' products in the IHWD market. The challenge lies in expanding more middleware and application software modules and applying the applications to IHWD products, as well as developing an appropriate channel strategy to access this market. From the primary source data gathered for this report, it is clear that, for a significant portion of the ODMs and OEMs, partnership with ISVs, or outsourcing some parts of their development work to the ISVs, is also a win-win situation because it results in a shorter development cycle and faster access to the market.

To supplement the analysis of the market demand and to better assess the market attractiveness and develop a sustainable competitive strategy for an ISV competing in the IHWD market, Michael Porter's five-forces framework is used to analyze the independent software vendor sector of the IHWD industry in the following section.

5.1 Market Attractiveness Assessment: Five-Forces

Michael Porter’s five-forces framework, developed in 1979 and presented in his book *Competitive Strategy*, is a tool in strategic planning, commonly used to identify opportunities and threats in any business landscape. This framework has several limitations; most significantly, it focuses on the whole industry rather than individual firms and pays little attention to factors affecting demand. However, the industry analysis based on this framework provides an assessment of market attractiveness and will help inform the strategic plan for Company_X to enter as an ISV and successfully compete in the IHWD market. Attractiveness in this context refers to the overall industry profitability. In an attractive industry, the combination of the five forces drives up the overall profitability. The five forces are rivalry, potential new entrants, substitutes, suppliers and buyers within the industry. Table 8 summarizes the key determinants of the five-forces for independent software firms in the IHWD industry.

Table 8: Five-Forces Analysis Summary for ISVs in the IHWD Industry

| Rivalry | New Entry | Substitutes | Suppliers | Buyers |
|---|--|---------------------|---|---|
| Ability to differentiate Different costs Low concentration Demand growth Diversity of competitors | Economies of learning Capital requirement Scarce resources: distribution channels, proprietary technology Network Externality | NA | Switching costs Ability to forward integrate Large size | Price sensitivity Switching costs Size (large, medium and small) and high concentration |
| Moderate attractiveness | Moderate attractiveness | High attractiveness | Low-Medium attractiveness | Low attractiveness |

*This table created by author from analysis of the IHWD industry.

Rivalry or direct competition for the ISV sector of the IHWD industry comes from other independent software vendors and engineering houses specialized in telecommunications, particularly in mobile handset and mobile computing software development, systems integration and user interface design. Section 3.3 outlines the characteristics of competitor firms. To develop a competitive strategy, an ISV should be able to differentiate in operations, products and, most importantly, customer services. Cost of operations, products and services, demand growth for products and services, and the number of competitive firms and their concentration within a cluster of customer firms (equipment manufacturers) and suppliers are other factors affecting the competition. Thus, rivalry can be assessed as contributing to moderate attractiveness, as indicated in Table 8.

New entry into the ISV sector of the industry is limited by many factors. These include the learning curve (economies of learning) for new technologies, the capital required for operations, tools and testing equipment, and scarce resources such as distribution channels and partners to access the market, as well as proprietary technology and intellectual properties used in the development of software products, and network externality. Although these barriers to entry are not as high as those for ODMS or OEMs, a new startup ISV entering the IHWD industry will have to overcome all these limiting factors. Thus, the new entry force can be assessed as contributing to moderate attractiveness.

Substitutes are products and services outside of the industry, and since there are no products or services that can replace what ISVs offer for IHWDs substitutes are not applicable here. Thus, this force can be assessed to contribute to high attractiveness.

Supplier power refers to bargaining power of the upstream industry sector. The price the suppliers, such as SoC vendors, charge for their hardware development platform depends on the supply to and demand from the downstream market. Also, the upstream suppliers can erode industry profits if they are concentrated and their ISV customers or partners are locked into relationships with them due to specific investments and the learning curve imposed by the suppliers' technology. The threat of forward integration by chip vendor suppliers, unlike the situation prior to the dotcom market crash in 2001, is not considered to be serious. However, OS suppliers such as Microsoft have the capital and could execute a strategy to take over ISVs in both upstream and downstream market. If this threat is credible, the ISV firms in the industry may be forced to accept high supply prices or risk direct competition from the suppliers. Thus, the supplier power force can be assessed to contribute to a low-medium level of attractiveness of the IHWD industry for ISVs.

