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# **Factors Affecting Mobile Data Technology (MDT) Adoption by Canadian SMEs**

by

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## **ABSTRACT**

Mobile Data Technologies (MDT) are a natural extension to the traditional office computing environment. MDT usage growth outpaced desktop computers in 2004 by 36% compared to 8%. It is predicted that 66% of the workforce will be mobile by 2007. This research aims at identifying what factors influenced Canadian Small and Medium-Sized Enterprises most in making a decision to adopt an MDT, and how that decision to adopt an MDT was initiated, evaluated and approved.

Based on existing innovation literature, two A-Priori theoretical frameworks were developed. In the first framework, the variance theory approach was taken and 15 variables were included to test their influence on the decision to adopt. Out of these, 10 were found to be significantly important. In the second framework, the innovation process theory approach was taken to explore how a decision to adopt an MDT was initiated, evaluated and approved. Content analysis revealed that there was almost a total lack of formal business case creation to evaluate the MDTs and that the approval process was brief. Primary data was collected through a questionnaire and structured interviews involving 34 respondents.

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## INTRODUCTION

Porter (1985) stated twenty years ago in a comment that is still relevant today, that using technology is no longer a matter of choice, but one of survival. Organizations must utilize technology to maintain and improve their competitiveness (Gagnon & Toulouse, 1996). Technologies are tools that should be used within the business environment. It is those tools that offer unique benefits that have their own power of attraction which prompts managers<sup>1</sup> to adopt these technologies (Munro & Noori, 1988). In today's technological environment, competition is the principal driver of change. In the changing global economy, adoption of technology is an essential element of most successful firms. Perhaps it is even more true for Information Technology (IT)<sup>2</sup> than for more traditional technologies in this information age. IT systems are the backbone of business transactions and have risen beyond the traditional support role and is now a

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<sup>1</sup> As this research is focusing on the decision maker within the organization, the terms manager and organization can be used synonymously as the manager is making the decision for the organization.

<sup>2</sup> For the purposes of this paper, the terms IT (Information Technology) and IS (Information Systems) can be used interchangeably. Generally, IS is comprised of software (e.g. code, programmes) and IT is comprised of hardware (things you can touch like a keyboard, modem or mouse). In isolation, each is useless. Hardware needs software to 'do' something and software needs hardware to 'run' on. Formally defined, "Information Technology is any computer-based tool that people use to work with information and support the information and information processing needs of an organization" (Haag, Cummings, McCubrey, Pinsonneault, & Donovan, 2004) and Information Systems "is a man-made system that consists of an integrated set of computer-based and manual components established to facilitate an organization's operational functions and to support management decision making by providing information that managers can use to plan and control the activities of the firm" (Gelinas, Sutton, & Fedorowicz, 2004).

driver of business strategy (Lee & Runge, 2001). As stated by Chan *et al.*, (1997) companies that perform best align their business strategies with their IT strategies.

Mobile Data Technologies (MDT) is a natural evolution from the stationary office computing environment. The traditional method of accessing information through a stationary terminal or personal computer (PC) is a thing of the past. Devices have instead become mobile, including cellular phones, personal digital assistants (PDAs) and laptops. The emergence of these ‘mobile’ devices is allowing employees the prospect of information exchange anytime/anywhere. This portability is a compelling driver for organizations to adopt mobile technologies. No enterprise hoping to remain competitive can ignore the fact that business lives in an ever changing technological world marked by increasing mobility, and that this mobility is becoming the mainstay of modern business. From the globe-trotting CEO to the roving sales representative, mobile devices have radically changed the way employees work. One of the benefits of having the right information in the hands of the right people at the right time is an increase in the timeliness of information. This timeliness has its own benefits in turn. For example, timeliness will increase the accuracy of data which will lead to better decision making, improved customer service, and increased productivity and effectiveness of the enterprise (Varshney, 2002). With organizations embracing mobility within their business environment, MDT’s have experienced tremendous growth in 2004. The market research firm Canalys<sup>3</sup> reported that the overall worldwide mobile device market is up 51% in 2004 as compared to the year before (Canalys, 2005).

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<sup>3</sup> Canalys provides technology companies with strategic marketing intelligence, research, market data and analysis.

To date, most research on technology adoption has been done in the context of larger organizations (Paul Cragg & Zinatelli, 1995; Riemenschneider, Harrison, & Mykytyn, 2003; Yap, Soh, & Raman, 1992). However, Small and Medium-Sized Enterprises (SME) are a major contributor to any nation's economy. In Canada, SMEs are the foundation for economic growth. According to a 2004 Statistics Canada's report, 95 percent of all businesses operating in Canada employed fewer than 50 employees while 75 percent of all businesses employed fewer than ten employees. SMEs decision-makers face different challenges in adopting IT compared to their counterparts in large organizations. For example, when SMEs lack resources, whether the resources are either financial or human capital (Van-Akkeren & Harker, 2002), the commitment of even a single person could represent a significant resource allocation on the MDT adoption process (Lee & Runge, 2001). By comparison, in large organizations it may be insignificant to allocate a single employee or an entire IT department to oversee the MDT adoption (Dankbaar, 1998). This is one fundamental difference between SMEs and large organizations. Given the differences in operating conditions and concerns between SMEs and large business decision makers, MDT decisions may be influenced by different factors.

The research objective of this paper is to conduct an exploratory investigation into the factors affecting organizational decisions to adopt MDTs within Canadian Small and Medium Sized enterprises. The intention of this exploration is to gain a better understanding of the organizational decision making process in adopting an MDT and to capture the organization's decision-making behaviour at the time the decision was made. The theoretical framework of this investigation is based on using the variance and

process approaches. The variance approach is derived from Moore and Benbasat's (1991) study of the initial adoption of IT innovations within organizations and from Fink's (1998) study of the factors that facilitate the adoption of IT. The process approach is based on the Markus and Tanis (2000) Enterprise System Experience Cycle.

This thesis is organized into six chapters. The first chapter is the introduction to the thesis. The second chapter reviews the literature related to SMEs, mobility, technology adoption and the A Priori model for this thesis. The third chapter highlights the research objectives. The fourth chapter provides the theoretical framework of the A Priori models this research is proposing. The fifth chapter describes the research methodology used in the framework, data collection and explains how the data will be analyzed. Finally, the sixth chapter discusses the benefits and limitations of the research.

## **LITERATURE REVIEW**

This chapter consists of four sections and lays the theoretical foundation for the research. The first section defines the domain of the paper: Small and Medium Size Enterprises (SMEs) within Canada. The second section highlights the scope of the study: Mobile Data Technologies (MDT). The third section discusses the literature onto adoption of technology, and the chapter ends with a review of previous adoption studies.

### **Defining Small and Medium Size Enterprises**

#### **Classifying SMEs**

Defining Small and Medium-Sized Enterprise (SMEs) is not an easy task to accomplish. Throughout the world, there is no standard or universal definition of SMEs; rather, it is clear that many countries use a variety of different types of criteria's to define SMEs (Amboise, 1991). In Table 1 - Five Countries' Attempts to Define SMEs; Amboise (1991) summarizes five countries common practices of defining SMEs. Also some criteria are applicable to all industry areas while others are relevant only to certain types of business (Longenecker, Moore, Petty, & Donlevy, 1998).

**Table 1 - Five Countries' Attempts to Define SMEs**

<b>Country</b>	<b>Attempt to Define SMEs</b>
United States	<ul style="list-style-type: none"> <li>▪ No universal definition of small business in the U.S.</li> <li>▪ According to the Small Business Act of 1953: "A small business is independently owned and operated, and is not dominant in its field of operation."</li> <li>▪ Firms employing an upper limit of 500 employees</li> </ul>
England	<ul style="list-style-type: none"> <li>▪ In economic terms, a small firm is one that has a relatively small share of its market</li> <li>▪ An essential characteristic of a small firm is that it is managed by its owner or part owners in a personalized way</li> <li>▪ Is independent in the sense that it does not form part of a larger enterprise and that the owner-managers should be free from outside control</li> <li>▪ Firm adopting 200 employee upper limit for manufacturing and a series of definitions in terms of whatever measures appeared appropriate for other trades.</li> </ul>
Japan	<ul style="list-style-type: none"> <li>▪ A firm where number of employees or capital does not exceed precise figures. These indicators are fixed for each major sector</li> </ul>
France	<ul style="list-style-type: none"> <li>▪ No formal definition of SMEs</li> <li>▪ Firms employing less than 500 people are generally considered to be small businesses</li> <li>▪ Firms employing less than 10 are usually classified as "craft industries."</li> </ul>
Canada	<ul style="list-style-type: none"> <li>▪ No single definition of small business has yet been agreed upon</li> <li>▪ Variety of different measurements. Most common is the difference between the goods-producing firm and service producing firm. Goods-producing firms upper limit is 500 employees while service-producing firms limit is 249.</li> </ul>

In Canada, there is no clear guideline or definition for classifying SMEs (Amboise, 1991; Balderson, 2003; Longenecker *et al.*, 1998). For example, legislators may exclude small firms from certain regulations if they fall below a certain number of employees. Statistics Canada usually classifies an organization as a small business when there are fewer than 500 employees, and Revenue Canada uses a minimum profit amount to define SMEs. Furthermore, a business may arbitrarily be described as "small" when compared to larger firms, but "large" when compared to smaller ones. In the absence of a standard definition to define SMEs in Canada or elsewhere, it is necessary to introduce a specific definition for the purposes of this study.

Before this paper defines SMEs for its own research, it will highlight four criteria commonly used to distinguish the size of an organization (Amboise, 1991; Balderson, 2003; Longenecker *et al.*, 1998). They are: number of employees, total revenue, profit,

and type of management-ownership structure. Each of these will be discussed in succession.

### 1. Number of Employees

The Number of Employees criterion is the most widely used to size a business (Amboise, 1991; Balderson, 2003; Longenecker *et al.*, 1998). Industry Canada classifies the size of an organization based on the number of employees and whether the organization is a goods-producing firm or service producing firm. A goods-producing business is considered small if there are fewer than 100 employees, while for service-producing firms the cut-off point is 50 employees. Legislators may exclude small firms from certain regulations if they have fewer than 10 or 15 employees (Longenecker *et al.*, 1998). Various government departments define small businesses differently. In British Columbia, businesses with fewer than 50 employees and businesses operated by a person who is self-employed, without paid help are classified as small business (B.-C.-Stats, 2003). Statistics Canada has several different definitions for classifying businesses. In Statistics Canada's Survey of Innovation 1999, manufacturing SMEs are defined as having between 20 and 249 employees. In contrast, Statistics Canada's Survey of Electronic Commerce and Technology (SECT), defined business size in the following manner: small firms as having fewer than 20 employees; medium-sized firms as having between 20 and 99 employees (in the service-producing) or 20 and 499 if a goods-producing firm; and large firms as having more than 100 employees (service-producing) or 500 if a goods-producing firm (Industry-Canada, 2003). As well, in consultation with Statistics Canada, the National Research Council of Canada and Industrial Research Assistance Program (NRC-IRAP) developed the following size categories: small firms as

having 1-99 employees, medium firms as having 100-499 employees and large firms as having greater than 500 employees. The NRC-IRAP further classifies the small firm into three sub-categories: 1-19 employees, 20-49 employees, 50-99 employees. An even smaller-sized classification is the Very Small Enterprise (VSE), defined as a business with fewer than 10 employees (Harfield, Driver, & Beukman, 2001; Philp, 1998). Industry Canada calls the smallest of small businesses Micro Enterprises, defined as having fewer than five employees<sup>4</sup> (Industry-Canada, 2005).

## 2. Total Revenue

Total revenue is a frequently used measurement for defining small business (Amboise, 1991; Balderson, 2003). Export Development Corporation defines a small firm as one that has export sales under \$1 million. Statistics Canada also defines small businesses as those having annual revenue between \$30,000 and \$5,000,000. In Harfield *et al.*, (2001), a VSE is defined as a company with a turnover of less than \$1 million annually.

## 3. Profits

Canada Revenue Agency (CRA) uses operating profits as a guideline to define which businesses qualify for the “Small Business Deduction”<sup>5</sup>. Companies with net operating profits of \$200,000 or less get a reduced tax rate.

## 4. Type of Management-Ownership Structure

The type of management-ownership structure can be used to define a small business, for example the owner is also be the day-to-day manager of the business. Van

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<sup>4</sup> It is possible to have no employees in a business because of factors such as; people/family members working without pay for the firm; sub-contractors, self-employment, owners not taking a salary, holding company

<sup>5</sup> Part of the Income Tax Act, section 125

Akkeren's (2002) defines a small business as one in which one or more people make all the key managerial decisions. Balderson (2003) outlines the approach followed by the Committee for Economic Development in the United States under the committee's definition, if any two of the following characteristics exist, the business may be classified as a small business: independent management (owner is the manager); owner-supplied capital; local area of operations; and relatively small size within its industry. In the book, Small Business Management (1998) by Longenecker *et al.*, a similar general set of criteria is used to define SME. They are;

- Financing of the business is supplied by one individual or a small group
- Firm's operations are geographically localized
- Compared with the biggest firms in the industry, the business is small
- The number of employees in the business is usually fewer than 100

As explained above, there are many ways to define SMEs. No definition will satisfy every situation nor can it be expected or attained, given the complexity of business and the wide range of purposes for which SMEs definitions are developed. Government programs will still need to determine categories according to their particular policy objectives and researchers will still have to present their findings according to the most significant groupings (Amboise, 1991).

### **Impact of SMEs**

Although there is no clear agreement on how to define small and medium-sized enterprises within Canada, it is clear that SMEs are the foundation for Canada's economic growth (Amboise, 1991; Balderson, 2003; Iacovou, Benbassat, & Dexter, 1995; Longenecker *et al.*, 1998). According to Industry Canada, the total number of

Business Establishments<sup>6</sup> reached 2,346,881 in June 2004. Table 2 - Number of Business Establishments, June 2004; shows the total business establishments and the cumulative percentage of “employer” businesses. To highlight some of the key facts, 95 percent of all businesses operating in Canada employed fewer than 50 employees, while 75 percent of all businesses had fewer than ten employees. In other words, there are just over 2,800 business establishments, or 0.3 percent in Canada, that employ more than 500 employees. Figure 1 - Size of Business Establishments in Canada, June 2004; highlights the impact and importance of SMEs within the Canadian work environment.

**Table 2 - Number of Business Establishments in Canada, June 2004**

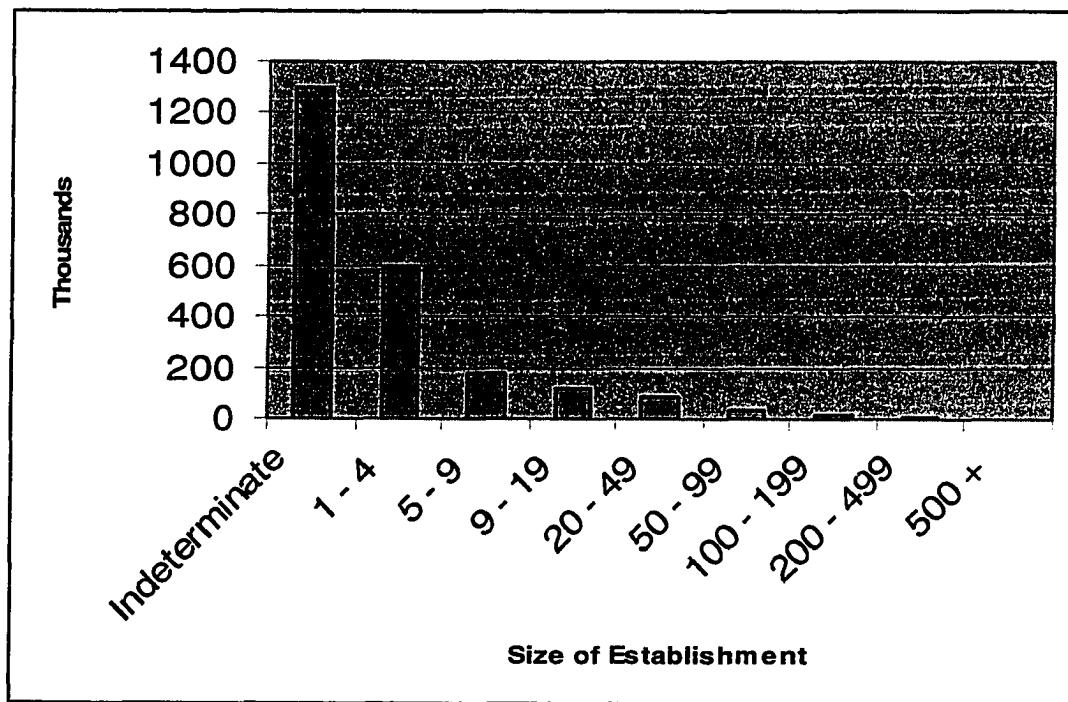
<b>Number of Employees</b>	<b>Cumulative Percent of “Employer” Businesses</b>	<b>Total Business Establishments</b>
Indeterminate <sup>7</sup>		1,300,536
Employer Business		
1-4	57.5%	601,652
5-9	74.6%	178,971
10-19	86.3%	122,856
20-49	94.7%	87,472
50-99	97.7%	30,810
100-199	99.0%	14,548
200-499	99.7%	7,167
500+	100.0%	2,869
Employer Business Total		1,042,345
<b>Grand Total</b>		<b>2,346,881</b>

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<sup>6</sup> Statistics Canada defines a Business Establishment as having at least one paid employee, having annual sales revenue of at least \$30 000, or being incorporated and having filed a federal corporate income tax return at least once in the past three years. Business establishments comprise indeterminate and employer businesses.

<sup>7</sup> Indeterminate are businesses that are incorporated or unincorporated businesses without registered employees

**Figure 1 - Size of Business Establishments**



### **Defining SMEs**

For the purpose of this research, the criterion used to measure the size of a business will be the Number of Employees<sup>8</sup>. This criterion is justified by the abundant adoption studies that have classified SMEs through 'number of employees' (Paul Cragg & King, 1993; Paul Cragg & Zinatelli, 1995; Fink, 1998; Harrison, Mykytyn, & Riemenschneider, 1997; Iacovou *et al.*, 1995; Igbaris, Zinatelli, Cragg, & Cavaye, 1997; Raymond, 1985; Jeanette Van Akkeren & Harker, 2003). Table 3 - Definition of Small and Medium Size Enterprise; illustrates how this paper has defined five size classifications of Small and Medium Sized businesses.

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<sup>8</sup> Consideration must be taken into account regarding counting 10 full-time equitant employees.

**Table 3 - Definition of Small and Medium Size Enterprise**

<b>Category</b>	<b>Size Definition</b>	<b>Source</b>
Indeterminate	Workforce that is not on the payroll consisting of contracted workers, family members, business owners, self-employed owners. Also possibility that business is a holding company.	(Industry-Canada, 2005)
Micro Enterprises (ME)	1-4 employees	(Industry-Canada, 2005)
Very Small Enterprises (VSE)	5-19 employees	(Harfield <i>et al.</i> , 2001; Industry-Canada, 2005; Longenecker <i>et al.</i> , 1998; Philp, 1998; Statistics-Canada, 2004)
Small Enterprises (SE)	20-50 employees	(B.-C.-Stats, 2003; Industry-Canada, 2005; Statistics-Canada, 2004)
Medium Enterprises (MeE)	51-249 employees (for service-producing sector) 51-499 employees (for goods-producing sector)	(Industry-Canada, 2005; Statistics-Canada, 1999, 2004)

## **Mobile Data Technology**

This part of the literature review consists of three sections. The first section highlights the importance of enterprises embracing mobility within the work force. The second section discusses the spectrum of mobile devices that can be utilized by an organization. The last section defines Mobile Data Technology (MDT).

### **Embracing Mobility**

Mobile technologies have primarily been accepted and adopted in the consumer-oriented sector (Barnes, 2002), although interest within the broader business environment is increasing (Captaris, 2003). No longer can organizations rely on just one device, namely a stationary terminal or personal computer (PC) with a standard monitor and keyboard, that is utilized for a variety of applications (Gebauer & Shaw, 2002). In fact,

according to IDC<sup>9</sup>, laptop shipments in 2004 posted a growth rate of 36%, while during the same period, the desktop market grew only 8% (IDC, 2005). With the changing demands of business, employees need to be able to work in a variety of different environments, ranging from walking around the workplace, working off-site at a client's location or simply working while in transit from location to location. With the onslaught of new mobile devices, many employees are depending on mobile technology to help them perform their daily activities. In other words, in today's environment, the work force is increasingly on the move. As stated in Adesso Systems' White Paper (2005) "AMR Research estimates 35% of all workers are currently mobile, and their numbers are rapidly rising" and that "IDC predicts 66% of the work force will be mobile by December 2006." Although these are U.S. statistics, when comparing the various technology adoption rates between Canada and the U.S. (Coursaris, 2003), it appears that Canada matches closely or outperforms the U.S. in adopting technologies. Hence, it can be assumed that Canada's mobile work force could be estimated to reach 66% in 2006.

Table 4 – Adoption Rates between Canada and the U.S.; illustrates the adoption rates for various technologies between Canada and the U.S.

**Table 4 - Adoption Rates between Canada and the U.S.**

Technology	Canada	U.S.	Source
Mobile Internet	24%	25%	CWTA, 2002
PC Internet	50%	26%	StatsCan, 2001
Cell Phone	29%	24.4%	CWTA, 2002
PC	61%	40%	ACNielsen, 2000
Telephone	96%	93.9%	StatsCan, 2001

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<sup>9</sup> IDC is a global market intelligence and advisory firm in the information technology and telecommunications industries. IDC is a subsidiary of IDG, the world's leading technology media, research, and events Company (IDC, 2005).

Leung & Antypas (2001) note that mobile computing can enhance business efficiency by distributing information to the workforce remotely and by offering new channels through which employees can interact with customers and work processes. In any modern business employees must be given the opportunity to work away from the office and on the move using mobile devices. No enterprise hoping to remain competitive can ignore the fact that businesses will change with the environment. Mobile devices have radically changed the way organizations conduct their day-to-day business. Increased mobility offers a significant opportunity for businesses, whether it is in improving customer service, increasing employee productivity or allowing for shorter decision approval cycles. Kalakota and Robinson (2002) define mobility as the portability of a device that travels easily with the employee inside or outside the organization. It is mobile devices that are allowing employees better access to and utilization of organizational information, which in turn, enhances business efficiency in the workforce (Kalakota & Robinson, 2002; Leung & Antypas, 2001). For example, using a personal digital assistant (PDA) with built-in wireless allows employees to remain connected to the company's network at times when they are away from the traditional office or desk. This cuts down on lost time due to employees traveling and not having access to information anytime/anywhere.

### **Types of Mobility**

The benefits of a mobile workforce are expressed in mobile communication, mobile collaboration, and mobile commerce (Sarker & Wells, 2003). To address the role of the mobile workforce within the organization, it is important to distinguish between a number of key terms: wireless versus mobility; and traveling, wandering and visiting.

There is frequent confusion of the terms “wireless” and “mobility”. The term wireless deals with connectivity and refers to a type of communication system. Connectivity is how employees connect to the organization and is divided into two sub-categories; wired and wireless. Wired connectivity, meaning connection facilitated by a physical wire/connection, such as a traditional dial-up or high-speed Internet connection. The term wireless refers to connectivity between the employee and organization that is created without using any physical wire/connection. A wireless communication system is simply a method of communicating between devices without physical connectors. Wireless systems are often used in mobile devices to facilitate network connectivity, but they are not a mobile device or a form of mobility in and of themselves (B'Far, 2005). The term mobility refers to mobile computing which allows employees to work away from the traditional office space environment. Basically, mobility means portability. A laptop, PDA, TabletPC and many other portable technologies are all mobile devices. A device does not have to include a means of wireless connectivity to be considered a mobile device. An example of the differences between the two terms (mobile and wireless) can be found in an ordinary laptop. When an employee has to work away from a stationary PC, a laptop can allow the employee to continue to be as productive. This laptop, however, does not have to be able to communicate with other devices or networks to be a useful “mobile” tool. However, if the laptop has wireless capabilities by means of establishing a wireless connection, then the laptop is both mobile and wireless.

Kalakota and Robinson (2002) also describe mobility into two parts: Offline Mobility and Online Mobility. Offline Mobility refers to situations where the mobile device operates while not connected to the Internet. Online Mobility, also considered

wireless, describes transmissions of voice, data and other content that are not being restricted to physical cables or other physical media. This research will be focusing on mobility, whether or not the mobile device connectivity is wireless.

It is also important to understand that mobile device users are not always in the same location, as the user's location is constantly changing (B'Far, 2005). With this in mind, there are three other terms<sup>10</sup> that are important to distinguish when it comes to mobility, they are; Traveling, Wandering, and Visiting (Kristoffersen & Ljungberg, 1998; Sarker & Wells, 2003). Traveling refers to an employee working outside of the organization and on the move. Examples could include sales representatives at a client's locations or maintenance crews on service calls. Wandering relates to an employee who is working within the physical location of the organization but not confined to one location. For example, employees conducting inventory checks within their organization who may carry around a mobile device to aid in the process. Visiting describes an employee who is at a different location for a significant period of time.

This study focuses on "mobility" in respect to why the organization would adopt MDT. For the purpose of exploring this decision making process, mobility will be defined in the terms of Field Based Mobility and Location Based Mobility. Field Based Mobility consists of field sales/service operations that have the means of conducting on the spot billing, inventory look-ups, and real time dispatching. A further example of field sales includes an employee obtaining sales information from their organization that would aid the sales person in completing the transaction. Example of field service would be obtaining old maintenance records of items requiring service at a customer's location,

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<sup>10</sup> Although these three terms are used in several articles, they are, at times, used synonymously with other terms. For example, Deloitte uses the term "hotelling" instead of "wandering".

or performing complex diagnostics that require access to the organization's databases. Location Based Mobility allows employees mobility within the office and/or working environment. For example, employees who work within the retail sector are able to make use of a mobile device to maintain store inventory/restocking by moving freely around the premises utilizing the device.

Therefore, for organizations it is no longer important whether their employees are working within the company's traditional work environment, larger physical plant or off-site. The key is to not allow employees to become entrenched in using the traditional office computer, but rather to encourage employees to utilize mobile devices to help perform their daily tasks more efficiently and productively and hence allow the organization to remain competitive.

## **Mobile Device Classification**

There is no mobile device that serves all needs for all organizations<sup>11</sup>. No longer can organizations rely on one type of device, mainly a stationary PC, to fulfill the day-to-day demands of running an organization. An issue that arises in referring to these mobile devices is how to classify the devices into categories. Devices differ in size, weight, performance, storage capacity, display (screen) and input (Keyboard) dimensions, and other so-called cost form-factors (Gebauer & Shaw, 2002). Organizations need to set criteria to help evaluate the devices, whether the criteria differ in functionality, cost and/or portability. Gebauer & Shaw's paper (2002) proposed to position devices along a

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<sup>11</sup> At the time of writing this paper, it could be said that no single mobile device currently serves all needs of an organization. It should be noted however, that because of ever changing technological advances, it is plausible that someday there may be a single device that meets all mobile requirements in one device.

portability continuum, where portability is determined by the weight and size of a device. At one end of their continuum are stationary PCs, which are typically used in one location and not moved. At the other end of their continuum are devices built specifically to be carried by the mobile workforce (pocket-sized or even smaller). These devices include cell phones, pagers, and pocket sized PDAs. In the middle of their continuum are portable devices such as PocketPCs, laptops and TabletPCs.

This study is based on a three consideration evaluation criteria to categorize six groupings of mobile devices. The three considerations are as follows: price, portability and functionality. Price is simply defined as the cost of the device. All organizations are price sensitive when adopting new technologies, hence price is our first consideration. Portability is determined by weight and size of the device. We are in agreement with Gebauer & Shaw (2002) that portability is an essential factor for the mobile worker and hence plays an important role in establishing the mobile continuum. We are not in agreement with Gebauer & Shaw (2002) that portability is the only factor that should be used to position mobile devices on a continuum. Functionality is our last consideration and determines the sum of what a product, such as a mobile device, can do for the user (Whatis.com, 2005a). Table 5 – Categorizing Device; highlights how the three considerations<sup>12</sup> have ordered the six devices<sup>13</sup>.

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<sup>12</sup> Four web sources (Best Buy, Staples, Rogers's communications and Telus communications) were used to gather facts on each device category. Searching was compiled in March 2005. It should be noted that these factors of the three considerations will change with time. While the format remains useful, the searched facts can quickly become outdated.

