A Marketing Study of Consumer Acceptance & Perceived Greenness of Wood Concrete Products

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ABSTRACT

Market research was conducted to determine consumer response and perceptions regarding a novel building material. Mountain Pine Beetle Wood Concrete Products (MPBWCP) are wood based products made from a concrete-like compound, with wood fibre from dead pine trees used in place of aggregate. The properties of MPBWCP make it ideal for a wide variety of applications, such as countertops, tiles, garden blocks and decorative uses. This research entailed a survey completed by 210 respondents in different consumer groups: industrial consumers, professional consumers, home consumers, and environmental organization supporters. The primary finding of the research was that, on average, consumers are quite interested in learning more about and potentially using MPBWCP as a building material. They also perceive it to be a green product. Significant differences were noted between the groups of survey respondents for several questions, especially when considered on an occupational level. These findings will serve as a guide for those involved in the eventual launch of MPBWCP as a commercially available building material, as well as for others attempting to market a wood based product.

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DEDICATION

I dedicate this report to my family, especially…

to Gabriela, Jonathan, and André for their patience, understanding and love;

to Dad and Mom for instilling the importance of hard work;

to Tony and Kaili for their encouragement.

CHAPTER ONE – BACKGROUND AND OBJECTIVES

Introduction

Mountain Pine Beetle Wood Concrete Products, or MPBWCP for short, are made from a concrete-like building material that contains wood fibre from dead pine trees killed by the mountain pine beetle. MPBWCP is a wood based product, but has many of the characteristics of concrete. It has the potential to be a very versatile building material, with potential applications for countertops, flooring, garden tiles, and other non-structural uses.

The mountain pine beetle is a major issue in British Columbia, with millions of hectares of pine forest killed. This has the effect of devaluing the wood. Dealing with the impact of the mountain pine beetle is a major concern for the forest industry and the communities that depend on it for their livelihood. The issue of what to do with the billions of trees killed by the mountain pine beetle is not yet adequately addressed. Responding to the pine beetle epidemic is a major concern for the forest industry and the communities that depend on it for their survival. Research into MPBWCP is of value to the British Columbia forest industry because it offers an effective use of the otherwise useless pine fibre from dead trees.

For many lumber mills, the poor quality of dead pine beetle wood makes it economically unfeasible to produce traditional lumber products. Without an economically workable alternative, there is minimal motivation for forest companies to log and remove the dead pine forests and to replant new forests. MPBWCP provides a solution in this instance, as it is an alternative that can help maximize the value of the dead pine trees (Making Concrete With Wood 2007).

This research explores what, if any, associations with specific consumers: industrial consumers, professional consumers, home or "do-it-yourself" consumers, and environmental organization supporters in various geographical areas Prince George, Vancouver and Los Angeles make between the concepts of "green" (environmentally friendly/sustainable) products.

Chapter 1 introduces and states the research problem, and gives background and history of UNBC's development of wood concrete. Chapter 2 outlines the scope, objectives and research questions of this study. Chapter 3 summarizes the extant literature on wood products and their marketing. Chapter 4 discusses the design and methodology of this research. Chapter 5 presents and summarizes the results of the research. Chapter 6 provides a discussion of these results regarding MPBWCP. Finally, Chapter 7 offers conclusions.

Statement of Problem

The purpose of this study is to examine how consumers respond to Mountain Pine Beetle Wood Concrete Products (MPBWCP), and the importance of consumer perception of the product as "Green." Is MPBWCP a green (environmentally friendly/sustainable) building product with attributes that affect purchasing decisions? "Green" (environmentally friendly/sustainable) products are a subject of increasing interest on local, regional, national and international fronts and the assessing of potential market opportunities is important.

Background and History of UNBC Wood Concrete

The UNBC Wood Concrete Marketing Team was formed to help bring MPBWCP to market as a commercially viable product. This primary goal is accomplished through three key functions:

- Examining the potential for commercialization of MPBWCP.
- Building partnerships with industry, and leverage support from government to further the development of MPBWCP.
- Performing marketing research regarding consumer perceptions of MPBWCP and disseminating the research outcomes to the public.

I have been extensively involved with the UNBC Wood Concrete Marketing Team, as the Project Manager since 2009. Dr. Alex Ng and Dr. Sungchul Choi, professors with the UNBC School of Business serve as the Principal Investigators on the project. Sorin Pasca, the original developer of MPBWCP, continues to provide technical expertise. The MPBWCP project has attracted a large grant from the Social Sciences and Humanities Research Council of Canada (SSHRC), as well as another grant from the Western Economic Development (WED) Community Adjustment Fund.

The major research activities for the "Market Research Towards Commercialization of Mountain Pine Beetle Wood Concrete Products (MPBWCP)," include: Phase 1 (A Preliminary Survey) to examine two domains of sustainability – environmental and economic sustainability, and their effects with price on consumer responses, Phase 2 (Focus Groups) to provide rich, broad and meaningful viewpoints about the marketing questions leading to successful commercialization of wood concrete products and Phase 3 (Conjoint

Analysis) to provide more information regarding optimal product types, places of distribution, price levels, and promotion attributes leading to successful commercialization of wood concrete products.

The Mustel Group, a market research firm from Vancouver, BC was the successful applicant in the request for proposal (RFP) and tender for phase 1. The Mustel Group activities included administration, design/pre-implementation (i.e. screening questionnaire, recruitment of online survey participants), focus groups (participants completed online surveys), quantitative surveys (i.e. online data collection, date file and codebook preparation) and project deliverables (i.e. written quantitative methodology, UNBC consent form completion and final submission).

About Mountain Pine Beetle Wood Concrete Products

Mountain Pine Beetle Wood Concrete Products (MPBWCP) use beetle-killed pine wood to form a hybrid wood and concrete product. The pine wood fibre takes the place of the aggregate in concrete. By using various sizes of wood chips, MPBWCP has the potential to be a highly attractive and unique alternative building product to a variety of consumers, because it combines some of the structural strength of concrete with the aesthetic quality of wood.

MPBWCP arose from the research of Sorin Pasca and Dr. Ian Hartley at the University of Northern British Columbia (UNBC). The original idea behind MPBWCP was to see if the material could be a suitable replacement for drywall or gypsum board. Over the course of experimentation with the material, several new potential applications were

identified, ranging from countertops to flooring (Making Concrete With Wood 2007). MPBWCP has not yet been certified or tested for structural applications, but this use is under consideration.

In the mixing of standard concrete, Portland cement acts as the binder that holds the mineral aggregates (sand, pebbles and crushed stones) together. In the mixing of MPBWCP, the mountain pine beetle wood particles take the place of the mineral aggregates. As such, MPBWCP is a hybrid of ordinary concrete and wood particle boards. The size of the wood particles used to create MPBWCP may vary from the size of sawdust to the size of wood shavings; this offers a wide range of different design options to end-users.

Several characteristics of MPBWCP are similar to traditional concrete: water resistance, fire resistance, fungal/termite/mold resistance, acoustic insulation, bending strength, and durability. Other properties, such as its light weight, nail/screw holding capacity, and workability, make MPBWCP closer in nature to wood particle boards. Furthermore, MPBWCP is less dense than concrete, which provides a benefit by reducing the mass of the product. Please refer to Appendix A to view the physical characteristics and technical specifications of MPBWCP.

Moldability is the key characteristic of MPBWCP that distinguishes it from other wood cement products. The wood/cement/water mixture is poured into forms and let to set and cure. In terms of finishing the product, staining could be the only requirement for applications such as stepping stones or pavers, but grinding, polishing and coating are needed for high end products such as countertops.

CHAPTER TWO – STUDY OBJECTIVES

Scope

The scope of this research will be focused around the designed research questions which will be examined through the use of collected primary data (survey questionnaires) to develop descriptive research results and exploratory research (literature review) to discuss MPBWCP, a wood based product. Articles from forest products journals on the public perception of wood products and the manner in which consumers respond to wood products, in addition academic articles that deal with the marketing of green products are reviewed. The study will look at three cities from the western side of North America and four distinct groups: industrial consumers, professional consumers, home consumers (DIY), and environmental organizations.

Objectives and Research Questions

The purpose of this study is to research how consumers evaluate wood concrete products. There are four key questions that are to be investigated within this study:

1. What are consumer attitudes towards MPBWCP?
2. What are consumer buying intentions towards MPBWCP?
3. How do people feel about the greenness of MPBWCP?
4. Are there explanations as to why people could feel differently about their views on MPBWCP (i.e. occupational group and geography)?

CHAPTER THREE – LITERATURE REVIEW

Structure of Literature Review

The existing academic literature relating to this project covers two distinct areas. MPBWCP is an example of a wood based product, and has several characteristics that make it a "green" product. In the literature review section, I first discuss the segmentation of the market for building products. Next, I examine articles from forest products journals on the public perception of wood and wood-based products and the manner in which consumers respond to these wood products. I then discuss a selection of articles that deal with the marketing of green products and the public's demand for environmental and economically sustainable products.

Segmentation of the Market for Building Products

It is an important realization that not all consumers and users of building products are equal. Do-it-yourself (DIY) homeowners represent a large part of the market for building products. These DIYers perform their own work for a variety of reasons, including a desire to improve the value of their homes, a sense of independence, cost savings from doing their own work, and problems finding or trusting contractors (Williams 2008).

Similarly, the demand from certain consumers for "green" building products has come to light over the past decade as a significant market segment. Straughan and Roberts (1999) devised a method to profile and segment green consumers. This research also identified several predictors of green consumers, including perceived consumer effectiveness (a belief that the actions of individuals makes a difference), altruism (a concern for the well-being of others), and liberal/left-wing political views. Thompson et al. (2009) found evidence

supporting green consumer segmentation specific to the forest products industry. This segmentation existed both for value-added products (such as wood furniture) as well as for non-value-added products (such as plywood). Females and those who knew about environmental certification were more likely to be a part of the green consumer segment.

Literature on the segmentation of the building products market related to the demand from industry professionals is minimal or non-existent, based on my research. Still, the fact remains that contractors, wholesalers, homebuilders, and other professionals purchase a great deal of building materials to complete their day to day work.

Consumer Response to Wood Products

Many different studies over the past decade have examined the market potential for a variety of innovative wood products, as well as products certified under various environmental certification programs. Though none of the literature examined focuses specifically on a wood concrete material similar to MPBWCP, the findings of these studies can be generalized and applied to this project.

The research of Ewald Rametsteiner (1999) examined the factors that enter into the purchase decisions of wood products (specifically, furniture) by Europeans. This research found that the greatest proportion of respondents placed the most attention on high overall quality, durability, and appealing shape and material. On the other side, the country of origin and the exclusivity of the product were the least important factors affecting purchase decisions of wood products by Europeans. Pricing and environmental considerations were

found to be of intermediate importance to the consumers surveyed. The findings of Rametsteiner are presented in the following figure.

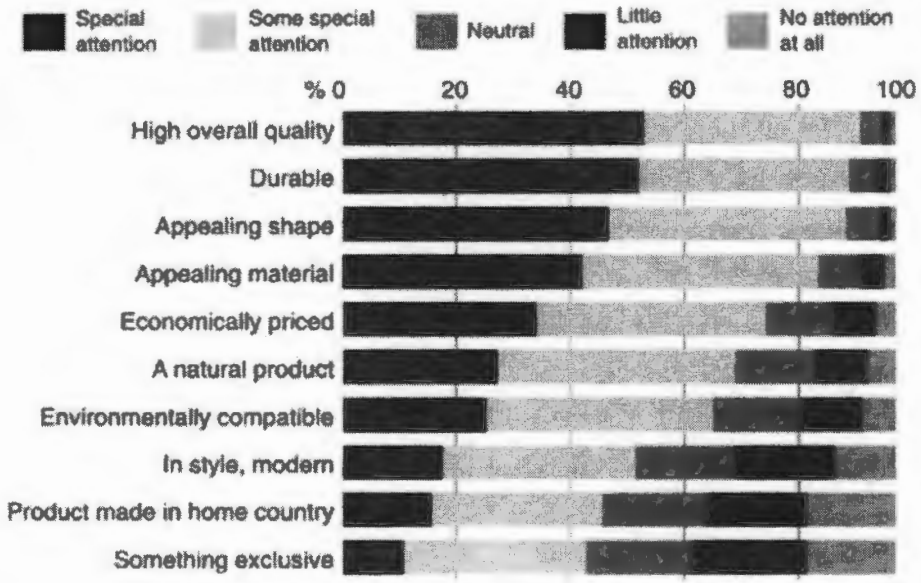

Figure 1. Attention paid to different product features in purchasing decisions (Rametsteiner 1999).

