GARMENT ENTERPRISE OWNERS' PERCEPTIONS OF A COMPUTER-AIDED APPAREL DESIGN SERVICE

BY

LIGIA OSORIO COELHO

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Department of Clothing and Textiles
University of Manitoba
Winnipeg, Manitoba

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Name Ligia Osorio Coelho

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To

Diogo, Ana and Tiago

You were the sources of my motivation

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Abstract

Using selected concepts from the theory of diffusion of innovations by Rogers, the researcher identified perceptions of a computer-aided design service, which include relative advantage, uncertainties, conditions that encourage and prevent the use of a CAD service, and the likelihood of using a CAD service. A questionnaire was developed and administered by semi-structured interviews. Nine small business owners were interviewed. Major relative advantage of using a CAD service include facilitating production, time reduction and reallocation, organization. Uncertainties include competence of service givers, ability to respond to deadlines, cost, security, access and the potential users' knowledge of CAD. Conditions preventing the use of a CAD service include high cost, inability to satisfy clients, inconvenient location, inability to safeguard designs, poor reputation, unqualified service givers, many employees working on the same design, too slow to complete orders, poor access to the service and the respondents' lack of knowledge of CAD. Conditions encouraging respondents to use a CAD service are the opposites of the conditions that prevent them from using it. The small sample failed to reveal relationships between likelihood of using a CAD service and selected characteristics of the owners and the enterprise. Overall, findings of this study seem to be consistent with concepts in Rogers' theory.

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CHAPTER ONE

INTRODUCTION

Small business has been recognized as a contributor to economic growth, job creation, and ultimately the well being of a nation (Harvey-Jones, 1991). The apparel industry in North America is made up of a large number of small companies. In 1989, 88 percent of the Canadian apparel industry employed fewer than 100 employees (Industry, Science, & Technology, 1992). Also, it is an industry characterized by low profit margin and labour intensiveness.

To compete in the marketplace, large companies are adopting computer-aided design (CAD) to respond quickly to market demand. The widespread use of CAD technology in the North American apparel industry has given many companies a distinctive advantage over others. However, because of its high cost, CAD has been the purview of large manufacturers. In the long term, the adoption of CAD may have implications on the structure of the apparel industry which is predominantly fragmented and labour intensive. As the resourceful manufacturers continue to acquire the latest CAD technologies, eventually, the small manufacturers who cannot afford to invest in CAD will have difficulty surviving in a fiercely competitive and industry.

This research originates from the researcher's belief that small manufacturers could also enjoy the benefits of CAD despite the financial barriers. An alternative is to consider a computer-aided design service. The advantages of

a CAD service are numerous. Small business owners do not have to be burdened with the capital layout of the CAD system. Thus, the CAD service could be particularly important for small companies that are in the developmental stage. If the service is well managed, it would enable small manufacturers to respond quickly to their clients' demands.

Problem Statement

The purpose of the research was to examine how owners of small enterprises perceive a CAD service offered by an educational institution.

Objectives

The objectives of the study were:

1. To identify the types of relative advantage that owners of small enterprises perceive in using a CAD service offered by an educational institution.
2. To identify uncertainties in using a CAD service.
3. To identify conditions that prevent the use of a CAD service.
4. To identify conditions that encourage the use of a CAD service.
5. To examine the relationship between the likelihood of using a CAD service and:

a. selected characteristics of the enterprises;

b. selected characteristics of the owners.

Justification

After reviewing literature from home economics, human ecology, clothing and textiles, marketing and management, the researcher could not locate published research pertaining to the feasibility of a computer-aided design (CAD) service. Literature in home economics, human ecology, and clothing and textiles focuses on the development and features of CAD and the implications for education. Literature in marketing and management focuses on decision making in regard to selecting a CAD system and its managerial implications. This research may provide insights for institutions that have opportunities to offer a CAD service.

Definitions

1. Small enterprises: these are establishments engaging in producing garments. To be included in the sample, the enterprise must employ fewer than 50 employees; the generation and grading of patterns and marker making must be done within the enterprise. Excluded from the sample are contractors who specialize only in the assembly of garments and those who use CAD in their business.
2. Owners: those who finance and manage the enterprise.

3. Computer-aided design service: a service that provides computer-aided design facilities such as generation, alteration, and storage of pattern pieces, grading and marker making. A fee will be charged for the services provided.

4. Relative advantage: the advantages of a CAD service relative to the owners' current business practices.

5. Uncertainties: concerns owners have about using a CAD service.

6. Characteristics of the enterprises which include:

   a. types of garments produced;
   b. length of time in business;
   c. number of employees;
   d. number and relation of family members in the business;
   e. number of customers;
   f. the degree of change in the pattern pieces;
   g. number of items produced per year;
   h. ways to produce and grade patterns and make markers;
   i. number of markers produced per week;
   j. use of computer for business operation;
   k. when are the markers made;
   l. whether the garments are made before or after receiving the orders.

7. Owners' characteristics which include:
    a. owners' activities in the enterprise;
    b. age;
    c. education;
    d. previous work experience;
    e. reasons for starting their business;
    f. use of and familiarity with computers;
    g. knowledge of CAD.

Conjectures

The researcher did not formulate hypotheses for several reasons. At the time the study was developed, the researcher could not locate literature pertaining to management of a CAD service, therefore, it was not known what were the variables that underly the perceptions of a CAD service. As this study was exploratory in nature, the researcher was not interested in prediction. Instead, she was interested in understanding the perceptions of a CAD service. Furthermore, because the sample size was small, formal testing of hypotheses would not have been practical. Alternatively, the researcher made several conjectures after reviewing literature on diffusion and adoption of innovations.

Conjecture 1

As owners accumulate experience over time, they gain an appreciation for the labour intensiveness of garment production. As a result, they may consider using technologies such as CAD to reduce the labour intensiveness of their business. Therefore, **the likelihood of using a CAD service may be related to the length of time the enterprise has been in business.**

Conjecture 2

Because labour is directly related to the number of garments produced by an enterprise, enterprises that produce a large number of items may have a greater need for technologies that would reduce the labour intensiveness of the production process. Therefore, it is conceivable that **the likelihood of using a CAD service may be influenced by the number of garments an enterprise produces.**

Conjecture 3

Designers make new patterns or modify existing patterns to create new styles. The degree of style change affects the amount of time designers have to spend on creating or modifying patterns. Therefore, **the likelihood of using a CAD service may be affected by the degree of style change.**

Conjecture 4

The owners' level of education may affect their understanding and appreciation of computer technologies in apparel design. Education may reduce the resistance to adopt a new technology because the owners have the ability to understand its complexity. Therefore, **the owners' level of education may influence the likelihood of using a CAD service.**

Conjecture 5

According to Raymond (1988), business owners' past computer experience is positively related to their likelihood of using computers in the business. Similarly, owners of small garment enterprises who have had experience with computers may appreciate the benefits of a CAD service. Therefore, **the owners' computer experience may affect their likelihood of using a CAD service.**

Conjecture 6

Familiarity with CAD may predispose owners to the benefits of CAD. Therefore, it is conceivable that **the likelihood of using a CAD service may be influenced by the owners' experience with CAD.**

Assumptions and Limitations

This research assumes that the small enterprises that specialize in custom designs are potential clients of a CAD service. Because of the time limitation, enterprises with more than 50 employees were not included in this study. The size of the sampling frame was small because of current economic conditions in Manitoba. In addition, because many small enterprises were not registered, the sampling frame contained only units that were known and accessible to the researcher. Consequently, the results of this study cannot be generalized to all small enterprises.

CHAPTER TWO

REVIEW OF LITERATURE

Because there is no published work on implementing a computer-aided design service for the apparel industry, the theoretical basis of this research is derived from literature from several disciplines -- home economics, clothing and textiles, marketing and management. This chapter includes discussions of research related to small business in the economy, small business in the apparel industry, diffusion and management of innovation, implementation of computer-aided design and a description of a computer-aided design service.

Role of Small Business in the Economy

Small business has been recognized as a contributor to economic growth, job creation, and ultimately the well-being of a nation (Harvey-Jones, 1991). Small businesses have many advantages over large companies -- informal lines of communication allow managers to gather information directly by observing and experiencing events (Grosh & Kantor, 1989) and the flexibility to quickly adapt to market fluctuations (Harvey-Jones, 1991). Ultimately, success of a business depends upon the manager's background and experience, the ability to adapt to changes in the market, and competitiveness (Steiner & Solem, 1988).

However, small business failure is a common occurrence (Steiner & Solem, 1988). Lack of strategic planning is cited as a major reason for failure (Crawford & Ibrahim, 1985). Strategic planning is defined as a process of systematic evaluation of the organization's capacity, opportunities, and risks present in the environment (Crawford & Ibrahim, 1985; Nelton, 1992). Nelton (1992) notes that businesses also fail because of the owners' lack of knowledge and the lack of ability to establish interpersonal relationships. Other reasons for failure include the lack of resources and expertise in developing new products or utilizing new technology (McDougall & Munro, 1984).

These last two factors are important in that Koehler (1989) and Kolbeck (1984) state that change in businesses is inevitable. However, managers in small businesses have limitations inhibiting the growth of their businesses. For example, owners of small businesses may recognize the need to change, but the absence of expertise may prevent them from identifying changes related to the company's objective and proposing solutions to problems (Grosh & Kantor, 1989). Furthermore, small businesses are limited by other factors such as managers' fear of failure (Epstein, 1992); resistance to change (Robbins, 1991); the vast number of complex choices; inadequate human capacity in decision-making; a lack of financial resources in organizations

(More, 1992); a lack of careful evaluation of new technology (Currie, 1989) or a lack of awareness about strategic and operational impact of the new technology (Crawford & Ibrahim, 1985; Currie, 1989).

Small Businesses in the Apparel Industry

The apparel industry in North America is characterized by a large number of small firms. In 1989, 88 percent of the Canadian apparel industry employed fewer than 100 employees (Industry, Science and Technology, 1992). Regardless of the size of individual apparel manufacturers, the apparel industry in general is characterized by labour intensiveness (Collier & Collier, 1990) and low profit margin.

The apparel manufacturing process involves planning and execution of product assembly such as making production patterns, grading patterns, generating markers, cutting, sewing, finishing, and pressing (Glock & Kunz, 1990). The process is divided into preassembly and assembly tasks. Preassembly process refers to the preproduction tasks that begin when a style is accepted in the line and that are completed when a style is ready for assembly. There are three major preproduction tasks. The first step involves creating patterns that meet all quality and production requirements. The second step is pattern grading which involves increasing and decreasing the dimension of a

pattern piece according to certain grade rules of proportional changes. This is done in order to create different sizes of a garment. The third step is marker making which involves diagramming or arranging the pattern pieces for style(s) in size(s) so that they may be cut at one time (Glock & Kunz, 1990).

Traditionally, the preproduction tasks are predominantly manual tasks that demand high levels of expertise and that are time consuming to perform with accuracy (Lee & Steer, 1991). More recently, Weintraub (1987) suggests that domestic apparel production is only feasible when applying modern technologies and current management methods.

With regard to modern technologies, Walter (1984) states "computer technology has unquestionably made the most significant impact in the recent past and will continue to do so in the immediate future" (p. 8). Today large apparel companies are using computer technology to decrease the labour intensiveness of the preproduction tasks (Wilhelm, 1983). Mechanization of preproduction tasks in garment manufacturing has resulted in improved production efficiency and, ultimately, an increase in competitive position of the manufacturing operations (Kosh, 1988). The use of computer technology in apparel design and manufacturing has been instrumental in lowering production costs.

To compete in the marketplace, owners of small garment manufacturing enterprises should be aware of the technological developments in the manufacturing process. In particular, computer-aided design (CAD) would have immense value to small apparel manufacturers. CAD would enable small manufacturers to respond quickly to style change and the market's demands.