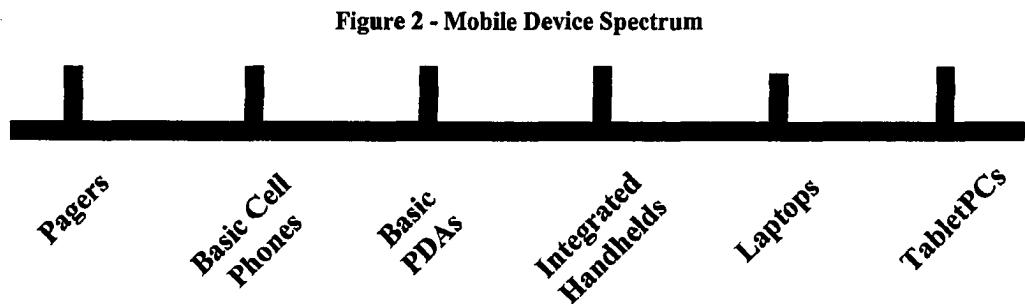
<sup>13</sup> It should be noted that the device categories and their descriptions will change as advances in technology continue.

**Table 5 – Categorizing Devices**

<b>Device Category</b>	<b>Price</b>	<b>Portability (Grams / Size)</b>	<b>Functionality</b>
<u>Pagers</u> - a radio receiver that uses a specific frequency to retrieve signals.	\$50 - \$150	60 grams	n/a
<u>Basic Cell Phones</u> - a sophisticated radio transceiver used to make phone calls.	\$30 - \$300	100 grams	n/a
<u>Basic PDA</u> - a scaled down PC. Basic features include: address book, notepad, appointments diary, calculator and phone list.	\$120 - \$300	120 grams	n/a
<u>Integrated Handhelds</u> - digital wireless devices that can send and receive voice, data and video as well as operate software programs. Able to connect to the internet for e-mail and web access.	\$130 - \$800	140 grams	12(w)*7.5(h)*2(d)
<u>Laptops</u> - a full-blown computer that can do anything a desktop computer can do.	\$1000 - \$3100	3.5 kg	35(w)*26(h)*3(d)
<u>TabletPCs</u> - allows the user to write directly on the screen, making it easier for the user to capture, access, and utilize information.	\$2800 - \$3600	1.8 kg	27(w)*27(h)*3(d)
			High with unique features

Each consideration contributes evenly towards ordering the devices on a continuum. The first four devices are easily put into order using the considerations described. It is the last two that are somewhat more subjective. Although laptops were placed in the fifth order, they appeared at the end of the continuum when the portability consideration was applied. We rated TabletPCs at the end of our spectrum because they were rated the highest in the continuum in regards to functionality, as this type of technology makes it easier for the user to capture, access, and utilize information. As well TabletPCs rated furthest on the price continuum, as these devices are still the most

expensive to purchase. It is the ordering of the six categories through the three considerations that this study is proposing a mobile device spectrum, see Figure 2 - Mobile Device Spectrum.



### **Defining Mobile Data Technology**

A search through the literature has provided limited results on the definition of MDT. This is not surprising given the recent emergence of these technologies. Van Akkeren (2002) describes MDT as being a mobile device, whether it is a mobile phone, PDA, or an integrated handheld, that is associated with services and is delivered on existing devices with which users are familiar. As well, Van Akkeren (2003) suggests that MDT ‘marries’ the two components of mobile phones and e-commerce technologies, hence, helping to eliminate time and distance barriers for organizations. In Computer Associates’ White Paper (Computer\_Associates, 2002) mobile devices are defined as portable electronic components that are used by mobile people to do their work. Schmidt (A. Schmidt, Lauff, & Beigl, 1998) defines a handheld computer as an unobtrusive computing device that is accompanying the user most of the time and provides assistance

in different situations and for a wide range of tasks. This paper defines Mobile Data Technology as:

*End user technology which enables the mobility of employees in order to provide functionality for the organization anytime/anywhere.*

## **Adoption of Technology**

As has been stated earlier, all sizes of organizations must adopt technology in order to maintain or improve their competitiveness (Gagnon & Toulouse, 1996; Porter, 1985). It is no longer a choice for organizations to adopt technology; it is a matter of survival (Porter, 1985). This sub-section of the literature review will discuss three theoretical theories, define innovation and the different types of innovation, explain the difference between variance and process theory and conclude with the summarization of recent literature from the last twenty years on factors affecting the adoption of IT by small business.

### **Theoretical Theories**

Although there has been little research regarding MDT adoption specifically, there is a solid foundation of theories previously studied that help explain the concepts of technology adoption. This paper will discuss three theories: Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM) and Task-Technology Fit (TTF) model

The Theory of Reason Action is a widely studied theory derived from social psychology. It was one of the first intention behavioural models which had the means of predicting and explaining user acceptance of computer systems (Ajzen & Fishbein, 1980;

Fishbein & Ajzen, 1975). The foundation of the TRA is created by distinguishing amongst beliefs, attitudes, intentions, and behaviours. According to TRA, a person's performance of a specified behaviour is determined by his or her behavioural intention. This in turn is determined by the person's attitude. The person's attitude toward a behaviour is determined by his or her salient belief (Davis, Bagozzi, & Warshaw, 1989). Thus, attitude towards IT is derived from the strength of the person's beliefs that adopting IT will lead to certain consequences, each weighted by the evaluation of each belief's behavioral consequences (Ajzen & Fishbein, 1980). The downfall of TRA is that the model is too general and can explain virtually any human behaviour (Ajzen & Fishbein, 1980).

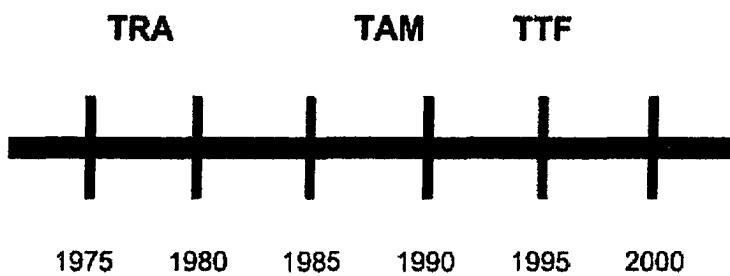
In an attempt to be more specific, an adaptation of TRA was developed. The Technology Acceptance Model was specifically meant to explain computer usage behaviour and focused on two key factors: perceived usefulness and perceived ease of use (Davis *et al.*, 1989). The goal of TAM was to provide an explanation of the "determinates of computer acceptance capable of explaining user behaviour across a broad range of end-user computing technologies and user populations" (Davis *et al.*, 1989). The key purpose of TAM was to understand the impact of perceived usefulness and perceived ease of use on user attitudes, intentions and actual computer adoption behaviour.

When an organization adopts a mobile technology, the prime objective for management is to find the best technology fit between the employee's task and the mobile device's capabilities. One way to demonstrate this is through the Task-Technology Fit (TTF) model, which describes the degree to which a technology assists an

individual in performing his or her portfolio of tasks (Goodhue & Thompson, 1995). In this theory, technology is defined as a tool that is used by individuals in carrying out their tasks. Tasks are defined as the actions carried out by individuals in turning inputs into outputs. TTF suggests ways in which a better fit between technology functionalities, task requirements, and individual abilities will lead to better performance or faster and more effective task accomplishment (Goodhue, 1995; Goodhue & Thompson, 1995). This model has four key factors: task characteristics, technology characteristics, task-technology fit and the outcome variable.

These three theories (TRA, TAM, and TTF) provide the theoretical base of the articles reviewed for this study and have an indirect impact in the development of our framework. TRA focuses on the general human behaviour, TAM highlights the attitudes based on perceived usefulness and ease of use and TTF examines on the match between the technology functionalities and task requirements. Figure 3 - TRA/TAM/TTF Time Line; illustrates the time line development of the two theories and one model in the last thirty years.

**Figure 3 - TRA/TAM/TTF Time Line**



### **Innovation**

The term “innovation” is usually applied three different contexts: invention; process; and an idea, practice or material artifact (Zaltman, Duncan, & Holbek, 1973).

**Table 6 - Innovation Contexts;** describes Zaltman *et al.*, description of each context in detail. Rogers and Shoemaker (1971) define innovation as an idea, practice, or object perceived as new by the individual. Writing a few years later, Zaltman et al., (1973) define innovation as an idea, practice, or material artifact perceived to be new by the adopting organization. The primary difference between these two definitions is that Zaltman adds the unit of adoption may be larger than just an individual. Daft (1978) goes on to define organizational innovation as the adoption of a new idea or behavior by an organization. The common element between the three definitions is that it does not matter whether or not an idea is new. An individual may have known about an innovation for some time but not yet developed a favorable or unfavorable attitude towards it, nor have adopted or rejected it (Rogers, 1983). What matters is that the idea has not previously been used by the adopting organization. If the idea seems new and different to the decision maker, it is an innovation (Rogers & Shoemaker, 1971).

**Table 6 - Innovation Contexts**

<b>Context</b>	<b>Description</b>
Invention	A creative process whereby two or more existing concepts or entities are combined in some novel way to produce a configuration not previously known by the person involved
Process	An existing innovation becomes a part of an adopter's cognitive state and behavioural repertoire.
An idea, practice or material artifact	Invented or that is regarded as novel independent of its adoption or nonadoption.

Organization innovations are normally classified in the follow three ways: administrative and technical, product and process, and radical and incremental. The distinction between administrative and technical innovation is important because it relates to a more general distinction between social structure and technology (Damanpour, 1991; Evan, 1966). Product and process innovation helps firms by providing competitive

advantages (Damanpour, 1991; Evan, 1966). Radical and incremental innovation is used to describe different types of technological process innovations (Dewar & Dutton, 1986).

Table 7 - Types of Innovations; describes in detail the context of each type of innovation.

**Table 7 - Types of Innovations**

<b>Administrative and Technical Innovation</b> <i>Distinguish between social structure and technology</i>	
<u>Administrative</u> - Involves organizational structure and administrative processes related to management. Indirectly related to the policies of recruitment, allocation of resources, structuring of tasks, and authority and reward.	(Damanpour, 1991; Damanpour & Evan, 1984; Evan, 1966)
<u>Technical</u> - Pertains to products, services and production process technology. Related to basic work activities and can concern either product or process.	
<b>Product and Process Innovation</b> <i>Provide competitive advantage</i>	
<u>Product</u> - Introduction of new products or services which the organization produces, sells, or gives away to meet an external user or market need.	(Damanpour, 1991; Knight, 1967; Utterback & Abernathy, 1975)
<u>Process</u> - New elements introduced into an organization to produce a product or render a service. Pertain to input materials, task specifications, work and information flow mechanism.	
<b>Radical and Incremental Innovation</b> <i>Describe different types of technological process innovations</i>	
<u>Radical</u> - Fundamental changes that represent revolutionary changes in technology. Represents clear departure from existing practices.	(Damanpour, 1991; Dewar & Dutton, 1986)
<u>Incremental</u> – Minor improvements or simple adjustments in current technology. Represents little departure from existing practices.	

This study will focus on the “process” context of the innovation, as most MDTs are new elements that are introduced into the organization to produce a product or render a service. We will use Daft’s definition of an innovation, as MDTs will be bringing in a new idea/behaviour to the organization. As to the types of innovations, this study will be concerned with technical innovations; as MDTs will improve basic work activities; increase process innovation; bring a new element to the organization; and finally, provide a combination of both radical and incremental innovations. The reason for this is that

adopting MDTs is more than just an incremental innovation. Bringing MDTs into the organization is more than minor improvements, as this is the first time the organization is using this type of technology, but it is less than a radical innovation; as the MDTs are not a big enough change on how the SMEs will conduct their business.

It is important to note that the adoption of MDTs within SMEs, overall, is not a complicated decision event as compared to adopting large and very expensive Enterprise Resource Planning (ERP) systems within large organization (Markus & Tanis, 2000). What is important in regards to the adoption of the innovation is that there has to be at least some degree of benefit or advantage for its potential adopters (Rogers, 1962, 1983).

### **Variance and Process Theories**

There are two broad approaches commonly used in the literature for researching innovation: the variance theory and the process theory (Mohr, 1982). Variance research is a type of data gathering/analysis that consists of measuring a set of variables over a specific time period. Such research is usually conducted using quantitative research methods by assigning numerical values to the attributes behaviours/attitudes (Rogers, 2003). Process research is a type of data gathering/analysis that seeks to determine the sequence of a set of events over time (Mohr, 1982; Rogers, 2003). Such research is conducted using qualitative research methods which seek to gain insight and understand human behaviours/attitudes (Rogers, 2003).

Mohr's comparison of process theory and variance theory identified a major distinction between "necessity"<sup>14</sup> and "sufficiency"<sup>15</sup>. Variance theory relies on necessity

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<sup>14</sup> Necessity means that a variable is absolutely required to explain the results.

and sufficiency and focuses on the grouping of variables and their correlation with a specific outcome. Process theory relies on necessity alone and aims to describe a series of events which leads to results over a period of time (Langley & Truax, 1994; Mohr, 1982). Table 8 – Mohr's Characteristics of Variance and Process Theory; highlights Mohr's variance and process theory in greater detail.

**Table 8 - Mohr's Characteristics of Variance and Process Theory**

<b>Variance Theory</b>	<b>Process Theory</b>
<i>The basis of explanation is causality</i>	<i>The basis of explanation is probabilistic rearrangement</i>
<ol style="list-style-type: none"> <li>1. The precursor (X) is a necessary and sufficient condition for the outcome (Y)</li> <li>2. A variance theory deals with variables</li> <li>3. A variance theory deals with efficient causes</li> <li>4. In variance theory, time ordering among the contributing (independent) variables is immaterial to the outcome</li> </ol>	<ol style="list-style-type: none"> <li>1. The precursor (X) is a necessary condition for the outcome (Y)</li> <li>2. A process theory deals with discrete states and events</li> <li>3. A process theory deals with a final cause</li> <li>4. In process theory, time ordering among the contributing events is generally critical for the outcome</li> </ol>

Most research on technology adoption is variance-type investigation (Langley & Truax, 1994; Rogers, 2003). This research uses both theories. The variance theory will measure what factors influenced SMEs most when adopting MDTs, while the process theory will attempt to explain the events leading up to the initiation, evaluation and approval of the MDT adoption. While the variance approach excels at explaining variation in the magnitude of certain outcomes, the process approach provides powerful explanations even when necessary causal agents cannot be demonstrated as sufficient for the outcomes to occur (Kumar, Maheshwari, & Kumar, 2002).

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<sup>15</sup> Sufficiency means that although the variables do not exclusively explain the outcome they are good enough to explain the outcome.

## **Previous Adoption Studies**

### **Adoption and Diffusion**

When research on organizational innovation is conducted, studies discuss the perspectives of adoption, the perspectives of diffusion or both. This paper will explain the differences between adoption and diffusion and why this paper focuses only on the adoption perspective of the innovation.

In regards to the adoption perspective, researchers have tended to concentrate on the appropriate mix of employee and organizational attributes. This is in contrast to the perspective of diffusion, where the focus is on the attributes of the innovation (Kimberly, 1986). Adoption is the decision to make full use of a given innovation as the best course of action available (Kimberly, 1986; Rogers, 2003). Adoption also refers to the stage in which the innovation is selected for use before the innovation (in this paper's case, technology) has been purchased. Diffusion in contrast, is the way in which a given innovation spreads within a population of potential organizational users (Kimberly, 1986).

To explain in general terms, adoption is related to the buyer. In adoption, the decision maker is choosing to take on or adopt the innovation and bring the innovation into the organization. Diffusion occurs when the decision maker promotes the use of the innovation within the organization after the innovation has been purchased.

### **Previous Adoption Studies**

As this research's domain is focusing on Small and Medium Sized organizations, an extensive literature review on articles that relate to SMEs that have adopted

technology into their organization has been conducted. Table 9 – SME Research on Adoption; identifies 25 articles with a variety of attributes that affect technology adoption in small business. This table summarizes each article's proposed independent variables and highlights the article's significant findings. The significant findings from this literature review support this paper's theoretical foundation for the proposed variance A Priori model to be discussed in the Theoretical Framework section.

**Table 9 – SME Research on Adoption**

Year	Cite	Journal	Method	n	Proposed Independent Variables	Significant Findings	Adoption Measure
2003	(Akkeren & Harker, 2003)	Mobile Commerce: Technology, Theory and Applications	Interview	500 small businesses	Perceived benefits, computer literacy, assertiveness, perceived control, subjective norm, mistrust of IT industry, time, return on investment, organizational readiness, external pressure, customer/supplier dependency, structural sophistication, size sector status, information intensity	Perceived benefits, computer literacy, assertiveness, perceived control, education level, age, gender, return of investment, organizational readiness, external pressure, customer/supplier dependency, structural sophistication, size sector status, Information intensity, communication e-commerce security	IT Adoption
	(Riemenschneider, Harrison, & Mykytyn, 2003)	Information & Management	Survey	156 small business	Usefulness, ease-of-use, intention, attitude, perceived behavioural control	Usefulness, ease-of-use, intention (presence), attitude (effective), perceived behavioural control (easy/difficult)	Adoption Decision
2001	(Lee & Runge, 2001)	Journal of Computer Information Systems	Surveys	166 small firms	Relative advantage of IT use, social expectation for IT use, innovativeness	Firms innovativeness	IT Adoption
	(Mehrtens, Cragg, & Mills, 2001)	Information & Management	Case Study	7 small firms	Perceived benefits, organizational readiness, external pressure	Perceived benefits, organizational readiness, external pressure	Adoption Decision
1999	(Thong, 1999)	Journal of Management Information Systems	Survey	166 small business	CEO's innovativeness, CEO's IS knowledge, relative advantage of IS, compatibility of IS, complexity of IS, business size, employees' IS knowledge, Information intensity, competition	CEO's innovativeness, CEO's IS knowledge, relative advantage of IS, compatibility of IS, complexity of IS, business size, employees' IS knowledge	IS Adoption
	(Premkumar & Roberts, 1999)	Omega	Survey	78 rural small businesses	Relative advantage, cost, complexity, compatibility, top management support, size, IT expertise, competitive pressure, external support, vertical linkages	Relative advantage, (Top management support, size, competitive pressure, external support	Adoption of Information and Communication Technologies

	(Karahanna, Straub, & Chervany, 1999)	MIS Quarterly	Questionnaires and Interviews	268	Perceived usefulness, image, compatibility, ease of use, visibility, results demonstrability, trialability, top management, supervisor, peers, friends, MIS department, local computer specialists	Usefulness, ease-of-use, results demonstrability, visibility, trialability	IT Adoption
1998	(Fink, 1998)	International Journal of Information Management	Survey	93 SME	Internal resources, Benefits of IT, Outside support, External resources, External environment, Inhouse IT expertise, Organizational culture, Availability of IT, IT selection, IT implementation	Benefits of IT, Availability of IT, Organizational culture, Inhouse IT expertise	Adoption of IT
1997	(Harrison, Mykytyn, & Riemenschneider, 1997)	Information Systems Research	Survey	162 small businesses	Behavioral intention, Normative beliefs, Subjective norm, Motivation to comply, Perceived control, Control belief, Perceived power, Attitude, Evaluations, Behavioural beliefs	Behavioural (improve efficiency, increase speed, improve access, leads to more downtime), Control (hardware compatibility, financial assets), Normative (Clients/vendors, other employees, people who are important approve)	Intentions to adopt IT
	(Agarwal & Prasas, 1997)	Decision Sciences	Survey	73	Relative advantage, Ease of use, Compatibility, Trialability, Visibility, Results demonstrability, Image, Voluntariness	Visibility, Compatibility, Trialability, Voluntariness (external pressure to use the innovation)	IT Innovation
	(Igbaria, Zinatelli, Cragg, & Cavaye, 1997)	MIS Quarterly	Survey	358 small firms	Intraorganizational factors, Extraorganizational factors, Perceived ease of use, Perceived usefulness, System usage	Perceived ease of use, Perceived usefulness, System usage	Technology Acceptance
1995	(Iacovou, Benbassat, & Dexter, 1995)	MIS Quarterly	Case Studies	7 companies under 200 employees	External pressure, Perceived benefits, Organizational readiness, EDI integration	External pressure, Perceived benefits, Organizational readiness	Adoption and Integration of EDI

	(Thong & Yap, 1995)	Omega	Survey	166 small business	CEO innovativeness , CEO attitude towards Adoption of IT, CEO IT knowledge, Business size, Competitiveness of environment, Information intensity	Business size, CEO attitude towards adoption of IT, CEO innovativeness, CEO IT knowledge	Adoption of IT
1994	(Julien & Raymond, 1994)	Entrepreneurship Theory and Practice	Survey	79 small retailers	Centralization, Complexity, Size, Sector, Status, Assertiveness, Rationality, Interaction	Sector, Status, Decentralization, Bureaucratization, Strategic proactiveness, Future orientedness	IT adoption
1993	(Cragg & King, 1993)	MIS Quarterly	Interviews	6 manufacturing firms	Relative Advantage, Education, Managerial Time, Economic, Technical, Other factors	Motivators (improved enthusiasm for the technology), Inhibitors (Inadequate resources and limited education about IS)	Growth of IS
1992	(Yap, Soh, & Raman, 1992)	International Journal of Management Science	Survey	92 small business	Consultant effectiveness, Vendor support, CBIS <sup>1</sup> experience, Sufficiency of financial resources, CEO support, User participation, Number of administrative applications, Presence of programmer/systems analyst	Consultant effectiveness, Vendor support, CBIS experience, Sufficiency of financial resources, CEO support, User participation	IS Success
1991	(Moore & Benbassat, 1991)	Information Systems Research	Survey	532	Voluntariness, Image, Relative Advantage, Compatibility, Ease of Use, Results demonstrability, Trialability, Visibility	Voluntariness, Image, Relative Advantage, Compatibility, Ease of Use, Results demonstrability, Trialability, Visibility	IT Adoption

<sup>1</sup> CBIS means computer-based information systems

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	(Lefebvre, Harvey, & Lefebvre, 1991)	R&D Management	Survey	144 manufacturing companies fewer than 200 employees	Size of firm, Financial performance, Reduction in cost, Reduction in labour, Increase of overall productivity, Increase in quality of products, increase in flexibility, Increase in quality of customer service, improvement of firms image, Influence of CEO, Influence of engineering, Influence of marketing, Influence of consultants, Influence of suppliers, Influence of customers, Purchase price, Knowledge of technologies being considered	Increase of overall productivity, Increase in quality of products, Increase in quality of customer service, Influence of CEO	Technology Adoption Decision
1990	(Kagan, Lau, & Nusgart, 1990)	Entrepreneurship Theory and Practice	questionnaire	884 small business firms	Software Sophistication, Type of business, Firm size, Hardware Capacity, Remote Processing, Fact finding, Software satisfaction	Type of business, Hardware capacity, software sophistication	Impact of IT upon small business
	(Treadgold, 1990)	Service Industries Journal	Case study	n/a	n/a	The role external agents play in influencing the adoption, the character of the population of potential adopters, and the nature of the innovation	IT Adoption
1988	(Montazemi, 1988)	MIS Quarterly	Interview	83 small firms	System analysis, End-user involvement, End-user computer literacy, Online application, Application systems, Duration of CBIS operation, Organizational size	End-user satisfaction is correlated with the number of system analysts present within the firm, with the degree of analysis of information requirements, with the level of participation, and with end users' level of computer literacy.	User Satisfaction
	(DeLone, 1988)	MIS Quarterly	Survey	93 manufacturing small business	External, EDP <sup>2</sup> knowledge, plan, involve, accept, control, age, training, type	Chief executive knowledge of computers and involvement in computerization leads to more successful computer use in small business	Successful use of CBIS

<sup>2</sup> EDP (electronic data processing) is an infrequently used term for what is commonly called information services today (Whatis.com, 2005)

	(Raymond, 1988)	Journal of Small Business Management	Survey and Interview	91 SME manufacturing	Computer training, Computer experience, User comprehension, User participation, Information satisfaction, Batch usage, Online usage, Administrative applications used	Computer training, Computer experience	Attitudes and Usage Behavior
1985	(Raymond, 1985)	MIS Quarterly	Survey	464 small manufacturing businesses	EDP experience, Development, Operation, Applications, Interface, MIS rank, Region	Organizational computer-usage characteristics are significantly associated to MIS success and found that most of these characteristics are related to the length of a firm's EDP experience.	User Satisfaction and System Utilization
1982	(Tornatzky & Katherine, 1982)	IEEE Transactions on Engineering Management	Meta-Analysis	75 articles	Relative advantage, Association with major enterprise, Clarity of results, Compatibility, Communicability, Continuing cost, Divisibility, Ease of operation, Flexibility, Importance, Initial cost, Mechanical attraction, Observability, Payoff, Pervasiveness, Profitability, Radicalness, Rate of cost recovery, Regularity of reward, Reliability, Riskiness, Specificity of evaluation, Saving of discomfort, Saving of time, Scientific status, Social approval, Trialability, Visibility	Compatibility, Relative advantage, Complexity, Cost, Communicability, Divisibility, Profitability, Social approval, Trialability, Observability  NOTE: compatibility, relative advantage and complexity had most consistent significant relationships to innovation adoption.	Innovation Adoption and Implementation

### Three Key Research Articles

In this sub-section of the literature review, we are going to highlight three key research papers in the field of technology adoption. They will be: Rogers's innovation diffusion theory (Rogers's five attributes of innovation); Tornatzky and Klein's meta-analysis of 75 articles; and Moore and Benbasat's comprehensive instrumental design to examine the decision to adopt IT adoption.

Rogers' innovation diffusion theory<sup>18</sup> is widely used as a theoretical framework in adoption of technological innovation research. The perceived attributes of innovation are some of the most important factors influencing the adoption of innovation. They consist of relative advantage, compatibility, complexity, trialability, and observability. Rogers first proposed these characteristics in his 1962 book Diffusion of Innovation. Rogers's choice of these characteristics is based on past writings and research with a focus on maximum generality (Rogers, 1962). In 1971, Rogers and Shoemaker<sup>19</sup> modified the definition of the five attributes, and the modified set of definitions has changed very little in the subsequent thirty four years. Table 10 - Rogers' Attributes of Innovation (1962 to 2003); illustrates the minor changes from 1962 to 1971 and the similarities from 1971, 1983, 1995 and to Rogers's latest edition of Diffusion of Innovation in 2003. As a result, relative advantage, compatibility, complexity, trialability, and observability, maintain widespread acceptance as the attributes of innovation and are the most widely cited

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<sup>18</sup> Overall, the terms adoption or diffusion of innovation are still the subject of an on going debate as to where there is a difference between the two. In this paper, we have distinguished between adoption and diffusion, although throughout the literature, adoption is inter-changeable with diffusion. This interchangeability explains why in the wording *Roger's innovation diffusion theory* – “diffusion” is used in the context of “adoption” of a technological innovation.

<sup>19</sup> Although this book by Rogers and Shoemaker from 1971 is called Communication of Innovation, it is considered the second edition to Diffusion of Innovations.

factors that influence adoption measurement (Agarwal & Prasad, 1997; Karahanna *et al.*, 1999; Lee & Runge, 2001; Moore & Benbassat, 1991; Premkumar & Roberts, 1999; Thong, 1999; Tornatzky & Klein, 1982).

**Table 10 - Rogers' Attributes of Innovation (1962 to 2003)**

Attribute	1962 (1 <sup>st</sup> edition)	1971 (2 <sup>nd</sup> )	1983 (3 <sup>rd</sup> )	1995 (4 <sup>th</sup> )	2003 (5 <sup>th</sup> )
Relative Advantage	is the degree to which an innovation is superior to ideas it supersedes	is the degree to which an innovation is perceived as being better than the idea it supersedes.	SAME as 1971	SAME as 1971	SAME as 1971, 1983
Compatibility	is the degree to which an innovation is consistent with existing values and past experiences of the adopters	is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of the receivers.	Slight Modification. At the end of the sentence 'needs of the receivers', has been modified to 'needs of potential adopters.'	SAME as 1983	SAME as 1983
Complexity	is the degree to which an innovation is relatively difficult to understand and use	is the degree to which an innovation is perceived as relatively difficult to understand and use.	SAME as 1971	SAME as 1971	SAME as 1971, 1983
Trialability	(Called Divisibility) is the degree to which an innovation may be tried on a limited basis	is the degree to which an innovation may be experimented with on a limited basis.	SAME as 1971	SAME as 1971	SAME as 1971, 1983
Observability	(Called Communicability) is the degree to which the results of an innovation may be diffused to others	is the degree to which the results of an innovation are visible to other.	SAME as 1971	SAME as 1971	SAME as 1971, 1983

Tornatzky and Klein (1982) reviewed 75 articles pertaining to innovation characteristics and created a meta-analysis of the findings. There were three principal authors<sup>20</sup> for these articles which contributed a total of 53 references. The breakdown is: 35 references (Rogers & Shoemaker, 1971); 15 references (Rothman, 1974); and 3 references (Zaltman *et al.*, 1973). Within this meta-analysis of findings, thirty different

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<sup>20</sup> These three authors articles have been reviewed throughout the article (Rogers & Shoemaker, Rothman, and Zaltman *et al.*,

characteristics<sup>21</sup> were identified from the articles reviewed<sup>22</sup>. The ten most frequently addressed attributes, in the order of the number of times they were referenced, are displayed in Table 11 - Tornatzky and Klein Meta-Analysis. It is interesting to note that five of the characteristics identified from Tornatzky and Klein's findings match Rogers's attributes of innovation. From Tornatzky and Klein's findings, three innovation characteristics (compatibility, relative advantage and complexity) had the most consistent significant relationships to innovation adoption.