The research of Tabarsi et al. (2003) involved a survey on the potential for manufacturing using oriented strandboard (OSB), which was sent to nearly 2,000 producers of wood office furniture and doors. The degree of familiarity amongst manufacturers was low for OSB, and there was a perception amongst respondents that technological improvements in manufacturing would be required in order for OSB to succeed commercially. Direct and personal communication with manufacturers was found to be the preferred manner in which to disseminate product information. This last finding of their research is especially relevant to the successful commercialization of MPBWCP, because effective product dissemination will be necessary to bring about consumer acceptance of the product.

Perception and Discussion of Composite Wood and/or Concrete Products

Composite wood products are made of wood and some other material. In order to successfully market a wood based product, it is vital to know about the consumer perceptions of these wood based materials. The research of Jonsson et al. (2008) did just that, and examined how Swedish consumers described different types of wood and wood based materials, and also identified preferences. The preferred characteristics of such materials were naturalness, smoothness, "living impression" (e.g. the grain of the wood), and value. On the other hand, the least preferred characteristics were a high level of processing, hardness, and heaviness. Although the research involved Scandinavian respondents, most of the findings can be applied to the North American consumer of building products. This research has significant implications for my project, since I am seeking to determine the consumer reaction to a specific wood based composite material (MPBWCP). The one important distinction that must be made is that the study of Jonsson et al. compared wood composites with natural wood itself, while MPBWCP is targeted more as a replacement building material for concrete.

Marketing and Consumer Attitudes Towards Green Products

Consumer attitudes towards environmentally friendly products have brought about the development of the discipline of green marketing. Green marketing, in its various forms, has been studied extensively over the past ten to fifteen years.

Some research has attempted to identify common characteristics amongst consumers of green or eco-labelled wood products. Roos and Nyrud (2008) surveyed consumers of flooring and decking in do-it-yourself stores in Sweden and Denmark. Their sample included both consumers with a preference for green products as well as those without a preference. Focusing on the green consumers, they tended to be less price-sensitive, and made less advance purchase plans of building materials. The subsample of eco-conscious consumers also included a higher share of married, highly educated, and female consumers. Although this research took place in Scandinavian DIY stores, it is reasonable to assume that many of the traits of a green consumer would be similar in North American markets.

Bigsby and Ozanne (2002) used conjoint analysis to determine customers' preferences for environmentally friendly or environmentally certified wood furniture in the New Zealand marketplace. The source, forest type, environmental certification, warranty length, and price of the wood were the five attributes considered. By offering a variety of different product bundles to subjects, the researchers concluded that the source of the wood was the most important attribute for buyers, with local (New Zealand) wood preferred over imported wood. Forest type (preference for plantations over natural forests), environmental certification, and warranty length were the next most important aspects, in that order. Price was the least important of the five aspects.

Ginsberg and Bloom (2004) also note that consumers are wary of green marketing tactics. Indeed, in their decisions, consumers are unlikely to compromise on the "traditional" elements of a product—such as price and quality. Ginsberg and Brown characterized four levels of green marketing: "lean", "defensive", "shaded", and "extreme", ranging from

passive to aggressive marketing tactics. The authors noted that no single green marketing strategy will work for every company; rather, companies should select and follow one of their four strategies. They caution users of green marketing to carefully consider the strategy to be followed.

Many different types of environmental certification for wood products currently exist in the global marketplace. The best-known example is the Forest Stewardship Council (FSC), which allows certified wood products to carry a recognizable tree-and-checkmark logo. At the same time, there are at a minimum several dozen other environmental certification programs in place around the world. The sheer number of programs is such that one organization, the Programme for the Endorsement of Forest Certification schemes (PEFC), exists to oversee these programs. Like with the FSC, products that meet the certification requirements of the PEFC can carry a logo. With so many certification programs in effect, consumers can easily become overwhelmed (Teisl 2002).

Environmental certification was examined in the research of Kozak et al. (2004) Specifically, they looked at consumer attitudes and perceptions towards certification of value-added wood products (e.g. flooring and furniture). Consumer knowledge of certification programs was found to be severely lacking for the most part. Despite this, many of the participants in the study expressed an interest in purchasing certified value-added wood products in the future. The researchers also found that consumers would be generally willing to pay a small premium for such certification of wood products.

Teisl et al. (2002) also examined the many kinds of environmental certification labels carried by wood products. Using focus groups, the researchers determined that

environmental labelling on wood products is complicated and that consumers are wary of potential schemes involving such certification. Comparability between environmental labels was a priority for the subjects. Another key finding was that consumers desire environmental certification from recognizable, trustworthy entities.

Environmental certification is not without its challenges. Irland (2007) examined the supply chains for certified wood products in the United States in an attempt to determine why a relatively small amount of the wood harvested from certified forest reached retail outlets with certification labels. A major part of the problem is that there can be as many as six or seven different links in the supply chain, most of which would need to participate in the certification process. The level of education on certification programs is low for many of the intermediaries in the supply chain. Irland recommended that a focus be made initially on specialty wood products, where the costs and difficulties of certification could be justified financially. This approach would be followed by increasing certification efforts for more wood products afterwards. The implications for MPBWCP are such that all parties involved in the production and processing of the material would need to work together if MPBWCP were to be certified.

Summary of Literature Review

My research unites the existing literature on wood and wood based products with that on the subject of green marketing and labelling. There are many similarities between MPBWCP and other wood products, but none of the other research I examined dealt directly with a wood concrete compound.

The most important findings from this study of the literature are twofold: (1) consumers are generally willing to purchase products and materials they see as environmentally friendly or sustainable, but (2) they are wary of claims of a product's greenness, especially when such statements are not backed up by certification from a reliable third-party program (Bigsby and Ozanne 2002). My research will add to the literature, as there is no market research done on acceptance and perceived greenness of wood concrete products like MPBWCP.

CHAPTER FOUR – METHODOLOGY

Overall Study Design

The study collects primary data to respond to the research questions posed. The research design is comprised of two parts: 1) exploratory research is comprised of a literature review and 2) descriptive research using a pre-formed survey questionnaire. The questions were designed to gain further understanding to the reactions of potential consumers to MPBWCP, identify consumers' acceptance of wood concrete products, and whether consumers perceive wood concrete products as green. Both qualitative research (focus groups) and quantitative research (a survey) was undertaken for the study of MPBWCP.

The qualitative research conducted consisted of a dozen focus groups composed of targeted occupations in our targeted cities. The outcomes of the focus groups are not discussed further in this study. In certain circumstances a focus group might not be representative of the whole population, can vary greatly in its participants, the moderator may not have control of the focus group, may lead to irrelevant data, participants may react off of one another, and tougher to analyze because comments might be from the reaction of other members of the focus group. A big factor in the implementation of focus groups is the high cost. In-depth individual interviews could have been an alternative to focus groups; however, the cost and time to conduct this form of data collection made it economically unfeasible.

A survey was used to examine MPBWCP on a quantitative level, through the collection of data from a large number of respondents. A survey also allowed for questions that focus on specific research interests, compared with a focus group, where this is more

difficult. This method of data collection is also easier to standardize and administrate which can reduce various types of data collection errors. Along with the data collection benefits, there were cost and time savings.

Questionnaire Model

The survey questionnaire was designed to examine the two domains of sustainability: environmental sustainability and community economic sustainability. The questionnaire examined how these two sustainability domains effect consumer response and buyer intention. The intended outcome of the survey was to gain further insight and answer the research questions, and provide information for decision making (i.e. regarding the commercial potential of MPBWCP).

The questionnaire questions were predominately of the type asking respondents to rank their agreement or disagreement with a provided statement. When responding to the scale questions on the questionnaire, individuals could specify their level of agreement to a statement ranging from strongly disagree to strongly agree (see Appendix B). There were seven demographic questions, followed by nine questions relating specifically to the research. The questionnaire allows for the collection of data which can be tested for reliability and validity.

Respondents followed a set of designed activities:

1. Watched a presentation on Mountain Pine Beetle Wood Concrete Product, time allotted: 15 minutes
2. Completed a short survey (Survey questions) on MPBWCP, 5 minutes

Respondents were drawn from three cities: Prince George BC, Vancouver BC, and Los Angeles, California, USA. In those three cities, respondents were drawn from four consumer groups: Industrial Consumers, Professional Consumers, Home Consumers and Environmental Organizations. For the different cities, Los Angeles was picked because the United States is Canada's most important export market for wood products, Prince George was selected due to the lower costs to conduct research and to represent a rural town demographic, Vancouver represents a major Canadian city demographic.

The online quantitative data collection was done on November 4th – 30th 2009. There were 210 useable surveys that were completed in total. The number of participants per group was established so that statistical validity could be accounted while respecting the financial constraints of the research budget.

The respondents were selected from 4 groups:

Table 1. Consumer groups for survey.

Geographical Market	**Local Market**	**Regional Market**	**USA Market**
	Prince George	Vancouver	Los Angeles
Participant Segment			
Industrial Consumers	Wholesalers, Retailers, Commercial property construction, Home builders, Home designers		
Professional Consumers	Professional handy men, Home contractors, Small business contractors, Renovators		
Home Consumers	(Do-it-yourself) Home owners, Average consumers		
Environmental Organizations	Members of environmental organizations (Sierra Clubs, David Suzuki Foundation, etc.) and eco-friendly green building organizations (SLO Green Build, The Natural Building Network, etc.)		

The web-survey participants were recruited through a marketing research firm, the Mustel Group, which followed UNBC's contract protocols and procedures. Data collection for the market research consisted of two components: qualitative focus groups and quantitative on-line surveys. The Mustel Group recruited participants for both components simultaneously, since the qualitative respondents were also eligible for and encouraged to complete the quantitative research phase (Mustel 2009). The use of web-surveys was used to meet the timeframe and budgetary constraints.

A random telephone recruitment method was employed as much as possible. Households listed with listed telephone numbers were randomly sampled in the three market regions. Businesses were randomly selected from business telephone databases in the three market regions with stratification on the basis of business sector (SIC industry code). Due to difficulties in recruiting in the Los Angeles area other databases were used to supplement the

recruiting effort such as focus group databases and e-Rewards business panels. The research firm's incentive to online survey participants was a prize draw for $500.00 cash which was randomly selected, the winner was notified directly (Mustel 2009).

The confidentially of all participants and respondents was and will be maintained at all times and there will be no identifiers in this report of who and how a person(s) responded. Approval from the UNBC Research Ethics Board for "Market Research Towards Commercialization of Mountain Pine Beetle Wood Concrete Products," - Phase 1 was received for this research, and a copy of the certificate is contained in Appendix C.

CHAPTER FIVE – RESULTS

Response Rate and Respondents

The survey data was collected by the Mustel Group, a Vancouver marketing research firm. In total there were 210 questionnaires completed. Data collection for market research on MPBWCP consisted of quantitative online surveys. The Mustel Group recruited and screened participants for survey, and distributed incentives for their participation.

The sample populations for this research were grouped as follows:

1. **Do-it-yourself (DIY) consumers:**

    i. completed in past 2 years or plan to complete in next 2 years DIY home project,

    ii. involving installation of materials such as gypsum, drywall, countertops, flooring, any type of tiles or landscaping products such as stones or concrete pavers or blocks for terracing

2. **Environmentally-minded consumers:**

    i. current member of an environmental organization or

    ii. volunteered or donated to an environmental organization in past 2 years

3. **Industrial business (influencers):**

    i. building and construction, wholesale or retail building supply, home design or architecture,

    ii. buy materials for sale in a wholesale or retail environment or make recommendations to contractors, builders, designers or the public regarding their choice of materials, and/or

iii. solely responsible for or recommend/influence building material choices for residential or commercial projects

4. **Professional business (builders, contractors and handymen):**

i. general building and construction, renovations, or general handyman services,

ii. including use of materials: gypsum, dry wall, countertops, flooring, tiling, landscaping products such as stones, concrete pavers or blocks for terracing

iii. solely responsible for or recommend/influence material choices for residential and/or commercial projects

Quantitative, Online Surveys Distribution

The respondents of the quantitative survey were distributed as follows:

Table 2. Online survey respondents.