CAD is a computerized method for drafting, grading, and analysing garment patterns and designs. Wight (1992) describes the three main functions of CAD as:

1. Pattern input - the digitizing of card patterns into a computer system.

2. Grading - the creation of X,Y co-ordinates to generate additional sizes.

3. Marking - the creation of a lay plan via a graphics work station (p. 61).

There are numerous benefits in using CAD. Digitizing the patterns into a computer can reduce the amount of time companies would spend on creating new designs or altering existing designs. As a result, the costs are minimized because many trial garments can be eliminated (Wilhelm, 1991). Once patterns are created, the CAD system can grade patterns with greater speed and precision than the manual method. The speed allows more styles to be graded and reduces the labour intensiveness of the process. Fraser (1985) showed that 81.7 percent of designers, patternmakers,

and production managers employed in apparel manufacturing companies that use some form of computerized production function, agreed that "CAD allows quick style changes through altering just a few pattern pieces to create a complete new garment style" (p. 38).

At the marker-making stage, CAD systems allow the operator to position the pattern pieces until the best configuration is achieved (Fraser, 1985; Hirshorn, 1983; Viana, 1992), thus resulting in a reduction of fabric utilization by two to ten percent (Collier & Collier, 1990; Viana, 1992). Hirschhorn (1983) reports significant savings in material and time when companies use computerized pattern grading and marker making. Thus, CAD systems can accelerate preproduction activities (Chapman, 1983; Cole, 1984; Finkle, 1984; Shim, 1984; Walter, 1984) and reduce lead time (Kosh, 1988).

While some advantages of CAD systems can be quantified, Ebel and Ulrich (1987) state that the real advantages of CAD cannot be evaluated in accounting terms. Ashby (1992) describes the powerful capacity of the CAD system in generating design. The generation of basic blocks from a company's own design library allows more styles to be created with few blocks in a given period of time. Furthermore, by using a computer, configuration, alignment, and proportion of the pattern pieces can be quickly and effectively made, thus greatly improving the final product

(De Long, Ashdown, Butterfield, & Turnbladh, 1993). Also, computerized grading and marker making reduce human error. As well, the efficiency of the system permits manufacturers to optimize their best labour force (Hirshorn, 1983). In all these ways, CAD is likely to result in better quality products which will in turn, raise the competitiveness of the enterprise.

In sum, companies that adopt automation technology enjoy many benefits. These benefits have multidimensional effects on competitiveness. Benefits such as improved capital and labour productivity are directly quantifiable whereas improved quality, reduced lead times and better overall control of the production process tend to be less easily quantified but are nevertheless extremely important (Hoffman & Rush, 1988). Achieving these advantages is especially important to small businesses who must compete with large manufacturers, and among themselves. However, before these small businesses can effectively avail themselves of these advantages, they must become familiar with the diffusion and management of innovation.

Diffusion and Management of Innovation

In North America, new technologies are generated at a rapid speed and with increasing complexity. The profusion of technology makes it difficult for organizations to understand its benefit and as a result, organizations are

slow to adopt new technologies. Therefore, there is a gap between the rate of development of new technology and the rate of its adoption (More, 1992).

Theories of Diffusion of Innovations

According to Rogers (1983), innovation is an idea, product or service perceived as new by the users. There are two dimensions to any innovation -- the attributes of the physical product and how well the innovation works. Adoption of an innovation involves the innovation, communication channel, the social system in which the innovation exists, and time. Rogers (1983) defines diffusion of innovations as the process by which an innovation is communicated through certain channels over time amongst the members of a social system.

With respect to communication, Rogers (1983) asserts that adoption of innovations entails dissipating the ideas through a chosen channel which is a process whereby individuals create and share information among participants in order to reach a mutual understanding. Effective communication occurs when the individuals involved share similar attributes such as beliefs, education levels or social status. When individuals do not have similar attributes, communication problems may arise.

With respect to the next factor, Rogers (1983) identifies the social system as a set of interrelated units

that are engaged in problem solving to accomplish a common goal. Because the structure of a social system establishes regulations and norms that give stability to and sets standards of acceptable behaviour for those within the system, it exerts a powerful influence on the adoption of innovations. Within the social system, innovations are diffused through opinion leaders and change agents. Similarly, Van de Ven (1986) advocates understanding the culture and resources of a community and the structure of the industry in which innovation is located before implementing innovations.

Finally, with respect to time, Van de Ven (1986) points out that although innovations are consistently being generated, their usefulness is not known until they are implemented. Therefore, time has a strong impact when evaluating the process of adoption of innovation (Rogers, 1983). Mowen (1990) believes that speed of diffusion is affected by the compatibility of the innovation with the values of those who will be affected by the innovation.

Although Rogers' theory is widely used by researchers, other interpretations of Rogers' theory are noteworthy. Van de Ven (1986) conceptualizes innovation as having four dimensions, namely, the human factor, the idea, the relationship between the innovation and others, and leadership. The process of innovation is "the development and implementation of new ideas by people who over time

engage in transactions with others within an institutional context" (p. 591). Van de Ven's (1986) interpretation is very similar to Rogers' because it recognizes the importance of the social system in diffusion of innovations.

Rogers' theory has also been applied to explaining consumer behaviour. Mowen (1990) interprets the process of diffusion of innovative products as a result of passing information from person to person within and across groups. A product is innovative only if it alters the behaviour or lifestyle of consumers. Furthermore, diffusion depends on several factors -- the social system, the characteristics of the innovation, the characteristics of the innovator, the personal influence process and the extent of the marketing effort.

Although diffusion of innovations is a collective process, Rogers (1983) also acknowledges the importance of individual perceptions in the process. The perceptions include:

1. Relative advantage - whether the user perceives the innovation as better than other alternatives.

2. Compatibility - the degree to which the innovation is in harmony with existing values, past experience, and needs of potential adopters.

3. Complexity - the users' understanding of the innovation.

4. Trialability - the ease with which the innovation could be tried out.

5. Observability - the visibility of the results.

When an organization embarks on adopting innovations, the individuals within it can be sources of resistance to change (Robbins, 1991). Koehler (1989) states that effective management of change involves managing the human element. To lower employees' resistance and help them overcome the initial feeling of loss and disorientation when the change process begins, employers can include employees in the initial stage of the decision making. As the innovation is installed, employers can plan activities to orient employees to the new work environment (Koehler, 1989). Robbins (1991) suggests that education, communication, and participation can reduce individual resistance to change. When individual resistance to change is reduced, an organization will become more receptive to new innovations.

However, not all innovations are successful. A potentially useful innovation sometimes fails because its impact is not known. According to Rogers (1983), perceived uncertainties regarding an innovation could be reduced by gathering information about how well the innovation works. Literature on management of innovations would help to identify the critical factors in implementing innovations.

The diffusion of an innovation depends on several factors. For instance, the social system exerts a powerful influence on the adoption of innovations. The speed of diffusion is strongly related with individual's perception of the innovation. The acceptance of an innovation will be facilitated if the user understands the advantages and disadvantages of the innovation to solve problems that may arise in the workplace. These factors should be well understood before implementing CAD system.

Implementing Computer-Aided Design

The rapid development of CAD technology demands that the users understand all aspects of the technology so that they know how to use it to respond to changes in the market. Rogers' theory (1983) addresses the factors that may facilitate the adoption of an innovation such as a CAD system. Implementing CAD involves a series of decisions: setting objectives, choosing the specific technology, development of human resources, (Pipino & Necco, 1981; Currie, 1989) communication and evaluation (Building an Engineering Team, 1991).

Beatty and Gordon (1990) advocate setting short and long term objectives for adopting CAD systems. Davies (1992) claims that "the successful consideration of CAD investment will be dependent on the business qualifying its objectives for the future, supporting this with a

willingness to change, and specifying financial commitment" (p. 93). Formal planning is crucial because it reduces the time spent on training operators and encourages employee involvement (Lefebvre, 1991). Ebel and Ulrich (1987) reaffirm the significance of planning by suggesting that managers pay attention to issues such as initial development and implementation cost, changes in the company's overall profitability, productivity and the return on investment.

Once the decision to computerize is reached, the next step is to choose the particular technology. Pepino and Necco (1981) state that choosing a technology involves four decision points: (a) studying feasibility; (b) identifying alternatives; (c) selecting a specific system; and (d) determining how to finance the system.

Although a new technology may have attractive strategic value, managers must consider its effects on the workplace, especially the people who will be directly or indirectly affected by installation of innovations. Beatty and Gordon (1990) warn that introducing a new technology in the workplace may create resistance to change. To overcome resistance to change, the authors suggest using a cross-functional project team with a "technology champion." The "champion" is one who has strong beliefs about improving the company's competitive position and technical expertise; he or she is able to motivate all those affected by the new system. Similarly, Ebel and Ulrich (1987) contend that, in

order to maximize the benefits of CAD, apparel manufacturers should establish teams with balance of knowledge, expertise, and seniority.

Furthermore, Bruwer and Havenga (1991) and Raymond (1988) agree that training is essential in adopting computer technology. Bruwer and Havenga (1991) suggest that the quality and the quantity of training in the use of computer systems determines the extent of trust that the user has in the systems. Finally, Beatty and Gordon (1990) also advocate using a pilot project before full-scale implementation continues.

The next step in implementing a CAD system involves communication of the new technology. Rosen (1993) contends the first vital step in the process of converting raw data into an intelligent decision is communication. According to Building an Engineering Team (1991), More (1992), Beatty (1990), and Beatty and Gordon (1990), the establishment of teams facilitates communication, thus promoting pro-active interaction between groups. Effective communication is achieved by putting everyone that needs to be in a team close to one another. Cross functional teams are recommended, because they contribute expertise to the project's success (Building an Engineering Team, 1991). However, the communication process is not complete without the ability of cross functional team to provide feedback, the key step in converting data into information.

Feedback is also related to the evaluation process in implementing a CAD system. Currie (1991) states that "it is virtually impossible to be in a position to assess quantifiable benefits from CAD in such a short space of time" (p. 25). However, the new system should be monitored to ensure that the desired objectives of the system are being met (Grosh and Kantor, 1989). The system should be flexible enough to adapt to the environment, when changes occur.

In order to evaluate the costs and benefits of implementing CAD in the manufacturing process, Grudier (1993) presents a step-by-step cost analysis to quantify the saving and benefits a CAD system can offer. Barbee (1988) estimates that it costs $146,250 to acquire the AM-5 system from Gerber Garment Technology Inc.

Therefore, for small apparel companies, the benefits of computer technology come at a very high cost. Kosh (1988) suggests that a company becomes increasingly involved with computer automation once it reaches the 101-200 employee level and Currie (1991) states that it will probably take one year and half to know whether CAD is a success. However, in smaller firms, there is a clear preference for investing in equipment with a short payback period (Hoffman & Rush, 1988). One alternative that would allow small companies access to CAD without the financial burden is to make available to them an independent CAD service.

A Computer-Aided Apparel Design Service

CAD would have immense value to small apparel manufacturers. CAD would enable small manufacturers to respond quickly to the market's demands. One way to allow small apparel producers to enjoy the benefits of CAD would be for them to have access to a CAD service offered by an educational institution. The services provided could include generation, alteration, and storage of pattern pieces, grading and marker making. A fee would be charged for the service.

The development of a CAD service must take into account the characteristics of a service and how it is evaluated by consumers. Unlike CAD software, which is a good, a CAD service, like any other service, is a performance (George & Berry, 1981) that is intangible. In addition, because people are involved in providing services, the quality of services may be inconsistent from one provider to the next (Berkowitz, Kerin, Rudelius, & Crane, 1991). Another characteristic of services is that their production and consumption may or may not be separable (Berkowitz et al., 1991). For example, the purchase of computer-aided design service is separate from its consumption when clients submit their orders to the service, the service providers work on the orders and the clients pick them up after a period of time. On the contrary, when clients use the CAD facilities in the service to work on their designs themselves, the

production of the CAD service is then inseparable from its consumption.