**Table 11 - Tornatzky and Klein Meta-Analysis**

Attribute	Description	Referenced
Compatibility	SAME as Rogers 1971, 1983, 1995, 2003	40
Relative Advantage	SAME as Rogers 1971, 1983, 1995, 2003	29
Complexity	SAME as Rogers 1971, 1983, 1995, 2003	21
Cost	is assumed to be negatively related to the adoption of the innovation, although the less expensive the innovation, the more likely it will be quickly adopted and implemented (Tornatzky & Klein, 1982).	20
Communicability	is the degree to which aspects of an innovation may be conveyed to others (Rothman, 1974). Note: this is very similar to Rogers's 1962 observability.	13
Divisibility	is the extent to which an innovation can be tried on a small scale prior to full adoption (Fliegel, Kivlin, & Sekhon, 1968). Note: this is very similar to Rogers's 1962 trialability.	10
Profitability	is the level of profit to be gained from adoption of the innovation (Tornatzky & Klein, 1982).	10
Social Approval	Refers to status gained in one's reference group, "a nonfinancial aspect of reward" (Fliegel <i>et al.</i> , 1968).	8
Trialability	SAME as Rogers 1971, 1983, 1995, 2003	8
Observability	SAME as Rogers 1971, 1983, 1995, 2003	7

In 1991, Moore and Benbasat's contribution to IT adoption theory was the creation of a comprehensive tool designed to measure perceptions of adopting an IT innovation. The researchers pooled a set of existing attributes from Rogers and

<sup>21</sup> In Table 11, column 'Proposed Independent Variables' list the thirty attributes.

<sup>22</sup> A fact that raises serious questions about the independence of these dimensions (Tornatzky & Klein, 1982)

Tornatzky & Klein, and added three new attributes to create a new scale instrument which was then subjected to four rounds of sorting expert judges. The result development was a 38-item instrument comprised of eight attributes. This instrument is a useful tool for studying the initial adoption and diffusion of innovations (Moore & Benbassat, 1991). Five of the attributes used in the instrument were based on Rogers's diffusion of innovation literature. The remaining three attributes consisted of: image, voluntariness of use and results demonstrability. Moore & Benbassat defined image as the degree to which use of the innovation is perceived to enhance one's image or status in one's social system. Voluntariness was used to refer to the degree to which use of the innovation is perceived as being voluntary, or of free will. Results demonstrability was defined as the degree to which the use of the innovation is a benefit in one's job<sup>23</sup>

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<sup>23</sup> In Moore and Benbasat's paper, where using PWS (personal work station) was innovation focus, they defined benefit as the degree to which the use of the PWS was a benefit in one's job.

## **Research Objectives**

The previous section highlights the abundant amount of research completed on adoption/implementation of technology. As well, as shown in earlier sections, there is a significant amount of research in regards to the adoption/implementation of technology by small and medium size organizations. What is missing in the literature is research on adoption of Mobile Data Technologies within SMEs. From the gap in the literature, the key research questions that will be addressed in this paper are:

1. What factors influence organizations most in making a decision to adopt MDT?
2. How is the decision to adopt an MDT initiated, evaluated and approved?

The main purpose of this thesis is to gain a better understanding of the factors affecting Mobile Data Technology adoption by Canadian Small and Medium Sized enterprises.

## **Theoretical Framework**

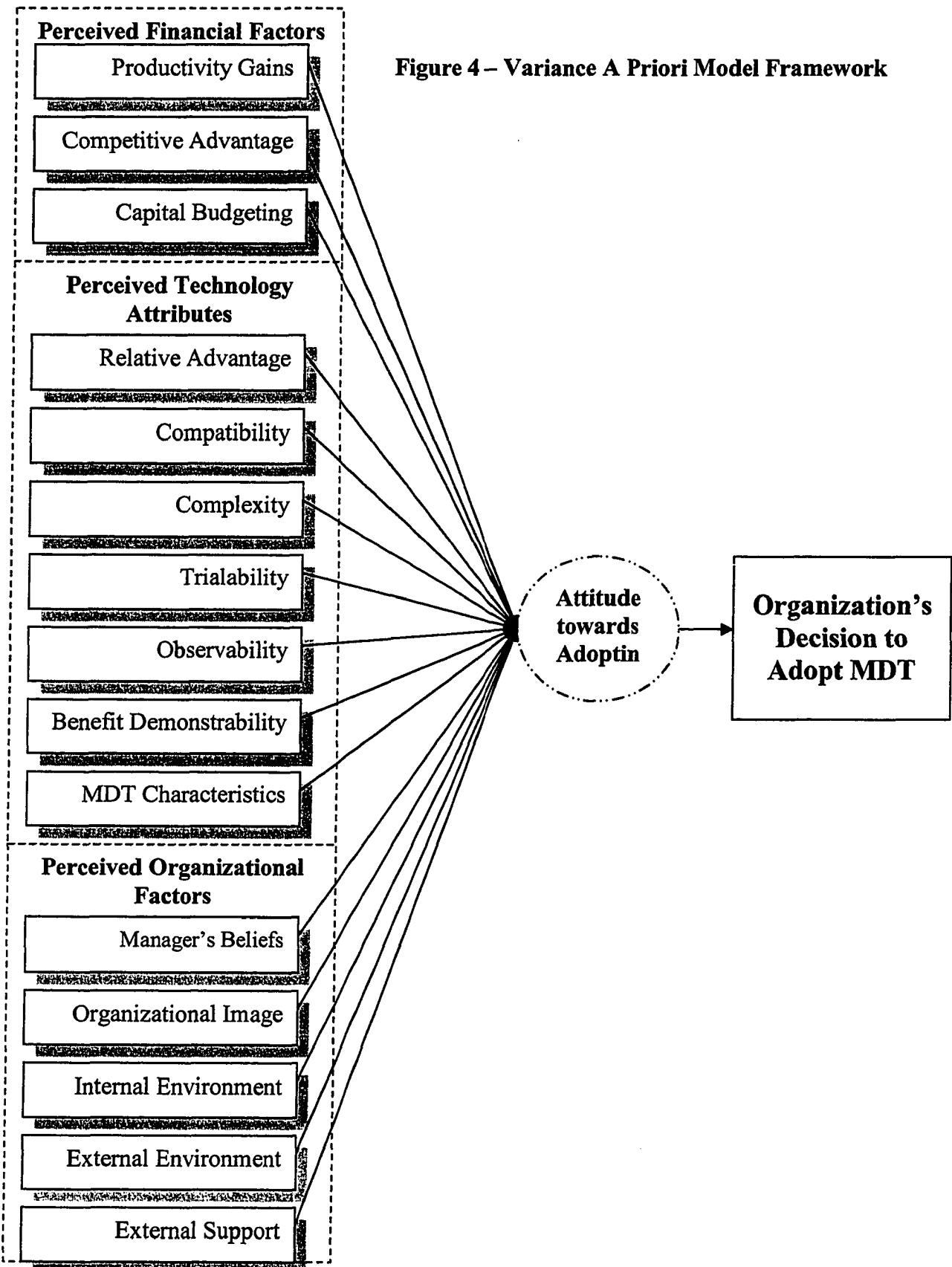
The previous chapter examined various theories in technology adoption that comprise the theoretical foundation for this study. On the basis of the findings of the literature review, two A Priori models were created using the findings from the research. Some aspects of the two proposed models are well defined throughout the literature, but as Rogers (2003) states, “scholars should keep an open mind towards other possible attributes that may be important in a specific situation for a particular set of individuals adopting a unique set of innovations.” As Rothman (1974) demonstrated in using a cookbook analogy, the researcher should understand that in real situations, the ingredients differ every time. So there is not a fixed result as there is from a cookbook process. In other words, just because similar domains (in our case SMEs) have been previously studied with conclusive results it does not mean when the scope of the innovation changes (in our case MDTs), the same results will follow.

In this chapter, two A Priori models will be introduced along with the justification of how both were operationalized.

### **Variance A Priori Model**

The variance model consists of fifteen attributes clustered into three groupings, see Figure 4 - Variance A Priori Model Framework. The first grouping (Perceived Technology Factors) consist of: relative advantage, compatibility, complexity, trialability, observability, benefit demonstrability and MDT characteristics. The second grouping

(Perceived Organizational attributes) consist of: manager's beliefs, organizational image, internal/external environment and external support. The third grouping (Perceived Financial Factors) consist of; productivity gains, capital budgeting and competitive advantage.



## **Selection of Attributes**

From the twenty-five SME Research on Adoption Articles reviewed, careful selection of each attribute was made to yield the best results about which factors influenced organizations most in making a decision to adopt the MDT. Some of these attributes are considered “classic adoption factors”<sup>24</sup> that are solidly grounded throughout the adoption literature. From the researcher’s significant findings, fifteen of the main eighteen attributes were chosen<sup>25</sup>. Table 12 - Number of Times Attributes were Referenced; illustrates the number of times each attribute was found to be significant within the articles reviewed. Table 13 – Theoretical Background; shows which article reviewed used the attributes we are proposing.

**Table 12 - Number of Times Attributes were Referenced**

<b>Category</b>	<b>Attributes</b>	<b># of times Referenced</b>
Perceived Technology Factors	<ul style="list-style-type: none"><li>● Relative Advantage</li><li>● Compatibility</li><li>● Complexity</li><li>● Trialability</li><li>● Observability</li><li>● Benefit Demonstrability</li><li>● MDT Characteristics</li></ul>	<ul style="list-style-type: none"><li>9</li><li>4</li><li>11</li><li>4</li><li>5</li><li>5</li><li>6</li></ul>
Perceived Organizational Attributes	<ul style="list-style-type: none"><li>● Manager’s Beliefs</li><li>● Organizational Image</li><li>● Internal Environment</li><li>● External Environment</li><li>● External Support</li></ul>	<ul style="list-style-type: none"><li>7</li><li>4</li><li>10</li><li>7</li><li>5</li></ul>
Perceived Financial Factors	<ul style="list-style-type: none"><li>● Productivity Gains</li><li>● Capital Budgeting</li><li>● Competitive Advantage</li></ul>	<ul style="list-style-type: none"><li>4</li><li>5</li><li>4</li></ul>

<sup>24</sup> These are Rogers’s five: relative advantage, compatibility, complexity, trialability and observability.

<sup>25</sup> The three other common attributes from the significant findings that were not used were: size (mentioned 3 times), sector (mentioned 2 times) and status (mentioned 2 times). Size and sector were not used in our framework as this study’s domain is SMEs. Status was not used in our framework as we know we are talking to the decision maker who has already made the decision.

Table 13 – Theoretical Background

Category	Attributes	Theoretical Background
44 Perceived Technology Factors	<ul style="list-style-type: none"> <li>• Relative Advantage</li> <li>• Compatibility</li> <li>• Complexity</li> <li>• Trialability</li> <li>• Observability</li> <li>• Benefit Demonstrability</li> <li>• MDT Characteristics</li> </ul>	<p>(Cragg &amp; King, 1993; Harrison, Mykytyn, &amp; Riemenschneider, 1997; Igbaris, Zinatelli, Cragg, &amp; Cavaye, 1997; Karahanna, Straub, &amp; Chervany, 1999; Moore &amp; Benbassat, 1991; Premkumar &amp; Roberts, 1999; Riemenschneider, Harrison, &amp; Mykytyn, 2003; Thong, 1999; Tornatzky &amp; Klein, 1982)</p> <p>(Moore &amp; Benbassat, 1991; Premkumar &amp; Roberts, 1999; Thong, 1999; Tornatzky &amp; Klein, 1982)</p> <p>(Agarwal &amp; Prasas, 1997; Akkeren &amp; Harker, 2003; Harrison <i>et al.</i>, 1997; Iacobou, Benbassat, &amp; Dexter, 1995; Igbaria, Zinatelli, Cragg, &amp; Cavaye, 1997; Karahanna <i>et al.</i>, 1999; Mehrtens, Cragg, &amp; Mills, 2001; Moore &amp; Benbassat, 1991; Riemenschneider <i>et al.</i>, 2003; Thong, 1999; Tornatzky &amp; Klein, 1982)</p> <p>(Agarwal &amp; Prasas, 1997; Karahanna <i>et al.</i>, 1999; Moore &amp; Benbassat, 1991; Tornatzky &amp; Klein, 1982)</p> <p>(Agarwal &amp; Prasas, 1997; Akkeren &amp; Harker, 2003; Karahanna <i>et al.</i>, 1999; Moore &amp; Benbassat, 1991; Tornatzky &amp; Klein, 1982)</p> <p>(DeLone, 1988; Karahanna <i>et al.</i>, 1999; Moore &amp; Benbassat, 1991; Thong, 1999; Thong &amp; Yap, 1995)</p> <p>(Fink, 1998; Harrison <i>et al.</i>, 1997; Igbaris <i>et al.</i>, 1997; Kagan, Lau, &amp; Nusgart, 1990; Raymond, 1985; Treadgold, 1990)</p>
Perceived Organizational Attributes	<ul style="list-style-type: none"> <li>• Manager's Beliefs</li> <li>• Organizational Image</li> <li>• Internal Environment</li> <li>• External Environment</li> <li>• External Support</li> </ul>	<p>(Agarwal &amp; Prasas, 1997; DeLone, 1988; Harrison <i>et al.</i>, 1997; Lefebvre, Harvey, &amp; Lefebvre, 1991; Thong, 1999; Thong &amp; Yap, 1995; Yap, Soh, &amp; Raman, 1992)</p> <p>(Fink, 1998; Moore &amp; Benbassat, 1991; Riemenschneider <i>et al.</i>, 2003; Tornatzky &amp; Klein, 1982)</p> <p>(Akkeren &amp; Harker, 2003; Fink, 1998; Harrison <i>et al.</i>, 1997; Iacobou <i>et al.</i>, 1995; Mehrtens <i>et al.</i>, 2001; Montazemi, 1988; Moore &amp; Benbassat, 1991; Raymond, 1985, 1988; Thong, 1999; Yap <i>et al.</i>, 1992)</p> <p>(Agarwal &amp; Prasas, 1997; Akkeren &amp; Harker, 2003; Iacobou <i>et al.</i>, 1995; Mehrtens <i>et al.</i>, 2001; Moore &amp; Benbassat, 1991; Premkumar &amp; Roberts, 1999; Treadgold, 1990)</p> <p>(Akkeren &amp; Harker, 2003; Harrison <i>et al.</i>, 1997; Premkumar &amp; Roberts, 1999; Treadgold, 1990; Yap <i>et al.</i>, 1992)</p>
Perceived Financial Factors	<ul style="list-style-type: none"> <li>• Productivity Gains</li> <li>• Capital Budgeting</li> <li>• Competitive Advantage</li> </ul>	<p>(Cragg &amp; King, 1993; Lee &amp; Runge, 2001; Lefebvre <i>et al.</i>, 1991; Riemenschneider <i>et al.</i>, 2003)</p> <p>(Akkeren &amp; Harker, 2003; Cragg &amp; King, 1993; Harrison <i>et al.</i>, 1997; Tornatzky &amp; Klein, 1982; Yap <i>et al.</i>, 1992)</p> <p>(Akkeren &amp; Harker, 2003; Fink, 1998; Lee &amp; Runge, 2001; Tornatzky &amp; Klein, 1982)</p>

## **Operationalizing the Attributes**

This section of the chapter will operationalize the attributes in order to create a better understanding of how each factor will be measured.

### *Attitude of Adopting*

Although we are not directly measuring the manager's attitude towards adopting the MDT, there is still significance in understanding his/her attitude. Theories based on the Theory of Reasoned Action (Fishbein & Ajzen, 1975) suggest that an individual's beliefs about an innovation lead to the formation of an attitude about the innovation; while that attitude leads to behavioural intentions, which ultimately affect the actual behaviour of the manager in response to the innovation. For the purpose of this study, attitude will be defined as the manager's salient beliefs about the benefits and drawbacks of adopting the MDT. Thus, attitude is derived from the strength of the individual's beliefs that adopting the MDT will lead to certain consequences, each weighted by the evaluation of each belief's behavioral consequences (Ajzen & Fishbein, 1980).

### *Perceived Technology Attributes*

For the purpose of this study, the first grouping of perceived technology attributes will be defined as the attitude towards adopting the MDT that is generated by the manager's salient beliefs about the benefits/drawbacks of the perceived technology attributes. The work of three authors was used to help operationalize this cluster of attributes. Six attributes can be considered as core adoption factors. Of these six, five originated from Rogers's (1971) work (relative advantage, compatibility, complexity, trialability and observability). The single remaining core attribute was incorporated from

Moore & Benbasset's (1991) work: benefit demonstrability. The last attribute that is added to this cluster is MDT characteristics. Madria *et al.*, (Madria, Mohania, Bhowmick, & Bhargava, 2002) suggest that mobile research should accommodate the limitations of mobile computing. As this studies' focus is technology related, it makes sense to include this attribute. Table 14 - Perceived Technology Attributes; describes each attribute in regards to how it will be utilized in this.

**Table 14 - Perceived Technology Attributes**

<b>Attribute</b>	<b>Description</b>	<b>Author</b>
Relative advantage	Is the degree to which adopting the MDT is perceived as being better than using the practice it supersedes	(Rogers & Shoemaker, 1971)
Compatibility	Is the degree to which adopting the MDT is compatible with the existing values, past experiences, and needs of the employees	(Rogers & Shoemaker, 1971)
Complexity	Is the degree to which adopting a particular MDT is perceived as relatively difficult to understand and use	(Rogers & Shoemaker, 1971)
Trialability	Is the degree to which an MDT may be experimented with on a limited basis	(Rogers & Shoemaker, 1971)
Observability	Is the degree to which the MDT is visible in the organization	(Rogers & Shoemaker, 1971)
Benefit demonstrability	Is the degree to which the MDT is beneficial in one's job	(Moore & Benbassat, 1991)
MDT Characteristics	Is the characteristics of the mobile device	(Madria <i>et al.</i> , 2002)

#### Perceived Organizational Factors

For the purpose of this study, the second grouping of perceived organizational factors will be defined as the attitude towards adopting the MDT that is generated by the manager's salient beliefs about the benefits/drawbacks of the perceived organizational factors. In this cluster, the work of four authors helps to operationalize these attributes. In regards to manager's beliefs, some owners/mangers are very enthusiastic towards IT (Paul Cragg & King, 1993; Martin, 1989). This leads to question, will their enthusiasm effects the MDT adoption? To answer this query, we will use another one of Moore & Benbasset's (1991) contributions – organization image. Fink's work (1998) provides the

basis for the final definitions in this cluster. Through his research, Fink determined that the internal/external environment and external support are important factors for successful adoption of IT. Table 15 - Perceived Organizational Factors; describes each attribute in regards to its function in this paper's research.

**Table 15 - Perceived Organizational Factors**

<b>Attribute</b>	<b>Description</b>	<b>Author</b>
Manager's beliefs	Is the degree of how the adoption of the MDT motivated with the managers beliefs	(Paul Cragg & King, 1993; Martin, 1989)
Organizational Image	The degree to which adoption of the MDT is perceived to enhance the organization's image	(Moore & Benbassat, 1991)
Internal environment	The degree to which internal influences affected the adoption of the MDT	(Fink, 1998)
External environment	The degree to which external influences affected the adoption of the MDT	(Fink, 1998)
External support	The degree to which external support influenced the adoption of the MDT	(Fink, 1998)

#### Perceived Financial Factors

For the purpose of this study, the third grouping of perceived financial factors will be defined as the attitude towards adopting the MDT that is generated by the manager's salient beliefs about the benefits/drawbacks of the perceived financial factors. In this cluster, there are three authors work that help operationalize these attributes. We focus on Lefebvre et al., (1991) work in regards to productivity gains. In their research, increase in overall productivity was one of the most important factors found to bear on the adoption decision. Competitive advantage stems from Thongs & Yap (1995) work. Thongs & Yap suggest that in adopting IT, businesses will need to change their environment to remain competitive. The concept of capital budgeting is taken from Van Akkeren & Cavaye's (1999) work. The authors state that financial issues are vitally important to managers when adopting technology in small firms. While SMEs may recognize the benefits of the technology, if they do not understand the financial

implications of the technology in terms of short or long-term investing, the organization may not be able to fund the adoption. Table 16 - Perceived Financial Factors; describes each attribute with references to its function in our research.

**Table 16 - Perceived Financial Factors**

<b>Attribute</b>	<b>Description</b>	<b>Author</b>
Productivity gains	The degree to which productivity gains influenced the adoption of the MDT innovation.	(Lefebvre <i>et al.</i> , 1991)
Competitive advantage	The degree to which the competitive advantage influenced the adoption of the MDT innovation.	(Thong & Yap, 1995)
Capital Budgeting	The degree to which the capital budgeting influenced the adoption of the MDT innovation.	(Jaenette Van Akkeren & Cavaye, 1999)

### **Measuring the Attributes**

This section of the chapter will describe the way in which the attributes are being measured. Rogers (2003) stated that some researchers want to utilize existing scale items already developed by other investigators. Although Rogers generally discourages this approach in favour of creating new scale items for each set of innovations to be adopted, this study will compromise by modifying existing constructs from seven authors. Two of these authors accounted for ten out of fifteen sets of constructs<sup>26</sup>. Of the fifteen attributes in our model, seven existing sets of constructs were taken from the work of Moore & Benbasat (1991) and three existing sets of constructs were derived from the contributions of Fink (1998). Table 17 - Constructs Used to Measure the Attributes; illustrates what set of constructs were used to measure each attribute.

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<sup>26</sup> There are two sets of constructs to measure each attribute.

**Table 17 – Constructs Used to Measure the Attributes**

Category	Attribute	Source	Constructs
<b>Perceived Technology Factors</b>	<ul style="list-style-type: none"> <li>▪ Relative Advantage</li> <li>▪ Compatibility</li> <li>▪ Complexity</li> <li>▪ Trialability</li> <li>▪ Observability</li> <li>▪ Benefit Demonstrability</li> <li>▪ MDT Characteristics</li> </ul>	<p>(Moore &amp; Benbassat, 1991)</p> <p>(Madria, Mohania, Bhowmick, &amp; Bhargava, 2002)</p>	<ul style="list-style-type: none"> <li>▪ Using a MDT will enable employees to accomplish tasks more quickly?</li> <li>▪ Using a MDT will make it easier for the employees to do their job?</li> <li>▪ Using the MDT will be compatible with most aspects of employees' work?</li> <li>▪ Using the MDT will fit well with the way the employees like to work?</li> <li>▪ Will the employees find the MDT cumbersome to use?</li> <li>▪ Overall, will the employees believe that the MDT is easy to use?</li> <li>▪ Was there an opportunity to try various MDT's?</li> <li>▪ Was the MDT tested/piloted?</li> <li>▪ I have seen MDT used outside my firm?</li> <li>▪ It is easy for me to observe others using MDT's in my firm?</li> <li>▪ I would have no difficulty telling employees about the benefits of using a MDT?</li> <li>▪ The benefits of using a MDT are apparent to me?</li> <li>▪ Will limited battery power affect the usage of the MDT?</li> <li>▪ Will the physical size of the MDT be important?</li> </ul>
<b>Perceived Organizational Attributes</b>	<ul style="list-style-type: none"> <li>▪ Manager's Beliefs</li> <li>▪ Organizational Image</li> <li>▪ Internal Environment</li> <li>▪ External Environment</li> <li>▪ External Support</li> </ul>	<p>(Cragg &amp; King, 1993)</p> <p>(Moore &amp; Benbassat, 1991)</p> <p>(Fink, 1998)</p> <p>(Fink, 1998)</p> <p>(Fink, 1998)</p>	<ul style="list-style-type: none"> <li>▪ Did peers influence the MDT adoption decision?</li> <li>▪ Did the IS department influence the MDT adoption decision?</li> <li>▪ Will the MDT improve the employee's image within the organization?</li> <li>▪ Will the MDT improve the employee's image outside the organization?</li> <li>▪ What is the level of IT expertise among employees?</li> <li>▪ What is the employee attitude of IT acceptance within the organization?</li> <li>▪ Did competitor usage of MDT influence MDT adoption?</li> <li>▪ Did trading partners influence MDT adoption?</li> <li>▪ Were outside consultants involved in the MDT decision?</li> <li>▪ Did the organization receive IT vendor support?</li> </ul>
<b>Perceived Financial Factors</b>	<ul style="list-style-type: none"> <li>▪ Productivity Gains</li> <li>▪ Capital Budgeting</li> <li>▪ Competitive Advantage</li> </ul>	<p>(Riemenschneider, Harrison, &amp; Mykytyn, 2003)</p> <p>(Van Akkeren &amp; Cavaye, 1999)</p> <p>(Thong &amp; Yap, 1995)</p>	<ul style="list-style-type: none"> <li>▪ Will the MDT help employees perform tasks more efficiently?</li> <li>▪ Will the MDT help employees perform tasks faster?</li> <li>▪ To what extent was return on investment (ROI) conducted?</li> <li>▪ To what extent was Total cost of ownership (TCO) conducted?</li> <li>▪ Will the MDT capture new revenue opportunities?</li> <li>▪ Will the company re-engineer the business processes in conjunction with implementing the MDT?</li> </ul>

## **Process A Priori Model**

Our process model is a modification of the first stage of Markus and Tanis's (2000) Enterprise Systems Experience Cycle (ESEC). As the ESEC model is typically used for large ERP systems, the body of research relating to Markus and Tanis's ESEC in SMEs has been increasing rapidly over the last few years (Loh & Koh, 2004). Loh & Koh's article presents 12 authors' research that has linked the chartering phase and definitions from Markus and Tanis's ESEC. This research will adopt Markus and Tanis (2000) model and utilize that model within SMEs adopting MDTs.

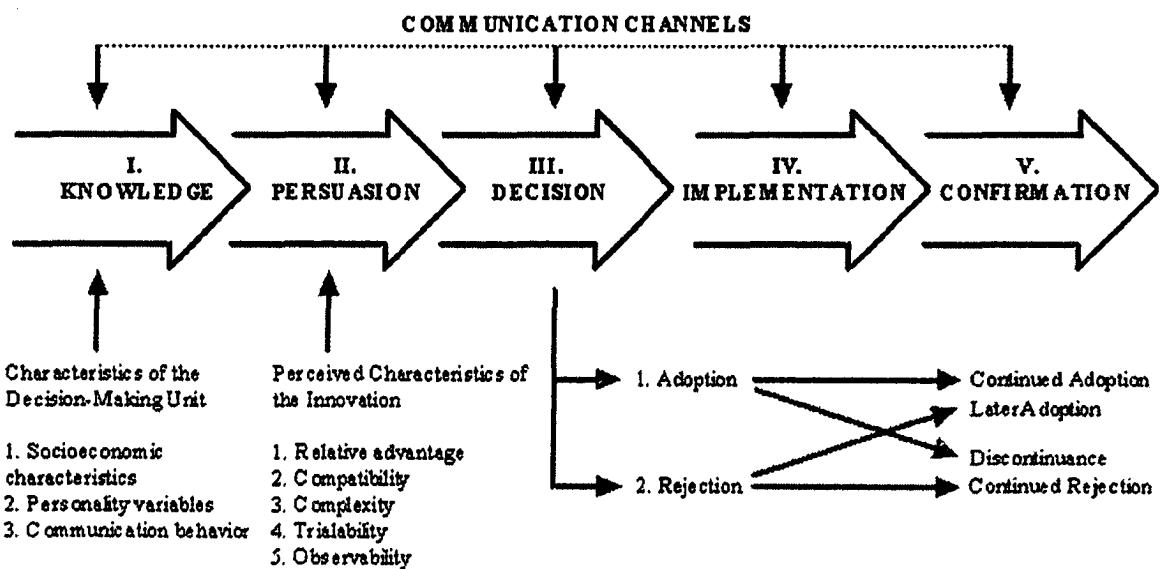
When using the process theory to determine the sequence of events over time, a common approach is to divide an organization's decision to adopt an innovation into a series of stages. As Rogers's (1995) work suggests "an individual's decision to adopt an innovation is not an instantaneous act. Rather, it is a process that occurs over time, consisting of a series of actions and decisions." Kumar *et al.* (2002) paper highlights four proposed researchers' theoretical models of the innovation process stage. They are: Rogers 1983, Cooper & Zmud 1990, Soh & Markus 1995 and Markus and Tanis 2000. This study has added two additional process stage models from the literature. Table 18 – Innovation Process Stage Models, illustrates the six models. The four earliest models will be briefly highlighted and greater detail provided regarding the remaining two.