Web Survey Respondents	Total	Prince George	Vancouver	Los Angeles
Do-It-Yourself Consumer	49	17	22	10
Environmental Organization Member/donor/volunteer	51	7	40	4
Industrial Segment (Wholesaler/purchase influenced	62	9	23	30
Professional Segment (Builder/user)	48	8	18	22
TOTAL	210	41	103	66

The overall completion rate for the online survey was 57% among those randomly recruited. Results for each question were collected in an Excel spreadsheet, breaking the

responses into distinct groups. In each group, answers from the Likert Scale questions were separated in categories from strongly disagree to strongly agree and then summed. When responding to a Likert questionnaire item, participants specify their level of agreement to a statement (Likert 1932).

Demographics

Survey Questions 1 through 7 asked respondents about basic demographic information regarding age, gender, income level, and other questions of this type.

Table 3. Demographic data.

Age		**Highest Level of Education**	
20-29	7%	Junior high school graduate	3%
30-39	18%	Senior high school graduate	11%
40-49	17%	College graduate	21%
50-59	27%	University graduate	23%
60-69	12%	Postgraduate	25%
70+	3%	Other	16%
		No response	2%
Gender			
Male	58%		
Female	42%	**Occupation**	
		Professional worker	37%
Marital Status		Clerical worker	4%
Married	67%	Manager	15%
Unmarried	18%	Self-management	13%
Other/No response	15%	Labourer	3%
		Homemaker	3%
Annual Income		Student	2%
Less than $20,000	3%	Other	25%
$20,000 - $29,999	5%		
$30,000 - $39,999	6%	**Residence Type**	
$40,000 - $49,000	7%	House	69%
$50,000 - $59,999	11%	Apartment	23%
$60,000 - $69,999	8%	Townhouse	6%
$70,000 - $79,999	7%	Other	1%
$80,000 - $89,999	8%		
$90,000 - $99,999	5%	**Number of Respondents**	210
Over $100,000	29%		
No response	11%		

Note: Values have been rounded to the nearest percent.

Research Question 1 – Descriptive Results

The first research question seeks to gauge consumers (industrial consumers, professional consumers, home consumers and environmental organizations) attitudes towards MPBWCP. Survey questions were posed to respondents, with the first four on a seven-point scale, with a response of 1 corresponding to "strongly disagree" with the statement, 4 being "neither agree nor disagree", and 7 being "strongly agree".

Survey Question 8 asked respondents to rate their agreement with the statement "I think MPBWCP is a marketable product". There was a very strong level of agreement with this statement, which bodes well for the marketability of MPBWCP. The mean response value was 6.3 and the median was 7, which represents the highest level agreement with any of the questions in the entire questionnaire. The response to this question is very encouraging to the viability of MPBWCP, since the respondents to this survey represent a cross-section of likely users of the product.

Graphical representations of these survey results are presented in Appendix D.

Research Question 2 – Descriptive Results

The second research question seeks to determine the buying intentions of consumers for MPBWPC. To answer this research question, the pricing of MPBWCP was examined by survey respondents. This is an important consideration because even if all other aspects of the product are executed perfectly, consumers may not purchase the product if it is priced too high.

Survey Question 16 asked respondents how willing they would be to pay more for MPBWCP on a scale of 1 to 7. This question had a unique response scale compared to the

other questions. A value of 1 represents a 15% discount to comparable materials, while a value of 7 represents a 15% premium. A value of zero represents an equal willingness to pay for MPBWCP and comparable materials. The mean response of 4.9 and the median of 5 indicate that, on average, consumers are willing to pay a premium of 5% for MPBWCP over comparable materials.

Survey Question 11 asked respondents to rate their agreement with the statement "I would switch from my usual brands and buy MPBWCP". Though not nearly as strong as the previous question, there was a general agreement amongst respondents, with a mean value of 5.3 (slightly agree) and a median of 6 (somewhat agree). These values indicate that potential users of MPBWCP would be only slightly or somewhat willing to switch from their usual brands and types of building materials to use MPBWCP for their projects.

Survey Question 14 asked respondents to rate their agreement with the statement "I would travel further in order to purchase MPBWCP". This question yielded a mixed response, with the lowest level of agreement of any of the questions in the questionnaire. The mean response was 4.9 and the median was 5, which corresponds to respondents "slightly agreeing" (on average) with the statement. This finding will be important, since opinions amongst likely users appear mixed regarding the likelihood that they would travel further to purchase MPBWCP. This may mean that it will be necessary to have MPBWCP carried in many locations to ensure that potential users can access the product without travelling further to obtain it. Figure 2 shows the results of Survey Question 14 by the occupation of the respondents.

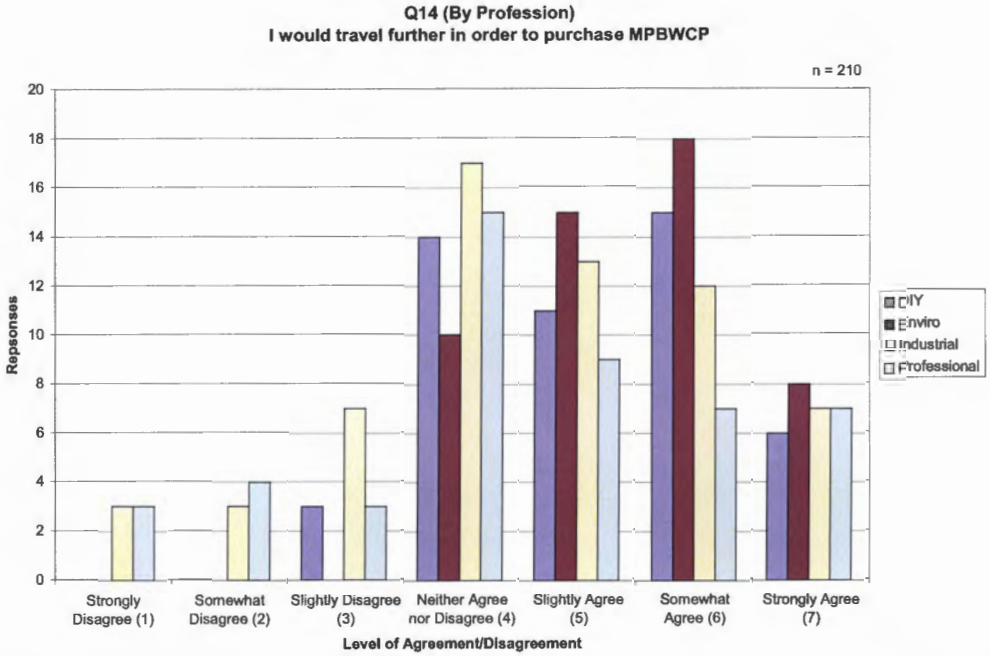

Figure 2. Respondents' level of agreement with the statement "I would travel further in order to purchase MPBWCP" (by occupation of respondents).

Survey Question 15 asked respondents to rate their agreement with the statement "I would pay attention to advertisements about MPBWCP". There was a very strong response showing agreement to this statement, with a mean value of 6.1 and a median of 6. The results for this question are somewhat surprising, since advertising can be easily ignored by consumers.

Graphical representations of the full survey results are presented in Appendix D.

Research Question 3 – Descriptive Results

The third research question 3 seeks to determine how consumers feel about the greenness of MPBWCP as a building product. As with the previous questions, a response of

1 corresponded to "strongly disagree" with the statement, 4 was "neither agree nor disagree", and 7 was "strongly agree".

Survey Question 9 asked respondents to rate their agreement with the statement "I think MPBWCP is an environmentally friendly product". There was a very strong level of agreement with this statement amongst respondents, with a mean response value of 6.1 and a median of 6. The response to this question demonstrates that likely users of MPBWCP perceived that the product was environmentally friendly.

Survey Question 10 asked respondents to rate their agreement with the statement "I think MPBWCP is an economically sustainable product for communities". As with the previous question, there was a strong level of agreement. The mean response value was 6.0 and the median was 6, which correspond to a high level of agreement with the statement.

Finally, two questions were asked to respondents regarding the content of package label information. Survey Question 12 asked respondents to rate their agreement with the statement "I would often compare package label information about the environmental friendliness of MPBWCP". The mean response value was 5.7 and the median value was 6. Similarly, Survey Question 13 asked respondents to rate their agreement with the statement "I would often compare package label information about the economic community sustainability of MPBWCP". The mean response value here was 5.5 and the median was 6. Combined, both Survey Questions 12 and 13 provide strong support that the likely users of MPBWCP would read and compare product labelling concerning both the environmental and economic aspects of the product.

Graphical representations of these survey results are presented in Appendix D.

Research Question 4 – Descriptive Results

The fourth research question seeks to determine whether there are differences between the evaluations of potential consumers based on their location and consumer group. The survey was given to respondents in Prince George, Vancouver, and Los Angeles to respondents who were either do-it-yourself homeowners, supporters of environmental groups, building professionals, or people in the building materials industry. With a great distance between locations and non-similarities in groups, there is the potential for differences to exist in the survey results.

ANOVA Results

A single-variable analysis of variance (ANOVA) was performed in order to test the differences in survey results between the different cities and the different MPBWCP consumer groups of respondents. An ANOVA is a statistical test of the equality of means across different groups (in this case, the mean under examination is the mean response to each of the survey questions). Two ANOVAs are calculated with Microsoft Excel for each of the survey questions: one for the different cities and the other for the different professions.

The ANOVA was performed using the following null hypotheses:

- Cities: H_0 = no difference in response across the different cities.
- Occupations: H_0 = no difference in response across the different occupations.

A null hypothesis is used by convention for the analysis of variance between different means. However, this still allows for specific research hypotheses to be considered using the results from the ANOVA.

In the output of an ANOVA, the comparison of the calculated F-statistic with the critical F value allows for the acceptance or rejection of the null hypothesis. If F-calculated is greater than F-critical, then the null hypothesis should be rejected.

Table 4, which follows, summarizes the results of the analysis of variance. The complete ANOVA output is presented in Appendix E.

Table 4. ANOVA results.

Survey Question	City/Occupation	Mean Response	ANOVA		
			F	$F_{critical}$	H_o
1 to 7	Demographic questions – Not analyzed using ANOVA				
8 (by city)	LA PG VAN	6.03 6.59 6.39	4.55	3.04	Reject
8 (by occupation)	DIY ENV IND PROF	6.43 6.53 6.08 6.27	2.17	2.65	Accept
9 (by city)	LA PG VAN	5.83 6.17 6.16	1.89	3.04	Accept
9 (by occupation)	DIY ENV IND PROF	5.96 6.24 5.77 6.31	2.82	2.65	Reject
10 (by city)	LA PG VAN	5.73 6.29 6.01	3.00	3.04	Accept
10 (by occupation)	DIY ENV IND PROF	5.94 6.25 5.73 6.04	1.95	2.65	Accept
11 (by city)	LA PG VAN	5.09 5.56 5.41	2.37	3.04	Accept

11 (by occupation)	DIY ENV IND PROF	5.41 5.80 5.00 5.21	4.82	2.65	Reject
12 (by city)	LA PG VAN	5.52 5.51 5.85	1.96	3.04	Accept
12 (by occupation)	DIY ENV IND PROF	5.84 5.96 5.29 5.73	3.24	2.65	Reject
13 (by city)	LA PG VAN	5.42 5.29 5.68	1.44	3.04	Accept
13 (by occupation)	DIY ENV IND PROF	5.69 5.69 5.13 5.69	2.51	2.65	Accept
14 (by city)	LA PG VAN	4.64 4.90 5.09	2.01	3.04	Accept
14 (by occupation)	DIY ENV IND PROF	5.14 5.47 4.58 4.50	5.81	2.65	Reject
15 (by city)	LA PG VAN	5.80 6.37 6.09	3.34	3.04	Reject
15 (by occupation)	DIY ENV IND PROF	6.37 6.39 5.58 5.98	7.11	2.65	Reject
16 (by city)	LA PG VAN	4.77 4.63 5.17	4.11	3.04	Reject
16 (by occupation)	DIY ENV IND PROF	5.06 5.39 4.63 4.75	4.65	2.65	Reject

The results of the ANOVA in Table 4 show that in several instances over the survey, there are differences in mean response across the cities and the occupations surveyed. Those differences were significant where the null hypothesis was rejected (Table 4). The most apparent overall trend from the analysis of variance is that differences in mean response are most often significant for different occupations. When examining responses by occupation of the respondents, there is a rejection of the null hypothesis in six of the nine questions (Survey

Questions 9, 11, 12, 14, 15, and 16)—in other words, the mean response is different across the four occupations. On the other hand, there was only a rejection of the null hypothesis in three questions (Survey Questions 8, 15, and 16) when sorted by city. This seems to indicate that the consumer group of the respondent has a greater impact on the response to the survey than does the city. This suggests these different consumer groups are real given their different responses to MPBWCP.