The intangible and inconsistent nature of services often result in risk perception. To make services perceived as consistent in their quality, companies may consider standardizing work procedures and training service providers (George & Berry, 1981). Furthermore, Berkowitz et al. (1991) state that clients evaluate services according to their complexity and divergence. Complexity is the number of steps and how complex are the steps in acquiring the services. Divergence is the amount of freedom clients may exercise in executing the service.

The Role of Educational Institutions in Promoting Apparel Computer Technology and Assisting Small Businesses

As the apparel industry in North America continues to use computer technology in design and production, apparel manufacturers will increasingly demand professionals with experience in CAD (Sheldon, 1988). Fraser (1985) reports that designers, patternmakers and production managers of apparel companies agree that education of the workforce is an important factor in adoption of computer technology. Therefore, it behooves educational institutions to pay attention to the human resource implications of the use of CAD because higher educational institutions are responsible

for preparing students for careers in the apparel industry (Sheldon & Regan, 1990).

The educational sector has many roles in a society or community. Its mandate is to educate students for careers and to create and transfer knowledge (Allen & Rohman, 1985) and technology (Raymond & Holmes, 1986). Technology is transferred when graduates begin working in the field. The second way to transfer knowledge and technology is when educational institutions provide continuing education to the community. Louzine (1983) proposes using short-term courses, group consultancy, action-oriented training, films, visits to factories currently using technological advanced systems to raise awareness of technology. Lastly, when faculty engage in consulting activities, knowledge and technology created at universities are put to practical use.

Another important role of educational institutions is to initiate innovations and development in the apparel industry. Sheldon and Regan (1990) suggest that Home Economics programs have the potential to lead the apparel industry in its efforts to computerize by providing students trained in CAD systems.

Although computer technology has become extensively used in apparel manufacturing, many teaching establishments do not have the technology to give hands-on experience to students ("Computer Course", 1983). Sheldon (1988) expresses concern that if computer technology continues to

be absent in clothing and textiles curricula, there will be a technology gap between education and the apparel industry in the future. The necessity to include computer-aided design in curricula of clothing and textiles programs in universities and colleges is also emphasized by Caldwell and Workman (1985).

The establishment of a CAD service in an educational institution may benefit both the students and the small enterprises. The service becomes an avenue to train students to apply theories learned in the classroom to practical problem solving. The students will learn to identify the needs of small enterprises in relation to pre-production tasks (designing, grading, and marker making) and to generate research projects to solve their problems. At the same time, short courses and workshops can be offered to give small business owners an opportunity to become familiar with the CAD system.

Educational institutions can contribute to small businesses by assisting newcomers in starting a business or by providing advisory service to existing businesses. Both Allen and Rohman (1985) and Miller and Kirschstein (1988) suggest that universities can provide an incubator environment for beginning small businesses by renting out the use of computer equipment based on profit. Incubators serve to fill the knowledge gap and reduce start-up operating costs (Allen & Rohman, 1985). The incubator

concept has been practised by the garment manufacturing sector in the city of Toronto (Todd, 1991).

Universities can also provide management assistance to small manufacturers to improve their competitive advantage. While many firms are aware of CAD, many do not know how to implement the new technology in the workplace (Ahlbrandt, 1992). To bridge the gap, educators could provide consulting service to assist in the choice and implementation of technology in small businesses. Again, the consultants could involve students in the projects so that the students could learn to apply theories to practical problem-solving.

To summarize, the development of computer technology has a tremendous impact on the apparel industry. Advantages of using CAD include improvements in productivity and efficiency. However, because of the high cost of CAD systems, only large manufacturers have been able to use the technology. For small manufacturers, owning a CAD system may not be practical because of financial or production-related constraints. One way to provide small manufacturers with the benefits of CAD is to establish a CAD service in an education institution. However, there is little information on how small apparel manufacturers perceive the advantages and disadvantages of a computer-aided design service.

Because there is no published research related to setting up a computer-aided design service, it is premature

to determine the feasibility of a CAD service. According to Rogers (1983), innovations are accompanied by uncertainties. Potential users of the service may not be certain how the CAD service may benefit them. There is no research pertaining to this area. However, Rogers' (1983) theory is used to deduce the relevant issues. According to Rogers (1983), understanding the user's perception of the CAD service may facilitate the introduction, as well as, the acceptance of CAD system into small garment manufacturing. By understanding potential users' perceptions and their uncertainties pertaining to a CAD service, it will give the provider of the service the basis for marketing the service.

CHAPTER THREE

METHOD

The researcher used a survey method to collect data because "surveys deal with phenomena as they exist; they do not attempt to alter anything experimentally nor do they involve random assignment of subjects or conditions as in experimental research" (Touliatos & Compton, 1988, p. 263). Also, well designed surveys provide accurate information about people; they allow the researcher to obtain specific data about a person's own experience or attitude. This chapter presents the procedure for carrying out the research and data analyses.

Procedure

To achieve the objectives of this research, the researcher developed a questionnaire which consisted of closed-ended and open-ended questions (Appendix A). The questionnaires were administered by structured interviews. During the interviews, respondents completed the close-ended questions, followed by an explanation of a potential CAD service and finally, the open-ended questions. In this section, the researcher accounts for activities pertaining to the development of the questionnaire, the sample, the presentation, the pilot test, data collection and analyses.

Development of the Questionnaire

Small enterprise owners often personally attend to many activities in the business. The absence of delegation of managerial responsibilities often shapes the operation of the enterprises (Grosh & Kantor, 1989). In this research, the questionnaire was developed to collect information about the owners' characteristics, the characteristics of the enterprises, the owners' perceptions of a CAD service, and the likelihood of using a CAD service.

Characteristics of the Owners

Seven questions were constructed to identify the characteristics of the owners. The questions pertained to the owner's age, level of education, reasons for starting the business, use of computer, and familiarity with computers and CAD. The research by Good and Levy (1992) provided the basis for the items for questions on reasons for starting the business.

Characteristics of the Enterprises

Eighteen questions were constructed to identify the characteristics of the enterprises. Some questions were designed to allow the researcher to understand the structure of the enterprises. The questions included the types of garments produced by the enterprise, the length of time the owners have been operating their business, the number of

employees, the number and relationship of the family members involved in the business, the number of garments produced and sold, and the number of customers. Furthermore, there were questions pertaining to the products and their production. The questions included the number of seasons produced, the number of lines per season, the number of styles per line, the number of sizes per style, the degree of style change, how the slopers are made, grading and marker-making practices.

Uncertainty and Relative Advantage

To identify owners' perceptions of using a CAD service, the researcher applied the concepts of uncertainty and relative advantage in Rogers (1983). The questions were open-ended because the types of relative advantage and uncertainties of using a CAD service were largely unknown. Open-ended questions allowed the subjects to convey their opinions to the researcher and the researcher could seek clarification of ideas where appropriate.

To identify uncertainty, subjects were asked to respond to the question "What concerns do you have about using a CAD service?" To identify relative advantage, two questions were posed to subjects -- "How would using a CAD service change the way you make garments?" and "How would using a CAD service change the business activities that you or your employees may do?" The questions were worded to reflect the

definition of relative advantage in Rogers (1983) which states that relative advantage is how the users perceive the new technology to be better than the method or methods they normally use. Note that the two questions cover the production and non-production dimensions of the enterprises. Because the owners often personally attend to many activities in the business, it was important to separate the two dimensions.

Conditions That Prevent or Encourage the Use of a CAD Service

Currently, there are companies that offer computer-aided design service in Canada. The researcher wanted to know whether the conditions that would prevent or encourage the use of a CAD service differ depending on the whether the institution is profit or non-profit oriented. Furthermore, when an institution considers offering a CAD service, the decision makers have to allocate resources. Therefore, it is important to consider both the technical aspects of the service and the support activities. Participants responded to the following open-ended questions:

1. If a private company offered a CAD service, what are the conditions that would attract you to use the service?
2. What would prevent you from using a CAD service provided by a private company?

3. If an educational institution offered a CAD service, what are the conditions that would attract you to use the service?

4. What would prevent you from using a CAD service provided by an educational institution?

The Sample

The sampling frame consisted of persons who operate small-scale garment manufacturing facilities in Winnipeg. It included members of professional organizations, enterprises listed under "Dressmaker" and "Designers-Apparel" in the Yellow Pages of the telephone book, names suggested by faculty members in the Clothing and Textiles Department, and names provided by the Government of Manitoba's Department of Trade, Industry and Tourism.

The enterprises had to meet several criteria before the researcher included them in the sample. The criteria were as follows:

1. The enterprise had to have fewer than 50 employees.
2. The owner had to be involved in the day-to-day management of the enterprise.
3. The enterprise had to produce apparel. Enterprises producing apparel and non-apparel items were also included in the sample.
4. The tasks of patternmaking, grading and marker-making had to be performed in the owner's workplace.

A volunteer sample was chosen because the sampling frame was small. To maximize the size of the final sample, the researcher interviewed all those who fit the criteria and agreed to participate.

Presentation

The purpose of the presentation was to provide respondents with sufficient information to make tentative judgements on whether they would use a CAD service. The presentation was purely descriptive; it was given after the respondents completed the close-ended questions.

Posters were constructed to help the interviewer describe and explain the CAD system and the CAD service. During the presentation, the interviewer explained CAD functions such as creating styles, developing lines, drawing silhouettes, developing patterns, grading patterns and making markers. The interviewer then continued to describe the services that a CAD service could provide, namely, pattern development, pattern grading and marker making.

Pilot Test

A research instrument must have validity. According to Walizer and Wienir (1978), face validity is a method that uses common sense and experience to judge the adequacy of a measurement device and the procedure. In cases of novel research projects where researchers cannot clearly define

the concepts, the indicators of the concepts must be thoroughly examined. Pre-testing was necessary because it could help the researcher to refine the questionnaire design and identify errors in the questionnaire, especially for novel research projects (Reynolds, Diamontopoulos & Schlegelmilch, 1993).

Following approval of the questionnaire by the Faculty of Human Ecology's Ethics Review Committee (Appendix B), the questionnaire was tested on three owners of small enterprises in Winnipeg. After the questionnaires were administered and the interviews were completed, the owners were asked to evaluate the clarity of the questions and to suggest changes (Appendix C). Subsequently, the researcher revised the instrument.

Pretesting the questionnaire allowed the researcher to assess the operational definitions of uncertainty and relative advantage; to clarify several questions and to eliminate questions that yielded meaningless responses. Several modifications to the questionnaire were made. The major change occurred in the question about the owner's likelihood of using a CAD service. The original question had five classifications of likelihood. However, in the pre-tests, respondents had difficulty relating to the classification of "maybe, if the conditions were favourable" because "if the conditions were favourable" was not the reason for responding to "maybe." To avoid biasing the

respondents, the researcher decided to ask them to mark the likelihood of using a CAD service on a continuous line which was 126 mm in length. One end of the line was labelled "definitely will use" and the other end was labelled "definitely will not use." This method allowed respondents to freely attribute meanings to any level of likelihood.

Data Collection

Data collection took place over the months of October and November of 1993. In early October, 1993, letters (Appendix D) were sent to 61 businesses. One week after the letters were mailed, the researcher telephoned the owners. At the initial telephone contact, the researcher asked a series of questions to screen out the businesses that did not fit the established criteria. Among those who fit the criteria, 11 owners agreed to be interviewed. Two of the eleven were eliminated from data analysis because one enterprise specialized in alteration of garments; the other enterprise was a manufacturer whose characteristics were very different from the home-based businesses. Consequently, nine businesses were included in data analysis.

The questionnaires were administered by structured interviews. Because the researcher's first language is Portuguese, she hired an English-speaking graduate student

in Clothing and Textiles to conduct the interviews. The researcher and the interviewer visited the owners in person.