Buyer power refers to the ability of individual ODM and OEM customers to negotiate purchase prices of the products and services from the ISVs that directly impact profits. Thus, buyer power is an indirect power in competitive markets. Significant switching costs that result from being locked into a relationship with a particular ISV that has a specific investment, relationship or proprietary technology are another factor that affects buyer power. Finally, the size and concentration of the ODM and OEM customers relative to ISVs should also be considered as an influencing factor in the industry. ODMs and OEMs firms competing in the IHWD industry outnumber the ISV supplier firms, which should be good news for ISVs who prefer to have more customer bases. However, among the factors impacting the bargaining power of the customers, price sensitivity has

the highest impact on this force. ODMs and OEMs are looking for ways to reduce their product's cost. Open source software and price negotiations with ISVs are some of the way that increase the buyer power and hence decrease industry attractiveness for ISVs. Thus, the buyer power force can be assessed to contribute to low attractiveness of the IHWD industry for ISVs.

In summary, this five-forces analysis finds the IHWD industry to be of moderate attractiveness for ISVs. The five-forces analysis and the comprehensive market research based on the 5Cs, presented in chapter 3, along with a detailed demand analysis are the main pillars of this project and should be further expanded and used in a market requirement plan by the product management team of the GEO division as a pre-entry study into this new market. From this study, competitive strategies needed for the firm to successfully compete in the IHWD market will emerge.

6: STRATEGY FOR MARKET ENTRY (GOING-TO-MARKET)

A marketing strategy involves two main activities: positioning in the selected market segment and developing a plan based on product and services, place or distribution channel, promotion and pricing (the 4Ps) to achieve the desired positioning. The first step of the positioning process involves a marketing analysis of the 5Cs (discussed in section 3) and selection of market segments (discussed in section 4.2). For the purpose of this report, only strategies for product and services and the channel are discussed in this chapter. Promotion and pricing, two essential parts of product management activities at different phases of the product life cycle, are not within scope of this project.

6.1 Products & Services

Company_X's GEO division is well positioned to develop products and services for ODMs and OEMs operating in the IHWD market. Using its in-house hardware knowledge of XScale and ARM processors, firmware and software development, Windows Mobile and CE, Linux and Symbian OS kernels, system integration and user interface expertise, GEO should be able to reuse and customize the existing telephony and VoIP integration and power management for software products (such as BSP and SDK) for the IHWD market. GEO should also develop new middleware and applications software to meet the needs of OEM customers in this market. New middleware and applications such as navigation solutions and Location Based Systems (LBS) to track

locations of users equipped with GPS featured devices are demanded by different handset user demographics and regulatory bodies in some countries (such as the U.S.) as a part of 911 emergency response procedure.

6.2 Channel

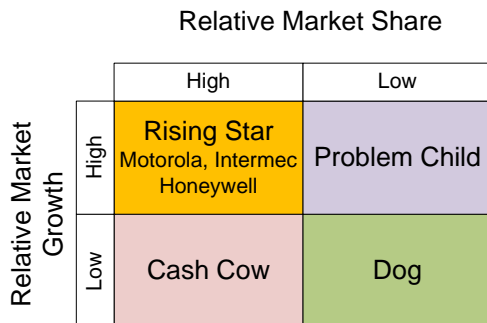
A marketing channel is the set of tasks through which a firm goes to market and accesses its customer base. The channel tasks in order of execution are demand generation, demand fulfilment, pre and after sale service and customer support, and customer information feedback, which is used for strategy development. These tasks are the output of specific functions within the firm's ecosystem of partners and distributors. These functions include the company's sale force, partners, dealers, distributors and VADs, the company's online sales portal and online sales dealers. Online sales can also be used to establish and increase brand awareness. The company's internal sales force, partners and distributors are responsible for all or some of the subtasks: generating leads, qualifying customers, presales activity and support, conducting the sale process, closing the sale, delivering the product to the customers, after sales support and ongoing customer account management. Using a mix of internal and external channel functions, a company can design a hybrid channel system to more efficiently access all the market segments. In the hybrid system, the subtasks mentioned above can be mapped according to the functions available within the firm's ecosystem. Many technology companies go to market through their own sales force, focusing on large customer accounts, and use distributors and partners to establish smaller customer accounts.

Company_X should also use a hybrid channel model to effectively access the customer base. The company can use its own sales force to deal with the large ODM and

OEM customers, such as Motorola, Honeywell and Intermec. Doing so, Company_X will have a direct communication channel with the customers who will be the highest potential revenue source for the company in the IHWD market. The company will have a better understanding of these customers' needs and provide a "best-in-class" pre- and post-sales technical support by prioritizing its internal resources.

With internal resources focused on the large accounts, the company should use the channel partners and distributors for smaller customers. As the IHWD market is a new market for Company_X, ideally, the company should secure a design win with one or two "rising star" players. Such players have large market share and a high market share growth rate. Alternatively, design wins with "cash cow" device manufacturers who have large market share and low market share growth rate in this market would also be desirable. Both 'rising star' and "cash cow" device manufacturers have achieved economies of scale by producing more units at the lowest unit cost. This relationship is illustrated in Figure 5.