For both the city and occupational groups, there were significant differences in the mean response for Survey Questions 15 and 16, which relate to consumer interest in advertising about MPBWCP and willingness to pay a premium (versus comparable materials) for MPBWCP. This indicates that these two questions elicited a broad range of responses, which differed based on the city and occupation of the respondent.

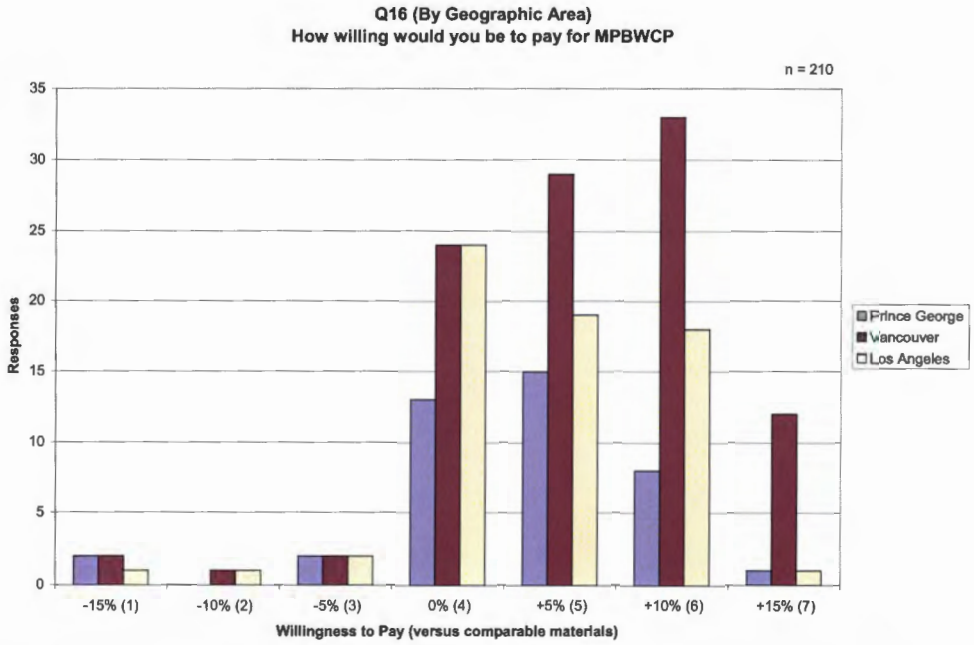

Figure 3. Respondents' willingness to pay for MPBWCP relative to comparable materials (by location of respondents).

As indicated by Table 4, residents of Prince George were most likely of the three cities to pay attention to advertising about MPBWCP, but the least likely to be willing to pay a premium for the product. When differentiating by occupation, industrial and professional consumers were less willing to pay a premium for MPBWCP compared to do-it-yourself and environmental consumers (Table 4). An interpretation of these results is offered in the Discussion.

CHAPTER SIX – DISCUSSION

The questions contained in the survey sought to answer four key research questions, regarding how consumers respond to MPBWCP as a building material, their likelihood of buying it, how consumers perceived the greenness of MPBWCP, and what differences exist in the responses of various segments of consumers. The results of the survey are important in the determination of whether or not MPBWCP can succeed as a viable building material in a competitive marketplace.

Research Question 1 – Consumer Perceptions of MPBWCP

The responses to the survey questions pertaining to Research Question 1 gave a clear indication of consumer interest towards MPBWCP. Overall, there was a very strong positive reaction towards MPBWCP as a marketable building product. The survey respondents were, surprisingly, quite favourable towards paying attention to advertising featuring information about MPBWCP. This is important because future consumers of MPBWCP would only purchase the product if they were reasonably informed on its applications and specifications. On average, the surveyed consumers were willing to pay about a five percent premium for MPBWCP versus comparable materials.

As mentioned earlier, the research of Rametsteiner (1999) is quite valuable in the understanding of which traits consumers most desire in wood products, as well as the traits for which they care the least. The most important characteristics were, in order:

- Quality
- Durability
- Appealing shape and material

- Economical pricing

Some characteristics of wood products were determined to be of less importance to consumers, including product exclusivity and point of origin. The production of information and marketing highlighting the important points listed above will aid in the decision-making process for potential consumers of MPBWCP, and should steer them towards considering the product for the building material purchases. The research of Bigsby and Ozanne (2002) shows that the point of origin or source of wood based products was important to respondents. This finding supports MPBWCP, because it too supports local economies.

A thorough review of the literature on green marketing and environmental certification initiatives shows that consumers are generally interested in purchasing building materials and other products that carry certification. However, these same consumers are quite wary of false claims and unknown certification programs.

Research Question 2 – Consumer Buying Intentions for MPBWCP

The responses to the survey questions pertaining to Research Question 2 demonstrated that there is a high level of interest amongst respondents in purchasing and using MPBWCP for their building material needs.

The main issue that arose from the survey regarding Research Question 2 was that survey respondents were (on average) only slightly willing to travel further in order to purchase MPBWCP. I believe that this is the case because consumers, particularly those who are employed full-time, are busy and have little free time to travel further to purchase their building products. Although the findings of Straughan and Roberts (1999) and Thompson

(2009) seem to suggest that environmentally conscious consumers might travel further, this would not necessarily be the case for the professional and industrial consumers of building materials. This implication is discussed further in the analysis of Research Question 4, which follows. The slight willingness to travel further in order to purchase MPBWCP will be problematic, since consumers will only travel further if they know about the product ahead of time and are set on buying it.

In addition, respondents claimed to be only slightly willing to switch to MPBWCP from their usual brands. I believe that this could be overcome by an education effort on the benefits and advantages of MPBWCP as a building material. With time, as more construction involving MPBWCP is complete, consumers should have an improved willingness to switch from their usual brands of materials.

The survey results have shown, on average, consumers are willing to pay a premium of 5% for MPBWCP over comparable materials. This small premium could erode under prolonged tough economic times as consumer willingness to spend extra money diminishes. Even though the unpleasant economic state of affairs has had a negative effect on consumer purchasing, the acceptance of green products is still very high. This reveals that the majority of consumers consider a product's environmental impact before purchasing. Environmental concerns are still dominant despite hard financial times. This could indicate that consumers' principles towards the value of green products do not change during an economic downturn.

Research Question 3 – MPBWCP as a Green Product

As mentioned above, the results of the survey showed a great deal of promise for MPBWCP as a viable product that surveyed consumers would use. Survey respondents were highly in agreement that MBPWCP is both an environmentally friendly product and an economically sustainable product for communities. Whether or not either of those statements is a completely accurate characterization of MPBWCP is a question that remains to be answered, but it is a major positive to have potential consumers tend to view the product that way initially.

Product labelling is a key part of green marketing. As discussed in the review of the academic literature, there are many different environmental certification and labelling programs in effect in the domestic and global marketplaces (Teisl 2002 and Kozak 2004). These articles focused on environmental certification and labelling, but in the survey, respondents were asked whether they would compare labelling information about both environmental friendliness and also what was referred to as "economic community sustainability". This economic community sustainability labelling would provide consumers with information on the geographic source of the wood used to make the product, and also potentially information about how the forestry industry supports such communities. For the most part, respondents said they were somewhat likely to read and compare the information presented on both kinds of labels. Respondents were slightly more likely to compare the environmental friendliness label (mean response of 5.7) than they were to compare the economic community sustainability label (mean response of 5.5).

Future marketers of MPBWCP will need to be mindful of the possibility of "greenwashing", which occurs when overly boastful claims about the environmental sustainability of a product are made in hopes of attracting interest from environmentally conscious consumers. Such tactics can easily backfire, harming the image and reputation of the product. Despite this, the academic literature and our survey results indicate that consumers do have a genuine interest in learning more about how building products compare in terms of both environmental and economic community sustainability.

Research Question 4 – Difference in Response across Cities and Occupations

The analysis of variance (ANOVA) provided insight into the differences between the responses from the three cities and four occupations surveyed. One of the most striking findings of the ANOVA was the differences in mean occurred in greater frequency when the survey responses were grouped by the consumer group of the respondent (for six of the nine survey questions). There were only significant differences in mean when the responses were grouped by city in three of nine questions. This finding makes sense in hindsight, since it is reasonable to imagine that those members of a common occupation (say do-it-yourself homeowners) share a set of common characteristics that are quite different from other occupations (such as building professionals). Marketing recognizes that home consumers are different from industrial buyers. Environmental group supporters also appear to represent a distinguishable market segment, based on the ANOVA results (Table 4). This finding supports the outcome of the research of Thompson et al. (2009), which determined that green consumers represented a distinguishable market segment. The cities surveyed are all North American cities with reasonably high standards of living, so it is not a stretch of the

imagination to assume that their populations have many traits in common relating to the purchase of building materials.

The results of the ANOVA showed that for the last two questions in the survey, which asked about interest in advertisements and willingness to pay a premium for MPBWCP, there were significant differences in the mean response for both cities and for occupations. Residents of the Los Angeles were the least interested in advertising for MBPWCP. Residents of Prince George were the least interested in paying a premium for MPBWCP (versus comparable materials), perhaps because they know that the mountain pine beetle epidemic has created an abundance of inexpensive pine fibre. For these same two questions, respondents who were do-it-yourself homeowners or supporters of environmental groups were the most likely to express an interest in advertising for the product and to pay a premium price for MPBWCP. Similar to the distinguishable market segment of green consumers, this indicates that do-it-yourself consumers also represent a market segment—which is supported by some of the findings of Williams (2008). Respondents from the professional and industry groups were less likely to pay attention to advertising and to pay a premium, possibly because they are relatively more busy and cost-conscious.

These same groups of do-it-yourself homeowners and environmental supporter were slightly more likely (than the other consumer groups) to be willing to switch to MPBWCP and to compare labelling information about the environmental and economic sustainability. However, for some of the questions there wasn't a statistically significant difference between the mean survey responses of the different groups, most notably for survey questions 10 and 13, which asked about whether MPBWCP were an economically sustainable product and

whether respondents would read about economic community sustainability labelling. As stated previously, differences between the survey cities were less prevalent than between the different occupation groups. The full data for the ANOVA is contained in Appendix E.

Alternative explanations to consumer responses

It is possible that there are alternative ways in which to explain the responses of the survey. First, it is likely that the processes for choosing building materials vary across different occupations surveyed. For instance, professional and industrial consumers will typically have criteria outlined for selected products, while do-it-yourself consumers can act with less formal planning, or even on impulse. In general, the respondents from the various occupational groups and cities will have different experiences with building products, and this can factor into all the responses to the survey questions.

One of the questions in the survey asked respondents about the premium (or discount) they would be willing to pay to obtain MPBWCP. This is potentially problematic because consumers, in reality, will be making their purchasing decisions will a specific application in mind (i.e. a countertop or floor tiles). They may have a willingness to pay a premium for one product but expect a discount for another. Further analysis on a product level would be required for certainty on this matter. A related factor is that MBPWCP is a new product and consumers would demand more information (beyond what was provided prior to the survey) in order to make an informed purchasing decision.

The survey did not provide respondents with a specific definition of the word "green", and left that decision to each respondent to make. The definition of "green" for one

consumer is almost certainly different for the definition of another consumer, although there would be similarities between the definitions.

Limitations of this Study

There are several potential limitations to this research study, the first being that Western Canada (British Columbia) and the Western United States (Los Angeles) were the only geographic regions analyzed. This was intentional, as the sale of MPBWCP, at least initially, is targeted to these regions of North America. As such, the results from this study may only be helpful to the specific region of study, and there may be certain regional and geographical influences. It is possible that MBPWCP will eventually be marketed to consumers in Eastern North America, Europe, and Asia, but these regions were also excluded from the survey.

A further limitation to this study was that obtaining survey participants is costly, due to the challenge of obtaining respondents who have working lives, as opposed to many marketing studies that recruit students. Thus it is necessary to select a sample of representative cities (Prince George, Vancouver, Los Angeles) in which to conduct the survey. This selection meant that the opinions of residents of smaller centres were not included in the survey results. The collected survey results reflect the opinions of residents from mid to large sized centres.