At the beginning of the interviews, the interviewer reiterated the purpose of the research and asked the participants to sign the consent form (Appendix E). After the participants completed the close-ended questions, the interviewer gave a presentation of CAD and CAD service. After the presentation, the interviewer asked the open-ended questions. The responses were recorded on an audio tape.

Data Analysis

Mosteller and Tukey (1977) describe three levels of statistical analysis -- indication, determination, and formal inference, representing progressively higher levels of precision. For this research, indication is a suitable course to take because the sample is small. Formal inference is not possible because tests of significance could be meaningless and misleading. The researcher analyzed the data by using primary statistics and graphs.

Coding of Responses to Open-Ended Questions

After the open-ended responses were transcribed from the audio tapes, five sets of responses were randomly selected from the nine transcripts for pre-coding. For pre-coding, the researcher, the researcher's advisor and the research assistant independently read the five

transcriptions and established tentative categories of responses. The three coders met to compare the categories they assigned to the responses. When disagreements occurred, the coders clarified their interpretations of the responses until agreements were reached. Where coders could not compromise on their interpretations, a new category was established. The exercise resulted in a tentative coding scheme.

Using the tentative coding scheme, the researcher and her advisor proceeded to code all the cases independently. When the two coders compared their work, there was a high level of agreement in the way they assigned responses to the categories. When the two coders disagreed with the assignment of responses, they either clarified their interpretations until an agreement was reached or established a new category. Appendix F contains the coding scheme for the open-ended responses.

CHAPTER 4

RESULTS

This chapter contains descriptions of the characteristics of the respondents, the characteristics of the enterprises, the types of relative advantage of a CAD service, the uncertainties of using a CAD service, the conditions that prevent and encourage the use of a CAD service, and finally, the likelihood of using a CAD service.

Characteristics of the Respondents

Table 1 summarizes the demographic characteristics of the respondents. A majority of the respondents are between 31 to 50 years old. Six respondents have been in the business of dressmaking for ten or more years; three have been in their businesses for fewer than two years. Five respondents have had some or completed university education; two respondents have had at least some grade school or high school; and two have had some or completed vocational training or community college.

Seven respondents have previous work experience not related to apparel design. Four respondents worked in the apparel manufacturing enterprises; three taught apparel design or learned drafting and sewing in design courses. Three respondents sewed for themselves or for others before starting their businesses.

Table 1

Demographic Characteristics of Respondents (N = 9)

Demographic Characteristics	n	%
Age		
30 years and younger	0	0
31 to 50 years old	8	88.9
51 years or older	1	11.1
Education		
Some grade school	1	11.1
Some high school	1	11.1
Some university	4	44.4
Completed university	1	11.1
Some vocational training	1	11.1
Completed vocational training	1	11.1
Previous Work Experience		
Others	7	77.7
Apparel manufacturing enterprises	4	44.4
Design courses	3	33.3
Sewing by myself	3	33.3

Table 2 shows the major reasons respondents gave for starting their own business, while Table 3 shows the reasons that were ranked 1, 2, or 3 by the respondents. Most of the respondents wanted to achieve a personal sense of accomplishment and to use their own experience and skills. Seven respondents indicated that they had relevant previous work experience and they wanted to run a business on their own. Six respondents started their own business because they thought there was a need for their products. Some

thought that starting a business was a good way to create a job for themselves and they wanted to be their own bosses.

Table 2

Respondents' Reasons for Starting Their Own Business (N = 9)

Reasons	n	%
I want to achieve a personal sense of accomplishment.	8	88.9
I want to use my own experience and skills.	8	88.9
I have relevant previous work experience.	7	77.8
I want to run a business on my own.	7	77.8
There is a real need for my product.	6	66.7
It is a good way to create a job for myself.	6	66.7
I want to be my own boss.	6	66.7
I need to make a living.	4	44.4

Table 3

Respondents' Ranking of Selected Reasons for Starting Their Own Business (N = 9)

Reasons	Rank in Order Of Importance	Frequency
I want to achieve a personal sense of accomplishment.	1	1
	2	3
	3	3
I want to use my own experience and skills.	1	1
	2	3
	3	2
I want to run a business on my own.	1	2
	2	1
I want to make a living.	1	3
I want to be my own boss.	1	1
	3	2

Table 4 shows that although a majority of the respondents never used computers in their everyday lives, many were aware of computers. One-half of those who used computers used them for business purposes. Six respondents reported knowing nothing at all about computer-aided design whereas three reported having some familiarity with CAD software.

Table 4

Respondents' Familiarity With Computers and With CAD (N = 9)

Computer Literacy	n	%
Use of computer		
Always	0	0
Most of the time	1	11.1
Sometimes	2	22.2
Rarely	1	11.1
Never	5	55.6
Purpose of using computer		
Business purposes	2	22.2
Particular purpose	2	22.2
Familiarity with computer		
Know how to use	4	44.4
Know about but do not use	2	22.2
Nothing at all	3	33.3
Familiarity with CAD		
Know how to use	0	0
Know about but do not use	3	33.3
Nothing at all	6	66.7

Characteristics of the Enterprises

Responses to questions about the number of lines, the number of styles, the number of sizes and the number of markers made per week are omitted from discussion because the respondents engage in custom work.

The enterprises produce basically four categories of garments (Table 5). A majority of the enterprises produced

formal wear, women's wear and sportswear. Others produced children's wear; one specialized in alterations.

Table 5

Types of Garments Produced by Enterprises (N = 9)

Types of Garment	n	%
Formal wear	8	88.8
Women's wear	6	66.7
Sportswear	5	55.5
Children's wear	4	44.4
Alteration	1	11.1

The enterprises have been in business from 34 months (2.83 years) to 360 months (30 years). The average length of time is 143.78 months (12 years); the median is 144 months (12 years). Seven enterprises reported having no employees other than the respondents themselves. For the two enterprises that reported having employees, there is only one employee in each case. The respondents perform many activities such as production, construction, design, consultation, management, and retail (Table 6).

Table 6

Respondents' Activities in Their Business (N =9)

Activities	n	%
Production	9	99.9
Construction	8	88.8
Design	5	55.5
Consultation	4	44.4
Management	2	22.2
Retail	1	11.1

From 1991 to 1993, the enterprises reported having anywhere from 36.67 to 1800 customers. The mean number of customers is 333.04 whereas the median is 64.16.

For the average number of garments produced per year from 1991 to 1993, Table 7 shows that a majority of respondents produced an average of fewer than 100 garments. One enterprise produced over 2,000 garments. Almost all respondents produced garments after orders have been received.

Table 7

Average Number of Garments Produced and Production Plan

(N = 9)

Production Characteristics	n	%
Number of garments produced		
Fewer than 100	4	50.0
Between 101 and 300	3	37.5
More than 2000	1	12.5
Percentage of garments made after receiving orders		
60%	1	11.1
95%	1	11.1
100%	7	77.8

Table 8 shows that all respondents perform preproduction activities such as making and grading of patterns, and marker making by hand. Five respondents reported having to draft new patterns always or most of the time whereas one respondent rarely drafts new patterns. Four respondents reported planning markers in advance always or most of the time.

Table 8

A Summary of Production Activities Reported by Respondents

(N = 9)

Activities	n	%
Drafting slopers by hand	9	100
Grading patterns by hand	9	100
Making markers by hand	9	100
Making new patterns		
Always	1	11.1
Most of the time	4	44.4
Sometimes	3	33.3
Rarely	1	11.1
Planning markers in advance		
Always	1	11.1
Most of the time	2	22.2
Sometimes	1	11.1
Never	1	11.1

In summary, the enterprises have been in business for an average of 12 years. The respondents are 31 to 50 years old; many completed or have some university education. Many worked in areas other than apparel design before starting their own business; all respondents have some experience in clothing construction. Respondents embarked on their own business primarily because it gave them a sense of accomplishment and the opportunity to use their own experience. Many tend not to use computers in their everyday lives but are familiar with them. Many respondents know nothing about CAD; those who know something about CAD

do not know how to use it. The enterprises are often operated by the respondents themselves. The number of customers ranges from 37 to 1800 with one half of the respondents having at least 64 customers for the years 1991 to 1993. A majority of the enterprises make fewer than 100 garments per year. The design activities of drafting patterns, grading and marker making are often done by hand.

Criteria for Using a CAD Service

Respondents indicated the importance of nine criteria for using a CAD service. Table 9 shows that credibility of the institution offering the service approaches "extremely important"; all respondents regarded this criterion either "very important" or "extremely important." Grading rules, cost of the service, security of designs, and turnaround time were considered "very important" by respondents. To be able to attend CAD workshops or to personally use the CAD software, the service's distance from the respondents' workplace and who operates the service were "somewhat important."

Table 9

Importance of Criteria for Using a CAD Service (N = 9)

Criteria	Importance[a]
Credibility of the institution offering the service	4.67
Grading rules used by the service	4.22
Cost of the service	4.11
Security of my designs	4.11
Turnaround time	4.11
To be able to attend CAD workshops	3.78
To be able to come to the service and personally use the CAD software	3.67
Distance from my workplace	3.22
Who operates the service	3.11

[a] 5 = Extremely Important 4 = Very Important
3 = Somewhat Important 2 = Not Very Important
1 = Not Important At All

Relative Advantage

Rogers (1983) defines relative advantage as "the degree to which an innovation is perceived as better than the idea it supersedes" (p. 15). To identify relative advantage, respondents were asked the questions "How would a CAD service change the way you make garments?" and "How would

using a CAD service change the business activities that you or your employees may do?"

It was evident from the interviews that responses to both questions were almost identical. Hence, the researcher reports the results without making any distinctions between production and non-production activities.

The types of relative advantage expressed by respondents are listed in Table 10. Although respondents generally perceived the use of a CAD service leading to changes in practice that were better than their current practice, they also perceived changes that might not be better than their current practice. The negative changes will be pointed out as the results are being reported.

Facilitating Production

A majority of the respondents expressed the opinion that a CAD service would facilitate production by enabling them to produce patterns that are accurate and to become more efficient and productive in their work.

Time Reduction

A CAD service may reduce the amount of time respondents would spend on generating patterns and markers; it may reduce the amount of time they spend on fitting the garments as well as the frequency of fitting the garments.

Table 10

Types of Relative Advantage in Using a CAD Service (N = 9)

Relative Advantage	n	%
Facilitating production	6	75.0
Time reduction	5	62.5
Reallocation of time*	4	50.0
Organization	4	50.0
Cost structure*	2	25.0
Help financially	1	12.5
Additional service	1	12.5
Employ more people	1	12.5
Flexibility	1	12.5
No difference	1	12.5

Note. * indicates repondents perceived advantage and disadvantage.

Reallocation of Time

Some respondents indicated that they may reallocate their time as a result of using a CAD service. When the patterns, grading and marker making are done by someone else, the time that respondents would normally spend on these activities could be used for other activities such as spending time with clients. On the other hand, one respondent expressed the concern that if the time saved on

the design functions is spent on commuting to the place where the service is provided, there may not be any advantage to using a CAD service.

Organization of Information

Respondents thought that a CAD service would help them organize and retrieve their clients' information.

Other Advantages

Less frequently mentioned advantages of using a CAD service include the possibility of improving the financial situation of the business. If the business became prosperous as a result of using CAD, respondents said that they may employ more people. A CAD service may enable some respondents to be flexible in providing additional services such as pattern making only.

Uncertainties in Using a CAD Service

To ascertain the uncertainties in using a CAD service, the researcher asked the respondents to express their concerns about using a CAD service. The six areas of uncertainties are listed in Table 11, followed by an account of each type of uncertainty.