**Table 18 - Innovation Process Stage Models**

<b>Authors</b>	<b>Phases</b>	<b>Source</b>
(Rogers, 1962)	Adoption	Diffusion of Innovation, 1 <sup>st</sup> edition
(Zaltman <i>et al.</i> , 1973)	Adoption & Implementation	Innovations and Organizations
(Pierce & Delbecq, 1977)	Initiation, Adoption, Implementation	Academy of Management Review
(Cooper & Zmud, 1990)	Initiation, Adaption, Adoption, Acceptance, Implementation & Institutionalization	Management Science
(Rogers, 1995)	Knowledge, Persuasion, Decision, Implementation, Confirmation	Diffusion of Innovation, 4 <sup>th</sup> edition
(Markus & Tanis, 2000)	Project Chartering, Project Configuration, Shakedown, Onwards & Upwards	The Enterprise System Experience: From Adoption to Success

In 1962, Rogers developed a single phase model focusing on the adoption process of an innovation. In 1973, Zaltman *et al.*, added the idea of implementation to Rogers's adoption phase and in 1977, Pierce & Delbecq added planning (initiation) into the process model. Rogers's model in 1995 consisted of five stages, as shown in Figure 5 - Rogers's Innovation Process Stage Model. He described the innovation-decision process as "the process through which an individual (or other decision-making unit) passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision." Rogers's innovation-decision process is essentially an information-seeking and information-processing activity in which managers are motivated to reduce uncertainty about the relative advantages and disadvantages of an innovation.

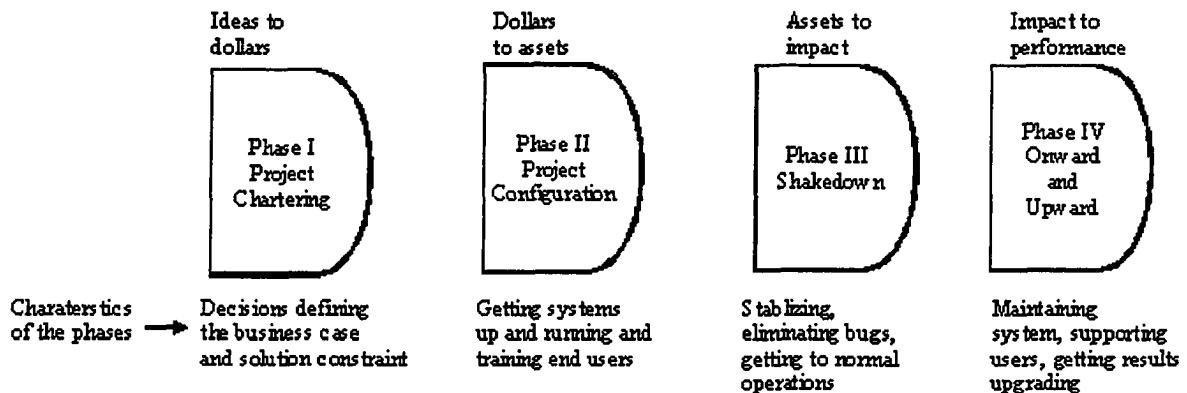
**Figure 5 - Rogers's Innovation Process Stage Model**



The last innovation process stage model is derived from Markus & Tanis (2000) Enterprise Systems Experience Cycle, as shown in Figure 6 - Markus & Tanis Enterprise Systems Experience Cycle. An organization's experience with an innovation can be described as moving through several phases, characterized by key players, typical activities, characteristic problems, appropriate performance metrics, and a range of possible outcomes (Markus & Tanis, 2000). The ESEC's four phases of the innovation process are:

- Project Chartering - this is where ideas to dollars happen and decisions defining the business case and solution are established
- The Project Configure & Rollout – this is where dollars to assets happens and get the system and end users “up and running”
- Shakedown – this is where assets to impact happens and stabilizing, eliminating “bugs” and getting to normal operations
- Onward and Upward – this is where configuration impacts to performance and maintaining system, supporting users, getting results and upgrading

**Figure 6 - Markus & Tanis Enterprise Systems Experience Cycle**



The project-chartering phase in this framework is the focus of this paper's exploration. Using the typical activities associated with the chartering phase, we will illustrate the organizations decision-makers' initiation, evaluation and approval stages of MDT adoption. Table 19 - Project Chartering Phase: Typical Activities; details Markus & Tanis's (2000) suggested "typical activities" that can be measured doing the Project Chartering phase. In the same Table, research by Markus & Tanis has been modified to fit our research objectives.

**Table 19 - Project Chartering Phase: Typical Activities**

Markus & Tanis	This Paper's Process Operationalized
<ul style="list-style-type: none"> <li>▪ Idea of adopting enterprise systems surfaced</li> <li>▪ Business case for investment developed (may be highly informal)</li> <li>▪ Definition of key performance indicators and process of measurement</li> <li>▪ Current state analysis (may be deferred or not done)</li> <li>▪ Selection of software, hardware platform, networking, database, implementation partner, project manager (may be partially or totally deferred to project phase)</li> <li>▪ Initial plans for how system will be rolled out, supported, and maintained, upgraded, etc. (may be deferred)</li> <li>▪ Communication to organization</li> <li>▪ Organizational changes and/or incentives related to enterprise system and/or organizational performance improvement, if any (may be deferred)</li> <li>▪ Decision to proceed, approval of project plan</li> </ul>	<p><b>Can you explain how the idea of adopting the MDT was initiated?</b></p> <ul style="list-style-type: none"> <li>▪ Who initiated it?</li> <li>▪ Why was it initiated? <i>(first reaction)</i></li> <li>▪ When was the idea initiated? <i>(How long ago)</i></li> </ul> <p><b>Can you explain how the MDT was evaluated?</b></p> <ul style="list-style-type: none"> <li>▪ What was the main reason for adopting the MDT? <i>(productivity, online, access anywhere/anytime)</i></li> <li>▪ Was a business case used in the evaluation? <i>(formal or informal)</i></li> <li>▪ Were any criteria set to help evaluating the device? <i>(price, size, availability, functionality)</i></li> <li>▪ What is your level of information technology awareness?</li> <li>▪ Was the ever changing technological environment evaluated? <i>(was that a concern)</i></li> <li>▪ Were other additional costs associated with the adoption of the MDT?</li> <li>▪ Did you test pilot the MDT before the decision was made?</li> <li>▪ Were plans created to support, train, maintain and upgrade the MDT?</li> <li>▪ Was there a plan created for how the MDT was going to be rolled out within the organization? <i>(formal or informal)</i></li> <li>▪ Were the end users consulted about the MDT?</li> <li>▪ Was there a plan created for how the MDT was going to be communicated to the organization? <i>(formal or informal)</i></li> <li>▪ When deciding to adopt the MDT's, to what extent would re-engineering have to take place in your work process after the adoption?</li> </ul> <p><b>Can you explain how the decision to adopt the MDT was approved?</b></p> <ul style="list-style-type: none"> <li>▪ What was the time period from initiation to evaluation to approval? <i>(how long)</i></li> <li>▪ How many were involved in making the approval?</li> <li>▪ Was the MDT approval method the same as other technology acquisitions?</li> </ul>

## **Research Methodology**

This chapter describes the research methodology used for this study. There are six sections in this chapter. Section 1 discusses the research design. Section 2 describes the sample characteristics. Section 3 provides a detailed account of the questionnaire design. Section 4 describes the data collection process. Section 5 describes the pre-test. Finally, section 6 discusses the analysis of the data.

### **Research Design**

This research was exploratory and employed an Ex Post Facto Design. The dependent variable was not measured, as the decision to adopt the MDT had already been made. Unfortunately, this research did not produce generalizable results; however, a reasonably representative sample provided valuable insight into organizations adopting MDTs. The primary data collection method was used for the purposes of this study. A survey instrument was used to collect the data; see appendix I – Survey Instrument. For the first objective ‘factors affecting MDT adoption’ a self-administered questionnaire was used. For the second objective ‘how the decision was made to adopt the MDT within the organization’ open-ended questions were used. The respondents were decision makers who made the decision to adopt the MDT.

## **Sample**

The sample frame used for this study was Canadian SME organizations that have already made the decision to adopt an MDT device. Due to time constraints and limited financial resources, a sample of convenience was chosen. The reason for this was that obtaining enough participants would be difficult, due to the extensive selection criteria. Finding organizations that had already made the decision to adopt an MDT in the last few years would prove challenging. All participants would be within two degrees of separation, meaning that the researcher knows the decision makers (first degree) or someone the participant knows knows the decision maker (second degree). This is also called the snowball sampling method. The study's goal for its sample size was to obtain responses from 30 SMEs within multiple industries. For the purpose of this study, firms selected were required to meet the following criteria:

- Canadian SMEs based on this study's definition, see Table 3
- Organizations who have already made the decision to adopt MDT
- The decision was made within the last 30 months (Fall 2002 – Winter 2005)

Decision makers could be owners, presidents or information technology specialists.

## **Questionnaire Design**

The survey instrument had four sections. The first section asked for general background information. The second section contained only open ended questions. There were three main questions with some points in each to frame the question. Section 3 comprised questions related to the variance A Priori Model. The last section asked the

respondents whether they would like to receive a summarized version of the results and if they were willing to be contacted again for follow-up questions.

## **Data Collection**

All organizations interviewed were contacted by telephone and then followed up by an email; see appendix II – Sample Email. An appropriate date and time was agreed upon for the interview. The survey along with a Letter of Information with ethics clearance was emailed to the individual in advance of the arranged interview; see appendix III – Letter of Information. Once the individual has been contacted, they were given an explanation as to the purpose of the study using the pre-arranged telephone scripts; see appendix IV – Telephone Script; the firm selection criteria; and how the survey would be administered. Respondents answered sections 1, 2 and 4, over the telephone and data was input by the interviewer. Section 3 was recorded. The actual interview duration was 15 – 20 minutes.

All efforts were made to ensure the anonymity of the participants. No mention of company or individual names was published in the research findings. A tape recorder was used to record the responses to the open-ended questions. All participants were offered full confidentiality.

The results have been stored in Dunton Tower on the 17<sup>th</sup> floor, in a secured locked filing cabinet. This data will not be used for other research purposes. Data will be destroyed after the research study is completed. The survey papers will be shredded in the main office of the Sprott School of Business, 7<sup>th</sup> floor of Dunton Tower. The tapes will be physically destroyed. This is expected to happen in fall 2005.

## **Pre-test**

A pre-test was conducted with one Ottawa-based technology firm. The manager was shown the proposed framework to help identify any problems which might arise while conducting the research. The pre-test did not result in any significant changes in the research instrument. The pre-test was conducted in the summer of 2004 after the model was developed.

## **Data Analysis**

Questionnaire data were analyzed using simple descriptive statistics. One-Sample tests were used to determine if the proposed factors were appropriate in understanding the organizations' attitudes to adopting MDTs. The SPSS statistical software package was used to analyze the data. A detailed quantitative analysis was not planned or attempted, due to validity concerns related to the small projected sample.

Open-ended questions were condensed in order to facilitate the analysis. Key trends and words were summarized; as well, issues and topics contained were highlighted. Two complete copies of the main data were recorded: one copy to work on and one retained as the original.

## **RESEARCH FINDINGS**

This chapter outlines the results of the data analysis including statistical findings and points of interest. The main findings of the research are discussed and presented in three sections. The first section describes the characteristics of the sample, the second section discusses the variance model results, and the final section highlights the findings from the process model open ended questions. At the end of each section, a Point of Interest will highlight the findings. These findings will be the basis of the next chapter's conclusion.

Before the research findings are presented, it is necessary to mention that this is an exploratory study with a limited snowball sample. This will limit the performance of an in-depth statistical analysis on the data and the results have to be treated with caution. However, best efforts have been made to derive maximum meaning from the data.

### **SAMPLE CHARACTERISTICS**

This section describes the characteristics of the survey respondents that participated in this research. Forty-four managers from various SMEs were contacted and asked to complete the survey. A total of 34 respondents completed the survey; this number exceeded our goal of 30 responses. The survey results will be summarized through a descriptive analysis using frequencies and percentages for each question. This is typically an appropriate way to begin organizing survey data for analysis (Chadwick, Bahr, & Albrecht, 1984). At the end of this section, two survey response questions (size

of the organization and selected MDT for the survey) will be combined for further investigation.

The characteristics of the role within the organization are described in Table 20 - Role within the Organization. This research focuses on Canadian SMEs which have already made the decision to adopt an MDT. The profile of decision makers illustrates that 71% of our respondents own the organization, while the rest are at a management level. It is important to note that in most cases, the owners were also the president of the company. To avoid overlap, the category "President", which has three responses, includes only individuals who did not own the organization.

**Table 20 - Role within the Organization**

<b>1. Role within the Organization</b>		
	<b>Frequency</b>	<b>Percent</b>
Owner	24	70.6 %
President	3	8.8 %
VP	3	8.8 %
Manager	4	11.8 %

The characteristics of the industry sector that best represents the main activity of the organization are described in Table 21 - Industry Sector. The responding organizations represent seven industries. The majority of the firms in the sample are in the Professional (52.9%) sector. Retail Trade (11.9%) was the second largest group followed by Construction (8.8%), Wholesale Trade (8.8%) and Arts & Recreation (8.8%). This distribution suggests that findings from this research may be generalizable to the Professional sector, as it represents 52.9% of the sample.

**Table 21 - Industry Sector**

<b>2. Industry Sector</b>		
	<b>Frequency</b>	<b>Percent</b>
Construction	3	8.8 %
Manufacturing	1	2.9 %
Wholesale Trade	3	8.8 %
Retail Trade	4	11.9 %
Finance and Insurance	2	5.9 %
Professional	18	52.9 %
Arts & Recreation	3	8.8 %

The characteristics of the size of the organization, measured as the number of full-time employees who were employed in the organization at the time the decision was made to adopt the MDT, are described in Table 22 - Size of Organization. Very Small Enterprise (29.4%) had the largest response rate followed closely by Micro Enterprise (26.5%) and Indeterminate (23.5%). These three categories total approximately 80% of our respondents.

**Table 22 - Size of Organization**

<b>3. Size of Organization</b>		
	<b>Frequency</b>	<b>Percent</b>
Indeterminate <sup>27</sup>	8	23.5 %
Micro Enterprises	9	26.5 %
Very Small Enterprises	10	29.4 %
Small Enterprises	3	8.8 %
Medium Enterprises	4	11.8 %

The characteristics of the organization's annual gross revenue are described in Table 23 - Organizations Gross Revenue. Of the respondents 35% had gross revenue between \$100,000 and \$500,000, while the other four categories ranged from 17.6% to 14.7%. This distribution suggests that the category \$100,000 to \$500,000 might yield

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<sup>27</sup> Workforce that is not on the payroll.

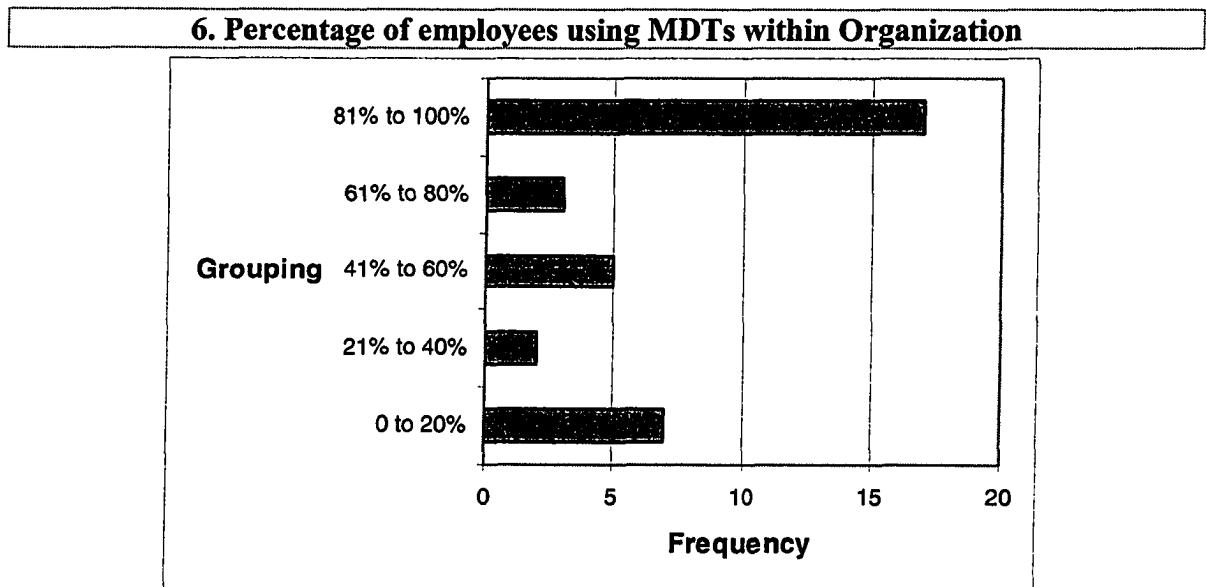
generalizable results, although caution should be taken observer, as the sample size for this grouping is only 12.

**Table 23 - Organizations Gross Revenue**

<b>4. Organizations Gross Revenue</b>		
	<b>Frequency</b>	<b>Percent</b>
Under \$100,000	5	14.7 %
\$100,000 to \$500,000	12	35.4 %
\$500,001 to \$1,000,000	6	17.6 %
\$1,000,001 to \$5,000,000	6	17.6 %
Greater than \$5,000,000	5	14.7 %

The characteristics of the percentage of employees using MDTs within the organization are described in Table 24 - Employees within Organization. In terms of employees' use of any type of MDTs, 50% of the firms have 81% to 100% of their employees using some sort of mobile device. This is followed by the firms that have less than 20% of their employees using some sort of mobile device (20.6%) and the firms that have 41% to 60% of their employees using some sort of mobile device (14.7%).

**Table 24 - Employees within Organization**



The characteristics of the MDT selected for the study are described in Table 25 - MDT Selected. Integrated Handheld Devices (32.4%) had the largest response rate, followed closely by Basic Cell Phone (29.4%) and laptops (20.6%).

**Table 25 - MDT Selected**

<b>7. MDT selected for study</b>		
	<b>Frequency</b>	<b>Percent</b>
Basic Cell Phone	10	29.4 %
Smart Phones	1	2.9 %
Basic PDA's	1	2.9 %
Integrated Handheld Devices	11	32.4 %
PocketPC	3	8.9 %
Laptops	7	20.6 %
TabletPCs	1	2.9 %

The characteristics for the next three questions have been placed in Table 26 – Purpose of, Assigned too and how many Purchased MDTs. Field Base Mobility (82.4%), Individual (85.3%) and plan to purchase 1 to 5 (91.2%) show a dominant response rate. While Location Base Mobility (17.6%) a minority of the responses for purposes of the MDT, and the less frequent responses to the other questions all presented less than 10% of the overall sample.

**Table 26 – Purpose of, Assigned too and how many Purchased MDTs**

<b>8. Purpose of the MDT</b>		
	<b>Frequency</b>	<b>Percent</b>
Field Base Mobility	28	82.4 %
Location Base Mobility	6	17.6 %
Other	-	-
<b>9. MDT assigned to</b>		
	<b>Frequency</b>	<b>Percent</b>
Individual	29	85.3 %
Group	3	8.8 %
Sign-up	1	2.9 %
<b>10. Planned to be purchased</b>		
	<b>Frequency</b>	<b>Percent</b>
1 to 5	31	91.2 %
6 to 10	2	5.9 %
Greater than 10	1	2.9 %

## **Clustering Groups**

As this research sample size is relatively small, and as a general rule subgroups should not contain fewer than 10 respondents for the purposes of analysis and interpretation (Edwards, Thomas, Rosenfeld, & Booth-Kewley, 1997), two groups of categories will be condensed into a smaller number of clusters<sup>28</sup>. The domain of this research, Small and Medium-Sized Enterprises, will be condensed from five (5) categories to three (3) categories and the scope of this research, Mobile Data Technologies, will be condensed from six (6) categories to three (3) categories. This subsection will introduce the regrouped clusters and then discuss some new sample characteristics.

### *Clustering Size of Organization*

Table 27 – New Clustering Size of Organization; describes the three regrouped categories that will be used to conduct the remaining analysis in regards to the size of the organization<sup>29</sup>. The first category “Micro Enterprises” consists of Indeterminate (workforce who are not on the payroll) and Micro Enterprise (1-4 employees). This matches Industry Canada’s (2005) definition of these categories as shown in the literature review. The second category “Small Enterprises” consists of Very Small Enterprises (5-19 employees) and Small Enterprises (20-50 employees). These categories have been used many times throughout the literature (B.-C.-Stats, 2003; Harfield *et al.*, 2001;

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<sup>28</sup> It is important to note that if the sample size had been larger, it would not have been necessary to compress the categories.

<sup>29</sup> This would not be necessary if the sample size was larger.

Industry-Canada, 2005; Longenecker *et al.*, 1998; Statistics-Canada, 2004). The third category, “Medium Enterprises” will remain the same as our original definition.

**Table 27 – New Clustering Size of Organization**

<b>Category</b>	<b>Size Definition</b>	<b>Source</b>
Micro Enterprises	Workforce that is not on the payroll, 1 - 4 employees	(Industry-Canada, 2005)
Small Enterprises	5-50 employees	(B.-C.-Stats, 2003; Harfield <i>et al.</i> , 2001; Industry-Canada, 2005; Longenecker <i>et al.</i> , 1998; Statistics-Canada, 2004)
Medium Enterprises	51-249 employees (for service-producing sector) 51-499 employees (for goods-producing sector)	(Industry-Canada, 2005; Statistics-Canada, 1999, 2004)

The characteristics of the regrouped organizations by size are described in Table 28 - Consolidated Organizational Sizes. Micro Enterprises (50.0%) received the largest response rate, followed by Small Enterprises (38.2%) and Medium Enterprise (11.8%). Medium Enterprises given with a broader definition has only a sample size of 4. Statistically, “it is not sound practice to use such small samples: Extreme responses by one or two respondents can skew the mean of a small group” (Edwards *et al.*, 1997). Accordingly, analysis or interpretation will reflect the small sample size for the Medium Enterprise subgroup and results will be treated with caution.

**Table 28 - Consolidated Organizational Sizes**

<b>Size of the Organization</b>	<b>Frequency</b>	<b>Percent</b>
Micro Enterprise	17	50.0 %
Small Enterprise	13	38.2 %
Medium Enterprise	4	11.8 %

### Clustering MDT Groupings

Table 29 - Clustered MDT Grouping; illustrates three consolidated categories that will be used in conducting the remaining analysis in regards to the MDT selected for the study<sup>30</sup>. The first category, “MDT Basic” comprises Pagers and Basic Cell Phones. The second category, “MDT Handhelds,” combines four of the original categories into one category, and the last category, “MDT Robust” combines Laptops and TabletPCs.

The rationale for setting the new groupings is based on previously suggested mobile device classifications (Table 5 – Device Classification, page 29; mentioned in the Mobile Data Technology section of the literature review.

**Table 29 - Clustered MDT Grouping**

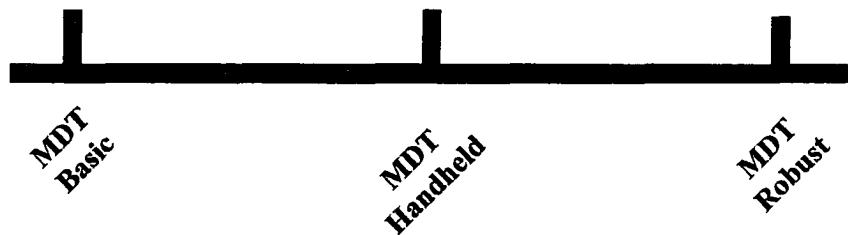
<b>Device Category</b>	<b>Price</b>	<b>Portability (Grams / Size)</b>		<b>Functionality</b>
<u>MDT Basic</u> – Basic cell	\$50 - \$300	60 – 100 grams	n/a	limited
<u>MDT Handhelds</u> – Basic PDAs, Smart phones, PocketPCs, Integrated handhelds (Blackberry/Trio)	\$120 - \$300	120 – 140 grams	12(w)*7.5(h)*2(d)	Medium
<u>MDT Robust</u> – Laptops, TabletPCs	\$1000 - \$3600	1.8 – 3.5 kg	30(w)*26(h)*3(d)	High

The consolidated mobile device spectrum can be observed in Figure 7 - Consolidated Mobile Device Spectrum.

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<sup>30</sup> This would not be necessary if the sample size was larger.

**Figure 7 - Consolidated Mobile Device Spectrum**



The new characteristics of the MDT groupings are described in Table 30 - Consolidated MDT Grouping. MDT Handheld (44.1%) has the largest response rate followed by MDT Basic (32.4%) and MDT Robust (23.5%).

**Table 30 – Consolidated MDT Grouping**

MDT Grouping	Frequency	Percent
MDT Basic	11	32.4 %
MDT Handheld	15	44.1 %
MDT Robust	8	23.5 %

### **Cross Tabulation Analysis**

This subsection will highlight four groups using cross tabulation analysis to gain a better understanding of our sample characteristics. It is important to note that these results are general responses from the respondent's latest MDT decision purchases.

#### *Size of Organization vs. MDT Groupings*

This analysis cross tabulates the size of the organization against the MDT groupings. Table 31 – Organizational Size vs. MDT; illustrates the distribution of mobile devices within the three sizes of organizational group. In terms of the size of the organization, Micro Enterprise had a total of 17 respondents with MDT Handheld (47.1%) received the most responses followed by MDT Basic (35.3%) and MDT Robust

(17.6%). Small Enterprise had a total of 13 respondents with an even distribution between the three MDT groupings. MDT Basic (38.4%) led the way followed by MDT Handheld and MDT Robust both with 30.8%. The last category, size of organizations, Medium Enterprise, had 4 respondents with only MDT Handhelds (75%) and MDT Robust (25%) as responses.

**Table 31 - Organizational Size vs. Device**

	Micro Enterprise		Small Enterprise		Medium Enterprise	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
<b>MDT Basic</b>	6	35.3 %	5	38.4 %	-	-
<b>MDT Handheld</b>	8	47.1 %	4	30.8 %	3	75.0 %
<b>MDT Robust</b>	3	17.6 %	4	30.8 %	1	25.0 %

This finding shows there is a tendency to use handhelds in all three groups of Canadian SMEs.

#### Size of the Organization versus Gross Revenue

As mentioned earlier, the category \$100,000 to \$500,000 might yield generalizable results with a response rate of 12 (35.4%); further analysis is required. A closer look at the data, Table 32 - Organizational Size vs. Revenue; revealed that 9 of the 12 respondents in the \$100,000 to \$500,000 category fall within the Micro Enterprise grouping. These 9 respondents total 56.3% of the Micro Enterprise subgroup.

**Table 32 - Organizational Size vs. Revenue**

	Micro Enterprise		Small Enterprise		Medium Enterprise	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
<b>Under \$100,000</b>	4	25.0 %	1	7.1 %	-	-
<b>\$100,000 to \$500,000</b>	9	56.3 %	3	21.4 %	-	-
<b>\$500,001 to \$1,000,000</b>	2	12.5 %	4	28.6 %	-	-
<b>\$1,000,001 to \$5,000,000</b>	1	6.1 %	4	28.6 %	1	25.0 %
<b>Greater than \$5,000,000</b>	-	-	2	14.3 %	3	75.0 %

This data is supported by substantive knowledge that larger organizations (i.e., those with greater employee group size) have higher revenue.

#### MDT Groupings versus Gross Revenue

The next step was to compare the \$100,000 to \$500,000 category with the MDT groupings, see Table 33 – MDT vs. Revenue. Of the 13 responses, MDT Robust captured 62.5%, followed by MDT Handheld (26.7%) and MDT Basic (27.3%).

Table 33 - MDT vs. Revenue

	MDT Basic		MDT Handheld		MDT Robust	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Under \$100,000	2	18.1 %	3	20.0 %	-	-
\$100,000 to \$500,000	3	27.3 %	4	26.7 %	5	62.5 %
\$500,001 to \$1,000,000	3	27.3 %	3	20.0 %	-	-
\$1,000,001 to \$5,000,000	3	27.3 %	3	20.0 %	-	-
Greater than \$5,000,000	-	-	2	13.3 %	3	37.5 %

The MDT Handheld group was evenly distributed over Gross Revenue groupings. The Greater than \$5,000,000 group showed a preference for more complex MDTs, perhaps due to more demanding business requirements.

#### Size of the Organization versus Industry Sector

As mentioned earlier, the Professional sector might yield generalizable results with a response number of 18 (52.9%); further analysis was merited. Micro Enterprise yields the greatest response rate in the Professional sector, with 12 responses or 70.6% of the Micro Enterprise grouping. This was followed by 5 responses by Small Enterprises and 1 response by Medium Enterprise; see Table 34 - Organization vs. Industry.