Another potential limitation is that the survey respondents were only asked to provide opinions regarding MPBWCP in general, and not regarding specific applications like countertops which could provide more reliable responses. In reality, they would be purchasing products made from MPBWCP (e.g. countertops or tiles), so consumer opinions

could vary for each of the individual wood concrete products. For instance, the decision (and the decision-making process) for a consumer to purchase a countertop made from MPBWCP would be quite different from that of a consumer purchasing garden blocks made of MPBWCP. Further research will be required to determine the viability of individual products made from MPBWCP.

CHAPTER SEVEN – CONCLUSION

Conclusion

Mountain Pine Beetle Wood Concrete Products (MPBWCP) continue to be developed and new applications are in the works. My research sought to determine how consumers feel about MPBWCP, especially as a green building material. The results of the survey indicate that MBPWCP are of substantial interest to consumers and industry professionals across Western North America. Surveyed respondents were, on average, very interested in learning about and using MBPWCP. They saw MPBWCP as a viable product in a competitive marketplace, which bodes well for its future as a building product. These respondents would also be somewhat likely to examine and compare labelling information on wood products about environmental and community economic sustainability. Some differences were noted across different consumer occupational groups, with significant differences between environmentally conscious consumers and professional/industrial consumers of building materials. Overall, there was a fairly uniform strong positive response to MPBWCP, which is an encouraging result of its future as a building product.

Recommendations for Future Research

Further study into different products made from MPBWCP through a conjoint analysis would provide more information regarding optimal product types, places of distribution, price levels, and promotion attributes leading to successful commercialization of wood concrete products. This conjoint analysis would examine consumer responses to different "bundles" of product attributes for MPBWCP.

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APPENDICES

Appendix A: Technical Specifications of MPBWCP

	Property	*Typical values (average)*	*What does it mean?*
1	Density	1,300 kg/cubic meter	It weighs half of ordinary concrete
2	Compressive strength	7 MPa (1,015 psi) after 7 days 9 MPa (1,305 psi) after 28 days	A 4" x 4"column could bear a load of 20,000 pounds
3	Bending strength	5 MPa (725 psi) after 28 days	A 4" thick and 8" wide bench plank could bear a load of 2,000 pounds at a span of 30"
4	Thickness swelling (after 24 hours soaking)	< 1%	>25% for most of wood-based panels (OSB, particleboard, or MDF)
5	Fire resistance	It passed a 2 minutes torch test	Provided a wood content of maximum 20% by mass, it is expected to pass even a non-combustibility test
6	Alkalinity	~ pH 11	It repels wood-boring insects and fungi even at high moisture contents
7	Moldability		It can be poured and molded in forms like ordinary concrete
8	Workability		It can be cut and machined (routed, planed, bored, spindled) with normal woodworking tools
9	Mechanical joints and fixing		It can be nailed or screwed without pre-drilling. Drill pilot holes are recommended for screw fixings and edge screwing Gluing and stapling are also options
10	Health and safety		No formaldehyde or other resins toxic emissions when uncoated Dust generation when machined must be controlled
11	Other hazards		Correct handling is recommended for avoiding strain or crush injuries

Appendix B: Questionnaire - Survey

Survey Questions: Market Research Towards Commercialization

of Mountain Pine Beetle Wood Concrete Products

Short survey on Buying Intention for MPBWCP (a seven-point scale)

1. My exact age is

2. My gender is

   1 Male
   2 Female

3. My annual income is

   1 Less than $20,000
   2 $20,000 to $30,000
   3 $30,000 to $40,000
   4 $40,000 to $50,000
   5 $50,000 to $60,000
   6 $60,000 to $70,000
   7 $70,000 to $80,000
   8 $80,000 to $90,000
   9 $90,000 to $100,000
   10 Over $100,000
   11 No response

4. My highest completed level of education is

   1 Elementary school graduate
   2 Junior high school graduate
   3 Senior high school graduate
   4 College graduate
   5 University graduate
   6 Postgraduate
   7 Other
   8 No response

5. My marital status is

   1 Married
   2 Unmarried
   3 Other
   4 No response

6. My highest completed level of education is

   1 Professional worker
   2 Clerical worker
   3 Manager
   4 Self-management
   5 Labourer
   6 Homemaker
   7 Student
   8 Other

7. My residence is a

   1 House
   2 Apartment
   3 Townhouse
   4 Other

8. I think MPBWCP is a marketable product.

   1 Strongly disagree
   2 Somewhat disagree
   3 Slightly disagree
   4 Neither agree nor disagree
   5 Slightly agree
   6 Somewhat agree
   7 Strongly agree

9. I think MPBWCP is an environmentally friendly product.

1 Strongly disagree
2 Somewhat disagree
3 Slightly disagree
4 Neither agree nor disagree
5 Slightly agree
6 Somewhat agree
7 Strongly agree

10. I think MPBWCP is an economically sustainable product for communities.

1 Strongly disagree
2 Somewhat disagree
3 Slightly disagree
4 Neither agree nor disagree
5 Slightly agree
6 Somewhat agree
7 Strongly agree

11. I would switch from my usual brands and buy MPBWCP.

1 Strongly disagree
2 Somewhat disagree
3 Slightly disagree
4 Neither agree nor disagree
5 Slightly agree
6 Somewhat agree
7 Strongly agree

12. I would often compare package label information about the environmental friendliness of MPBWCP.

1 Strongly disagree
2 Somewhat disagree
3 Slightly disagree
4 Neither agree nor disagree
5 Slightly agree
6 Somewhat agree
7 Strongly agree

13. I would often compare package label information about the economic community sustainability of the MPBWCP.

1 Strongly disagree
2 Somewhat disagree
3 Slightly disagree
4 Neither agree nor disagree
5 Slightly agree
6 Somewhat agree
7 Strongly agree

14. I would travel further in order to purchase MPBWCP.

1 Strongly disagree
2 Somewhat disagree
3 Slightly disagree
4 Neither agree nor disagree
5 Slightly agree
6 Somewhat agree
7 Strongly agree

15. I would pay attention to advertisements about MPBWCP.

1 Strongly disagree
2 Somewhat disagree
3 Slightly disagree
4 Neither agree nor disagree
5 Slightly agree
6 Somewhat agree
7 Strongly agree

16. How willing would you be to pay for MPBWCP? Check the premium or discount in percent over / below a comparable product that you agree with.

1 -15%
2 -10%
3 -5%
4 0
5 +5%
6 +10%
7 +15%

Appendix C: REB Approval

UNIVERSITY OF NORTHERN BRITISH COLUMBIA

RESEARCH ETHICS BOARD

MEMORANDUM

To: Sungchul Choi
CC: Alex Ng

From: Henry Harder, Chair
Research Ethics Board

Date: March 4, 2009

Re: **E2009.0304.034**
Market Research Towards Commercialization of Mountain Pine Beetle (MPB) Wood Concrete Products, Phase I

Thank you for submitting the above-noted proposal to the Research Ethics Board. Your proposal has been approved.

We are pleased to issue approval for the above named study for a period of 12 months from the date of this letter. Continuation beyond that date will require further review and renewal of REB approval. Any changes or amendments to the protocol or consent form must be approved by the Research Ethics Board.

Good luck with your research.

Sincerely,

Henry Harder

Appendix D: Survey Graphs

Survey Question 8

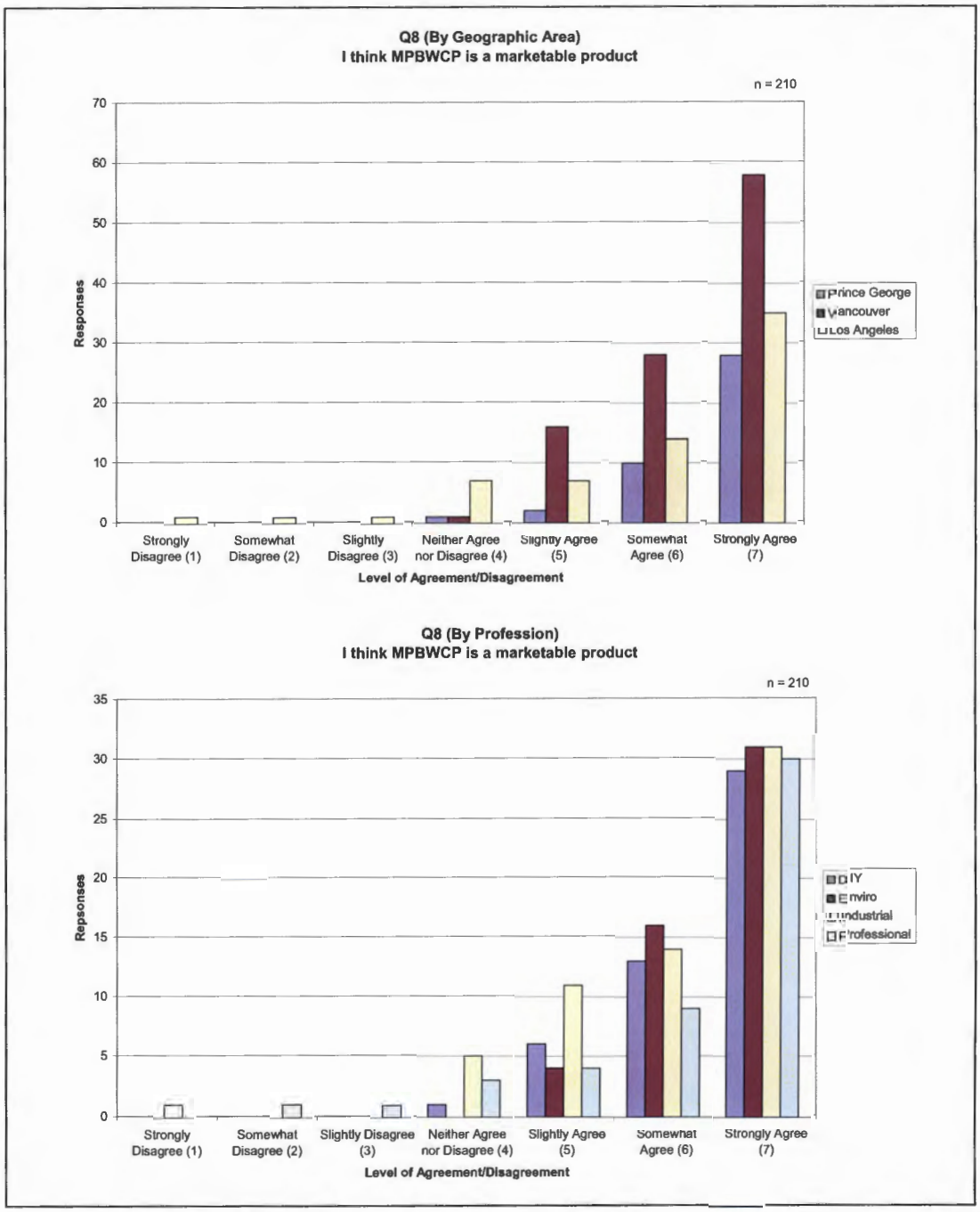

Figure 4. Respondents' level of agreement with the statement "I think MPBWCP is a marketable product" (by location and occupation of respondents).