Table 11

Concerns About Using a CAD Service (N = 9)

Concerns	n	%
Competence of service givers	7	77.7
Response to clients' deadlines	5	55.5
Cost	4	44.4
Security	2	22.2
Access	2	22.2
Knowledge	2	22.2

Competence of Service Givers

The majority of the respondents expressed concerns over the quality of work and accuracy of the patterns. Therefore, the competence of the service givers is an important consideration.

Response to Clients' Deadlines

Five respondents indicated that a CAD service must enable them to meet clients' deadlines. The service should be available to them when they need it; it should also be able to quickly complete the work.

Cost

Four respondents recognized that using a CAD service would incur additional cost of running their business. Therefore, the cost of using the service may affect whether or not they would use it.

Security

Two respondents were concerned that if they used a CAD service, their designs may be copied by other patrons of the service.

Access

Two respondents indicated that they do not want their orders to be placed on a waiting list when they want their work done. The physical location of the service may prevent potential users from getting to the service.

Knowledge

Two respondents indicated that to fully appreciate and understand the advantages of a CAD service, they must first have some knowledge of computer-aided design.

Conditions that Prevent or Encourage the Use of a CAD Service

When the respondents were asked to indicate the conditions that would prevent or encourage them to use a CAD service offered by a private institution versus one that is offered by an educational institution, they frequently indicated that they could not see any difference in the conditions regardless of who offered the service. As a result, the researcher coded the answers disregarding the institutions. However, a few responses about educational institutions are pointed out because they may have important implications.

Conditions that Prevent the Use of a CAD Service

Table 12 summarizes the 10 conditions that would prevent respondents from using a CAD service.

Cost. Many respondents would not use a CAD service if the cost of using it was too high.

Customer satisfaction. If the service could not guarantee quality and accuracy of the work, respondents may not use it.

Location. If the location of the service was not convenient, respondents expressed doubts about using a CAD service.

Security. Respondents expressed concerns over the security of their designs. They did not want anyone other than the service givers to have access to their designs.

Table 12

Conditions Preventing the Use of a CAD Service (N = 9)

Conditions	n	%
Cost	6	75.0
Customer satisfaction	3	37.5
Location	3	37.5
Security	2	25.5
Reputation	1	12.5
Qualification	1	12.5
Assignment of work	1	12.5
Speed	1	12.5
Access	1	12.5
Potential users' lack of knowledge	1	12.5

Others. Other infrequently mentioned conditions that would prevent the respondents from using a CAD service are as follows.

1. A **poor reputation** of the institution offering the service.
2. The service givers do not have the **qualifications** to carry out their work.

3. If many operators are allowed to work on an order, the quality of work may be jeopardized. Therefore, the **assignment of work** is an issue.

4. Respondents do not look favourably on a service that **fails to complete the order on time.**

5. A service that is **not available** to clients when they need to use it.

6. If the potential users of a CAD service are not **knowledgeable about computer-aided design**, they may not perceive the benefits of using it.

Conditions that Encourage the Use Of a CAD Service

The conditions expressed by respondents are frequently the opposites of the conditions that would prevent them from using a CAD service. Table 13 summarizes the conditions that would encourage respondents to use a CAD service.

Cost. Respondents may consider using a CAD service if the cost is reasonable.

Customer satisfaction. Respondents would consider using a CAD service if it can guarantee the quality and accuracy of its work. Respondents also expect business transactions to be handled in a professional manner.

Access. The location of the service should be such that it is convenient to reach. Respondents would like to be able to use the service at a time that is convenient to them.

Credibility. Respondents would take into consideration the credibility of the institution offering the service in their decision to use a CAD service.

Table 13

Conditions Encouraging the Use of a CAD Service (N = 9)

Conditions	n	%
Cost	8	88.9
Customer satisfaction	6	66.7
Access	5	55.6
Credibility	2	22.2
Speed	2	22.2
Security	2	22.2
Continuing education	2	22.2
Learning experience for students	2	22.2

Speed. To attract potential users, a CAD service must be able to process the orders in a timely fashion so that the potential users can meet their clients' deadlines.

Security. Respondents would look favourably upon a CAD service that safeguards the clients' designs.

Continuing education. Some respondents indicated that they would like to attend workshops about CAD so that they could learn more about it. Therefore, continuing education activities may be looked upon favourably by potential users.

Provide learning experience for students. A few respondents recognized that if a CAD service were offered by an educational institution, it could provide valuable learning experience for students.

Perceptions of a CAD Service Offered by a Private Institution vs. an Educational Institution

Overall, regardless of who offered a CAD service, the respondents' concerns were very similar. However, some respondents seemed to have perceptions of educational institutions that may have implications for marketing a CAD service.

If a CAD service were to be offered by an educational institution, some respondents expected to pay less for the service. Other specific remarks were made in reference to the perceived quality of work. For example, one respondent expressed the following:

> The only thing I might think of not using it would be if I wanted, for example, something that's professionally done, then I would go to somebody that is a private company that is well established.

When the respondent was asked to elaborate on what she meant by "professionally done", her response was:

> .. with an educational institution.....they are probably still in the process of learning, on going, mind you, it could be just as professionally done.

Likelihood of Using a CAD Service

Likelihood of using a CAD service was measured by asking respondents to place a mark on a line 126 mm in length with the left end marked "definitely will not use" and the right end marked "definitely will use." For each response, the distance from the left end to the mark was measured in millimetres.

The likelihood responses ranged from 0 mm to 120 mm. The respondent who marked 0 (definitely will not use) indicated that as she was approaching retirement, she saw no need for her to use a CAD service. The mean distance is 82.78 mm; two-thirds of the responses fall above the mean. The median is 91 mm. The mean and the median are different because the presence of the value of 0 lowered the average likelihood score. The researcher chose to use the median in subsequent discussions of likelihood of using a CAD service.

The researcher has several conjectures about the characteristics of the respondents and the likelihood of using a CAD service. The characteristics include the length of time the enterprise has been in business, the number of garments produced by the enterprise, the degree of style change, respondents' education, their familiarity with computers and computer-aided design.

The Length of Time the Enterprise Has Been In Business

Figure 1 shows that those who have been in business for a short time seem to be more likely to use a CAD service than those who have been in business for a long time. This is in contrast to the researcher's expectation that the greater the length of time the enterprises have been in business the more likely the owners would use a CAD service.

The Number of Garments Produced

Figure 2 shows a plot of the average number of garments produced by respondents between 1991 and 1993 and the likelihood of using a CAD service. Note that one respondent reported having produced 2,833 garments per year. For the four respondents who made fewer than 100 garments, the likelihood scores ranged from 67 to 120; this range is considerably wider than the range of likelihood scores among respondents who produced more than 100 garments, which is 91 to 107.

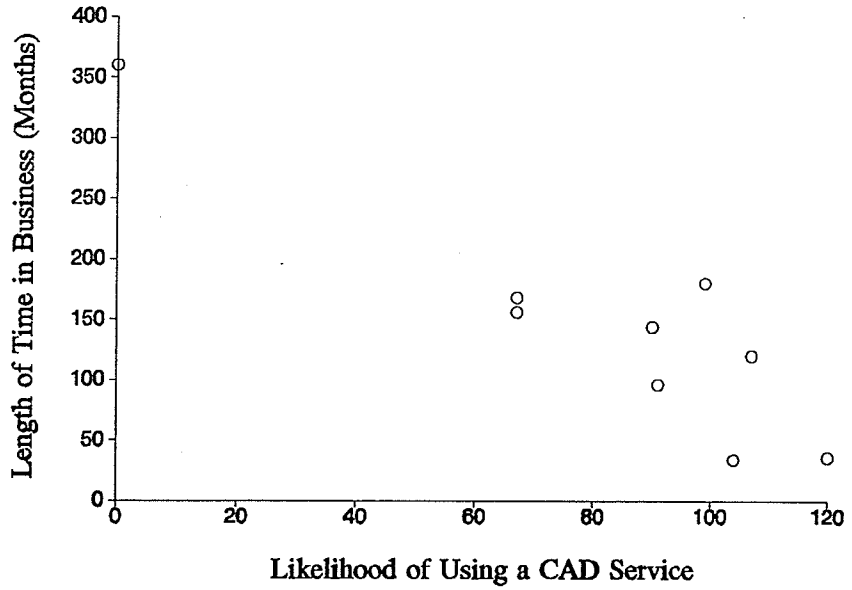

Figure 1. Length of time in business and likelihood of using a CAD service

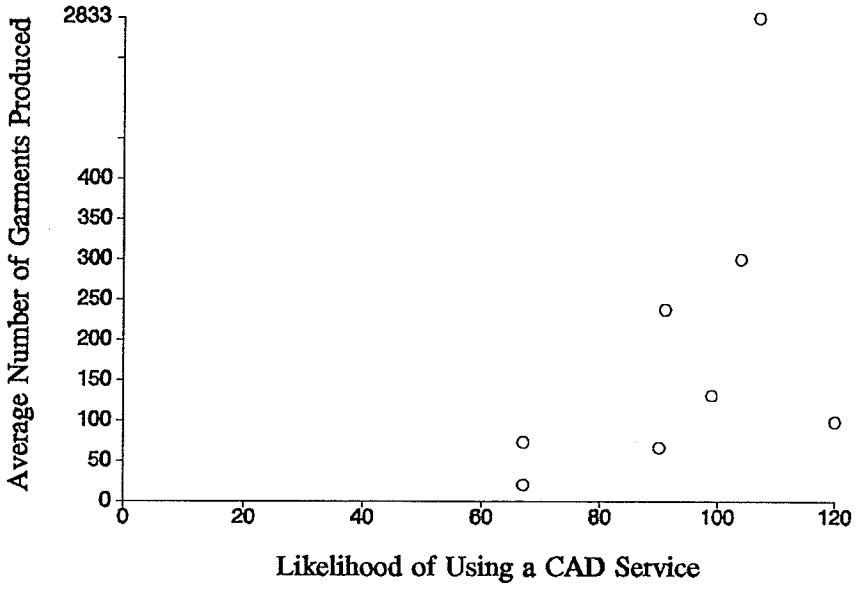

Figure 2. Average number of garments produced and likelihood of using a CAD service.

The Degree of Style Change

Figure 3 shows that among respondents with likelihood scores above the median, two draft new patterns some of the time, one drafts new patterns most of the time and one drafts new patterns all the time. Among respondents with scores below the median, three draft new patterns most of the time whereas one rarely drafts new patterns.

The Respondents' Level of Education

Figure 4 shows that among the respondents with likelihood scores above the median, three have had university education whereas one completed vocational training. Among respondents with likelihood scores below the median, two have had university education; one completed vocational training and one completed high school.

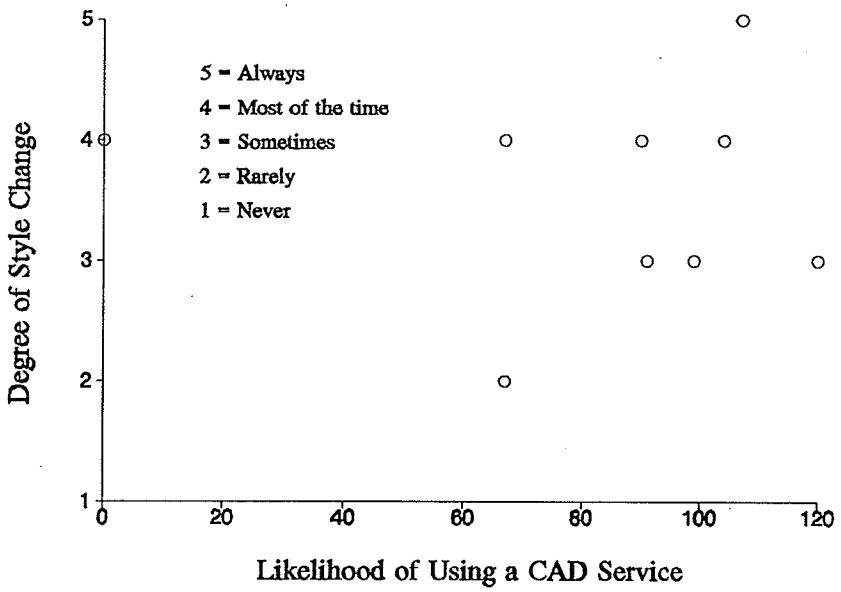

Figure 3. Degree of style change and likelihood of using a CAD service.