**Table 34 - Organization vs. Industry**

	Micro Enterprise		Small Enterprise		Medium Enterprise	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
<b>Construction</b>	2	11.7 %	1	7.7 %	-	-
<b>Manufacturing</b>	-	-	-	-	1	25.0 %
<b>Wholesale Trade</b>	1	5.9 %	1	7.7 %	1	25.0 %
<b>Retail Trade</b>	1	5.9 %	3	23.0 %	-	-
<b>Finance and Insurance</b>	1	5.9 %	1	7.7 %	-	-
<b>Professional</b>	12	70.6 %	5	38.5 %	1	25.0 %
<b>Arts and Recreation</b>	-	-	2	15.4 %	1	25.0 %

**MDT Groupings versus Industry Sector**

With 12 respondents from the Professional sector in Micro Enterprises, the next step was to see which MDT grouping they fit into. MDT Handheld captured 12 of the 18 respondents followed by MDT Robust (4) and MDT Basic (2); see Table 35 - MDT vs. Industry.

**Table 35 - MDT vs. Industry**

	MDT Basic		MDT Handheld		MDT Robust	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
<b>Construction</b>	2	18.2 %	-	-	1	12.5 %
<b>Manufacturing</b>	-	-	1	6.7 %	-	-
<b>Wholesale Trade</b>	2	18.2 %	1	6.7 %	-	-
<b>Retail Trade</b>	2	18.2 %	-	-	2	25.0 %
<b>Finance and Insurance</b>	1	9.0 %	-	-	1	12.5 %
<b>Professional</b>	2	18.2 %	12	80.0 %	4	50.0 %
<b>Arts and Recreation</b>	2	18.2 %	1	6.7* %	-	-

\* rounding up error

Professionals seem to prefer MDTs in the MDT Handheld category. This is likely due to the fact that they travel often and require a quick portable device.

## **Points of Interest**

It could be assumed from a fairly representative sample in the Professional sector<sup>31</sup> (response rate of 18 of 34) that the results will yield generalizable findings. The data revealed two findings. The first was that 67% of the professionals are using MDT Handhelds which represents 80% of the total of the MDT Handheld group. This is most likely due to the fact that professionals tend to provide services to clients at their location and hence are not confinable to a single working location. Therefore, professionals would require technology that supports access to information anywhere/anytime. The second finding comes from the cross-tabulation of the Micro Enterprise category, which had a sample size of 12 respondents, and the MDT Handhelds category, which also captured 12 responses. A more in-depth look into the data revealed that, out of the 12 respondents who selected MDT Handhelds for the interview, 8 (66.7%) of those belonged to the Micro Enterprise group. All 8 of those respondents were owners of their organization. The purpose of purchasing the MDT Handheld was for individuals for field based mobility. As well, these 8 owners had on average 4.6 MDTs<sup>32</sup> within their organization.

## **VARIANCE MODEL DISCUSSION**

The first research objective is to determine which factors influence organizations most in making a decision to adopt an MDT. Five statistical analyses were performed on

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<sup>31</sup> The Canadian professional sector is ranked 5<sup>th</sup> out of 18 industrial groupings when comparing the size of the organization (Industry-Canada, 2005).

<sup>32</sup> This average came from question 5 of the survey which asked to select all MDTs that are used in the organization.

the data; variable means, correlation analysis, One-Sample test, independent sample t-tests and an ANOVA. Correlation analysis will demonstrate the strength of the relationship among the constructs within each variable. A One-Sample test will determine which variables are significant to organizations. Additional statistical analysis has been conducted to measure each variable (using a t-test) in conjunction to Micro and Small Enterprises. The significant variables from the t-test will be used in an ANOVA to determine if they are significant for the three technology clusters. The analysis for this objective was quantitative and performed using SPSS 13.0, a statistical software package.

### **Variable Means**

Table 36 –Variable Means; displays the means and standard deviations of each variable. Data points with a zero (Not Relevant) were removed from the sample. In some situations, some constructs received two zeros, and for this reason the sample size varies from 22 to 34 respondents.

**Table 36 –Variable Means**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
<b>Relative Advantage</b>	34	3.00	5.00	4.3235	0.6382
<b>Compatibility</b>	33	2.50	5.00	4.0455	0.6657
<b>Complexity</b>	34	2.50	5.00	4.1912	0.8070
<b>MDT Characteristics</b>	34	1.00	5.00	3.0588	1.1333
<b>Productivity Gains</b>	34	2.50	5.00	4.1324	0.7911
<b>Organizational Image</b>	30	1.00	5.00	3.4167	1.0429
<b>Benefit Demonstrability</b>	34	2.50	5.00	4.6471	0.5971
<b>Competitive Advantage</b>	33	1.00	5.00	3.1406	1.3394
<b>Trialability</b>	33	1.00	5.00	2.5909	1.1212
<b>External Environment</b>	22	1.00	4.00	2.3182	1.3762
<b>Capital Budgeting</b>	33	1.00	5.00	2.3788	1.0234
<b>Internal Environment</b>	33	2.50	5.00	3.9118	0.7331
<b>Manager's Beliefs</b>	29	1.00	5.00	2.7241	1.2577
<b>External Support</b>	28	1.00	5.00	2.1607	1.3815
<b>Observability</b>	33	3.00	5.00	4.4091	0.6898

Data examination for outliers was performed to ensure that the results of the statistical analysis reflect most of the data, and are not influenced by just one or two errant data points (Stevens, 2002). Outliers can occur for two fundamental reasons: “(a) a data recording or entry error was made, or (b) the subjects are simply different from the rest”(Stevens, 2002). All variables were approximately normally distributed, so z scores of over 3 standard deviations will be considered as potential outliers, because 99% of the scores should lie within three standard deviations of the mean (Stevens, 2002). One variable sampled, Benefit Demonstrability, had an outlier according to the above criteria. In comparing the original survey to the SPSS input, no data entry error was found. A look at the individual’s responses was conducted and it appeared that the respondent is simply different from the rest. See Appendix V – Possible Outliers, for further explanation in regards to the outlier.

## **Correlation Analysis**

A correlation analysis was performed in order to statistically determine the strength of the relationship among the constructs that were used to measure each variable. Correlation is a technique used to determine to what degree and direction one variable is related to another (Burns & Bush, 2003; Stevens, 2002). The analysis will demonstrate the strength of the relationship between the constructs and show whether they are positively or negatively correlated. The variables showing significance would indicate that the respondents viewed the constructs similarly. Variables not showing significance will enable future researchers to modify the questions. Before calculating the correlations, the data was screened for outliers. One variable sampled, Benefit Demonstrability, yielded an outlier. The respondent's data points for that variable were removed and the correlation was conducted again. As the results demonstrated that the outlier was not influential, the outlier was not removed from the data set.

The correlation results for the constructs found to be correlated at a significance level of 0.10, 0.05 and 0.01 levels (2-tailed) are presented in Table 37 - Pearson Correlation.

**Table 37 - Pearson Correlation**

	<b>Pearson Correlation</b>	<b>Sig. (2-tailed)</b>	<b>n</b>
<b>Relative Advantage</b>	.456**	.008	34
<b>Compatibility</b>	.364**	.037	33
<b>Complexity</b>	.447***	.009	34
<b>MDT Characteristics</b>	.034	.857	34
<b>Productivity Gains</b>	.537***	.001	34
<b>Organizational Image</b>	.356*	.100	30
<b>Benefit Demonstrability</b>	.702***	.000	34
<b>Competitive Advantage</b>	.464**	.017	33
<b>Triability</b>	.176	.391	33
<b>Observability</b>	.018	.934	33
<b>External Environment</b>	.525**	.025	22
<b>External Support</b>	.711**	.001	28
<b>Internal Environment</b>	.324*	.066	33
<b>Capital Budgeting</b>	.101	.631	33
<b>Manager's Beliefs</b>	-.217	.498	29

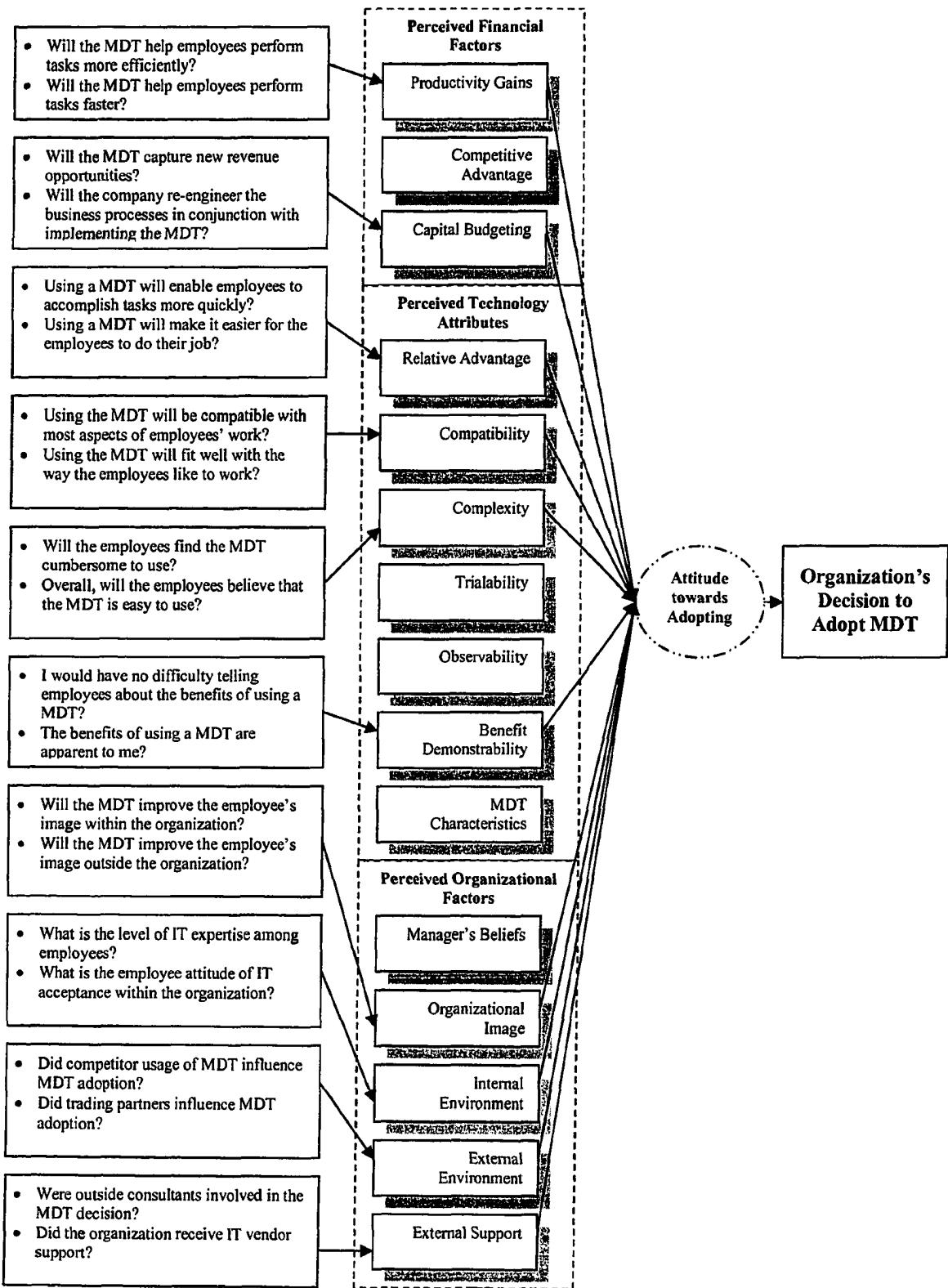
\*Correlation is significant at the 0.10 level (2-tailed)\*

\*\*Correlation is significant at the 0.05 level (2-tailed)

\*\*\* Correlation is significant at the 0.01 level (2-tailed)

The ten significant variable constructs used to measure each variable has been added to the variance a priori model. See Figure 8 - Significant Correlations from Framework.

**Figure 8 – Significant Constructs measuring Variables**



All statistical tests conducted used a 90% confidence interval as in studies with small group sizes “it can make sense to test at a more liberal level (.10 or .15)” (Stevens, 2002).

### **Significant Factors**

The One-Sample *t-test* statistic examines whether the mean of a variable differs from a specified constant. In this study, three different One-Sample *t*-tests were conducted using the Test-Values<sup>33</sup> of 2.0, 2.5, and 3.0. A summary of the variables not statistically significantly different from the Test-Values are displayed in Table 38 – One-Sample *t*-test Significant Factors. The summary reveals that a Test-Value of 2.5 has five variables not significant. Following the conservative route, the Test-Value mean of 2.5 will be used and will test which factors influenced the organization most in making a decision to adopt a MDT.

**Table 38 - One-Sample *t*-test Significant Factors**

Test-Value = 2.0	Test-Value = 2.5	Test-Value = 3.0
External Environment External Support	Trialability External Environment External Support Capital Budgeting Manager's Beliefs	MDT Characteristics Competitive Advantage Manager's Beliefs

Ten of the fifteen variables have been found to be statistically significantly different from the Test-Value of 2.5. Each variable will be discussed.

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<sup>33</sup> Test-Values are a relevant value used to compare the sample mean and the Test-Value in order to observe if there is a significant difference between the two at a specified Confidence Interval.

### **Relative Advantage**

The Relative Advantage One-Sample *t*-test statistic is 16.661 and the *p*-value from the statistic is .000. Such a *p*-value indicates that the average mean of the sample is statistically significantly different from the Test-Value 2.5. The 90% confidence interval estimate for the difference between the sample mean and 2.5 is (1.6, 2.0). This finding is not surprising, as relative advantage is one of Rogers's main attributes of innovation. As well, Relative Advantage was one of the most cited 'significant findings' highlighted (9 times) from this studies 25 article SME research on adoption.

### **Compatibility**

The Compatibility One-Sample *t*-test statistic is 13.336 and the *p*-value from the statistic is .000. Such a *p*-value indicates that the average mean of the sample is statistically significantly different from the Test-Value 2.5. The 90% confidence interval estimate for the difference between the sample mean and 2.5 is (1.3, 1.7). This finding is not surprising, as Compatibility is one of Rogers's main attributes of innovation and was cited four times in the 25 article SME research on adoption.

### **Complexity**

The Complexity One-Sample *t*-test statistic is 12.215 and the *p*-value from the statistic is .000. Such a *p*-value indicates that the average mean of the sample is statistically significantly different from the Test-Value 2.5. The 90% confidence interval estimate for the difference between the sample mean and 2.5 is (1.5, 1.9). This finding is not surprising, as Complexity is one of Rogers's main attributes of innovation and was the most often cited, eleven times, in the 25 article SME research on adoption.

### **MDT Characteristics**

The MDT Characteristics One-Sample *t*-test statistic is 2.875 and the *p*-value from the statistic is .007. Such a *p*-value indicates that the average mean of the sample is statistically significantly different from the Test-Value 2.5. The 90% confidence interval estimate for the difference between the sample mean and 2.5 is (.3, .9). This finding is supported by six findings from the 25 article SME research on adoption.

### **Productivity Gains**

The Productivity Gains One-Sample *t*-test statistic is 12.031 and the *p*-value from the statistic is .000. Such a *p*-value indicates that the average mean of the sample is statistically significantly different from the Test-Value 2.5. The 90% confidence interval estimate for the difference between the sample mean and 2.5 is (1.4, 1.9). This finding is supported by four findings from the 25 article SME research on adoption.

### **Organizational Image**

The Organizational Image One-Sample *t*-test statistic is 4.814 and the *p*-value from the statistic is .000. Such a *p*-value indicates that the average mean of the sample is statistically significantly different from the Test-Value 2.5. The 90% confidence interval estimate for the difference between the sample mean and 2.5 is (.59, 1.2). This finding is supported by four findings from the 25 article SME research on adoption.

### **Benefit Demonstrability**

The Benefit Demonstrability One-Sample *t*-test statistic is 20.968 and the *p*-value from the statistic is .000. Such a *p*-value indicates that the average mean of the sample is statistically significantly different from the Test-Value 2.5. The 90% confidence interval

estimate for the difference between the sample mean and 2.5 is (2.0, 2.3). This finding is supported by five findings from the 25 article SME research on adoption.

### **Competitive Advantage**

The Competitive Advantage One-Sample *t*-test statistic is 2.706 and the *p*-value from the statistic is .011. Such a *p*-value indicates that the average mean of the sample is statistically significantly different from the Test-Value 2.5. The 90% confidence interval estimate for the difference between the sample mean and 2.5 is (.24, 1.0). This finding is supported by four findings from the 25 article SME research on adoption.

### **Trialability**

The *p*-value of Trialability is .654, which is greater than the level of significance of 0.10. It indicates that trialability is not significantly different from the Test-Value 2.5. The positive test score implies that the sample is slightly greater than the Test-Value of 2.5, but the evidence (based on the *p*-value) is insufficient to conclude that Trialability is significantly different from the Test-Value of 2.5. This finding is surprising, as Trialability is one of Rogers's main attributes of innovation. Although within the 25 SME article review, trialability was cited the least number of times (4) amongst Rogers's main innovation attributes.

### **Observability**

The Observability One-Sample *t*-test statistic is 15.898 and the *p*-value from the statistic is .000. Such a *p*-value indicates that the average mean of the sample is statistically significantly different from the Test-Value 2.5. The 90% confidence interval estimate for the difference between the sample mean and 2.5 is (1.7, 2.1). This finding is supported by five findings from the 25 article SME research on adoption.

### **External Environment**

The *p*-value of External Environment is .542, which is greater than the level of significance of 0.10. It indicates that external environment is not significantly different from the Test-Value 2.5. The negative test score implies that the sample mean is slightly lower than the Test-Value of 2.5, but the evidence (based on the *p*-value) is insufficient to conclude that External Environment is significantly different from the Test-Value of 2.5. This finding is surprising as external environment was cited in 25 of the articles reviewed (7 references). External Environment is a factor that influences technology adoption in small business, and should be included in a general IT adoption model (Jaenette Van Akkeren & Cavaye, 1999).

### **External Support**

The *p*-value of External Support is .205, which is greater than the level of significance of 0.10. It indicates that trialability is not significantly different from the Test-Value 2.5. The negative test score implies that the sample is less than (external support mean of 2.16) than the Test-Value of 2.5, but the evidence (based on the *p*-value) is insufficient to conclude that External Support is significantly different from the Test-Value of 2.5. This finding is not surprising, as only 5 articles from the 25 article SME research on adoption revealed external support as being significant. As well, the finding is expected given that in adopting an MDT, outside consultants and vendor support are probably not required due to the nature of the technology.

### **Internal Environment**

The Internal Environment One-Sample *t*-test statistic is 11.229 and the *p*-value from the statistic is .000. Such a *p*-value indicates that the average mean of the sample is

statistically significantly different from the Test-Value 2.5. The 90% confidence interval estimate for the difference between the sample mean and 2.5 is (1.2, 1.6). This finding is one of the most cited (10) from our 25 article SME research on adoption.

### **Capital Budgeting**

The *p*-value of Capital Budgeting is .501, which is greater than the level of significance of 0.10. It indicates that capital budgeting is not significantly different from the Test-Value 2.5. The negative test score implies that the sample is slightly lower than the Test-Value of 2.5, but the evidence (based on the *p*-value) is insufficient to conclude that Capital Budgeting is significantly different from the Test-Value of 2.5. This finding is somewhat expected given 85% of our sample that has fewer than 20 employees. As Van Akkeren & Cavaye (1999) stated

Financial issues are vitally important to owner/managers and often drive technology adoption in small firms. An innovation small business owner may recognize all the benefits to his firm in adopting IT in terms of both a short- or long-term investment. However, without sufficient funding the owner cannot adopt.

### **Manager's Beliefs**

The *p*-value of Manager's Beliefs is .345 which is greater than the level of significance 0.10. It indicates that manager's belief is not significantly different from the Test-Value 2.5. The positive test score implies that the sample is slightly greater than the Test-Value of 2.5, but the evidence (based on the *p*-value) is insufficient to conclude that Manager's Beliefs is significantly different from the Test-Value of 2.5. Within the 25 article SME research on adoption Manager's Belief was referenced 7 times. It is surprising that manager's belief was not significant due to the fact that most firms in this study have fewer than 20 employees and are managed by owners who do not rely on peer

support outside of the organization. As well, it is not surprising that managers without IT departments do not help with the adoption, as most SME might not have the resources to staff its own IT department.

A summary of the One-Sample *t*-test with a Test-Value set at 2.5 is displayed in Table 39 – One-Sample *t*-test Results. Appendix VI - Test-Value 2.0/3.0, shows the two other One-Sample *t*-tests that used the Test-Value of 2.0 and 3.0.

**Table 39 - One-Sample *t*-test Results**

	Test-Value = 2.5					
	<i>t</i>	df	Sig. (2-tailed)	Mean Difference	90% Confidence Interval of the Difference	
					Lower	Upper
<b>Relative Advantage</b>	16.661	33	.000	1.82353	1.6383	2.0088
<b>Compatibility</b>	13.336	32	.000	1.54545	1.3492	1.7418
<b>Complexity</b>	12.215	33	.000	1.69118	1.4569	1.9255
<b>MDT Characteristics</b>	2.875	33	.007	0.55882	0.2299	0.8877
<b>Productivity Gains</b>	12.031	33	.000	1.63235	1.4027	1.8620
<b>Organizational Image</b>	4.814	29	.000	0.91667	-.5931	1.2402
<b>Benefit Demonstrability</b>	20.968	33	.000	2.14706	1.9738	2.3204
<b>Competitive Advantage</b>	2.706	31	.011	0.64063	0.2392	1.0421
<b>Trialability</b>	0.466	32	.645	0.09091	-0.2397	0.4215
<b>Observability</b>	15.898	32	.000	1.90909	1.7057	2.1125
<b>External Environment</b>	-0.620	21	.542	-0.18182	-0.6867	0.3231
<b>External Support</b>	-1.300	27	.205	-0.33929	-0.7840	0.1054
<b>Internal Environment</b>	11.229	33	.000	1.41176	1.1990	1.6245
<b>Capital Budgeting</b>	-0.680	32	.501	-0.12121	-0.4230	0.1806
<b>Manager's Beliefs</b>	0.920	28	.345	0.22414	-0.1714	0.6214

## **Additional Analysis**

In addition to exploring which factors influenced the organization most in making a decision to adopt an MDT, some addition statistical analysis was conducted. The first additional used an Independent-Sample *t*-test to compare each variable with Micro

Enterprise and Small Enterprise. The second additional took the significant findings from the Micro Enterprise and Small Enterprise<sup>34</sup> and conducted, an ANOVA to compare the variables with the three technology categories.

#### Independent-Samples t-test

The Independent-Samples *t*-test procedure compares the means of two groups whose scores are not related to one another. The fifteen variables proposed in our variance model were compared against Micro Enterprise and Small Enterprise. The results of the *t*-test using significant levels of 0.1 show five findings were significant: Compatibility, Complexity, MDT Characteristics, Trialability and Internal Environment. See Appendix VII – SPSS Print Out, for a detailed description.

The variable, **Relative Advantage**, showed no significant difference between Micro Enterprise and Small Enterprise. Levene's test for equality of variances had a *p*-value of .106. Therefore the *p*-value for the *t*-test ‘Equal variances not assumed’ was used (a value of .358). For Micro Enterprises, Relative Advantage leaned towards ‘likely’ (mean value of 4.29) which will enable employees to accomplish tasks more quickly and make it easier for employees to do their job. Where Small Enterprises leaned towards ‘likely’ and ‘extremely likely’ (mean value of 4.5) which will enable employees to accomplish tasks more quickly and make it easier for employees to do their job.

There was a significant difference between Micro Enterprise and Small Enterprise with respect to **Compatibility**. Levene's test for equality of variances had a *p*-value of .058. Therefore the *p*-value for the *t*-test ‘Equal variances not assumed’ was used and

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<sup>34</sup> The group Medium Enterprise will not be used in the additional analysis as the sample size is too small.

had a value of .056. For Micro Enterprises, compatibility leaned more to the high side of ‘likely’ (mean value of 4.25) with respect to the mobile devices being compatible with most aspects of employees’ work and the way in which employees like to work. In comparison, Small Enterprises found Compatibility lean more towards the low side of ‘likely’ (mean value of 3.8).

There was a significant difference between Micro Enterprise and Small Enterprise with respect to **Complexity**. Levene’s test for equality of variances had a *p*-value of .013. Therefore the *p*-value for the *t*-test ‘Equal variances not assumed’ was used and had a value of .055. For Micro Enterprises, Complexity leaned towards ‘likely’ (mean value of 4.06) with respect to employees finding the MDT cumbersome to use and easy to use; where Small Enterprises leaned towards ‘likely’ and ‘extremely likely’ (mean value of 4.54).

There was a significant difference between Micro Enterprise and Small Enterprise with respect to **MDT Characteristics**. Levene’s test for equality of variances had a *p*-value of .962. Therefore the *p*-value for the *t*-test ‘Equal variances assumed’ was used and had a value of .031. For Micro Enterprises, MDT Characteristics leaned towards neither ‘unlikely nor likely’ and ‘likely’ (mean values of 3.5) with respect to limited battery power usage and physical size of the device; where Small Enterprises leaned more towards neither ‘unlikely nor likely’ (mean values of 2.6).

The variable **Productivity Gains** showed no significant difference between Micro Enterprise and Small Enterprise. Levene’s test for equality of variances had a *p*-value of .343. Therefore the *p*-value for the *t*-test ‘Equal variances assumed’ was used and had a value of .404. For Micro Enterprises, Productivity Gains leaned towards ‘likely’ (mean

value of 4.0) with respect to helping employees to perform tasks more efficiently and faster; where Small Enterprises leaned more towards ‘likely’ on the high side (mean value of 4.7).

The variable **Organizational Image** showed no significant difference between Micro Enterprise and Small Enterprise. Levene’s test for equality of variances had a *p*-value of .161. Therefore the *p*-value for the *t*-test ‘Equal variances not assumed’ was used and had a value of .736. For Micro Enterprises, Organizational Image leaned towards neither ‘unlikely nor likely’ (mean value of 3.4) with respect to improving employees’ image within and outside the organization; where Small Enterprises leaned more towards neither ‘unlikely nor likely’ than ‘likely’ (mean value of 3.5).

The variable **Benefit Demonstrability** showed no significant difference between Micro Enterprise and Small Enterprise. Levene’s test for equality of variances had a *p*-value of .529. Therefore the *p*-value for the *t*-test ‘Equal variances not assumed’ was used and had a value of .788. For Micro Enterprises, Benefit Demonstrability leaned towards ‘likely’ than ‘extremely likely’ (mean value of 4.6) with respect to the apparent benefits of the MDT and telling employees about the benefits of using the MDT; where Small Enterprises leaned more towards extremely likely (mean value of 4.7).

The variable **Competitive Advantage** showed no significant difference between Micro Enterprise and Small Enterprise. Levene’s test for equality of variances had a *p*-value of .507. Therefore the *p*-value for the *t*-test ‘Equal variances not assumed’ was used and had a value of .888. For Micro Enterprises, Competitive Advantage leaned towards neither ‘unlikely nor likely’ (mean value of 3.1) with respect to capturing new

revenue opportunities and re-engineering the business processes; where Small Enterprises leaned more towards neither ‘unlikely nor likely’ (mean value of 3.2).

There was a significant difference between Micro Enterprise and Small Enterprise with respect to **Trialability**. Levene’s test for equality of variances had a *p*-value of .822. Therefore the *p*-value for the *t*-test ‘Equal variances not assumed’ was used (a value of .063). For Micro Enterprises, Trialability leaned towards ‘limited’ likelihood (mean value of 2.21) with respect to an opportunity to try and pilot tested various MDTs; where Small Enterprises leaned more towards neither ‘limited’ nor ‘extensive’ likelihood (mean value of 2.8).

The variable **External Environment** showed no significant difference between Micro Enterprise and Small Enterprise. Levene’s test for equality of variances had a *p*-value of .032. Therefore the *p*-value for the *t*-test ‘Equal variances not assumed’ was used (a value of .190). For Micro Enterprises, External Environment leaned towards ‘limited’ likelihood (mean value of 1.9) with respect to seeing MDTs being used inside and outside the organization; where Small Enterprises leaned slightly more towards limited likelihood (mean value of 2.8).

The variable, **External Support**, showed no significant difference between Micro Enterprise and Small Enterprise. Levene’s test for equality of variances had a *p*-value of .132. Therefore the *p*-value for the *t*-test ‘Equal variances not assumed’ was used (a value of .183). For Micro Enterprises, External Support leaned towards ‘very limited’ and ‘limited’ likelihood (mean value of 1.8) with respect to trading and outside consultants’ involvement with the MDT decision; where Small Enterprises leaned towards limited likelihood (mean value of 2.6).

The variable, **Capital Budgeting**, showed no significant difference between Micro Enterprise and Small Enterprise. Levene's test for equality of variances had a *p*-value of .048. Therefore the *p*-value for the *t*-test 'Equal variances not assumed' was used (a value of .429). For Micro Enterprises, Capital Budgeting leaned towards 'limited' likelihood (mean value of 2.1) with respect to what extend of return of investment and total cost of ownership were conducted; where Small Enterprises leaned towards the upper side of 'limited' likelihood (mean value of 2.4).