Survey Question 9

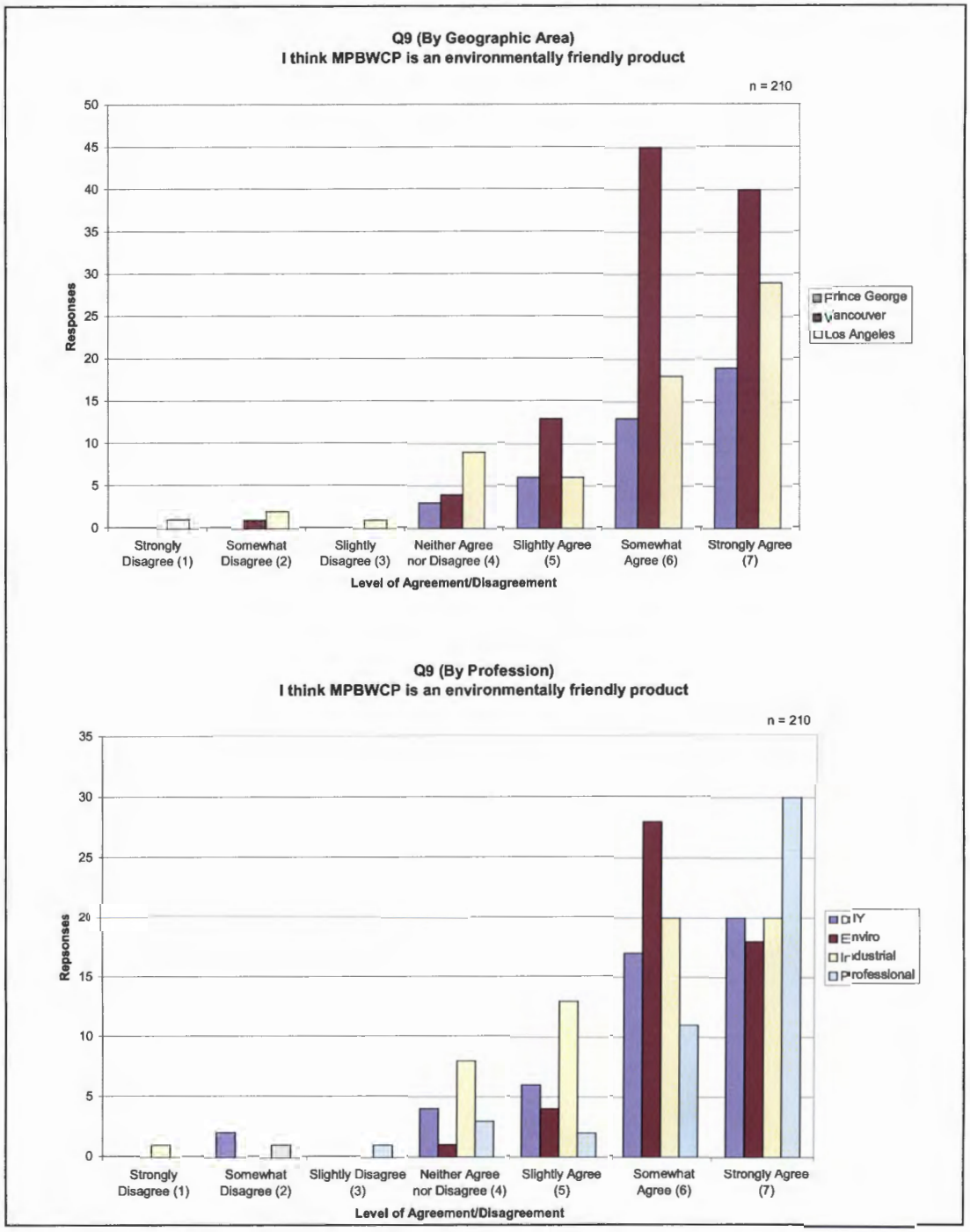

Figure 5. Respondents' level of agreement with the statement "I think MPBWCP is an environmentally friendly product" (by location and occupation of respondents).

Survey Question 10

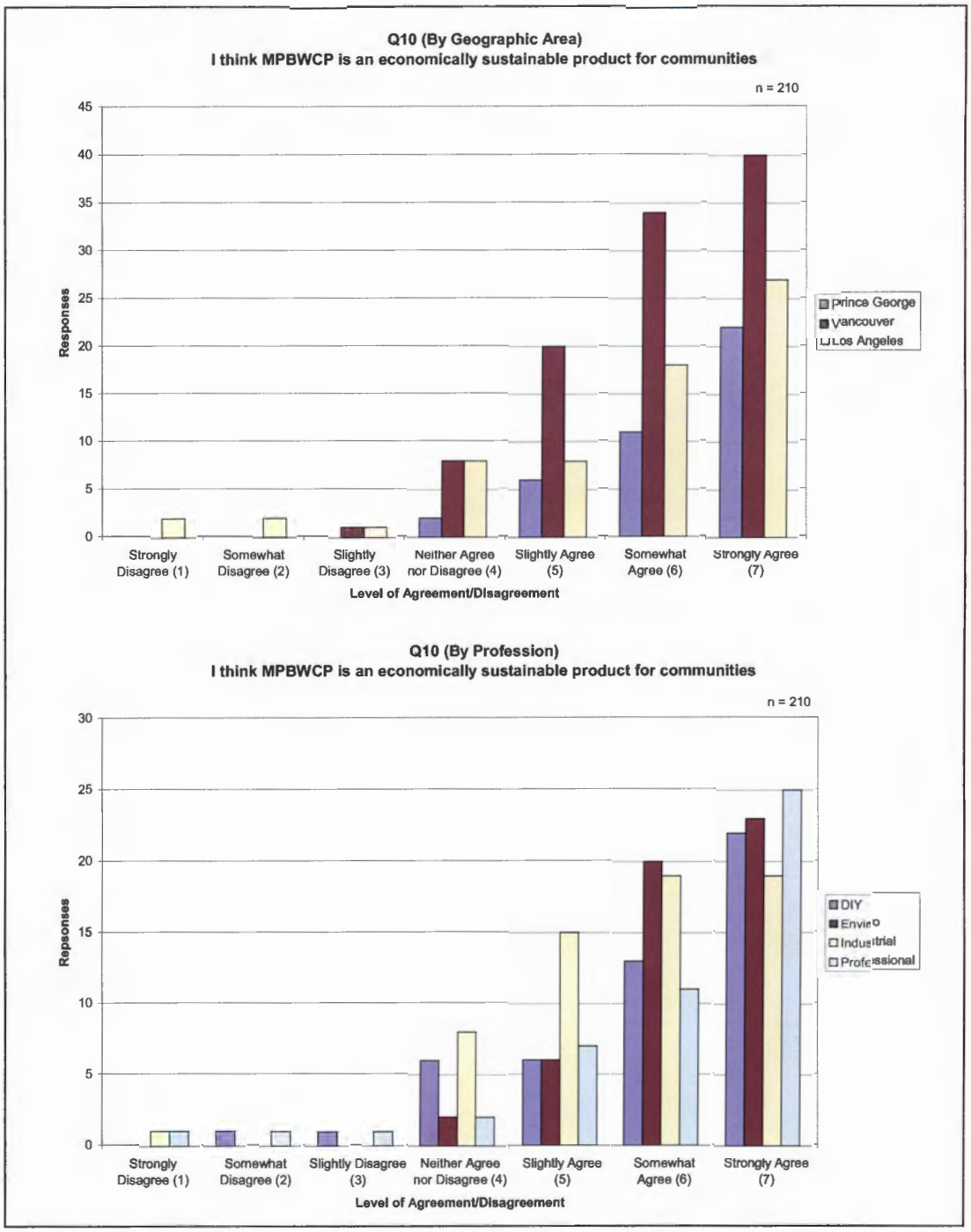

Figure 6. Respondents' level of agreement with the statement "I think MPBWCP is an economically sustainable product for communities" (by location and occupation of respondents).

Survey Question 11

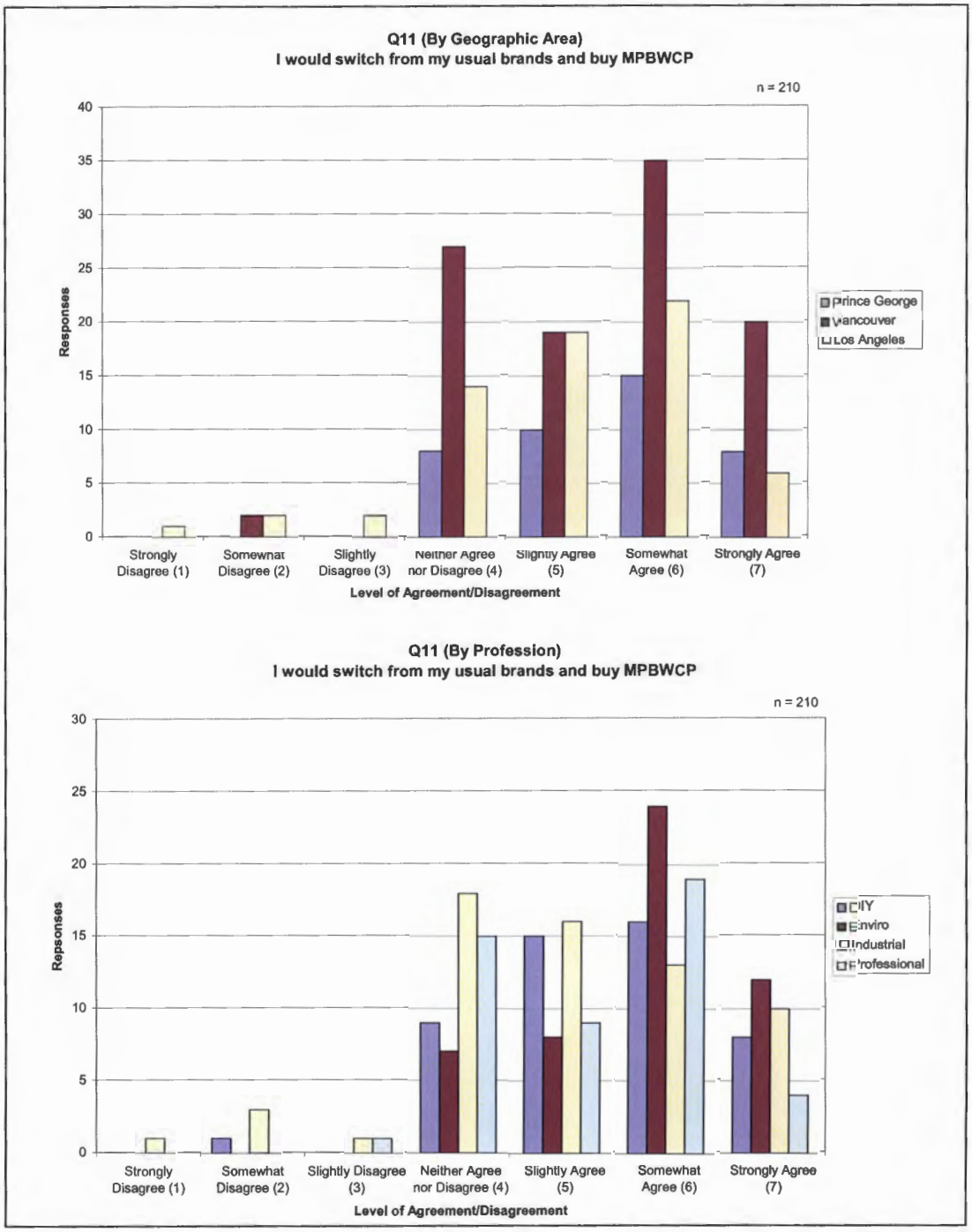

Figure 7. Respondents' level of agreement with the statement "I would switch from my usual brands and buy MPBWCP" (by location and occupation of respondents).