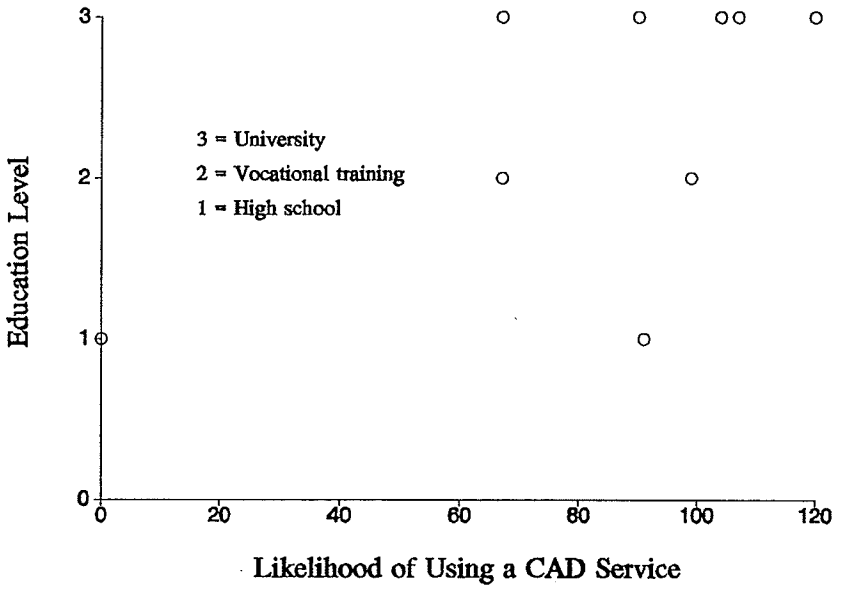

Figure 4. Education level and likelihood of using a CAD service.

The Respondents' Familiarity with Computers

Figure 5 shows that among the respondents with likelihood scores above the median, two knew how to use computers and two knew about computers but they did not know how to use them. Among respondents with likelihood scores below the median, two knew how to use computers and two knew nothing about them.

The Respondents' Familiarity with Computer-Aided Design

Figure 6 shows that all respondents do not know how to use CAD software for apparel design. Among respondents with likelihood scores above the median, three indicated knowing about CAD but they did not know how to use it; one indicated knowing nothing about CAD. All the respondents with scores below the median indicated knowing nothing about CAD.

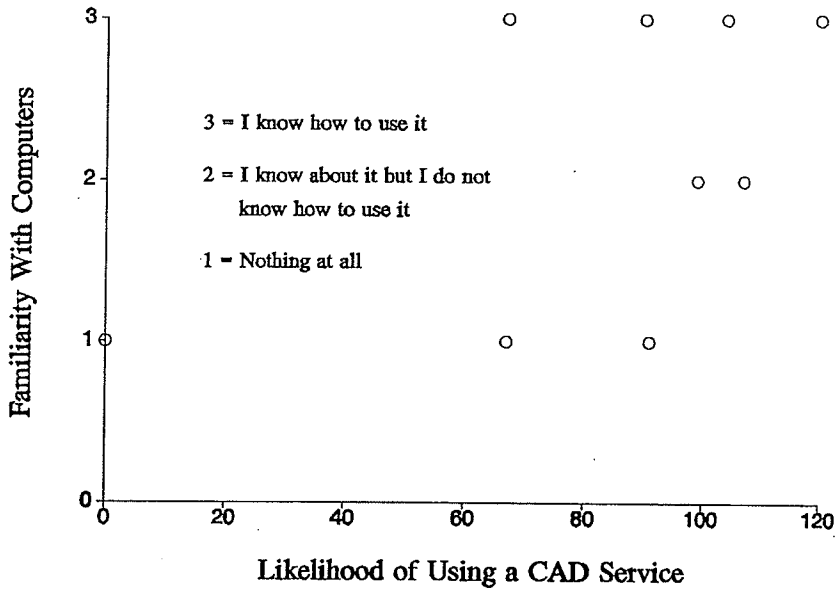

Figure 5. Familiarity with computers and likelihood of using a CAD service.

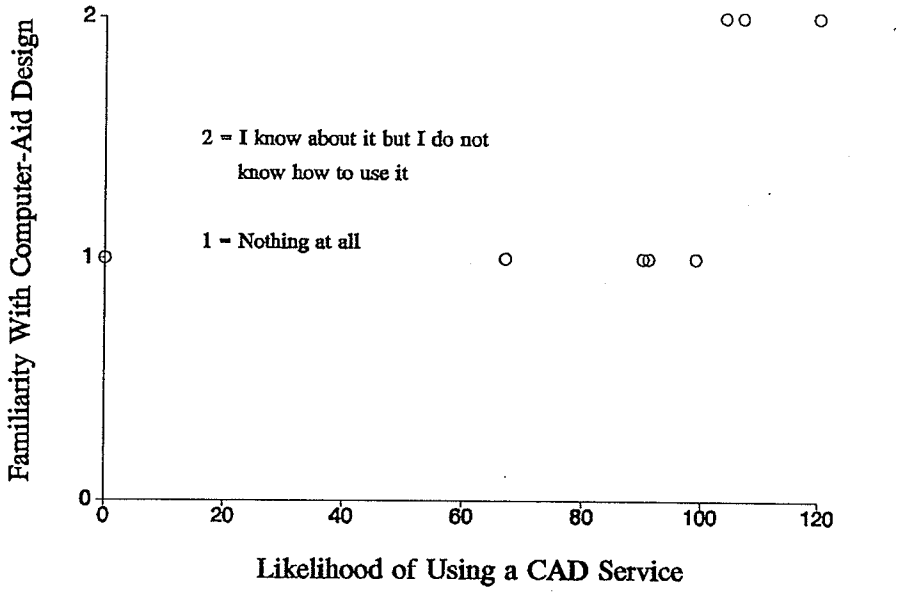

Figure 6. Familiarity with CAD and likelihood of using a CAD service.

CHAPTER 5

DISCUSSION

The chapter begins with a discussion of various observations followed by an interpretation of findings according to the theory of diffusion of innovations (Rogers, 1983) and characteristics of services. Frequently, the responses to questions about the uncertainties of using a CAD service and the conditions that encourage and prevent the use of a CAD service were similar. Therefore, the researcher interprets the findings to those questions according to the concepts of compatibility, complexity, trialability and observability (Rogers, 1983).

Sample

The low response rate of this study may have been attributed to the small sampling frame and the economic conditions of Manitoba at the time this study was conducted. The sampling frame is small because the number of businesses that fit the researcher's criteria is relatively small. In addition, the economic recession has seriously affected potential participant's willingness to give time for an interview.

Criteria for Using a CAD Service

When respondents were asked to indicate the importance of various criteria for using a CAD service in a close-ended format, the issue of credibility was the most important. However, during the interviews, when respondents were asked to comment on the concerns of and the conditions that would prevent or encourage them from using a CAD service, the issue of credibility did not seem to be pressing. No one mentioned credibility as a concern; no more than two respondents brought it up as a condition that would encourage or prevent them from using a CAD service. The other criteria in the questionnaire were eventually articulated by the respondents in the interviews.

Likelihood of Using a CAD Service

Because the sample size is small, the researcher cannot make any conclusive statements about what affects the likelihood of using a CAD service. However, two observations about the characteristics of the enterprises and the respondents warrant discussion.

The researcher's expectation that those who have been in business for a long time may be more inclined to use a CAD service is contradicted by the results of this study. It seems that there may be an inverse relationship between the length of time the enterprise has been in business and the likelihood of using a CAD service. Considering the

predominance of custom work in this sample, the nature of the product may have influenced the likelihood of using CAD. Another explanation may be that over time, some respondents may have developed a high degree of skill which enables them to execute their work quickly and accurately. Consequently, those who have been in business for a long time may not perceive any benefits in using a CAD service.

In addition, the observations about the degree of style change and the likelihood of using a CAD service further indicate the role of the product in adopting a CAD service. When the product involves a high level of workmanship and distinction in style, a CAD service may not bring readily identifiable benefits to the business owner.

Relative Advantage

The findings in this study seem to be consistent with the theory of diffusion of innovations by Rogers (1983) who defines relative advantage as "the degree to which an innovation is perceived as better than the idea it supersedes" (p. 15). Furthermore, the types of relative advantage perceived by potential adopters of innovations seem to be determined by the nature of the innovation.

Facilitating Production

Facilitating production seems to be a dominant relative advantage perceived by respondents. Furthermore, the time

dimension appears to have two elements -- time reduction and time reallocation. The nature of the innovation, the CAD service, allows the users to reduce the amount of time they spend on labour intensive activities such as producing patterns, grading, marker making and organization.

Time is an important dimension because the nature of apparel production is labour intensive. In many cases, the respondents' designs are highly customized and their production is time-consuming. Moreover, customized apparel production results in making new patterns for each order. As the number of customers increases, more time is needed to keep track of pattern pieces and client information. Respondents recognize that by using a CAD service, they may be able to store and retrieve patterns and clients' information in a more organized manner than their current practice.

The time saved on labour intensive activities may be reallocated to other activities in the business. In this study, many respondents are responsible for almost all aspects of their business; they recognize the CAD service as an opportunity to free up time to attend to other aspects of their business. On the contrary, if the time saved on labour intensive activities is spent on commuting to the service, there may not be any relative advantage in using a CAD service.

Economic Profitability

Rogers (1983) states that the degree of relative advantage is often expressed in terms of economic profitability. Respondents recognize that using a CAD service may incur additional cost to their business. On the contrary, a few respondents perceive that over time, a CAD service may result in economic profitability because the service would enable them to have more clients and to offer additional services. In other words, the respondents seem to have perceived both a potential for and lack of economic profitability in using a CAD service.

Compatability with Needs of the Client System

Rogers (1983) states that adoption of innovations is affected by its compatibility with the needs of the client system. In this study, some of the uncertainties of using a CAD service and some of the conditions that prevent or encourage the use of a CAD service seem to have stemmed from the types of apparel being produced, which in turn determine the respondents' need structure.

Nature of the Product

Many of the participating enterprises specialize in customized formal wear such as wedding gowns and bridesmaid's dresses. The uncertainties about the competence of service givers, the ability of a CAD service

to meet clients' deadlines and access may have been shaped by the type of apparel the respondents produce.

The symbolic significance of ceremonial apparel such as brides' and bridesmaids' dresses dictates a high quality of workmanship and fit. Furthermore, the occasion of a wedding also creates an uncompromisable limit on the amount of time it takes to finish the garments; if the garments are not completed on time, their utilities will be totally lost. The degree to which respondents can satisfy their clients' demands depends on the amount of control they can exert over the quality and accuracy of their work. In using a CAD service, respondents may have perceived risks of losing control over the quality and accuracy of their work.

Similarly, the type of products may have shaped the respondents' uncertainty about security. Consumers use the respondents' services presumably because they cannot find suitable substitutes in the ready-to-wear market. Respondents may be concerned that once the designs are placed in the care of a CAD service, the designs may be leaked to other users of the service. Failure to protect the "exclusive" status of their designs may result in losing the trust of their customers.

Complexity and Trialability

Respondents expressed uncertainties about their lack of knowledge to understand the benefits of a CAD service. This behaviour is consistent with Rogers' theory that a lack of knowledge about an innovation may lead to perception of risk about it. The concern about a lack of knowledge may be triggered by the complexity of CAD. Because the respondents know very little about CAD, they may find the concept of CAD and a CAD service complex; consequently they may have difficulty realizing the full range of benefits a CAD service can offer.