Figure 5: Boston Consulting Group Growth/Share Matrix



*This figure was adapted by the author with data from OEM websites and the market growth/share matrix from BUS752 and BUS754 lecture notes.

7: CONCLUSION AND RECOMMENDATION TO SPONSOR ORGANIZATION

This report is a preliminary study and a baseline marketing research analysis of the IHWD market. The report is a part of a project aimed to provide necessary marketing information required by Company_X to explore the new market. Using primary and secondary research data, the report includes an overview of the IHWD industry and the technologies behind these devices, a market assessment based on an analysis of the company, the potential customers and competitors, collaborators and market context and market segment size, as well as applications and demand evidence, and a market attractiveness analysis using Porter's five-forces.

This report concludes that there is no specifically independent industry for industrial handheld wireless products and services. The IHWD industry consists of a number of players operating within the telecommunications, computing and information technology industries. From researching the telecommunication and computing industries, it has become evident that many players from both industries are participating and interested in the emerging IHWD market. Considering a variety of market applications, from the retail and service sectors to manufacturing, medical, logistics and transportation, these players forecast a huge potential growth in the near future in this market according to the primary and secondary research done for this report. The research also finds that ODM and OEM customers would prefer modular platforms designed and easily customized for developing handheld devices for these market

verticals. The underlying reasoning for this requirement is that the equipment manufacturers want to reduce the cost of development and launch the devices faster to the market. Besides modularity and low unit and development cost for IHWDs, the equipment manufacturers want robust and rugged package design, lower power consumption, usability and user friendly user interface, open source operating systems, powerful software utilities and new applications (such as LBS navigation and tracking), easy access to distribution channel, and full technical support from the hardware and software designers.

The industry analysis done for this report based on Porter's five-forces analysis concludes that the overall attractiveness of the IHWD market for ISVs is of moderate level. From ISV firms' point of view, while the threat of substitute products is non-existent, the competitive rivalry within the industry and the threat of new software vendor entrants make the attractiveness of the market with regard to rivalry and new entry forces moderate. The strong bargaining powers of suppliers and customers make the market attractiveness in terms of these two forces at low level. Thus, the overall market attractiveness is averaged out as moderate by this framework while not considering the demand analysis.

The report estimates that the market size for the IHWDs can reach \$10 billion by 2010. Since 2005, when the IHWD market was \$5.7 billion, the IHWD market has been growing steadily with a modest growth rate of 1.9% CAGR. Since the mid 90s, IHWDs have primarily been used by some firms in the retail, manufacturing and logistics sectors in North America and some European and Pacific-Asian countries. Other vertical market sectors in other parts of the world have yet to adopt IHWD devices in their daily

operations. Moreover, all indications are that the IHWD market has not “crossed the chasm” yet to reach mass-market penetration. This presents emerging opportunities for newcomer ISV companies in the market, such as Company_X, to engage with ODMs and OEMs and benefit from the significant market growth while the technology is being adopted by the market pragmatics.

This report also finds that Company_X should leverage its strong capabilities in mobile software development and system integration on multiple operating systems and its long lasting partnerships with chip and software vendors to enter into the new market. Consequently, Company_X can have lower development costs for the middleware and application software stacks applicable to IHWDs than new startup software vendors entering the market. However, as a new player in the IHWD market, Company_X will need to plan an effective “go-to-market” strategy, particularly in designing a hybrid market channel system, to reach out and be a part of ecosystems of one or more “rising stars” such as Symbol Technologies (acquired by Motorola), the leader in this market space, or “cash cow” equipment vendors.

In order to successfully “cross the chasm”, it is recommended that Company_X employ a fundamental strategy that exploits the main difference between the visionaries of the early market and the pragmatists of the mainstream IHWD market. That fundamental strategy relies on the capability of the company to deliver a so-called “whole solution”: the minimum set of software components and services necessary to ensure that a pragmatic ODM or OEM customer’s needs are met to create a compelling reason to buy. To achieve this goal, the company may need to establish a beachhead of pragmatist customers in the IHWD mainstream market segment. Rather than engaging with as many

customers as possible and not meeting all their requirements, which in the end leads to delivering incomplete solutions and risks losing those customers, the company should engage with a few strong market leader ODMs or OEMs.

Company_X should investigate all of the vertical market applications and work very closely with market leader ODMs or OEMS to deliver software solutions that meet all platform requirements. The industrial handheld devices built for all the vertical market applications share the main core functionality in terms of processing, wireless, communications, integration and user interface features. A software middleware or application stack developed for one application can be reused for another application with a minor customization. This will be the key to a winning strategy to accelerate the development of the company's complete software solution and to gain an increased share of the IHWD market.

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