Survey Question 12

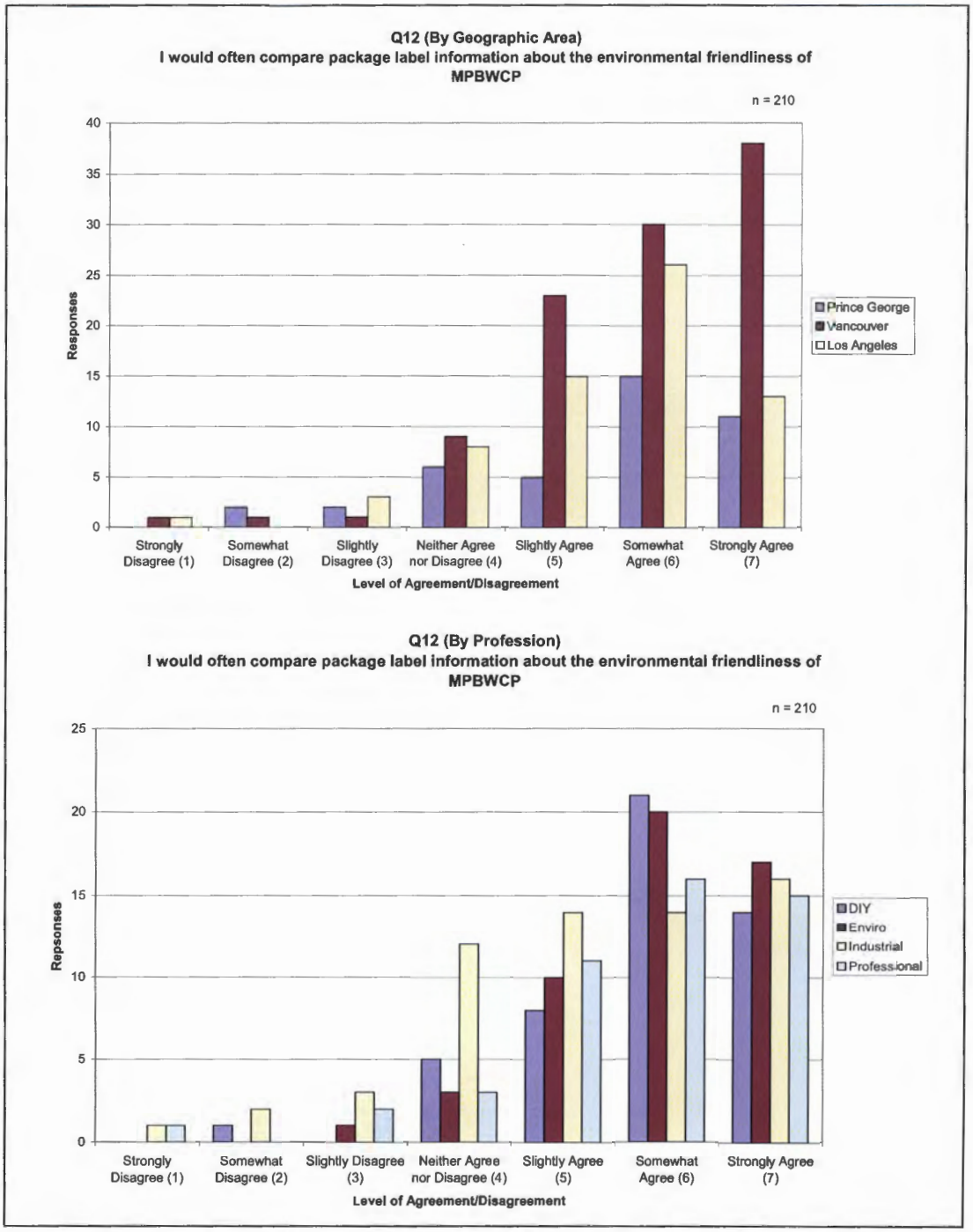

Figure 8. Respondents' level of agreement with the statement "I would often compare package label information about the environmental friendliness of MPBWCP" (by location and occupation of respondents).

Survey Question 13

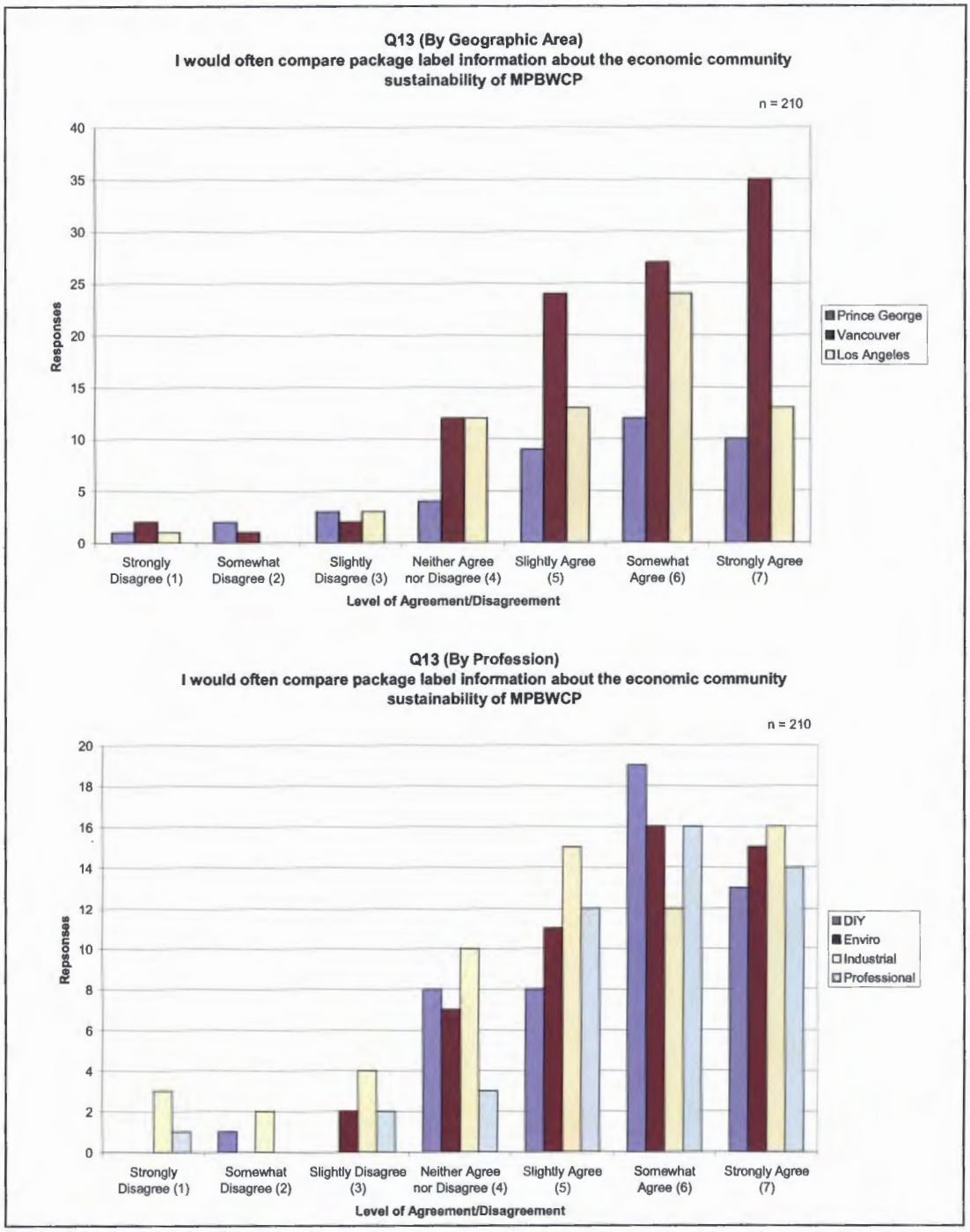

Figure 9. Respondents' level of agreement with the statement "I would often compare package label information about the economic community sustainability of MPBWCP" (by location and occupation of respondents).

Survey Question 14

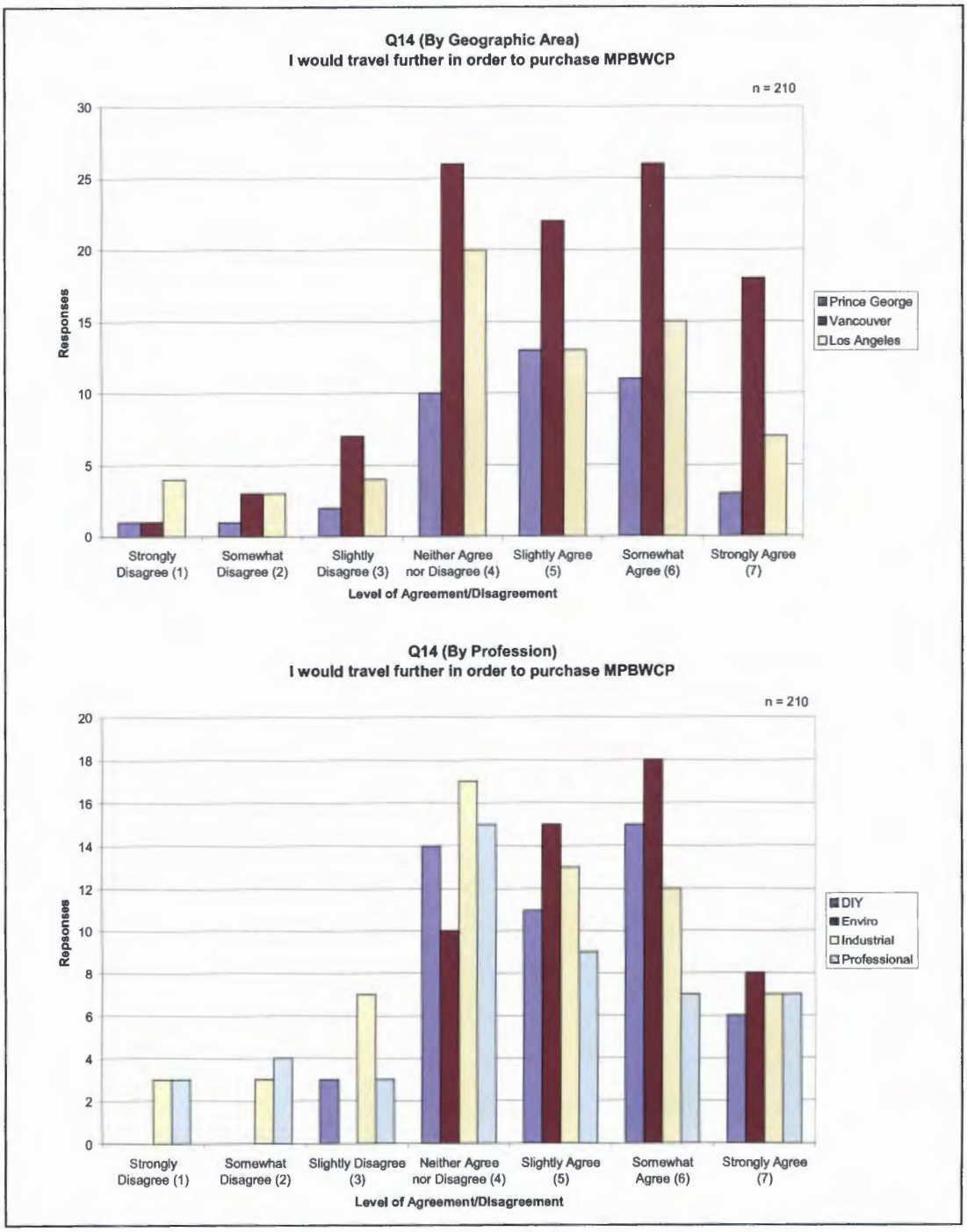

Figure 10. Respondents' level of agreement with the statement "I would travel further in order to purchase MPBWCP" (by location and occupation of respondents).

Survey Question 15

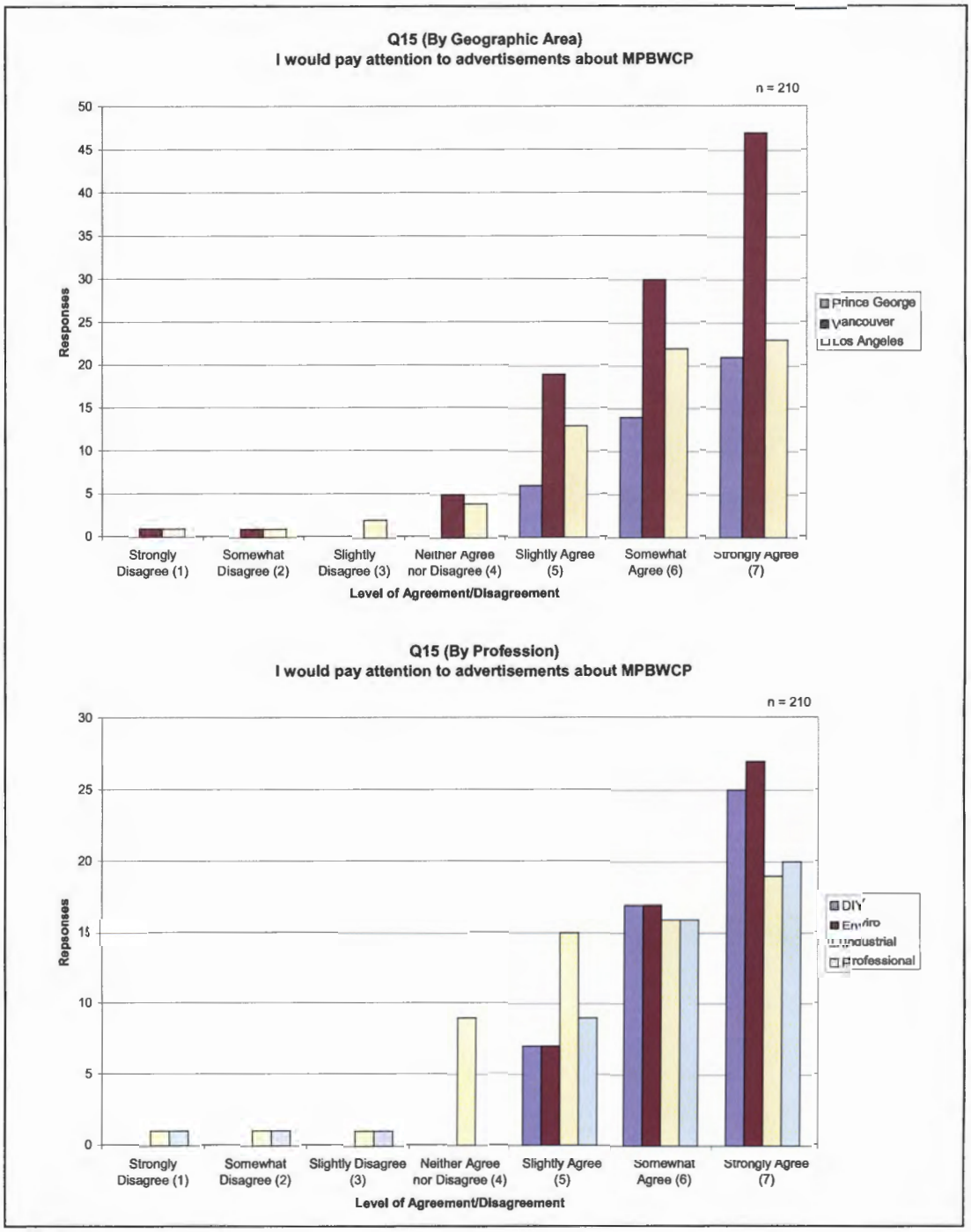

Figure 11. Respondents' level of agreement with the statement "I would pay attention to advertisements about MPBWCP" (by location and occupation of respondents).