Some respondents expressed the desire to attend CAD workshops offered by the service. This behaviour may be a response to lower the barrier presented by the lack of knowledge of CAD. By offering workshops, a CAD service introduces trialability, which is "the degree to which an innovation may be experimented with on a limited basis" (Rogers, 1983, p. 231).

Observability

Rogers (1983) states that observability of an innovation is the degree to which the results of an innovation is visible (p. 232). Some of the conditions described by respondents as preventing or encouraging them to use a CAD service may have stemmed from the intangibility of the service which, to the respondents, is not observable.

The risks perceived in cost, guarantee, access, security, qualifications and speed exist because the consequences are not visible.

CHAPTER 6

CONCLUSION, IMPLICATIONS AND SUMMARY

In this chapter, conclusions are made with respect to the objectives of this study. Implications for further research follow.

Relative Advantage

In general, although the sample size is small, the findings are consistent with the concepts in Rogers (1983). The researcher is able to identify several types of relative advantage of using a CAD service, with two major types being facilitating production and economic profitability. The types of relative advantage also seem to originate from the characteristics of formal wear.

In this study, the custom designs and the lack of division of labour in the respondents' businesses dictate the quality of the final product and the pace with which respondents work. A CAD service must be perceived as compatible with the potential users' time constraints and the quality of work their clients expect from them.

Economic profitability is another dominant type of relative advantage. The results of this study suggest that potential adopters of a CAD service seem to be able to envision the long-term benefits of using a CAD service but they are not altogether clear about its short-term financial implications. In addition, the observation that the

respondents could not separate how a CAD service may change the way they produce garments and the way they may conduct their business in general is an indication that they may not be aware of the cost structure of the business.

Uncertainties and Conditions that Prevent or Encourage the Use of a CAD Service

The uncertainties and the conditions that encourage and prevent the use of a CAD service form the attributes of a CAD service sought by potential users. The attributes are as follows (the order in which the attributes are presented is not an indication of its importance):

1. Credibility.
2. Confidentiality.
3. Qualified service givers.
4. Convenient location.
5. Convenient hours of operation.
6. Reasonable price.
7. Guarantees quality of work.

Likelihood of Using a CAD Service

Because of the small sample, the researcher refrains from making any conclusive remarks about the connection between the likelihood of using a CAD service and the characteristics of the enterprises and the characteristics

of the potential users. It is crucial to conduct further research to define the market.

The potential users of a CAD service may be seeking different packages of benefits from the service depending upon their needs. From the results of this study, there seems to be at least two types of potential users -- those who want to be directly involved with the use of CAD software on site; others may be content with dropping off the order and wait for it to be completed.

The two types of behaviour reflect the concept of separability in service marketing. For potential users who want to drop off their work at the service, the service and its utilization are separable. On the other hand, for potential users who desire to come to the service to use the CAD software, the service and its utilization are inseparable. The separability of the service from its consumption may have implications for allocation of human and money resources, operation policies and fee structure.

Perceived Image of Institutions Offering a CAD Service

As seven respondents did not perceive many differences between a CAD service offered by an educational institution versus one that is offered by a private institution. However, the researcher observes that some potential users perceive inferior qualities in a CAD service offered by an educational institution.

Implications for Further Research

Using the results of this study, the researcher can begin to develop a questionnaire that covers the various dimensions of a CAD service. Many suggestions are made for further research in assessing the feasibility of a CAD service. The researcher will comment on methodological as well as conceptual issues.

Because this study is highly exploratory in nature, the open-ended questions allowed the potential users to describe the perceptions of a CAD service with respect to the realities of their business. This type of inductive reasoning prevents the researcher's biases from shaping the responses. Although the information given by respondents is invaluable, the results provide only a semblance of a well developed instrument for assessing perceptions of a CAD service. To validate what has been found in this study, the researcher suggests modifying the instrument and administering the questionnaire to a larger group of respondents.

The home-based, owner-operated businesses form only a very small market segment. To identify other markets for a CAD service, companies with different organizational structures need to be studied. It is conceivable that in settings where division of labour exists, the perceptions of a CAD service may differ from those expressed by home-based business owners.

Considering the low response rate of this study, the researcher suggests that future studies be planned with the cooperation of the Manitoba Fashion Institute which is the professional organization representing the apparel manufacturers in Manitoba.

Throughout the study the concept of cost seems to surface frequently. The cost of using a CAD service warrants attention because it could be a strong barrier for adopting a CAD service. Because the CAD service is supposed to substitute the labour intensive activities of apparel production, researchers may consider examining the amount of time devoted to the labour intensive activities in various manufacturing settings. If an approximate cost of the labour intensive activities can be isolated, institutions offering a CAD service may be able to set realistic prices for their services. However, the researcher also recognizes that this is a formidable task.

While identifying the cost of providing CAD services, research needs to be done to identify the price potential users are willing to pay for the services. If the minimum cost of providing the service exceeds what the users are willing to pay, the service providers will have to find ways to help potential users perceive the value of the service.

Finally, given the importance respondents placed on the credibility of the institution offering a CAD service and the perceptions that an educational institution may deliver

inferior quality of work, it will be worthwhile to further investigate the perceptions of housing a CAD service in an educational institution. If misperceptions of educational institutions are widespread, steps may be taken to correct them.

Summary

The purpose of this study was to identify small enterprise owners' perceptions of a computer-aided apparel design service. Using the theory of diffusion of innovations (Rogers, 1983), the researcher identified several types of relative advantage, uncertainties and the conditions that would prevent or encourage the use of a CAD service.

In the summer of 1993, a questionnaire was developed and pretested. The questionnaires were administered by structured interviews in the fall of 1993. Sixty-one businesses were contacted; nine agreed to be interviewed.

The enterprises have been in business for an average of 12 years. The respondents are 31 to 50 years old; many completed or have had some university education. Many worked in areas other than apparel design before starting their own business; all respondents have had some experience in clothing construction. Respondents embarked on their own business primarily because it gave them a sense of accomplishment and the opportunity to use their own

experience. Many tend not to use computers in their everyday lives but are familiar with them. Many respondents know nothing about CAD; those who know something about CAD do not know how to use it. Seven enterprises are operated by the respondents themselves; two enterprises have one employee. The number of customers range from 37 to 1800 with one half of the respondents having at least 64 customers for the years 1991 to 1993. A majority of the enterprises make fewer than 100 garments per year. The design activities of drafting patterns, grading and marker making are often done by hand.

The types of relative advantage of using a CAD service include facilitating production, time reduction and reallocation, organization, financial gains, ability to provide additional services to clients and to generate employment. Potential users of the service perceived no relative time advantage if the time saved on labour intensive activities were spent on travelling back and forth to the service. If the cost of using a CAD service is too high, there may not be any relative cost advantage to using a CAD service.

The concerns of using a CAD service include competence of service givers, ability to respond to clients' deadlines, cost, security, access and the potential users' knowledge of CAD. The conditions that may prevent potential users from using a CAD service include high cost, inability to satisfy

clients, inconvenient location, lack of means to safeguard clients' designs, poor reputation, unqualified service givers, allowing many employees to work on the same design, too slow to complete clients' orders, inability to access the service when the clients need it and the potential users' lack of knowledge of CAD. The conditions that may encourage respondents to use a CAD service are the opposites of the conditions that may prevent them from using it.

The findings of this study seem to be consistent with selected concepts in Rogers' theory of diffusion of innovations. The types of relative advantage seem to be linked to the type of product the enterprises produce. The uncertainties and conditions that encourage or prevent the use of a CAD service seem to originate from the CAD service's compatibility with the needs of the home-based, owner-operated enterprises specializing in custom work.

Because of the small sample, no conclusive remarks can be made about the likelihood of using a CAD service. This is one area in which future research could be directed. Other research include validating the findings of this study on a large sample; identifying the activities that would be substituted by a CAD service; and clarifying the image of educational institutions as provider of CAD services.

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APPENDIX A: QUESTIONNAIRE

Questionnaire

PERCEPTIONS OF USING A COMPUTER-AIDED DESIGN (CAD) SERVICE

LIGIA OSORIO COELHO

GRADUATE STUDENT

DEPARTMENT OF CLOTHING AND TEXTILES

UNIVERSITY OF MANITOBA

WINNIPEG, MANITOBA

Please answer all questions to the best of your ability.

Do not put your name on this booklet.

Your responses will be kept strictly confidential.

Thank you for your cooperation.

The questions contained in this booklet deal with information about your business, your previous experience, and your feelings about the use of a computer-aided design service.

Please read each question carefully and select the response which is most applicable to you, or best describes your feelings. Try to respond to all questions. Any comments you wish to make may be added at the end of the questionnaire.

SECTION 1

The following information about your business is very important in analyzing and interpreting the results. Please read each question and mark the appropriate space, or fill in the blank. **If you do not understand the questions or the terms in the questions, please feel free to ask. For questions that do not apply to you, please write "N/A."**

1. Please list the types of garments you make.

2. How long have you been operating this business? _____ years

   _____ months

3. In addition to yourself, how many employees do you have? _____

4. Are your family members involved in the business? yes no
   If no, go to the next question.

   If yes, how many? _____

   What are their relationships to you? _____

5. Approximately how many garments did you make **for sale** in:

   1991 _____

   1992 _____

   1993 (since January) _____

6. Approximately how many garments did you sell in:

   1991 _____

   1992 _____

   1993, (since January) _____

7. How many customers did you have in:

   1991 _____

   1992 _____

   1993, (since January) _____

8. How many seasons do you produce per year? _____

9. How many lines do you produce per season? _____

10. How many styles do you produce per line? _____

11. How many sizes do you produce per style? _____

12. From one season to the next:

I draft new patterns to make new styles.

_____	_____	_____	_____	_____
Always	Most of the time	Sometimes	Rarely	Never

13. Do you make slopers: _____ by hand
_____ by computer
_____ both

14. Do you grade patterns: _____ by hand
_____ by computer
_____ both

15. Do you make markers: _____ by hand
_____ by computer
_____ both

If you marked the answer "by computer" or "both" in questions 13, 14 or 15, who provides the service?

_____ A private company

_____ Others, please specify

16. How many markers do you make each week? _____

17. Do you plan the markers in advance?

_____	_____	_____	_____	_____
Always	Most of the time	Sometimes	Rarely	Never

18. Please estimate the percentage of garments you make:

. before orders are received _____ %

. after orders are received _____ %

SECTION 2

The following information about **your experience** will help me analyze the results. Please read each question and check the answer that best describes your experience.

1. For the following items, please check all that apply to you under the column "Check." Then rank the ones you have checked in order of importance under the column "Rank."

What are the reasons for starting your own business?

	Check	Rank
I want to make a lot of money.	_____	_____
I have relevant previous experience.	_____	_____
I want to be my own boss.	_____	_____
I need to make a living.	_____	_____
I want to run a business on my own.	_____	_____
There is a real need for my product.	_____	_____
It is a good way to create a job for myself.	_____	_____
I want to use my own experience and skills.	_____	_____
I want to achieve a personal sense of accomplishment.	_____	_____
I could not stand the frustrations in my previous job.	_____	_____
Others:		
_____	_____	_____
_____	_____	_____

2. Your age:

_____ 30 years or younger.
_____ 31-50 years.
_____ 51 years or older.

3. Which is your highest level of education? (Check only one)

_____ Some grade school
_____ Completed grade school
_____ Some high school
_____ Completed high school
_____ Some university
_____ Completed university
_____ Some vocational training/community college
_____ Completed vocational training/community college
_____ Other, please specify _____

4. Do you use computers in your everyday life?

Always	Most of the time	Sometimes	Rarely	Never

5. For what purposes do you use computers?

6. Please check the one that best describes your familiarity with computers:

I know how to use them	I know about them but I don't know how to use them	Nothing at all

7. How much do you know about computer-aided apparel design (CAD) software?

I know how to use CAD	I know about CAD but I don't know how to use it	Nothing at all

****

Please use the space below for any additional comments you would like to make about yourself or your business.