There was a significant difference between Micro Enterprise and Small Enterprise with respect to **Internal Environment**. Levene's test for equality of variances had a *p*-value of .184. Therefore the *p*-value for the *t*-test 'Equal variances not assumed' was used (a value of .082). For Micro Enterprises, Internal Environment leaned towards an 'extensive' likelihood (mean value of 4.2) with respect to the employee attitude of IT acceptance and level of IT expertise among the organization; where Small Enterprises leaned more towards neither 'extensive nor limited' and 'extensive' likelihood (mean value of 3.7).

The variable, **Manager's Beliefs**, showed no significant difference between Micro Enterprise and Small Enterprise. Levene's test for equality of variances had a *p*-value of .040. Therefore the *p*-value for the *t*-test 'Equal variances not assumed' was used (a value of .404). For Micro Enterprises, Manager's Belief leaned was neither 'limited nor extensive' (mean value of 2.4) with respect to peers and the IS department influencing the MDT adoption; where Small Enterprises leaned towards the upper side of neither 'limited nor extensive' (mean value of 2.8).

The variable, **Observability**, showed no significant difference between Micro Enterprise and Small Enterprise. Levene's test for equality of variances had a *p*-value of .081. Therefore the *p*-value for the *t*-test 'Equal variances not assumed' was used and had a value of .859. For Micro Enterprises, Observability leaned more 'extensive' likelihood (mean value of 4.4) with respect to MDTs being used inside and outside the organization; where Small Enterprises leaned more towards 'extensive' likelihood (mean value of 4.4).

#### **ANOVA**

The Independent Sample *t*-tests found five variables to be significantly different. This section of the data analysis will compare the scope of the research (MDTs) and the means between the three technology clusters<sup>35</sup> and the significant variables found in the *t*-tests. The analysis of variance (ANOVA) will be used to accomplish multiple comparisons. Fundamentally, "ANOVA is an investigation of the differences between the group means to ascertain whether sampling errors or true population differences explain their failure to be equal" (Burns & Bush, 2003). In other words, if there is a difference between the three groups means, do they vary from one another significantly?

The analysis found no significant differences among the three technology groupings on the four variables found in the independent sample *t*-tests. Table 40 – ANOVA Results; reveals the results and Appendix VIII – ANOVA, illustrates the details.

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<sup>35</sup> MDT Basic, MDT Handheld and MDT Robust

**Table 40 - ANOVA Results**

Compatibility	No difference	$F (2.36) = 2.363, P = .111$
Complexity	No difference	$F (.498) = .498, P = .613$
MDT Characteristics	No difference	$F (.108) = .108, P = .390$
Internal Environment	No difference	$F (1.12) = 1.122, P = .339$
Trialability	No difference	$F (.299) = .299, P = .797$

### Points of Interest

As all the variables in this study were referenced many times throughout the literature review, one would expect to find that all of these variables were significantly statistically different. It was interesting to note that 5 of the 15 variables were found not to be statistically different. Those variables are Trialability, External Environment, External Support, Capital Budgeting, and Manager's Belief. Perhaps our One-Sample test Test-Value of 2.5 was too stringent<sup>36</sup>. It is not surprising that two of the variables (Capital Budgeting and External Support) are not statistically different. This lack of significances is supported in the literature from other studies that did not find External Support to be an important factor to adopt (DeLone, 1988; Raymond, 1985); but there is just as much support that External Support does influence the adoption decision as cited from our five sources (Akkeren & Harker, 2003; Harrison *et al.*, 1997; Premkumar & Roberts, 1999; Treadgold, 1990; Yap *et al.*, 1992). As stated in Pattillo's paper of Capital Investment Practices, six different authors have attempted to determine reasons "for the widespread nonuse of the recommended techniques" (Pattillo, 1981). Our

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<sup>36</sup>In this study, three Test-Values were used. If a Test-Value of 2.0 was used, only two variables (External Environment and External Support) would have been identified as not being statistically different. If a Test-Value of 3.0 was used, only three variables (MDT Characteristics, Competitive Advantage and Manager's Belief) would have been identified as not being statistically different. Therefore, selecting a Test-Value of 2.5 was the most conservative approach.

findings support Pattillo's statements but did not support the five sources this research used to develop its variance framework. Given the characteristics of our sample (85% of organizations have less than 20 employees and 89% of the organizations gross less than 5 million in sales), it is perceivable that SMEs lack the funds to use external resources to aid in the decision of adopting the device and lack the expertise/resources to conduct a proper capital budgeting analysis.

The results for the three remaining variables were surprising; as Trialability is one of Rogers's main innovation attributes, Manager's Belief are not being influenced by their peers to purchase new devices and External Environment for SMEs are not being influenced to adopt technology to remain competitive.

## **PROCESS MODEL DISCUSSION**

This section deals with the second research objective: how the decision to adopt an MDT is initiated, evaluated and approved. To evaluate this data, qualitative research was conducted.

Qualitative research involves collecting, analyzing, and interpreting data by observing what people do or say (Burns & Bush, 2003). Qualitative analysis transforms data into findings. The challenge of qualitative analysis lies in making sense of massive amounts of data. This involves "reducing the volume of raw information, sifting trivial data from significant data, identifying significant patterns, and constructing a framework for communicating the essence of what the data reveal" (Patton, 2002). As well, Patton (2002) states:

There are no formulas for determining significance. No ways exist of perfectly replicating the researcher's analytical thought processes. No straightforward tests

can be applied for reliability and validity. In short, no absolute rules exist except perhaps this: Do your very best with your full intellect to fairly represent the data and communicate what the data reveal given the purpose of the study.

This study endeavors to do just this, i.e., communicate what the data reveals.

All the interviews were transcribed, see appendix IX – Transcripts, form the full text write up. To analyze this data, a content analysis technique was used. Content analysis refers to searching text for recurring words or themes and identifies core consistencies and meanings. Organizing and simplifying data into some meaningful and manageable themes or categories is the basic purpose of content analysis (Patton, 1987, 2002).

Interview responses have been summarized and tabulated according to interview question. Each interview question has been reviewed for recurring words or themes and then categorized for simplicity. The goal is to identify new insights and perspectives into the three areas of the research question: initiation, evaluation and approval.

### **MDT Initiation**

#### **Question # 1 - Can you explain how the idea of adopting the MDT was initiated?**

Table 41 – Who Initiated the Idea of Adopting; shows the breakdown of MDT adoption initiation. Management and owners were by far the most likely to initiate the adoption of an MDT with 76.5%. End-users were only responsible for 23.5% of MDT adoption initiation.

**Table 41 - Who Initiated the Idea of Adopting**

<b>a. Who initiated it?</b>	<b>Frequency</b>	<b>Percent</b>
Management/Owner	26	76.5 %
End User	8	23.5 %

The reasons (first reaction) for adopting the MDT are highlighted below in Table 42 – Why Was the Adoption Initiated. Communications was the most frequent response at 47.1% followed by Mobility with 26.5%, followed closely by Productivity at 23.5% and finally Other with only 6.9% of the total responses.

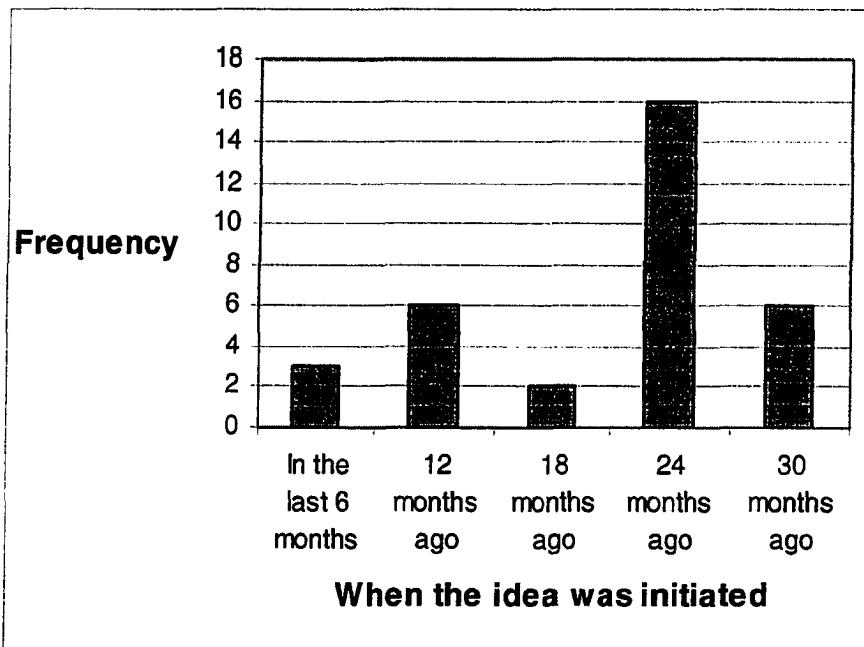
**Table 42 - Why Was the Adoption Initiated**

<b>b. Why was it initiated? (<i>first reaction</i>)</b>	<b>Frequency</b>	<b>Percent</b>
Communications	16	47.1 %
Mobility	9	26.5 %
Productivity	8	23.5 %
Other	2	6.9 %

When the idea, to adopt an MDT, was initiated is summarized in Table 43 – How Long Ago was the Idea Initiated; below. More than half of the respondents, 66.7%, initiated the idea 2 years or more in the past. Only three of the respondents initiated the idea in the last 6 months.

**Table 43 – How Long Ago was the Idea Initiated**

**c. When was the idea initiated? (*How long ago*)**



**Summary of MDT Initiation**

From the above presentation and analysis of our data we can summarize some key points as to how the decision to adopt an MDT was initiated. There is a clear delineation with regards to who initiated the decision to adopt an MDT. More often than not, 76.5% of the time, it was the owner of an enterprise who initiated the idea. This makes some substantive sense, in smaller organizations; where owners are more likely to take an active role in the initiation process. This may be because the adoption of an MDT is likely to affect them directly or simply because they possess the autonomy to subsequently implement the decision.

There was not such a clear consensus regarding the reasons behind initiating the decision. Communications was cited as the top reason but mobility and productivity

were not far behind. The reasons for initiating MDT adoption are likely influenced by the type of work performed by the business. Given that a large portion of our sample is in the professional sector, it makes sense that communications plays as large a role as it does in our analysis.

The lag between initiation and adoption is quite large; most organization waited 24 months or more before adopting the MDT. Given that some of these devices are expensive to acquire, maintain and support, it makes sense that time was required before definitive decisions were made. The fact that most SMEs have fewer funds for these types of capital purchases than do larger organizations may explain the large time lag.

The most likely path in adopting an MDT appear, given our analysis, to be that it is initiated by the owner of the organizations, in order to facilitate communications. Although the decision power rests with the person that is likely to initiate the idea, the owner, it still takes at least 24 months in most organizations before the decision to adopt an MDT is made.

## **MDT Evaluation**

### **Question # 2 - Can you explain how the MDT was evaluated?**

The main reason for adopting the MDT is outlined below in the following Table 44 - Main Reason for Adopting. Since the respondents were allowed to answer with multiple reasons, the total number of responses exceeds the total number of respondents. The most frequent answer was “to have Access anywhere/anytime” with 20 responses. “Productivity” followed closely behind with 18 responses. The remaining 4 response categories - Communication, Online, Mobility and Other - had 7, 2, 1 and 3 responses respectively.

**Table 44 - Main Reason for Adopting**

<b>a. What was the main reason for adopting the MDT? (productivity, online, access anywhere/anytime)</b>		
	<b>Frequency *</b>	
Access anywhere/anytime	20	
Productivity	18	
Communication	7	
Online	2	
Mobility	1	
Other	3	

\* Respondents were allowed to select multiple choices

The use and nature of the business case used to evaluate the MDT purchase decision is outlined in Table 45 – Was a Business Case Used. Only 5.9% (2 respondents) used formal business cases to evaluate the MDT. Over 70% of the respondents used informal (either minimal or a bit) business cases to evaluate the MDT. Eight respondents (23.5%) used no business case whatsoever to evaluate the MDT.

**Table 45 – Was a Business Case Used**

<b>b. Was a business case used in the evaluation? (formal or informal)</b>		
	<b>Frequency</b>	<b>Percent</b>
Formal	2	5.9 %
Informal – minimal	7	20.6 %
Informal – a bit	17	50.0 %
No	8	23.5 %

The evaluation criteria used are listed below in Table 46 – Criteria Used to Help Evaluate the Device. Functionality was the most frequently cited criterion with 24 responses. Price followed closely with 19 responses, Portability had 9, Availability had 7 and Other criteria received only one response.

**Table 46 – Criteria Used to Help Evaluate the Device**

<b>c. Were any criteria set to help evaluating the device? (price, size, availability, functionality)</b>		
	<b>Frequency*</b>	
Functionality	24	
Price	19	
Portability	9	
Availability	7	
Other	1	

\* Respondents were allowed to select multiple choices

The level of information technology (IT) awareness of the respondents is captured in the following Table 47 – Respondents Level of IT Awareness. Most of the respondents had an average level of IT awareness. Above Average level of IT experience was the second most frequent answer, followed by expert, very limited and limited IT awareness. More than 66% of the respondents had Average or greater than Average IT knowledge.

**Table 47 – Respondents Level of IT Awareness**

**d. What is your level of information technology awareness?**

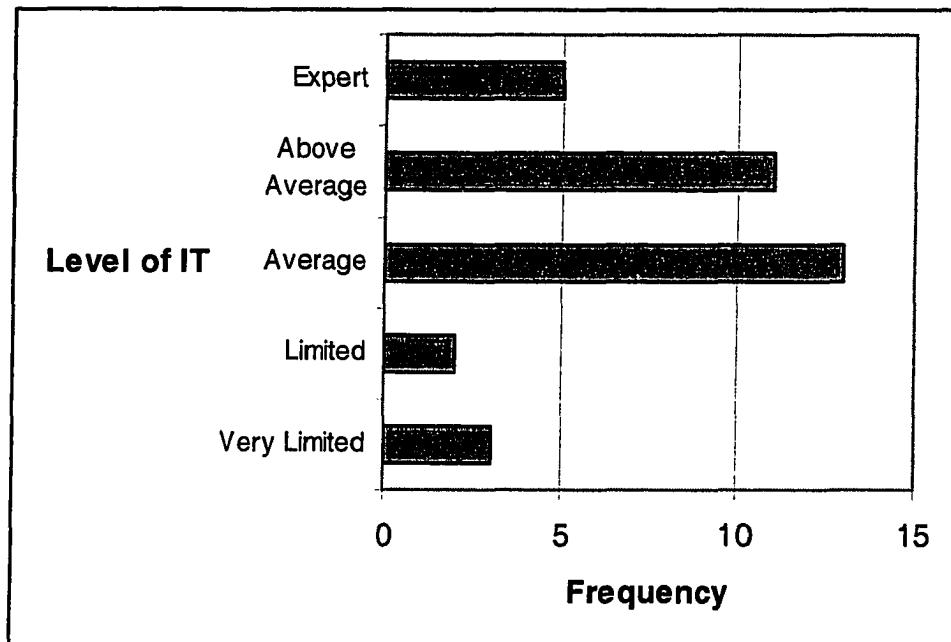


Table 48 – Concern with the Changing Technological Environment; below lists whether or not the changing technological environment was evaluated and whether or not it was a concern. The most frequent response, Yes, was given 41.2% of the time. No was the second most frequent response with 29.4% of the total. Not worried and Absolutely received 17.6% and 11.8% of the responses. Yes and Absolutely, an emphatic Yes, received more than 53% of the responses.

**Table 48 – Concern with the Changing Technological Environment**

<b>e. Was the ever changing technological environment evaluated? (was that a concern)</b>		
	<b>Frequency</b>	<b>Percent</b>
No	10	29.4 %
Not Worried	6	17.6 %
Yes	14	41.2 %
Absolutely	4	11.8 %

The following Table 49 – Additional Costs Associated with the Purchase; highlights the additional costs associated with the MDT adoption. There were additional costs in 55.9% of the cases and 44.1% had no additional costs associated with the adoption of the MDT.

**Table 49 - Additional Costs Associated with the Purchase**

<b>f. Were other additional costs associated with the adoption of the MDT?</b>		
	<b>Frequency</b>	<b>Percent</b>
Yes	19	55.9 %
No	15	44.1 %

Whether or not the MDT was test piloted is listed in Table 50 – Was there a Test Pilot Conducted. 61.8% of the respondents did not perform a test pilot. Thirteen of the

34 respondents (38.2%) did perform a test pilot before making the decision to adopt an MDT.

**Table 50 – Was there a Test Pilot Conducted**

<b>g. Did you test pilot the MDT before the decision was made?</b>		
	<b>Frequency</b>	<b>Percent</b>
Yes	13	38.2 %
No	21	61.8 %

Plans surrounding the support, training, maintenance and upgrade of the MDT are listed in Table 51 – Were Plans Created to Support/Train/Maintain/Upgrade the MDTs. Most of the respondents, 64.7%, had created no plans to support, maintain, train or upgrade their MDT. Twelve of the 34 respondents had created some plans to support, train, maintain and upgrade their MDT ranging in responses from ‘minimal’ to ‘yes’.

**Table 51 – Were Plans to Support/Train/Maintain/ Upgrade the MDTs**

<b>h. Were plans created to support, train, maintain and upgrade the MDT?</b>		
	<b>Frequency</b>	<b>Percent</b>
No	22	64.7 %
Minimum	2	5.9 %
Informal	4	11.8 %
Yes	6	17.6 %

Roll-out plans for the MDT and their creation within the organization are listed in Table 52 – Was there a Plan to Introduce the MDT to the Organization. The majority of the respondents, 52.9% had no plans for the roll-out of the MDT. Informally, 23.5% of the respondents’ organizations had created a plan. Only 17.6% of the organizations had a Formal plan and 5.9% had a Very Formal plan.

**Table 52 – Was there a Plan to Introduce the MDT to the Organization**

<b>i. Was there a plan created for how the MDT was going to be rolled out within the organization? (formal or informal)</b>		
	<b>Frequency</b>	<b>Percent</b>
No	18	52.9 %
Very Informal	2	5.9 %
Informal	8	23.5 %
Formal	6	17.6 %

Whether or not end-users were consulted about the adoption of the MDT is presented below in Table 53 – Were End Users Consulted. Of those for whom this question was applicable more than 75% consulted end-users, only 19% did not consult the end-users. There were 38.2% of the respondents found this not applicable.

**Table 53 – Were End Users Consulted**

<b>j. Were the end users consulted about the MDT?</b>			
	<b>Frequency</b>	<b>Percent</b>	<b>Percent *</b>
No	4	11.8 %	19.0 %
Yes - Informed	9	26.5 %	42.9 %
Yes - Involved	8	23.5 %	38.1 %
Not Applicable	13	38.2 %	-

\* Percent without Not Applicable

The creation of a plan to communicate the MDT to the organization is listed in Table 54 – Ware Plans Created to Communicate the MDT to the Organization. Almost half of the respondents for whom this question was applicable, (47.8%) created no plan to communicate the MDT to the organization. Of those for which this question was applicable 30.4% created Informal plans and 21.7% created Formal communication plans.

**Table 54 – Were Plans Created to Communicate the MDT to the Organization**

k. Was there a plan created for how the MDT was going to be communicated to the organization? ( <i>formal or informal</i> )			
	Frequency	Percent	Percent *
No	11	32.4 %	47.8 %
Informal	7	20.6 %	30.4 %
Formal	5	14.7 %	21.7 %
Not Applicable	11	32.4 %	-

\* Percent without Not Applicable

Whether or not re-engineering would have to take place post MDT implementation is listed in Table 55 – Will the MDT Change Business Processes. Exactly half of the respondents said no re-engineering would have to be done after adopting the MDT. Of those that did have to re-engineer, 35.3% of the total only had to minimally re-engineer and 14.7%, had some re-engineering to perform.

**Table 55 – Will the MDT Change Business Processes**

I. When deciding to adopt the MDT's, to what extent would re-engineering have to take place in your work process after the adoption?		
	Frequency	Percent
None	17	50.0 %
Minimal	12	35.3 %
Some	5	14.7 %

#### Summary of MDT Evaluation

The above analysis outlines how an MDT was evaluated, after it was initiated but before the MDT was approved. There are many factors that we believe, may play a role in MDT evaluation; the reasons for adopting an MDT; the existence and nature of a business case; the evaluation of the external environment; and the level of IT knowledge

and the existence of plan to support, maintain, communicate and re-engineer the workplace given the MDT to be adopted.

For the most part, Business Cases were informal at best. The most frequently used criterion to evaluate the MDT was functionality and the most frequent reason to adopt an MDT was Access anywhere/anytime. As well, price and productivity follow respectively. This seems to support our intuition that organizations are mostly concerned about what a device does and also with how much it costs.

Most of the respondents had a high level of IT knowledge. Over 50% of the organizations evaluated the external technology environment and given that most of the respondents had a high level of IT knowledge they probably did this well. Although our respondents were IT aware they did not seem too concerned with test pilots, communication, maintenance, or roll-out plans. They did make sure, however, to consult their end-users. Major re-engineering was only required in 14.7% of the cases and this did not have a major impact.

In conclusion, when evaluating an MDT respondents did not create plans, or only informally; they did evaluate their external environments but they did not feel the need to create business cases. End-users were contacted but there was not a lot of thought put into communicating the MDT adoption plan to end-users. Support, maintenance, upgrades and training were not planned for in advance either. It seems that respondents did most of their evaluating informally and did not worry too much about post-implementation issues.

## **MDT Approval**

### **Question # 3 - Can you explain how the decision to adopt the MDT was approved?**

The MDT initiation evaluation time period is presented in the following Table 56 – Time Period Between Initiation to Evaluation. Only 11.8% of the respondents evaluated directly after initiating and then approved the decision to adopt the MDT. Within two weeks 23.5 % had done this, within one month 14.3%, within six months 38.2% and 11.8% of the respondents needed more than one year to initiate, evaluate and approval the decision.

**Table 56 – Time Period Between Initiation to Evaluation**

<b>a. What was the time period from initiation to evaluation to approval? (how long)</b>		
	<b>Frequency</b>	<b>Percent</b>
Right Away	4	11.8 %
Within Two Weeks	8	23.5 %
Within One Month	5	14.3 %
Within Six Months	13	38.2 %
One Year and Greater	4	11.8 %

The number of people involved in the decision making is summarized in the following Table 57 – How Many Involved in the Approval Decision. Only one person was involved in the approval in 44.1% of the cases. Two people were involved in 26.5% and in three are 14.3% of the cases. Four or more people were involved in the decision making process 14.3% of cases.

**Table 57 – How Many Involved in the Approval Decision**

<b>b. How many were involved in making the approval?</b>		
	<b>Frequency</b>	<b>Percent</b>
One	15	44.1 %
Two	9	26.5 %
Three	5	14.3 %
Four and Greater	5	14.3 %

In the final Table, 58 – Was this Approval Method the Same as Other Technology Acquisitions; outlines whether or not the same approval method was used for other types of technology acquisition decisions. The same methodology was used in 76.5% of the cases. A more rigorous methodology was used in 8.8% and 14.3% of the respondents stated simply that the same method was not used.

**Table 58 – Was this Approval Method the Same as Other Technology Acquisitions**

<b>c. Was the MDT approval method the same as other technology acquisitions?</b>		
	<b>Frequency</b>	<b>Percent</b>
No	5	14.3 %
Same	26	76.5 %
More Rigorous	3	8.8 %

*Summary of MDT Approval*

The manner in which an MDT was approved was presented and analyzed in the above Tables. Exactly half of the decisions took one month or less with only 11.8% taking longer than one year. Most of the organizations involved only two people in the decision making process and evaluated the MDT in the same way that they would have with other technology acquisitions.

## **Points of Interest**

The preceding three subsections highlighted some of the most important factors in the decision to adopt an MDT. Usually owners initiated the decision to adopt MDTs and the bulk of the initiations happened 24 months in the past. Evaluation seems to be conducted very informally and sometimes not at all. The most interesting point is the almost total lack of formal business case creation to evaluate MDTs. Business cases are tools that support planning and decision-making (M. Schmidt, 1999). A good business plan outlines tangible benefits, resources, cost and risk (Wee, 2000). The approval process is “short and sweet”. Usually two or less people are involved and it usually takes only one month to get a purchase approved, in much the same way that other technology acquisitions are approved.

## **CONCLUSION**

This chapter presents the conclusion of the analysis and results. This chapter has five sections: research summary, conclusion, limitations, benefits and implications for future research.

This study bridges the gap in regards to adoption of MDTs within SMEs. An additional contribution is added regarding the study of micro and small enterprises. These sectors have been under-represented in the literature (Dankbaar, 1998; Langley & Truax, 1994) but plays an important role in the economy (Harfield *et al.*, 2001; Philp, 1998). This study will also contribute to a better understanding of smaller organizations.

## **RESEARCH SUMMARY**

The three sections in research findings; sample characteristics, variance model and process model, have identified some interesting results which are summarized below. For the purposes of this study, 44 managers at various SMEs were contacted. Of the 44 managers contacted, 34 of them completed the study and are included in the results. The number of respondents exceeded the goal of 30 set at the research design stage.

The analysis, through descriptive statistics, revealed that more than half, 18 of our respondents, were in the Professional sector. This represented 80% of the total of the 'MDT Handheld' group. This is most likely due to the fact that professionals provide services to clients and hence are not required to be located in a single working location, hence the requirement of access to information anywhere/anytime. The Micro Enterprise

and MDT Handheld categories had 12 respondents each. Looking closer at the data, it was found that 66.7% of all respondents that had an MDT Handheld belonged to the Micro Enterprise group and were owners of their organization. This is likely not an isolated result and may be more indicative of a general trend in Micro Enterprise owners.

The process model data analysis generated some interesting findings. Of the 15 variables identified in the literature review, only 10 were found to be important in influencing the SMEs to adopt an MDT. Interestingly, Capital Budgeting was found to not be important, a conclusion which is further supported by our findings in the variance model, that business cases are informal at best in most organizations. Both Capital Budgeting and External Support were found not important, this may be due to the characteristics of the sample, of whom, 85% had fewer than 20 employees and less than \$5 million in sales, which re-enforces the lack of external support and lack of capital budgeting significance. The other three variables found to be not important are: Trialability, External Environment, and Manager's Beliefs.

The process model section of this chapter outlined the reasons behind the decision to initiate, evaluate and approve an MDT. The analysis indicated that the process was generally short and informal, and that the owner initiated the adoption.

The idea of knowing about the technology started mostly from the owners. The idea was originated about 24 months or more before the decision to adopt the device. When evaluating the MDTs, business cases were absent. A business case helps maintain focus on business benefits (Wee, 2000). This finding is also supported in the variance model, where the variables Capital Budgeting and External Support were identified as not being important in the use of supporting decision-making plans. Respondents did a good

job of discussing the MDTs with end-users; this is likely because the organizations were so small that it would be difficult to not discuss the purchase with end-users. Even though the users were contacted, it does not mean that a plan was in place, or communicated to support, maintain and upgrade the MDT post-adoption. The final step, approval, was marked by the lack of a significant time lag, most often taking a month or less. This is consistent with the lack of external support or capital budgeting, since both of these would have extended the approval time required. Finally these organizations involved very few people, in most case two or fewer, in the approval process, and they evaluated this technology acquisition as they would any other.

## KEY FINDINGS

This study has uncovered three key findings that we feel are pertinent and relevant. They are:

1. There is a general absence of formal business case creation to evaluate MDTs

The first key research finding regards SMEs' nonuse of business cases to evaluate MDTs. This research showed that SMEs generally did not prepare formal business cases and most respondents prepared no businesses case at all.

2. Capital Budgeting and External Support were not important factors when making a decision to adopt an MDT

The second key finding is that Capital Budgeting and External Support were not an important decision making factors for SMEs when deciding to adopt an MDT.

3. Professionals are the dominantly using MDT Handhelds.

The last key research finding is that Professionals are dominantly using MDT Handheld devices for field based mobility to acquire access to information anywhere/anytime.

The above three key findings summarize the most important points drawn from this study of MDT adoption in Small and Medium Sized Enterprises.

## LIMITATIONS

This research is limited in generalizability and is a retrospective research study. Only the adoption process is being studied and the research is exploratory in nature.

With a sample size of 34 taken from multiple SMEs industries, generalizability and reliability cannot be ensured. The results produced may not hold true with other SMEs within the same industries.

Retrospective studies have limitations in that they rely on the memory of the participant provide a answer to the question. In conjunction with retrospective studies, interpretations of ex post facto findings are limited because the researcher does not know whether a particular variable is the cause of the result of the behavior pattern being studied (Watson, 2005). The ideal study is predictive, not retrospective (Tornatzky & Klein, 1982). Assessment of an “innovation should generally be obtained prior to, or concurrently with, a decision to adopt the innovation, and not after the fact. Perceptions of the attribute subsequent to the adoption/rejection decision may be affected by the perceiver’s knowledge of that decision” (Tornatzky & Klein, 1982).