Survey Question 16

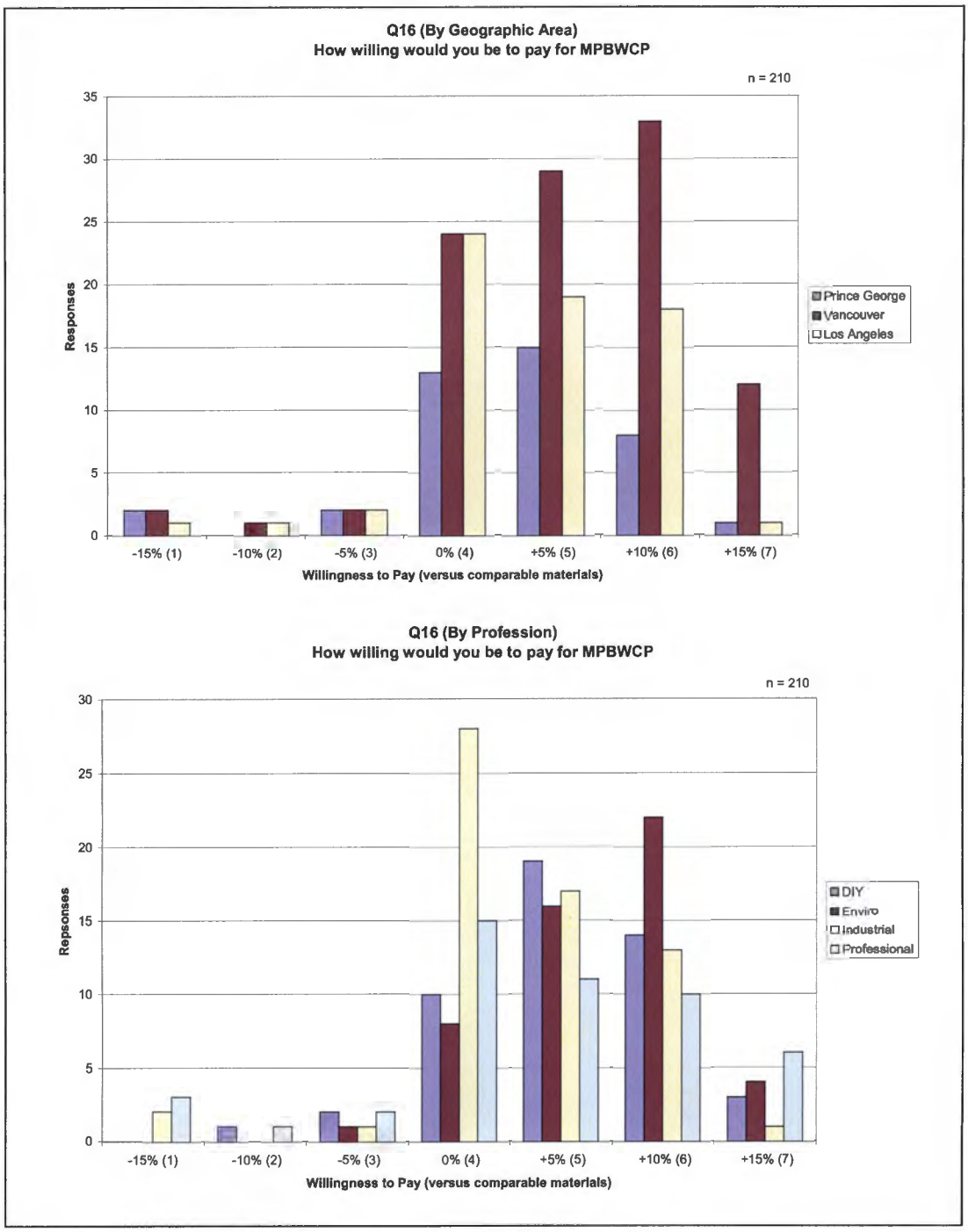

Figure 12. Respondents' willingness to pay for MPBWCP relative to comparable materials (by location and occupation of respondents).

Appendix E: ANOVA Tables

Survey Question 8: "I think MPBWCP is a marketable product."

Anova: Single Factor **CITY**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
LA	66	398	6.030303	1.845221
PG	41	270	6.585366	0.49878
VAN	103	658	6.38835	0.612412

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	8.90051	2	4.450255	**4.552373**	0.011619	**3.039508**
Within Groups	202.3566	207	0.977568			
Total	211.2571	209				

Anova: Single Factor **OCCUPATION**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
DIY	49	315	6.428571	0.625
ENV	51	333	6.529412	0.414118
IND	62	377	6.080645	1.419619
PROF	48	301	6.270833	1.435727

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	6.47532	3	2.15844	**2.17128**	0.092527	**2.648432**
Within Groups	204.7818	206	0.994087			
Total	211.2571	209				

Survey Question 9: "I think MPBWCP is an environmentally friendly product."

Anova: Single Factor **CITY**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
LA	66	385	5.833333	2.079487
PG	41	253	6.170732	0.895122
VAN	103	633	6.145631	0.811917

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	4.636731	2	2.318365	**1.890962**	0.153524	**3.039508**
Within Groups	253.7871	207	1.226025			
Total	258.4238	209				

Anova: Single Factor **OCCUPATION**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
DIY	49	292	5.959184	1.539966
ENV	51	318	6.235294	0.463529
IND	62	358	5.774194	1.423585
PROF	48	303	6.3125	1.368351

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	10.17775	3	3.392587	**2.815243**	0.040253	**2.648432**
Within Groups	248.246	206	1.205078			
Total	258.4238	209				

Survey Question 10: "I think MPBWCP is an economically sustainable product for communities."

Anova: Single Factor **CITY**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
LA	66	378	5.727273	2.355245
PG	41	258	6.292683	0.812195
VAN	103	619	6.009709	0.990101

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	8.311947	2	4.155974	**3.002022**	0.051855	**3.039508**
Within Groups	286.569	207	1.384391			
Total	294.881	209				

Anova: Single Factor **OCCUPATION**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
DIY	49	291	5.938776	1.60034
ENV	51	319	6.254902	0.673725
IND	62	355	5.725806	1.415389
PROF	48	290	6.041667	1.913121

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	8.122975	3	2.707658	**1.945116**	0.123452	**2.648432**
Within Groups	286.758	206	1.392029			
Total	294.881	209				

Survey Question 11: "I would switch from my usual brands and buy MPBWCP."

Anova: Single Factor **CITY**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
LA	66	336	5.090909	1.560839
PG	41	228	5.560976	1.052439
VAN	103	557	5.407767	1.400723

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	6.569345	2	3.284673	**2.373833**	0.095654	**3.039508**
Within Groups	286.4259	207	1.3837			
Total	292.9952	209				

Anova: Single Factor **OCCUPATION**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
DIY	49	265	5.408163	1.204932
ENV	51	296	5.803922	0.920784
IND	62	310	5	1.934426
PROF	48	250	5.208333	1.10461

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	19.20262	3	6.400874	**4.815981**	0.002909	**2.648432**
Within Groups	273.7926	206	1.32909			
Total	292.9952	209				

Survey Question 12: "I would often compare package label information about the environmental friendliness of MPBWCP."

Anova: Single Factor **CITY**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
LA	66	364	5.515152	1.484382
PG	41	226	5.512195	2.006098
VAN	103	603	5.854369	1.41976

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	6.079525	2	3.039762	**1.956902**	0.143901	**3.039508**
Within Groups	321.5443	207	1.553354			
Total	327.6238	209				

Anova: Single Factor **OCCUPATION**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
DIY	49	286	5.836735	1.181122
ENV	51	304	5.960784	0.958431
IND	62	328	5.290323	2.143839
PROF	48	275	5.729167	1.648493

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	14.755	3	4.918334	**3.238344**	0.023164	**2.648432**
Within Groups	312.8688	206	1.518781			
Total	327.6238	209				

Survey Question 13: "I would often compare package label information about the economic community sustainability of the MPBWCP."

Anova: Single Factor **CITY**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
LA	66	358	5.424242	1.601865
PG	41	217	5.292683	2.462195
VAN	103	585	5.679612	1.768894

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	5.344751	2	2.672375	**1.444202**	0.238301	**3.039508**
Within Groups	383.0362	207	1.850416			
Total	388.381	209				

Anova: Single Factor **OCCUPATION**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
DIY	49	279	5.693878	1.341837
ENV	51	290	5.686275	1.339608
IND	62	318	5.129032	2.737176
PROF	48	273	5.6875	1.62367

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	13.71216	3	4.570718	**2.513068**	0.059586	**2.648432**
Within Groups	374.6688	206	1.818781			
Total	388.381	209				

Survey Question 14: "I would travel further in order to purchase MPBWCP."

Anova: Single Factor **CITY**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
LA	66	306	4.636364	2.481119
PG	41	201	4.902439	1.640244
VAN	103	524	5.087379	1.904055

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	8.184877	2	4.092438	**2.011737**	0.136363	**3.039508**
Within Groups	421.0961	207	2.034281			
Total	429.281	209				

Anova: Single Factor **OCCUPATION**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
DIY	49	252	5.142857	1.333333
ENV	51	279	5.470588	0.974118
IND	62	284	4.580645	2.444209
PROF	48	216	4.5	2.851064

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	33.4783	3	11.15943	**5.808053**	0.000769	**2.648432**
Within Groups	395.8027	206	1.921372			
Total	429.281	209				

Survey Question 15: "I would pay attention to advertisements about MPBWCP."

Anova: Single Factor **CITY**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
LA	66	383	5.80303	1.668298
PG	41	261	6.365854	0.537805
VAN	103	627	6.087379	1.237388

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	8.258628	2	4.129314	**3.336785**	0.037473	**3.039508**
Within Groups	256.1652	207	1.237513			
Total	264.4238	209				

Anova: Single Factor **OCCUPATION**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
DIY	49	312	6.367347	0.528912
ENV	51	326	6.392157	0.523137
IND	62	346	5.580645	1.788472
PROF	48	287	5.979167	1.680408

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	24.80325	3	8.26775	**7.107723**	0.000144	**2.648432**
Within Groups	239.6206	206	1.163207			
Total	264.4238	209				

Survey Question 16: "How willing would you be to pay for MPBWCP? Check the premium or discount in percent over / below a comparable product that you agree with."

Anova: Single Factor **CITY**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
LA	66	315	4.772727	1.162937
PG	41	190	4.634146	1.487805
VAN	103	533	5.174757	1.478964

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	11.35681	2	5.678406	**4.110507**	0.017757	**3.039508**
Within Groups	285.9575	207	1.381437			
Total	297.3143	209				

Anova: Single Factor **OCCUPATION**

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
DIY	49	248	5.061224	1.10034
ENV	51	275	5.392157	0.843137
IND	62	287	4.629032	1.187996
PROF	48	228	4.75	2.361702

ANOVA

Source of Variation	*SS*	*df*	*MS*	***F***	*P-value*	***F crit***
Between Groups	18.87335	3	6.291118	**4.654382**	0.003598	**2.648432**
Within Groups	278.4409	206	1.351655			
Total	297.3143	209				