SECTION 3

INTERVIEW QUESTIONS

As we go along, you may have questions. I would like you to know that I will not answer any questions until the interview is over. So please save your questions until the end.

1. What activities do you do in your business?

2. What were your previous work experiences before starting your business?

3. Have you ever considered a facility that would do computer-aided design for you for a fee?

PRESENTATION

4. If a computer-aided design service was available, how important are the following criteria in deciding whether or not to use the service:

	Extremely Important	Very Important	Somewhat Important	Not Very Important	Not Important At All
Who operates the service	___	___	___	___	___
Cost of the service	___	___	___	___	___
Security of my designs	___	___	___	___	___
Turn around time	___	___	___	___	___
Credibility of the institution offering the service	___	___	___	___	___
Grading rules used by the service	___	___	___	___	___
Distance from my workplace	___	___	___	___	___
To be able to attend CAD workshops	___	___	___	___	___
To be able to come to the service and personally use the CAD software	___	___	___	___	___

5. What concerns do you have about using a CAD service?

6. I would like you to think about the way you make garments.

   How would using a CAD service change the way you make garments?

7. Just now, you talked about how a CAD service could change the way you make garments.

   Now, I would like you to think about all the activities that you and your employee(s) do in the business.

   How would using a CAD service change the business activities that you or your employee(s) may do?

8. A CAD service could be offered by a private company or an education institution.

a. If a private company offered a CAD service, what are the conditions that would attract you to use the service?

b. What would prevent you from using a CAD service provided by a private company?

c. If an education institution offered a CAD service, what are the conditions that would attract you to use the service?

d. What would prevent you from using a CAD service provided by an educational institution?

9. Now that I have introduced the idea of a CAD service, is this the first time that you have thought about it?

10. I would like you to consider the following question:

    What is the likelihood of you using a CAD service at this time?

    I am going to present to you a line. One end indicates "definitely will not use" and the other end indicates "definitely will use."

    I'd like you to mark a point on this line that best describes your answer.

Code Number: _____

What is the likelihood of you using a CAD service at this time?

Definitely Will Not Use _____ **Definitely Will Use**

APPENDIX B: LETTER OF APPROVAL FROM THE ETHICS REVIEW COMMITTEE

UNIVERSITY OF MANITOBA

FACULTY OF HUMAN ECOLOGY

APPROVAL FOR RESEARCH PROPOSAL INVOLVING HUMAN SUBJECTS

This is to certify that: Ms. Ligia Osorio Coelho, Department of Clothing and Textiles, University of Manitoba, submitted a proposal for a research project entitled:

Garment Enterprise Owners' Perceptions of a Computer-Aided Apparel Design (CAD) Service

The Faculty of Human Ecology Ethics Review Committee is satisfied that the appropriate ethical criteria for research involving human subjects have been met.

Members of the Committee:

Name	Position	Department
V. M. Bruce	Professor	Foods and Nutrition
K. Duncan	Assistant Professor	Family Studies
S. G. Turnbull	Associate Professor	Clothing and Textiles

Date: August 23, 1993

Rosemary S. L. Mills
Committee Chair

APPENDIX C: QUESTIONNAIRE EVALUATION FORM

I WOULD APPRECIATE YOU PROVIDING YOUR CRITICAL REACTION TO THE QUESTIONNAIRE ONCE YOU HAVE COMPLETED IT.

1. DID YOU FIND THE QUESTIONNAIRE EASY TO FILL OUT ?

   _____ YES _____NO

2. ABOUT HOW LONG DID IT TAKE YOU TO FILL OUT THE QUESTIONNAIRE ? _____ MINUTES

3. WERE THERE QUESTIONS FOR WHICH YOU COULD NOT FIND AN APPROPRIATE ANSWER, OR HAD NO OPPORTUNITY TO LIST YOUR OWN ANSWER? (PLEASE INDICATE THE NUMBER OF THE QUESTION AND YOUR ANSWER).

4. WERE THE QUESTIONS CLEARLY WORDED?

   _____YES _____NO

   IF NO, PLEASE INDICATE THE NUMBER OF THE QUESTION.

5. WHAT ADDITIONAL PROBLEMS, IF ANY, DID YOU HAVE IN ANSWERING THE QUESTIONS ?

6. WAS THE SIZE OF PRINT TO SMALL ?

   _____YES _____NO

7. WAS THE PRESENTATION CLEAR ?

   _____YES _____NO

8. DOES THE SEQUENCE OF THE QUESTIONS FLOW SMOOTHLY ?

_____YES _____NO

9. PLEASE FEEL FREE TO PROVIDE ANY ADDITIONAL SUGGESTION OR COMMENTS THAT WOULD HELP ME IMPROVE THIS QUESTIONNNAIRE.

RETURN THIS CRITIQUE FORM WITH YOUR COMPLETED QUESTIONNAIRE

THANK YOU FOR YOUR HELP

APPENDIX D: LETTER TO POTENTIAL PARTICIPANTS

THE UNIVERSITY OF MANITOBA
FACULTY OF HUMAN ECOLOGY
DEPARTMENT OF CLOTHING AND TEXTILES

Duff Roblin Building
Winnipeg, Manitoba
Canada R3T 2N2

(204) 474-9914
(204) 275-5299 FAX

Date

Dear Business Owner,

I am writing to seek your cooperation in a research project that is a requirement for my master's thesis. I am currently pursuing a master's degree in Clothing and Textiles at the University of Manitoba. Before I came to Winnipeg in 1991, I was a professor of clothing at the Federal University of Pelotas in Brazil. My education in Canada is supported by the Canadian International Development Agency.

My thesis is in the area of computer-aided apparel design. My research involves interviewing owners of small businesses to find out how they react to the idea of a computer-aided design service. To help you decide if you would like to be interviewed, I would like to let you know what is expected of you.

First, let me emphasize that you do not have to know anything about computer-aided design. If you agreed to participate, I will make an appointment to interview you; the interview will last no longer than one hour. A trained interviewer has been hired for this research. At the interview, you will be asked to fill out a questionnaire that provides me with information about your business, your role in the business and your experiences. Afterwards, the interviewer will ask you a series of questions about computer-aided design. The interviews will be recorded on an audio tape because it allows the interviewer to concentrate on listening and interacting with you.

You may be concerned about the information that you will be asked to disclose. Let me assure you that at any time during the interview, you can decline to answer questions with which you do not feel comfortable. The information that you share with me will be accessible only to me and my thesis advisor, Dr. Lena Horne. Dr. Horne needs to have access to the responses because she has to ensure that the information is properly coded and interpreted.

You may also be concerned with being identified in the research. For record keeping, I must keep a list of participants' names, addresses and telephone numbers, but this information will be strictly confidential. On the questionnaire and the tape, you will be identified by a numerical code. Under no circumstances will I or the interviewer reveal your identity to anyone. Also, in reporting the research results, you or your company's name will not be revealed. To protect the information that you share with me, all information will be placed under lock and key throughout the duration of the research. Upon

completion of the research, the tape will be returned to you and the list of participants' names, addresses and telephone numbers will be destroyed. A report on the research findings will be available to you upon request.

I hope you will participate in my research because the Clothing and Textiles Department has a strong link with the community through its continuing education endeavours. The community, especially small businesses, may benefit from supporting the Department's effort to incorporate computer-aided apparel design technology.

Thank you for your time. I will call you in a week to find out if you would like to participate in my research. Meanwhile, please call me at 474-9292 or Dr. Horne at 474-9914 if you have any questions.

Sincerely,

Ligia Osorio Coelho
Graduate Student

Lena Horne, Ph.D.
Thesis Advisor

APPENDIX E: CONSENT FORM

Consent Form

Thank you for agreeing to participate in Ligia's research. I would like to take a few minutes to refresh your memory about the purpose of the research and the procedure of this interview.

Ligia is interested in the feasibility of a computer-aided design sevice for small business owners. What we are doing today is purely for Ligia's research. At this time, the University of Manitoba has no intention of offering a CAD service.

I am going to begin by asking you to fill out a questionnaire. Afterwards, I will give a short presentation on computer-aided design. Then, I will ask you to verbally respond to a series of questions. The interview will be taped. Please bear in mind that you do not have to answer questions with which you do not feel comfortable.

Also, I would like to assure you that only Ligia and her advisor will have access to the information that you are about to give us. Your name, telephone number and address will not be revealed to anyone. At the completion of the research, the tape will be returned to you with a report on the findings. Any information we have about you will then be destroyed.

Before we proceed, would you please sign at the bottom of the form.

I understand the conditions of this research and agree to participate.

_____ _____

Signature Print name please

_____

Date

____ Yes, I would like to receive a report of the findings.

____ No, I do not want to receive a report of the findings.

APPENDIX F: CODING OF RESPONSES TO OPEN-ENDED QUESTIONS

Code Book - Open-Ended Questions

Previous Work Experience

Apparel Manufacturing Enterprises

- worked in apparel manufacturing companies

Design Courses

- drafting
- sewing
- teaching

Sewing For Self

- any experience with sewing for self or for others

Others

- any other work experience not related to apparel production

Question: What activities do you do in your business?

Consultation

- giving advice
- making patterns only - does not include production of garment
- order fabrics

Design

- creation of style, sketch
- knock-offs
- choosing fabrics for appropriate end use
- interpretation of designs

Production

- pattern development
- modify commercial patterns
- make patterns from commercial patterns
- grading
- marker making
- cutting
- make muslins or samples

Construction

- alterations
- making of garments
- stitching
- assembly
- pressing
- finishing

Management

- accounting
- marketing
- advertising

Retail

- sells garments on owners' premises

Question: What concerns do you have about using a CAD service?

Cost

- costs money to use a service

Security

- confidentiality of designs

Response to Clients' Deadlines

- availability
- how quickly can it be done

Access

- physical - be able to come and give you my order
- waiting list

Competence of Service Givers

- teaching me how to do it
- accuracy
- quality of service

Knowledge

- lack of knowledge on CAD

Question: How would using a CAD service change the way you make garments or the activities in your business?

Time Reduction

- takes less time to do fitting
- fewer fittings required

Reallocation of Time

positive - saving time on one task to be used on a different task.
negative - saves production time but loses transportation time.

Facilitating Production

- accuracy
- efficiency
- productive/productivity
- grading
- developing slopers or patterns

Organization

- better organized
- filing

Cost Structure

- affects pricing

Additional Services

- do patterns only

Employ People

- employ more people

Flexibility

- offering other services

Help Financially

- to be more productive; help financially

No Difference

Question: Conditions that encourage the use of a CAD service.

Cost

- if not too costly

Security

- confidentiality
- privacy

Access

- hours of operation
- waiting list
- location
- availability

Customer Satisfaction

- guarantee
- be professional
- accuracy of work
- quality of work
- referrals

Continuing Education

- gives workshops
- update knowledge

Speed

- promptness
- quick turnaround time
- how fast the service can be provided

Credibility

- qualified service giver

Question: Conditions that prevent the use of a CAD service:

Cost

- too expensive

Security

- confidentiality, privacy
- number of people working on the pattern

Customer Satisfaction

- guarantee
- be professional
- accuracy of work
- quality of work
- referrals

Reputation

- lack of reputation

Qualification

- education, licensing, training of service givers
- students doing the work

Assignment of Work

- too many students working on the same design

Location

- too far away

Speed

- cannot meet deadlines
- turnaround time
- slow in performing tasks

Lack of Knowledge

- knowing nothing about CAD

Access

- to be able to use the service at a time convenient to users