The ideal study would measure adoption and implementation. Research tends to stop with adoption and in many respects, adoption is just a prelude to of the most interesting part of the story (Kimberly, 1986). The mere adoption of an “innovation” by no means guarantees usage. It has been suggested (Kimberly, 1986; Tornatzky & Klein,

1982) that researchers need to concentrate as much on the actual use of innovations as they do on adoption. This is necessary for the research to “fully account for the adoption process, through utilization or routinization, not just the adoption decision” (Tornatzky & Klein, 1982).

Most IT adoption research dealing with SMEs has been exploratory. For the most part the research has not been grounded in a broad theory that can lead to general inferences about SMEs’ adoption decisions (Harrison *et al.*, 1997)

## BENEFITS

The main purpose of this thesis is to gain a better understanding of the factors affecting Mobile Data Technology adoption by Canadian Small and Medium Sized enterprises. The benefits of this research are to help organizations and vendors better understand MDT adoption. This research could also help organizations make better decisions by understanding some of the factors that affect in the adoption process. This study would also help vendors by better understanding what factors might be more important to organizations when selling MDTs.

Although not exhaustive, this study will provide a foundation for future research in the area of adoption within global SMEs and especially Canadian SMEs.

### Contributions from Research

This study believes it has contributed four topics to research. Topics have been summarized and the location within this thesis identified for easy reference.

### Summary of Adoption Literature

Table 9 – SME Research on Adoption, page 40; has compiled an extensive literature review on 25 articles with each article's proposed independent variables and dependent variables, along with the article's significant findings.

### Definition of SMEs and MDTs

This thesis has conducted an extensive review of the literature on how SMEs are defined. Table 3 – Definition of Small and Medium Size Enterprises, page 22; will be a good source for classifying Small and Medium Sized organizations when using number of employees as the measurement tool. As well, the MDT definition is one more attempt in helping to define mobile data technology.

### Rogers Attributes of Innovation Table

Table 10 – Rogers' Attributes of Innovation (1962 to 2003), page 46; illustrates a single source of Rogers's attributes of innovation and how these widely accepted factors differ from when they were introduced in 1962 to present.

### Mobile Device Spectrum and Classification

Figure 2 – Mobile Device Spectrum, page 30; brings forth a mobile device spectrum and more importantly, Table 5 – Device Classification, page 29; introduces a three classification evaluation criteria to help group different mobile devices.

## **IMPLICATIONS FOR FUTURE RESEARCH**

The most obvious area for future research would be to gather more data randomly. This would lead, inherently, to more generalizable results and more external validity of the research findings. As well, if the data set was larger, factor analysis could be conducted in order to develop a more robust and specific instrument.

Another area of future research identified in the study was the lack of external support during the initiation, evaluation and adoption of the MDT. It would be interesting to further study this relationship. Was there support unavailable? Was support irrelevant to the situation? Was support too expensive?

Business Cases, or rather the lack thereof, was an interesting deficiency. Is this true generally in SMEs? What are the characteristics of those firms that use business cases and those that do not? Does this affect the post-adoption success of the MDT?

Another fruitful avenue of future research would be extending this study longitudinally. This would help us to discover which factors were important post-adoption. Also it would be interesting to test which factors affected post-adoption success most as perceived by the adopters.

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York, USA: Wiley.

## **Appendix I – Survey Instrument**

### **Section 1**

**1. Please describe your role within the organization?**

**2. Describe the industry sector that best represents the main activity of your business?**

- |  |   |
|--|---|
| <input type="checkbox"/> Mining  | <input type="checkbox"/> Agriculture, Forestry, Fishing and Hunting   |
| <input type="checkbox"/> Utilities   | <input type="checkbox"/> Transportation and Warehousing               |
| <input type="checkbox"/> Construction  | <input type="checkbox"/> Accommodation and Food Services              |
| <input type="checkbox"/> Manufacturing   | <input type="checkbox"/> Real Estate, Rental and Leasing              |
| <input type="checkbox"/> Wholesale Trade   | <input type="checkbox"/> Professional, Scientific, Technical Services |
| <input type="checkbox"/> Retail Trade  | <input type="checkbox"/> Management of Companies and Enterprises      |
| <input type="checkbox"/> Finance and Insurance                                   | <input type="checkbox"/> Health Care and Social Assistance            |
| <input type="checkbox"/> Educational Services                                    | <input type="checkbox"/> Arts, Entertainment, and Recreation          |
| <input type="checkbox"/> Public Administration                                   | <input type="checkbox"/> Administrative and Support Services          |
| <input type="checkbox"/> Information (Publishing industries, telecommunications) |   |

**3. On average, how many full-time employees<sup>37</sup> were employed in your organization at the time the decision was made to adopt the MDT?**

- |   |  |
|---|--|
| <input type="checkbox"/> Indeterminate <sup>38</sup>  | 0 employees  |
| <input type="checkbox"/> Micro Enterprises (ME)       | 1 to 4 employees   |
| <input type="checkbox"/> Very Small Enterprises (VSE) | 5 to 19 employees  |
| <input type="checkbox"/> Small Enterprises (SE)       | 20 to 50 employees   |
| <input type="checkbox"/> Medium Enterprises (MeE)     | 51-249 employees (for service-producing sector)<br>51-499 employees (for goods-producing sector) |

**4. Approximately what was the organization's annual gross revenue?**

- Under \$100,000
  - \$100,001 to \$500,000
  - \$500,001 to \$1,000,000
  - \$1,000,001 to \$5,000,000
  - Greater than \$5,000,001
- 

<sup>37</sup> Employment size is derived from payroll remittance data. When counting 10 employees, this could represent 10 full-time employees, 20 part-time employees or any other workforce combination.

<sup>38</sup> Indeterminate means the workforce is not on the payroll, but consisting of contracted workers, family members, business owners, self-employed and possibly a holding company

5. Please select all MDT's that are used in your organization? (Check all that apply)

- |  |  |
|--|--|
| <input type="checkbox"/> Pagers                | <input type="checkbox"/> Basic cell phones                               |
| <input type="checkbox"/> Basic PDA's           | <input type="checkbox"/> Smart phones <sup>39</sup>                      |
| <input type="checkbox"/> PocketPC              | <input type="checkbox"/> Integrated handheld devices (Blackberry's/Trio) |
| <input type="checkbox"/> Laptops               | <input type="checkbox"/> PCTablets                                       |
| <input type="checkbox"/> Other, please specify | <input type="checkbox"/> Customized devices                              |

6. Please estimate the percentage of employees within the organization that use any type of MDT?

- 0 to 20       21 to 40       41 to 60       61 to 80       81 to 100

7. Which MDT will be used for the purpose of this survey?

8. What was the key purpose for the purchase of the MDT within the organization?

- Field based mobility (field sales/field service operations)  
 Location based mobility (mobility within the work environment)  
 Other, please specify

9. Was the MDT being assigned to an:

- Individual  
 Group  
 Sign Up  
 Other, please specify

10. How many MDT's were planned to be purchased?

- 1 to 5       6 to 10       11 to 20       21 to 50       51 and greater

---

<sup>39</sup> Smart phones have the capability of being Internet enable and other advance options

## Section 2

Question1 - Can you explain how the idea of adopting the MDT was initiated?

- a. Who initiated it?
- b. Why was it initiated?  
*(first reaction)*
- c. When was the idea initiated?  
*(How long ago)*

Question 2 - Can you explain how the MDT was evaluated?

- a. What was the main reason for adopting the MDT?  
*(productivity, online, access anywhere/anytime)*
- b. Was a business case used in the evaluation?  
*(formal or informal)*
- c. Were any criteria set to help evaluating the device?  
*(price, size, availability, functionality)*
- d. What is your level of information technology awareness?
- e. Was the ever changing technological environment evaluated?  
*(was that a concern)*
- f. Were other additional costs associated with the adoption of the MDT?
- g. Did you test pilot the MDT before the decision was made?
- h. Were plans created to support, train, maintain and upgrade the MDT?
- i. Was there a plan created for how the MDT was going to be rolled out within the organization?  
*(formal or informal)*
- j. Were the end users consulted about the MDT?
- k. Was there a plan created for how the MDT was going to be communicated to the organization?  
*(formal or informal)*
- l. When deciding to adopt the MDT's, to what extent would re-engineering have to take place in your work process after the adoption?

Question 3 - Can you explain how the decision to adopt the MDT was approved?

- a. What was the time period from initiation to evaluation to approval?  
*(how long)*
- b. How many were involved in making the approval?
- c. Was the MDT approval method the same as other technology acquisitions?

### Section 3

Please indicate the likelihood of each of the following, where 1 is "Extremely Unlikely", 3 is "Neither Unlikely or Likely" and 5 is "Extremely Likely". If the criteria are not applicable, indicate Not Relevant (N/R).

	Extremely Unlikely	Extremely Likely	N/R			
a. Using a MDT will enable employees to accomplish tasks more quickly?	1	2	3	4	5	0
b. Using a MDT will make it easier for the employees to do their job?	1	2	3	4	5	0
c. Using the MDT will be compatible with most aspects of employees' work?	1	2	3	4	5	0
d. Using the MDT will fit well with the way the employees like to work?	1	2	3	4	5	0
e. Will the employees find the MDT cumbersome to use?	1	2	3	4	5	0
f. Overall, will the employees believe that the MDT is easy to use?	1	2	3	4	5	0
g. Will limited battery power affect the usage of the MDT?	1	2	3	4	5	0
h. Will the physical size of the MDT be important?	1	2	3	4	5	0
i. Will the MDT help employees perform tasks more efficiently?	1	2	3	4	5	0
j. Will the MDT help employees perform tasks faster?	1	2	3	4	5	0
k. Will the MDT improve the employee's image within the organization?	1	2	3	4	5	0
l. Will the MDT improve the employee's image outside the organization?	1	2	3	4	5	0
m. I would have no difficulty telling employees about the benefits of using a MDT?	1	2	3	4	5	0
n. The benefits of using a MDT are apparent to me?	1	2	3	4	5	0
o. Will the MDT capture new revenue opportunities?	1	2	3	4	5	0
p. Will the company re-engineer the business processes in conjunction with adopting the MDT?	1	2	3	4	5	0

Please indicate the likelihood of each of the following, where 1 is "Very Limited" and 5 is "Very Extensive". If the criteria are not applicable, indicate Not Relevant (N/R).

	Very Limited	Very Extensive	N/R			
a. Was there an opportunity to try various MDT's?	1	2	3	4	5	0
b. Was the MDT tested/piloted?	1	2	3	4	5	0
c. I have seen MDT used outside my firm?	1	2	3	4	5	0
d. It is easy for me to observe others using MDT's in my firm?	1	2	3	4	5	0
e. Did competitor usage of MDT influence MDT adoption?	1	2	3	4	5	0
f. Did trading partners influence MDT adoption?	1	2	3	4	5	0
g. Were outside consultants involved in the MDT decision?	1	2	3	4	5	0
h. Did the organization receive IT vendor support?	1	2	3	4	5	0
i. To what extent was return on investment (ROI) <sup>40</sup> conducted?	1	2	3	4	5	0
j. To what extent was Total cost of ownership (TCO) <sup>41</sup> conducted?	1	2	3	4	5	0
k. What is the level of IT expertise among employees?	1	2	3	4	5	0
l. What is the employee attitude of IT acceptance within the organization?	1	2	3	4	5	0
m. Did peers outside the organization influence the MDT adoption decision?	1	2	3	4	5	0
n. Did the IS department influence the MDT adoption decision?	1	2	3	4	5	0

<sup>40</sup> ROI – Encompasses a set of financial cost models that weigh the net present value (NPV) of an investment in terms of improvements in revenues or cost reductions

<sup>41</sup> TCO – Includes all up-front costs and ongoing costs associated with the MDT

#### Section 4

1. In case of any follow-up study/clarification, may I contact you again?

- Yes
- No

2. Would you like to receive a summarized version of the results of the study?

- Yes
- No

## **Appendix IV – Telephone Script**

Hello XXX

My name is Al Pilcher and I am an MBA student at the Sprott School of Business, Carleton University.

Thank you for taking the time to help me out with my research.

The purpose of this research is to gain a better understanding of the factors affecting Mobile Data Technology adoption by Canadian Small and Medium Sized enterprises. Mobile Data Technologies are mobile devices such as laptops, PDA's Blackberry's ..., that are used within the organization.

The survey/interview will take no long than 20 minutes.

Just to let you know:

- All measures are being taken to make sure your responses will be kept anonymous. No mention of your name or your company name will be stated in the write-up of my research.
- It is possible that someone else you know has been asked to complete this survey as well. In no way will your information be discussed with other individuals.
- The data will be stored in my office at Carleton University and secured in a locked filing cabinet.
- This data will only be used for my research and will not be used for other research purposes.
- This data will be destroyed after the research study is completed. That is expected to be sometime in July 2005.
- Your participation is completely voluntary. Anytime throughout the survey, you may decline to answer any or all remaining questions.
- Part of the survey will be tape recorded for accuracy. I will tell you when I will turn it on and when I will turn it off. If you are not comfortable with this, you may refuse to be tape recorded.
- This survey has been approved by the Carleton University Research Ethics Committee. If you like, you can contact the Chair of the committee if you have any questions about the ethics of the project.

Do you have any questions before we begin?

## **APPENDIX V – Possible Outliers**

Possible outliers were checked using a  $z$  score of 3. Standard deviation was multiplied by 3 to find the range of the mean. All means below 2.7 will be considered possible outliers. A single mean of 2.5 was found in this data set. Comparing the original survey to the SPSS input, there was no date entry error. A look at the individual's questions was conducted and it appeared that the respondent is simply different from the rest. Below is how the respondent answered in section 3.

Question 14 m. Benefit Demonstrability - I would have no difficulty telling employees about the benefits of using a MDT? Selected “3”

Question 14 n. Benefit Demonstrability - The benefits of using a MDT are apparent to me? Selected “2”

	Mean	Std. Deviation	Low Side	High Side
<b>Relative Advantage</b>	4.3235	0.6382	2.4089	6.2381
<b>Compatibility</b>	4.0455	0.6657	2.0484	6.0426
<b>Complexity</b>	4.1912	0.807	1.7702	6.6122
<b>MDT Characteristics</b>	3.0588	1.1333	-0.3411	6.4587
<b>Productivity Gains</b>	4.1324	0.7911	1.7591	6.5057
<b>Organizational Image</b>	3.4167	1.0429	0.2880	6.5454
<b>Benefit Demonstrability</b>	4.6471	0.5971	2.8558	6.4384
<b>Competitive Advantage</b>	3.1406	1.3394	-0.8776	7.1588
<b>Trialability</b>	2.5909	1.1212	-0.7727	5.9545
<b>External Environment</b>	2.3182	1.3762	-1.8104	6.4468
<b>Capital Budgeting</b>	2.3788	1.0234	-0.6914	5.4490
<b>Internal Environment</b>	3.9118	0.7331	1.7125	6.1111
<b>Manager's Beliefs</b>	2.7241	1.2577	-1.0490	6.4972
<b>External Support</b>	2.1607	1.3815	-1.9838	6.3052
<b>Observability</b>	4.4091	0.6898	2.3397	6.4785

## APPENDIX VI - Test-Value 2.0/3.0

	Test-Value = 2					
	<i>t</i>	df	Sig. (2-tailed)	Mean Difference	90% Confidence Interval of the Difference	
					Lower	Upper
<b>Relative Advantage</b>	21.229	33	.000	2.32353	2.1383	2.5088
<b>Compatibility</b>	17.650	32	.000	2.04545	1.8492	2.2418
<b>Complexity</b>	15.826	33	.000	2.19118	1.9569	2.4255
<b>MDT Characteristics</b>	5.448	33	.000	1.05882	.7299	1.3877
<b>Productivity Gains</b>	15.716	33	.000	2.13235	1.9027	2.3620
<b>Organizational Image</b>	7.440	29	.000	1.41667	1.0931	1.7402
<b>Benefit Demonstrability</b>	25.851	33	.000	2.64706	2.4738	2.8204
<b>Competitive Advantage</b>	4.817	31	.000	1.14063	.7392	1.5421
<b>Trialability</b>	3.028	32	.005	.59091	.2603	.9215
<b>Observability</b>	20.062	32	.000	2.40909	2.2057	2.6125
<b>External Environment</b>	1.084	21	.290	.31818	-.1867	.8231
<b>External Support</b>	.616	27	.543	.16071	-.2840	.6054
<b>Internal Environment</b>	15.206	33	.000	1.91176	1.6990	2.1245
<b>Capital Budgeting</b>	2.126	32	.041	.37879	.0770	.6806
<b>Manager's Beliefs</b>	3.100	28	.004	.72414	.3268	1.1214

	Test-Value = 3					
	<i>t</i>	df	Sig. (2-tailed)	Mean Difference	90% Confidence Interval of the Difference	
					Lower	Upper
<b>Relative Advantage</b>	12.092	33	.000	1.32353	1.1383	1.5088
<b>Compatibility</b>	9.021	32	.000	1.04545	.8492	1.2418
<b>Complexity</b>	8.604	33	.000	1.19118	.9569	1.4255
<b>MDT Characteristics</b>	.303	33	.746	.05882	-.2701	.3877
<b>Productivity Gains</b>	8.346	33	.000	1.13235	.9027	1.3620
<b>Organizational Image</b>	2.188	29	.037	.41667	.0931	.7402
<b>Benefit Demonstrability</b>	16.085	33	.000	1.64706	1.4738	1.8204
<b>Competitive Advantage</b>	.594	31	.577	.14062	-.2608	.5421
<b>Trialability</b>	-2.096	32	.044	-.40909	-.7397	.0785
<b>Observability</b>	11.734	32	.000	1.40909	1.2057	1.6125
<b>External Environment</b>	-2.324	21	.030	-.68182	-1.1867	-.1769
<b>External Support</b>	-3.215	27	.003	-.83929	-1.2840	-.3946
<b>Internal Environment</b>	7.252	33	.000	.91176	.6990	1.1245
<b>Capital Budgeting</b>	-3.487	32	.001	-.62121	-.9230	.3194
<b>Manager's Beliefs</b>	-1.181	28	.247	-.27586	-.6732	.1214

## APPENDIX VII - SPSS Print Out

### Group Statistics

Employee Cluster		N	Mean	Std. Deviation	Std. Error Mean
Relative Advantage	Micro Enterprise	17	4.2941	.66283	.16076
	Small Enterprise	13	4.5000	.50000	.13868

### Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference			
									Lower	Upper	
Relative Advantage	Equal variances assumed	2.792	.106	-.934	28	.358	-.20588	.22051	-.65757	.24581	
	Equal variances not assumed			-.970	28.000	.340	-.20588	.21231	-.64077	.22901	

### Group Statistics

Employee Cluster		N	Mean	Std. Deviation	Std. Error Mean
Compatibility	Micro Enterprise	16	4.2500	.70711	.17678
	Small Enterprise	13	3.8077	.48038	.13323

### Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference			
									Lower	Upper	
Compatibility	Equal variances assumed	3.925	.058	1.921	27	.065	.44231	.23028	-.03019	.91480	
	Equal variances not assumed			1.998	26.281	.056	.44231	.22136	-.01247	.89709	

### Group Statistics

Employee Cluster		N	Mean	Std. Deviation	Std. Error Mean
Complexity	Micro Enterprise	17	4.0588	.89935	.21812
	Small Enterprise	13	4.5769	.49355	.13689

### Independent Samples Test

		Levene's Test for Equality of Variances			t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper		
Complexity	Equal variances assumed	7.034	.013	-1.868	28	.072	-.51810	.27733	-1.08618	.04998
	Equal variances not assumed			-2.012	25.758	.055	-.51810	.25752	-1.04768	.01148

### Group Statistics

Employee Cluster		N	Mean	Std. Deviation	Std. Error Mean
MDTCharacteristics	Micro Enterprise	17	3.5000	1.06066	.25725
	Small Enterprise	13	2.6154	1.04391	.28953

### Independent Samples Test

		Levene's Test for Equality of Variances			t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper		
MDTCharacteristics	Equal variances assumed	.002	.962	2.279	28	.030	.88462	.38815	.08952	1.67971
	Equal variances not assumed			2.284	26.186	.031	.88462	.38730	.08878	1.68045

### Group Statistics

Employee Cluster		N	Mean	Std. Deviation	Std. Error Mean
BenefitDemonstrability	Micro Enterprise	17	4.6765	.63593	.15424
	Small Enterprise	13	4.7308	.38813	.10765

### Independent Samples Test

		Levene's Test for Equality of Variances			t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper		
BenefitDemonstrability	Equal variances assumed	.406	.529	-.271	28	.788	-.05430	.20033	-.46467	.35607
	Equal variances not assumed			-.289	26.880	.775	-.05430	.18809	-.44030	.33170

### Group Statistics

Employee Cluster		N	Mean	Std. Deviation	Std. Error Mean
Trialability	Micro Enterprise	17	2.1176	.94422	.22901
	Small Enterprise	12	2.8333	1.02986	.29729

#### Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Trialability	Equal variances assumed	.051	.822	-1.937	27	.063	-.71569	.36950	-1.47384	.04247
	Equal variances not assumed			-1.907	22.484	.069	-.71569	.37527	-1.49298	.06161

### Group Statistics

Employee Cluster		N	Mean	Std. Deviation	Std. Error Mean
Observability	Micro Enterprise	16	4.4688	.80558	.20139
	Small Enterprise	13	4.4231	.53409	.14813

#### Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Observability	Equal variances assumed	3.292	.081	.175	27	.862	.04567	.26066	-.48915	.58050
	Equal variances not assumed			.183	26.079	.856	.04567	.25001	-.46814	.55949

### Group Statistics

Employee Cluster		N	Mean	Std. Deviation	Std. Error Mean
ProductivityGains	Micro Enterprise	17	4.0294	.69531	.16864
	Small Enterprise	13	4.2692	.85672	.23761

#### Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ProductivityGains	Equal variances assumed	.929	.343	-.847	28	.404	-.23982	.28320	-.81993	.34029
	Equal variances not assumed			-.823	22.796	.419	-.23982	.29137	-.84287	.36323

### Group Statistics

		Employee Cluster	N	Mean	Std. Deviation	Std. Error Mean
CompetitiveAdvantage	Micro Enterprise	16	3.0938	1.30663	.32666	
	Small Enterprise	12	3.1667	1.38717	.40044	

#### Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference			
									Lower	Upper	
CompetitiveAdvantage	Equal variances assumed	.453	.507	-.142	26	.888	-.07292	.51222	-1.12579	.97996	
	Equal variances not assumed			-.141	23.032	.889	-.07292	.51678	-1.14187	.99604	

### Group Statistics

		Employee Cluster	N	Mean	Std. Deviation	Std. Error Mean
CapitalBudgeting	Micro Enterprise	17	2.0882	.66697	.16176	
	Small Enterprise	12	2.3750	1.24545	.35953	

#### Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference			
									Lower	Upper	
CapitalBudgeting	Equal variances assumed	4.309	.048	-.804	27	.429	-.28676	.35681	-1.01887	.44534	
	Equal variances not assumed			-.727	15.469	.478	-.28676	.39425	-1.12487	.55134	

### Group Statistics

		Employee Cluster	N	Mean	Std. Deviation	Std. Error Mean
OrganizationalImage	Micro Enterprise	15	3.4000	.80623	.20817	
	Small Enterprise	12	3.5417	1.33924	.38660	

#### Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference			
									Lower	Upper	
OrganizationalImage	Equal variances assumed	2.085	.161	-.341	25	.736	-.14167	.41590	-.99823	.71490	
	Equal variances not assumed			-.323	17.169	.751	-.14167	.43909	-1.06736	.78403	

### Group Statistics

Employee Cluster		N	Mean	Std. Deviation	Std. Error Mean
ExternalEnvironment	Micro Enterprise	11	1.9091	.97000	.29247
	Small Enterprise	9	2.7778	1.66040	.55347

#### Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference			
	Lower	Upper								
ExternalEnvironment	Equal variances assumed	5.398	.032	-1.462	18	.161	-.86869	.59425	-2.11717	.37980
	Equal variances not assumed			-1.388	12.323	.190	-.86869	.62599	-2.22865	.49128

### Group Statistics

Employee Cluster		N	Mean	Std. Deviation	Std. Error Mean
ExternalSupport	Micro Enterprise	15	1.8000	1.20712	.31168
	Small Enterprise	10	2.5500	1.51749	.47987

#### Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference			
	Lower	Upper								
ExternalSupport	Equal variances assumed	2.436	.132	-1.374	23	.183	-.75000	.54590	-1.87928	.37928
	Equal variances not assumed			-1.311	16.327	.208	-.75000	.57221	-1.96105	.46105

### Group Statistics

Employee Cluster		N	Mean	Std. Deviation	Std. Error Mean
InternalEnvironment	Micro Enterprise	17	4.1765	.78941	.19146
	Small Enterprise	13	3.7308	.56330	.15623

#### Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference			
	Lower	Upper								
InternalEnvironment	Equal variances assumed	1.855	.184	1.724	28	.096	.44570	.25845	-.08372	.97512
	Equal variances not assumed			1.804	27.905	.082	.44570	.24711	-.06056	.95197

### Group Statistics

Employee Cluster		N	Mean	Std. Deviation	Std. Error Mean
ManagersBelief	Micro Enterprise	14	2.4286	1.50457	.40211
	Small Enterprise	11	2.8636	1.05097	.31688

### Independent Samples Test

	ManagersBelief	Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper	
	Equal variances assumed	4.737	.040	-.814	23	.424	-.43506	.53448	-1.54073	.67060	
	Equal variances not assumed			-.850	22.753	.404	-.43506	.51197	-1.49478	.62465	

## APPENDIX VIII - ANOVA

### Between-Subjects Factors

		Value Label	N
Technology Clusters,	1	Cluster 1	11
Group 1 - pagers/basic			
cell phones, Group 2 -	2	Cluster 2	15
Integradted handhelds,			
Group 3 - Laptops/tablets,	3	Cluster 3	8
Group 4 - Customized			

### Tests of Between-Subjects Effects

Dependent Variable: Compatibility

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.930 <sup>a</sup>	2	.965	2.363	.111
Intercept	496.117	1	496.117	1214.774	.000
TechClust	1.930	2	.965	2.363	.111
Error	12.252	30	.408		
Total	554.250	33			
Corrected Total	14.182	32			

a. R Squared = .136 (Adjusted R Squared = .078)

### Tests of Between-Subjects Effects

Dependent Variable: Complexity

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.669 <sup>a</sup>	2	.334	.498	.613
Intercept	567.555	1	567.555	844.315	.000
TechClust	.669	2	.334	.498	.613
Error	20.838	31	.672		
Total	618.750	34			
Corrected Total	21.507	33			

a. R Squared = .031 (Adjusted R Squared = -.031)

### Tests of Between-Subjects Effects

Dependent Variable: MDTCharacteristics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.294 <sup>a</sup>	2	.147	.108	.898
Intercept	300.246	1	300.246	221.144	.000
TechClust	.294	2	.147	.108	.898
Error	42.088	31	1.358		
Total	360.500	34			
Corrected Total	42.382	33			

a. R Squared = .007 (Adjusted R Squared = -.057)

### Tests of Between-Subjects Effects

Dependent Variable: Trialability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.604 <sup>a</sup>	2	.302	.229	.797
Intercept	211.843	1	211.843	160.392	.000
TechClust	.604	2	.302	.229	.797
Error	39.623	30	1.321		
Total	261.750	33			
Corrected Total	40.227	32			

a. R Squared = .015 (Adjusted R Squared = -.051)

### Tests of Between-Subjects Effects

Dependent Variable: InternalEnvironment

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.197 <sup>a</sup>	2	.598	1.122	.339
Intercept	492.974	1	492.974	924.041	.000
TechClust	1.197	2	.598	1.122	.339
Error	16.538	31	.533		
Total	538.000	34			
Corrected Total	17.735	33			

a. R Squared = .067 (Adjusted R Squared = .007)

## **APPENDIX IX – Transcripts**

Question 1 - Can you explain how the idea of adopting the MDT was initiated?

a. Who initiated it?

<b>ID</b>	<b>Device</b>	<b>Response</b>
1	Cell Phone	Myself
2	Blackberry	Myself
3	Blackberry	Myself
4	Cell Phone	Myself
5	Laptops	Myself
6	Palm Treo	Myself
7	Blackberry	End User
8	Cell Phone	Myself
9	PocketPC	Management team
10	Blackberry	Myself
11	Basic PDA	Myself
12	Blackberry	Myself
13	Blackberry	VP of sales/marketing
14	Laptops	Myself
15	TabletPC	Myself
16	Basic PDA	Myself
17	Cell Phone	Service people
18	Blackberry	Sales group
19	Laptops	Myself
20	Blackberry	Myself
21	Cell Phone	Myself
22	Cell Phone	Myself
23	Laptops	Myself
24	Smart Phone	Myself
25	Cell Phones	Myself
26	Cell Phone	Sales reps and Myself
27	Cell Phone	Myself
28	PocketPC	Myself
29	Laptops	Myself
30	Laptops	Myself
31	Laptops	Purchasing
32	Blackberry	End users
33	PocketPC	Myself
34	Blackberry	Myself

b. Why was it initiated? (*First reaction*)

<b>ID</b>	<b>Device</b>	<b>Response</b>
1	Cell Phone	Communication
2	Blackberry	Greater communication in the field and for email access
3	Blackberry	For users to access email away from office, for internal base users and for employees who travel or work long hours
4	Cell Phone	Technology, Bell Canada forced them to get it. Changed from a cell phone because of a residential line to business line
5	Laptops	Needed a computer, between PC or laptop, laptop made more sense because it gave flexibility. He could use it and access the internet. 'Hence mobility'
6	Palm Treo	Basically to enable access to email and access data remotely.
7	Blackberry	Because old cell phone was losing its battery power
8	Cell Phone	Wanted mobility to be able to carry on business, productivity
9	PocketPC	For operational effectiveness, for field base workers and for R&D
10	Blackberry	Became aware of them 3 or 4 years ago. First PDA, $\frac{3}{4}$ years ago. Lost PDA and wanted to convert to one device that has cell and PDA capabilities. (But still carries a cell phone)
11	Basic PDA	To have access to contact information and notes
12	Blackberry	Wanted people to have access to email at all times and be able to respond to clients when outside the office.
13	Blackberry	He was looking for a way to have access to email, while waiting in airports, taxis
14	Laptops	Basic needs and for mobility
15	TabletPC	Nieces husband recommended it
16	Basic PDA	Easier way to keep track of people's schedules throughout the office
17	Cell Phone	Communication
18	Blackberry	Sales felt they could respond to their customers faster
19	Laptops	To allow the staff to have more flexibility
20	Blackberry	Travel and needed both phone and email
21	Cell Phone	Needed better availability
22	Cell Phone	Communication
23	Laptops	Mobility
24	Smart Phone	Needed a way to respond to customer needs
25	Cell Phones	To have all the same phones on the same system
26	Cell Phone	Trouble-shoot problems
27	Cell Phone	To communicate with customers and dealers
28	PocketPC	Wanted something faster than traditional method
29	Laptops	Needed for mobility
30	Laptops	To interact better with organization, more effective use of time
31	Laptops	Environment was becoming harder to work, so device allowed to continue work but not be affected at place of work
32	Blackberry	Combining all devices into one and wireless
33	PocketPC	Better scheduling
34	Blackberry	To have better communication, via email

c. When was the idea initiated? (*How long ago*)

<b>ID</b>	<b>Device</b>	<b>Response</b>
1	Cell Phone	1.5 years
2	Blackberry	2 years
3	Blackberry	2 years
4	Cell Phone	1 year
5	Laptops	2 years
6	Palm Treo	4 or 5 months (Thought of it 5years ago, didn't exist that long ago)
7	Blackberry	1 year (Long time before it could be afforded)
8	Cell Phone	1.5 years
9	PocketPC	2.5 years
10	Blackberry	2 years
11	Basic PDA	1 year
12	Blackberry	2 months
13	Blackberry	1 year
14	Laptops	1 year
15	TabletPC	2 years
16	Basic PDA	2.5 years
17	Cell Phone	2.5 years
18	Blackberry	IT department had already demoed the device before the request was put forward by sales
19	Laptops	2 years
20	Blackberry	12 months
21	Cell Phone	2 years
22	Cell Phone	2.5 years
23	Laptops	2 years
24	Smart Phone	2 years
25	Cell Phones	2 years
26	Cell Phone	2 years
27	Cell Phone	2 years
28	PocketPC	2 years
29	Laptops	2 years
30	Laptops	2.5 years
31	Laptops	2.5 years
32	Blackberry	6 months
33	PocketPC	2 years
34	Blackberry	2 years

**Question 2 - Can you explain how the MDT was evaluated?**

- a. What was the main reason for adopting the MDT? (*Productivity, online, access anywhere/anytime*)

ID	Device	Response
1	Cell Phone	Communications
2	Blackberry	Access anywhere/anytime
3	Blackberry	Productivity - cost benefit analysis was done between the laptop and a blackberry. Tried to phase out laptops, because laptops more expensive and less useful.
4	Cell Phone	Access anywhere/anytime and forced
5	Laptops	Online and access anywhere/anytime
6	Palm Treo	Productivity, online, access anywhere/anytime
7	Blackberry	Access anywhere/anytime
8	Cell Phone	Access anywhere/anytime
9	PocketPC	Productivity, access anywhere/anytime to email, business applications and own applications
10	Blackberry	Productivity, expanding the horizon of access anywhere/anytime
11	Basic PDA	Productivity
12	Blackberry	Access anywhere/anytime (email) productivity (calendar)
13	Blackberry	Access anywhere/anytime
14	Laptops	Mobility and to have access with clients
15	TabletPC	Innovation and contribution to productivity
16	Basic PDA	Access anywhere/anytime
17	Cell Phone	Communication/productivity to result in efficiency
18	Blackberry	Productivity and responding to customer needs
19	Laptops	Productivity – work from home
20	Blackberry	Productivity
21	Cell Phone	Access anywhere/anytime
22	Cell Phone	Access anywhere/anytime
23	Laptops	Access anywhere/anytime
24	Smart Phone	Productivity
25	Cell Phones	Productivity, Access anywhere/anytime
26	Cell Phone	Order taking, dealing with dealer issue and keeping in touch
27	Cell Phone	Access anywhere/anytime and to be efficient
28	PocketPC	Access anywhere/anytime, communication, convenient
29	Laptops	Productivity, communication
30	Laptops	Productivity
31	Laptops	Productivity
32	Blackberry	Access anywhere/anytime, Productivity
33	PocketPC	Productivity (scheduling)
34	Blackberry	Access anywhere/anytime

b. Was a business case used in the evaluation? (*Formal or informal*)

ID	Device	Response
1	Cell Phone	Informal, minimal
2	Blackberry	Informal, compared product on the web with other devices
3	Blackberry	Informal and will be completed. looked at mitigation, will be done
4	Cell Phone	Informal, basic
5	Laptops	Informal, not really, weak
6	Palm Treo	Informal, cost benefit analysis, no mitigation
7	Blackberry	Informal, shopping around, determine what was best. Needed a new cell phone. Didn't need a PDA, but was thinking coming to the point where it might be needed. Cash flow was considered
8	Cell Phone	Informal on functionality. Don't need camera, web enable, visible.
9	PocketPC	Informal, looked at alternatives, R&D market industry market was going to make sure. Benefits and opportunities, but not very much as a process and process.
10	Blackberry	No
11	Basic PDA	Not a formal analysis. It was evaluated by his assistant that used the old method (technology) which was wasting time. Big decision was how their software was going to be integrated with new device, Act Contact Software. And how back ups on device worked
12	Blackberry	Research was done, benefits/opportunities, no risks mitigation
13	Blackberry	Very Informally – thinks of itself as a small company. Have IT department. They went out to take a look at what was available and to do some cost/ benefit analysis. Did some business risk analysis, especially from the stand-point of encryption, and secure access to mainframe, server based email and how that would impact security of desktops within the building.
14	Laptops	No
15	TabletPC	Informal, no risk mitigation
16	Basic PDA	Informal, but didn't realize it was done
17	Cell Phone	Formal study
18	Blackberry	Informal
19	Laptops	Yes, informal
20	Blackberry	Informal
21	Cell Phone	Informal – going to lose business if customer can't get a hold of me
22	Cell Phone	No
23	Laptops	Informal
24	Smart Phone	Informal, mental business case
25	Cell Phones	No, very informal
26	Cell Phone	No
27	Cell Phone	No
28	PocketPC	Informal, used word of month
29	Laptops	No, strictly a gut feeling
30	Laptops	(didn't understand the question)
31	Laptops	Yes, talked about it extensively
32	Blackberry	No
33	PocketPC	Informal
34	Blackberry	Informal

c. Were any criterions set to help evaluating the device? (*Price, size, availability..*)

<b>ID</b>	<b>Device</b>	<b>Response</b>
1	Cell Phone	Price. Functionality not an issue
2	Blackberry	Price and functionality
3	Blackberry	First tier evaluation, functionality (size was important). Second tier evaluation, price
4	Cell Phone	Functionality
5	Laptops	Functionality, screen size for business
6	Palm Treo	Price, functionality (user interface)
7	Blackberry	Price, size, fun (the tool thing)
8	Cell Phone	All – price, size, plan that worked best for phone
9	PocketPC	Functionality
10	Blackberry	Price and functionality were key drivers
11	Basic PDA	Functionality (hard disk space)
12	Blackberry	Functionality and price. Wanted all in one device. Didn't want to carry two devices
13	Blackberry	Functionality – went through a detailed listing of what the device had to have in functionality. Price (Total Cost of Ownership was an issue. Main reason they didn't go with another brand – Blackberry, that would of cost more to implement) and complexity of use and from an IS standpoint, complexity of maintaining the system
14	Laptops	Cost, weight, battery length
15	TabletPC	Ease of use, technology was stable and reliable and dependable, price was considered, size not an issue
16	Basic PDA	Price (big factor – didn't want to spend a lot of money when didn't know how it was going to be used), size, functionality
17	Cell Phone	Functionality, price, size, availability
18	Blackberry	Functionality, size
19	Laptops	Price, functionality
20	Blackberry	Price, functionality, how network worked
21	Cell Phone	Price,
22	Cell Phone	Size and reception
23	Laptops	Functionality - power
24	Smart Phone	Functionality,
25	Cell Phones	Quality of service
26	Cell Phone	Researched the package available
27	Cell Phone	Quality and service
28	PocketPC	Functionality – power, tracking text, syncing to PC
29	Laptops	Price and portability (weight)
30	Laptops	Price
31	Laptops	Functionality
32	Blackberry	Price, functionality
33	PocketPC	Price, functionality
34	Blackberry	Functionality (mobility of it, legibility – could read the screen, audibility – sound level)

d. What is your level of information technology awareness?

<b>ID</b>	<b>Device</b>	<b>Response</b>
1	Cell Phone	Above average
2	Blackberry	Above average
3	Blackberry	Very high
4	Cell Phone	Above average
5	Laptops	In the middle
6	Palm Treo	Above average
7	Blackberry	Moderate
8	Cell Phone	Middle of the road
9	PocketPC	Off the charts (very high)
10	Blackberry	Moderate
11	Basic PDA	Limited
12	Blackberry	Above average
13	Blackberry	Average – modest. Heavy user
14	Laptops	High
15	TabletPC	High
16	Basic PDA	Average
17	Cell Phone	High
18	Blackberry	High
19	Laptops	Average
20	Blackberry	Very high
21	Cell Phone	Very low – nothing, just getting by
22	Cell Phone	Limited
23	Laptops	Very high
24	Smart Phone	Expert
25	Cell Phones	Average
26	Cell Phone	Very limited
27	Cell Phone	Average
28	PocketPC	Very limited
29	Laptops	Average
30	Laptops	Average
31	Laptops	Average
32	Blackberry	Very high
33	PocketPC	Very high
34	Blackberry	Average

e. Was the ever changing technological environment evaluated?

*(Was that a concern?)*

ID	Device	Response
1	Cell Phone	Being locked onto a long term plan
2	Blackberry	Yes, the main reason he went with this device. He believes the carrier can help with forward and backward compatibility for next generations. This was an important reason for going with this device.
3	Blackberry	Not worried, but aware of the changes. Basically, will the technology still be valid within a year and a half.
4	Cell Phone	Not for the price of the cell phone
5	Laptops	Had to change network within work environment to cope with new technology
6	Palm Treo	Yes, but in the current market place, technology is always changing, this device will work for the next few years. Will be fine
7	Blackberry	Wasn't a concern as much as awareness. Just had to bite the bullet and buy it
8	Cell Phone	Yes, phones with screens, camera's just starting to hit main stream, was thinking if he was buying an out dated piece. Didn't have any other needs
9	PocketPC	Not a concern, but watched with a keen eye
10	Blackberry	Yes, big concern. Issue was always wanting evergreen technology. Source of frustration, can't keep up, but when bought device, colour screen came out a few weeks later, and so on.
11	Basic PDA	Yes, was going to buy a Blackberry, but Blackberry wasn't what was required
12	Blackberry	Yes, but did informal census with colleagues and this device always had high regard.
13	Blackberry	We were somewhat. It came within the support question. Wanted to make sure we were dealing with a platform that would be around in a year or 2 so wouldn't have constantly be re-evaluating/re-buying/re-hooking up. Didn't want to throw money away all the time.
14	Laptops	Yes
15	TabletPC	Clearly there is a tonne of technologies hitting the market (reason don't want to go with Blackberrys). But Tablet computing could be the answer
16	Basic PDA	Yes
17	Cell Phone	Yes, why the study was conducted
18	Blackberry	Always a concern, very aware of security enhancements
19	Laptops	Absolutely
20	Blackberry	No, went to CDMA. Sees all platforms going that way
21	Cell Phone	No
22	Cell Phone	No
23	Laptops	No
24	Smart Phone	Absolutely
25	Cell Phones	No, informed of the options
26	Cell Phone	Absolutely and thought about
27	Cell Phone	No
28	PocketPC	A bit, not sure if could use all the functions that was offered
29	Laptops	Yes, had to think if needed capabilities for the future
30	Laptops	Yes, concern that it would get outdated quickly
31	Laptops	Yes, but not know. Devices are just as expensive now
32	Blackberry	No
33	PocketPC	A bit, but researched into it
34	Blackberry	No

f. Were other additional costs associated with the adoption of the MDT?

ID	Device	Response
1	Cell Phone	Monthly plan costs
2	Blackberry	Yes, 1 year contract
3	Blackberry	Always, training, connectivity, software (customized)
4	Cell Phone	Forced cost from bell to get this done, monthly fee, contract
5	Laptops	Putting a new network in, software
6	Palm Treo	Yes, cell time
7	Blackberry	No
8	Cell Phone	Yes, extra dud's, car adapter, hands free
9	PocketPC	Yes, out of the box and training. Adding a wireless network
10	Blackberry	No
11	Basic PDA	Yes, the software and time of converting to Act. Act was the driver for the device
12	Blackberry	No, easy plug and play
13	Blackberry	Yeah, later on. Very minimal, software package to dial-up into the server and put a back up chip into the device. This was after the fact. So, once the device was bought, it was in use.
14	Laptops	Minor costs, bags ...
15	TabletPC	If went full scale, some server software/infrastructure cost
16	Basic PDA	Yes, had to upgrade the computer. Did at the time, but was concerned that might have to happen
17	Cell Phone	No
18	Blackberry	Data charges on a monthly basis,
19	Laptops	Yes, had to change network system and phone system
20	Blackberry	No
21	Cell Phone	Yes, other options
22	Cell Phone	No
23	Laptops	A bit
24	Smart Phone	No
25	Cell Phones	Yes
26	Cell Phone	No
27	Cell Phone	A bit – head set
28	PocketPC	Yes
29	Laptops	A bit - software
30	Laptops	Yes, software, customize software for retail
31	Laptops	Yes, network upgrades
32	Blackberry	Yes, new server. Wasn't explained very well when exploring to implement the devices. Therefore had to do this
33	PocketPC	No
34	Blackberry	No – roaming cost

g. Did you test pilot the MDT before the decision was made?

<b>ID</b>	<b>Device</b>	<b>Response</b>
1	Cell Phone	No
2	Blackberry	No, but read product reviews
3	Blackberry	Yes, 1.5 year test pilot, 8 in pilot with varying time lengths
4	Cell Phone	No
5	Laptops	No
6	Palm Treo	In store
7	Blackberry	Technically yes, had it before hand before to buy
8	Cell Phone	No
9	PocketPC	Kind of, couple of weeks. Not many pocket PC's involved. Just a few.
10	Blackberry	No
11	Basic PDA	Yes
12	Blackberry	No
13	Blackberry	1 unit for an IT person to travel with and do what ever he needed to do and to knock it around and see how it would work. It was great as he was able to fix a few of the kinks and that lead him to discover other addition software pieces that helped improve the device within the environment.
14	Laptops	No
15	TabletPC	Yes, 3 people tested for about a month
16	Basic PDA	No, but had talked to others
17	Cell Phone	No
18	Blackberry	Yes, 2 people
19	Laptops	Yes, took it for a day to try
20	Blackberry	No, but had less functional models before
21	Cell Phone	No
22	Cell Phone	No
23	Laptops	No
24	Smart Phone	No
25	Cell Phones	Yes
26	Cell Phone	Not really
27	Cell Phone	No
28	PocketPC	Yes
29	Laptops	No
30	Laptops	Yes, IT department
31	Laptops	Yes
32	Blackberry	Yes
33	PocketPC	No
34	Blackberry	No

h. Were plans created to support, training, maintain and upgrade the MDT?

<b>ID</b>	<b>Device</b>	<b>Response</b>
1	Cell Phone	No
2	Blackberry	No
3	Blackberry	Yes, was included in the business case.
4	Cell Phone	No
5	Laptops	For maintenance bought extended warranty and bought books (personal training)
6	Palm Treo	No, just walked out of store with it
7	Blackberry	No, he didn't need it
8	Cell Phone	Maybe support. Making sure had the extra features to serve the functions the business needed
9	PocketPC	Informally
10	Blackberry	No
11	Basic PDA	Yes, more upgrading issues
12	Blackberry	No, self taught
13	Blackberry	Not really
14	Laptops	Was a plan, very minimal
15	TabletPC	No
16	Basic PDA	No
17	Cell Phone	No
18	Blackberry	Informal, but no. Rarely over plans things. Blackberry server won't affect the core network
19	Laptops	Yes, as support and training
20	Blackberry	No
21	Cell Phone	No
22	Cell Phone	No
23	Laptops	No
24	Smart Phone	Minimum
25	Cell Phones	No
26	Cell Phone	No
27	Cell Phone	No
28	PocketPC	No
29	Laptops	No
30	Laptops	Informal
31	Laptops	Yes – privacy and training and security
32	Blackberry	On a support plan
33	PocketPC	No
34	Blackberry	No, just had to learn

- i. Was there a plan created for how the MDT was going to be rolled out within the organization? (*Formal or informal*)

<b>ID</b>	<b>Device</b>	<b>Response</b>
1	Cell Phone	Informal, minimal
2	Blackberry	No
3	Blackberry	Informal, but has to be formalized. As decision has been made, but not executed.
4	Cell Phone	Formal. A protocol was created for others to use within the organization
5	Laptops	No
6	Palm Treo	Just started using it
7	Blackberry	No
8	Cell Phone	Yes, informal. For trips, make calls on the road
9	PocketPC	Informally
10	Blackberry	Not really
11	Basic PDA	Yes, there was a time-line created for Act Contact Software to be up and running
12	Blackberry	Yes, a meeting discussed how the device was going to be used. A structure put in place
13	Blackberry	Plans weren't created except they spent an hour with the IT person to figure out how to use them
14	Laptops	No – single user
15	TabletPC	Yes, informal, used for presentation-not mobile users
16	Basic PDA	First reaction was no - Very informal
17	Cell Phone	Informally
18	Blackberry	Informal, test run in IT, then sales got it, then a few managers and then mandated that all sales use it
19	Laptops	Yes, through a formal method of staff meetings
20	Blackberry	No
21	Cell Phone	No
22	Cell Phone	No
23	Laptops	No
24	Smart Phone	No
25	Cell Phones	Very informal
26	Cell Phone	No
27	Cell Phone	No
28	PocketPC	No
29	Laptops	No
30	Laptops	Informal
31	Laptops	No, a case like wildfire. Once one went, many wanted
32	Blackberry	Informal
33	PocketPC	No
34	Blackberry	No

j. Were the end users consulted about the MDT?

<b>ID</b>	<b>Device</b>	<b>Response</b>
1	Cell Phone	N/A
2	Blackberry	N/A
3	Blackberry	Continuously
4	Cell Phone	Yes
5	Laptops	Yes, the end users were consulted
6	Palm Treo	N/A
7	Blackberry	Yes, was driving force
8	Cell Phone	Yes
9	PocketPC	A lot of the end users were involved in the process.
10	Blackberry	No
11	Basic PDA	N/A
12	Blackberry	Yes
13	Blackberry	Yes. They were involved with a list of what they needed and how they wanted to use it and had meetings very few weeks to see the progress. They were heavily involved.
14	Laptops	N/A
15	TabletPC	Yes – they where part of pilot
16	Basic PDA	N/A
17	Cell Phone	Were consulted
18	Blackberry	Yes
19	Laptops	Yes
20	Blackberry	N/A
21	Cell Phone	N/A
22	Cell Phone	N/A
23	Laptops	No
24	Smart Phone	No
25	Cell Phones	Yes
26	Cell Phone	Yes, discussed it with employees
27	Cell Phone	N/A
28	PocketPC	No
29	Laptops	N/A
30	Laptops	Were consulted throughout the process
31	Laptops	Yes
32	Blackberry	Yes, they requested it
33	PocketPC	N/A
34	Blackberry	N/A

k. Was there a plan created for how the MDT was going to be communicated to the organization? (*Formal or informal*)

<b>ID</b>	<b>Device</b>	<b>Response</b>
1	Cell Phone	N/A
2	Blackberry	N/A
3	Blackberry	Not yet, likely will be. Haven't gone to that detail yet
4	Cell Phone	Informal
5	Laptops	No, open communication within the work environment
6	Palm Treo	N/A
7	Blackberry	No
8	Cell Phone	Yes, informal
9	PocketPC	Informal
10	Blackberry	No plan
11	Basic PDA	No, both working on it
12	Blackberry	Just an email
13	Blackberry	No
14	Laptops	N/A
15	TabletPC	Informal
16	Basic PDA	No
17	Cell Phone	Formal - Let every know who had the phones and what their phone numbers were
18	Blackberry	No
19	Laptops	Yes
20	Blackberry	N/A
21	Cell Phone	N/A
22	Cell Phone	N/A
23	Laptops	N/A
24	Smart Phone	No
25	Cell Phones	Informal, created on the fly
26	Cell Phone	Formal
27	Cell Phone	N/A
28	PocketPC	No
29	Laptops	N/A
30	Laptops	Formal – staff meetings
31	Laptops	Yes, series of debates. How to deal with the fall out when someone didn't get one
32	Blackberry	Informal
33	PocketPC	N/A
34	Blackberry	No

*l. When deciding to adopt MDT's, to what extend would re-engineering have to take place in your work process after the adoption?*

ID	Device	Response
1	Cell Phone	No - Would have to if primary communication, but not first part of contact. So no
2	Blackberry	Not in a formal sense. Using it for email but has changed the way he conducts his business. No, but it evolved his system
3	Blackberry	No, that has been looked at. Will not have to re-engineer. Some of the work processes will be modify because of the tool, but not to change the standard work process.
4	Cell Phone	No not really
5	Laptops	Had to modify access to email. Before, using single email account. Had to change how that was done with multiple accounts.
6	Palm Treo	Yes, to a certain degree. Don't have to go into a wireless/hardwire network to access data/emails. Changed where I can receive information
7	Blackberry	No, but had to change a few things how to function because now he had only one device (cell and PDA into blackberry).
8	Cell Phone	Absolutely
9	PocketPC	Absolutely
10	Blackberry	To some extent on an ad hoc basis.
11	Basic PDA	Yes a little bit, limited to the software fields. Laptops not working in the field, taking too long to start and get ready.
12	Blackberry	Made them more efficient. Yes, one re-engineering process. Took notes on device right away and then that was synced into CRM
13	Blackberry	No haven't done anything yet, but it makes him wonder if he should be thinking about this. Bought it for an access standpoint. As email becomes more extensively used, wanted to have better access to it.
14	Laptops	Yes, almost all aspects of work was going to be modify. But wasn't planned, just need to be more efficient.
15	TabletPC	Not based on its application
16	Basic PDA	It would change a bit – now going into e-copy instead of paper
17	Cell Phone	A little bit, positively
18	Blackberry	No
19	Laptops	Transition was smooth once technology was in place.
20	Blackberry	Only to alert customer on how to contact them – email/phone
21	Cell Phone	A bit, always had to carry it
22	Cell Phone	None
23	Laptops	Very minimal
24	Smart Phone	Let's see how it works and if it works, lets take advantage of it.
25	Cell Phones	Didn't have to, implemented before business started. This was the way to do business
26	Cell Phone	No
27	Cell Phone	No
28	PocketPC	No - but it made life easier
29	Laptops	N/A
30	Laptops	Training and education process
31	Laptops	A bit, had to develop better communications
32	Blackberry	Can work anywhere, allows less clean up once back at the office
33	PocketPC	Made an existing process much easier
34	Blackberry	Minimal

**Question 3 - Can you explain how the decision to adopt the MDT was approved?**

a. What was the time period from initiation to evaluation to approval? (How long)

<b>ID</b>	<b>Device</b>	<b>Response</b>
1	Cell Phone	2.5 months
2	Blackberry	2 months
3	Blackberry	6 months
4	Cell Phone	1 week
5	Laptops	2 weeks
6	Palm Treo	1 minute
7	Blackberry	1 year
8	Cell Phone	1 week
9	PocketPC	2 weeks
10	Blackberry	1 year
11	Basic PDA	3 -6 months
12	Blackberry	A few months
13	Blackberry	5 to 6 months
14	Laptops	2 months
15	TabletPC	12 months
16	Basic PDA	1 month
17	Cell Phone	Right away
18	Blackberry	Different because IT had already checked it out, once it was initiated, almost happened right away
19	Laptops	6 months
20	Blackberry	1 month
21	Cell Phone	4 months
22	Cell Phone	1 month
23	Laptops	1 month
24	Smart Phone	2 months
25	Cell Phones	2 weeks
26	Cell Phone	1 week
27	Cell Phone	Right away
28	PocketPC	Bad impulse buyer – no thought when buying
29	Laptops	3 weeks
30	Laptops	6 months
31	Laptops	4-6 months
32	Blackberry	5 months
33	PocketPC	1 week
34	Blackberry	1.5 years

b. How many were involved in making the approval?

ID	Device	Response
1	Cell Phone	1
2	Blackberry	1
3	Blackberry	1
4	Cell Phone	3
5	Laptops	2
6	Palm Treo	1
7	Blackberry	2
8	Cell Phone	3
9	PocketPC	5
10	Blackberry	5
11	Basic PDA	2
12	Blackberry	2
13	Blackberry	3
14	Laptops	1
15	TabletPC	2
16	Basic PDA	1
17	Cell Phone	2
18	Blackberry	3 entities – Finance, Sales and IT
19	Laptops	3
20	Blackberry	1
21	Cell Phone	1
22	Cell Phone	1
23	Laptops	1
24	Smart Phone	1
25	Cell Phones	2
26	Cell Phone	1
27	Cell Phone	1
28	PocketPC	1
29	Laptops	1
30	Laptops	6
31	Laptops	6
32	Blackberry	5
33	PocketPC	2
34	Blackberry	2

c. Was the MDT approval method the same as other technology acquisitions?

<b>ID</b>	<b>Device</b>	<b>Response</b>
1	Cell Phone	No, investment small, not as much time needed to look into.
2	Blackberry	Yes
3	Blackberry	No, will try a simpler approval method to get it to pass. Basically, this is what everyone wants.
4	Cell Phone	No, because an outside partner (Bell Canada) was involved. No deep thought went into it.
5	Laptops	No, same process
6	Palm Treo	Yes, because of the price. Wasn't as big a decision to make compared to buying a laptop at \$5000 compared to \$400.
7	Blackberry	Yes, pretty much. Has to do with the need. Before the cell phone died, didn't need it. Is there a critical need to buy it and is there cash flow to handle it. But, if critical, would find the money.
8	Cell Phone	Yes
9	PocketPC	No, in most cases less extensive, but in some cases more extensive.
10	Blackberry	Yes, different in so far that people had different understandings. Was it a PDA, day timer, pager, or a mobile email device.
11	Basic PDA	Yes, typically a concession is created. Followed the same procedures.
12	Blackberry	Yes
13	Blackberry	More casual/ more informal. These devices not consider a mission critical device compared to other MRP systems. What would be consistent was typically user involved across functions from the start and all the way through.
14	Laptops	Principality, yes.
15	TabletPC	Yes, fell into the IT infrastructure approval method
16	Basic PDA	Generally yes
17	Cell Phone	Yes
18	Blackberry	Yes, does it make good business sense, is it going to improve our bottom line, will it save us money and increase sales
19	Laptops	More rigorous
20	Blackberry	Yes
21	Cell Phone	Yes
22	Cell Phone	Yes
23	Laptops	Yes
24	Smart Phone	Yes
25	Cell Phones	Same, thorough but informal
26	Cell Phone	Typically the same
27	Cell Phone	Yes
28	PocketPC	Yes
29	Laptops	Yes
30	Laptops	Yes, formal core staff are consulted
31	Laptops	little more complicated because it affected people's behaviour more
32	Blackberry	Pretty much
33	PocketPC	Yes
34	Blackberry	Yes